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OFC. OF ENVIRONMENTAL QUALITY CONTROL

Mr. Gary Hooser, Director
Office of Environmental Quality Control
State of Hawaii, Department of Health
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Subject: Kawainui Marsh Wetland Restoration and Habitat Enhancement Project Draft Environmental Assessment
Kailua, Oahu, Hawaii
TMK: (1) 4-02-013: portions of 005 and 022

Dear Mr. Hooser,

The State of Hawaii, Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) is proposing the subject project that involves an Agency Action. The State DLNR, DOFAW, serving as the Approving Agency, has reviewed the Draft Environmental Assessment (Draft EA) prepared for this project, and anticipates a Finding of No Significant Impact.

Please publish notice of the availability of this Draft EA in the January 8, 2012 issue of *The Environmental Notice*. We have enclosed a completed OEQC Publication Form, a hard copy of the Draft EA, and a copy of the Draft EA document in pdf format on a CD.

If you have any questions, please contact Mr. David Smith of the State DLNR, Division of Forestry and Wildlife at 973-9787.

Sincerely,

PZ William J. Aila, Jr.
Chairperson

Attachments

Publication Form
The Environmental Notice
Office of Environmental Quality Control

Instructions: Please submit one hardcopy of the document along with a determination letter from the agency. On a compact disk, put an electronic copy of this publication form and a PDF of the EA or EIS. Mahalo.

Name of Project:	Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Applicable Law:	Chapter 343, HRS and National Environmental Policy Act
Type of Document:	Draft Environmental Assessment
Island:	O'ahu
District:	Kailua
TMK:	(1) 4-02-013: portions of 005 and 022
Permits Required:	Special Management Area Use Permit; NPDES Permit (Construction Activities) and Construction Noise Permit.
Name of Applicant or Proposing Agency:	Division of Forestry and Wildlife Department of Land and Natural Resources
Address	State of Hawai'i
City, State, Zip	2135 Makiki Heights Drive
Contact and Phone	Honolulu, Hawai'i 96822 Telephone: (808) 973-9787 Contact: Mr. David Smith
Accepting Authority:	Division of Forestry and Wildlife
Address	Department of Land and Natural Resources
City, State, Zip	State of Hawai'i
Contact and Phone	2135 Makiki Heights Drive Honolulu, Hawai'i 96822 Telephone: (808) 973-9787 Contact: Mr. David Smith
Consultant	Helber Hastert & Fee, Planners, Inc.
Address	733 Bishop Street, Suite 2590
City, State, Zip	Honolulu, Hawai'i 96813
Contact and Phone	Ronald A. Sato, AICP, Senior Planner Phone: (808) 545-2055

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Project Summary: Summary of the direct, indirect, secondary, and cumulative impacts of the proposed action (less than 200 words).

The State of Hawai'i, Department of Land and Natural Resources, Division of Forestry and Wildlife is proposing to implement wetland restoration and habitat enhancement improvements to about 80 acres of Kawainui Marsh. Improvements include: 1) wetland restoration and erosion control; 2) habitat restoration for native Hawaiian waterbirds, migratory shorebirds and waterfowl; 3) improvements to support

Draft ❋ Environmental Assessment

KAWAINUI MARSH

Wetland Restoration And Habitat Enhancement Project

Kailua, O'ahu, Hawai'i

December 2011

Draft ❋ Environmental Assessment

KAWAINUI MARSH

Wetland Restoration And Habitat Enhancement Project

Kailua, O'ahu, Hawai'i

Prepared For:

State of Hawai'i
Department of Land and Natural Resources
Division of Forestry and Wildlife

In Cooperation With:

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Prepared By:

Helber Hastert & Fee, Planners, Inc.

December 2011

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A-2 Kailua Neighborhood Board No. 31
Regular Meeting Minutes; Thursday, August 5, 2010
Regular Meeting Minutes; Thursday, July 7, 2011

A-3 Public Informational Meeting, Thursday, July 29, 2010

A-4 Other Community Events
Envisioning Kawainui; Saturday, August 7, 2010
Envisioning Kawainui; Saturday, April 2, 2011
Ramsar World Wetlands Day 2011; Saturday, February 5, 2011

APPENDIX B .....Photos of Existing Project Site

APPENDIX C ..... Archaeological Reports

Archaeological Reconnaissance Survey with Limited Subsurface Testing in Support of the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project (August 2011)
Prepared by: Cultural Surveys Hawai'i, Inc.

APPENDIX D ..... Engineering Reports

Preliminary Engineering Report; Conceptual Drainage Improvements for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project (May 2011)
Prepared by: AECOM

CHAPTER 1
INTRODUCTION AND BACKGROUND

The State of Hawai‘i (State), Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) is proposing to restore a portion of Kawainui Marsh in the Kailua district of the island of O‘ahu in accordance with a conceptual restoration plan developed. This restoration project is referred to as the “Kawainui Marsh Wetland Restoration and Habitat Enhancement Project.” Figure 1.1 is a location map showing the project area.

Restoration will focus on a project area of approximately 80 acres within Kawainui Marsh that consists of about 60 acres of wetland and 20 acres of adjacent upland riparian and forested slopes. The restoration plan identifies improvements involving: 1) wetland restoration and erosion control; 2) habitat restoration for native Hawaiian waterbirds, migratory shorebirds and waterfowl, and native fish species; 3) improvements to support DOFAW’s maintenance operations; and 4) some public access and passive outdoor recreational amenities. Funding for the restoration plan improvements was obtained via a grant funded by the U.S. Fish and Wildlife Service (FWS), the State of Hawai‘i and other partners.

1.1 PURPOSE FOR ENVIRONMENTAL ASSESSMENT

The project is partially funded by both the FWS and the State DLNR, and the property affected is owned by the State of Hawai‘i under the jurisdiction of the DOFAW. As a result, restoration improvements involve the use of State funds and lands making it subject to the environmental documentation requirements prescribed under Chapter 343, Environmental Impact Statements, Hawaii Revised Statutes (HRS), as amended (State of Hawai‘i, 2007) and Title 11, Chapter 200 (Environmental Impact Statement Rules) of the State Department of Health’s Hawaii Administrative Rules (HAR), as amended (State of Hawai‘i, 1996).

Portions of the project area that are mainly associated with the wetland are situated within the State’s land use district’s “Conservation District” that fall under the jurisdiction of the State Board of Land and Natural Resources (BLNR). Permitted uses are delineated under Title 13, Chapter 5, HAR (State of Hawai‘i, 2006) and require compliance with the State’s environmental review process.

The project area is also situated within the City and County of Honolulu’s (City) Special Management Area (SMA), and improvements will thus require a SMA Use Permit (Major) from the City. Under Chapter 25 (SMA), Revised Ordinances of Honolulu (ROH), compliance with the State’s environmental review process is required.

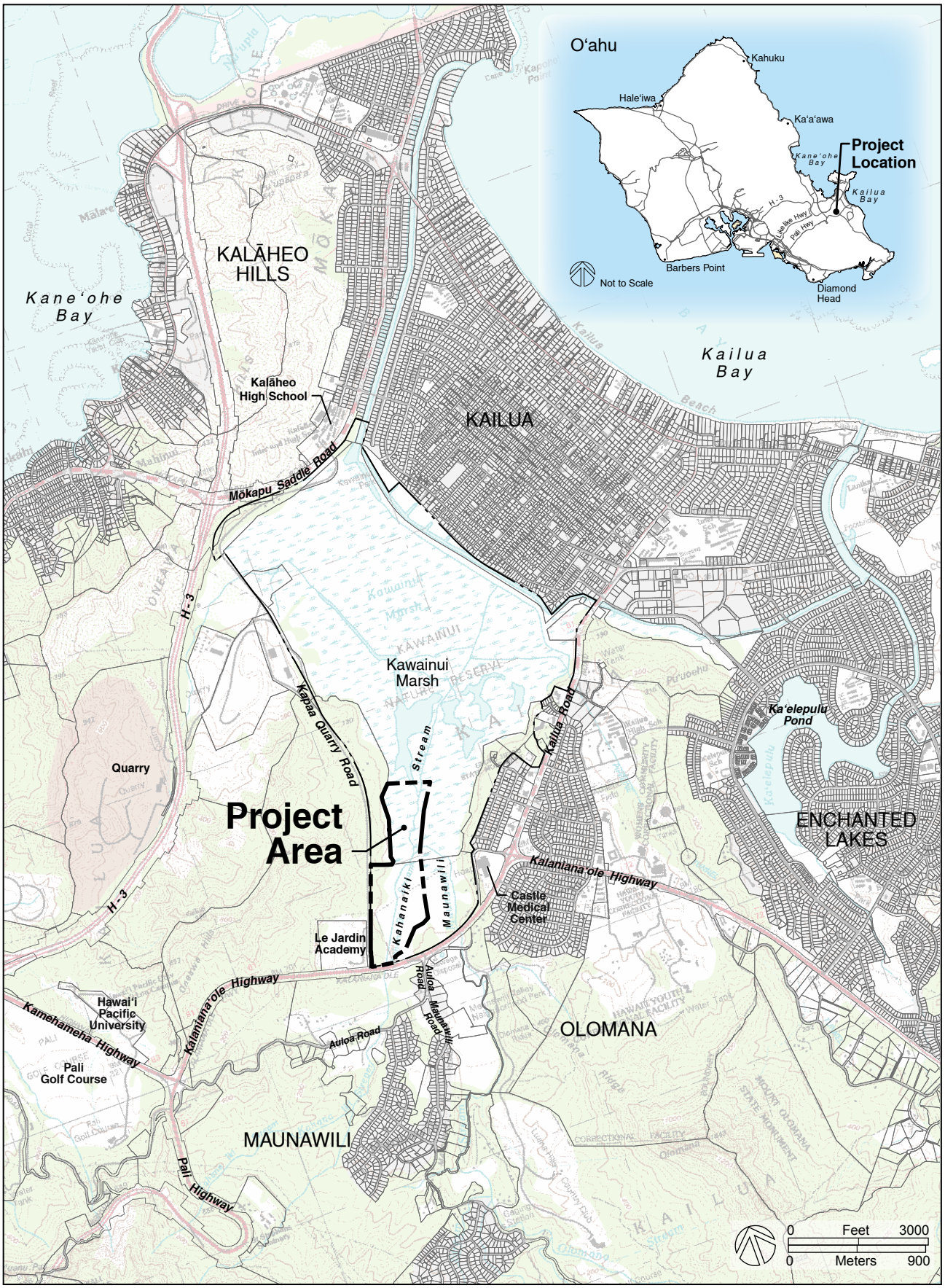


Figure 1.1
Project Location Map

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Restoration improvements also involve the use of Federal funds making the project subject to environmental requirements prescribed under the National Environmental Policy Act (NEPA). Improvements have not been "Categorically Excluded" under the FWS's NEPA compliance regulations. Therefore, an Environmental Assessment under NEPA is also required for this project, and a joint Federal and State environmental document has been prepared.

Applicant and Approving Agency

Helber Hastert & Fee, Planners, Inc. is serving as the "Authorized Agent" on behalf of the State DLNR, DOFAW (Applicant) in the preparation of this environmental document. The project is an "Agency Action" under the State's environmental review regulations because DOFAW is the proposing agency initiating it. The State DLNR will also serve as the "Approving Agency" for this Environmental Assessment. Table 1.1 provides a summary of pertinent project information.

This Draft Environmental Assessment (Draft EA) was prepared pursuant to Chapter 343, HRS, and Title 11, Chapter 200, HAR. A Finding of No Significant Impact (FONSI) is anticipated for this project. Pre-assessment consultation was conducted with various agencies and community organizations under the environmental review process, and consultation efforts are discussed in more detail later in this document. Copies of comment letters received from consulted parties and responses to them are included in Appendix A of this document.

The FWS will serve as the lead Federal Agency, or Administrator, responsible for the Environmental Assessment's preparation in compliance with NEPA documentation and processing requirements. The FWS will review comments received on this published Draft EA, and then make a determination whether a FONSI is issued for this project under NEPA. If issued, a Decision Notice would be prepared and published documenting this determination.

1.2 PROJECT BACKGROUND

Kawainui Marsh was recognized as a Ramsar Convention Wetland of International Importance in 2005 for its historical, biological, and cultural significance. The marsh encompasses about 830 acres of land and is the largest remaining wetland in the State of Hawaiʻi. Exhibit 1.1 provides a panoramic photo showing a portion of the project area within the marsh.

The marsh is located in the Kailua district of the island of Oʻahu, and generally bordered by major roadways on each side including Kalanianaʻole Highway and Kailua Road, Mōkapu Saddle Road, Kapaʻa Quarry Road, and Kīhāpai Street.

Table 1.1 Project Summary

Project Name:	Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Applicant:	Division of Forestry and Wildlife Department of Land and Natural Resources State of Hawaii 2135 Makiki Heights Drive Honolulu, Hawai‘i 96822 Telephone: (808) 973-9787 Contact: Mr. David Smith
Authorized Agent:	Helber Hastert & Fee, Planners, Inc. Pacific Guardian Center, Makai Tower 733 Bishop Street, Suite 2590 Honolulu, Hawaii 96813 Telephone: (808) 545-2055 Contact: Mr. Ronald A. Sato, AICP
Approving Agency:	Department of Land and Natural Resources State of Hawaii
Federal Funding Agency:	Pacific Islands Fish and Wildlife Office Fish and Wildlife Service U.S. Department of Interior
Project Location:	Kawainui Marsh, Kailua District, City and County of Honolulu
Tax Map Key:	(1) 4-02-013: portions of 005 and 022
Project Area:	A total of approximately 80 acres consisting of 60 acres of wetland and 20 acres of upland riparian and forest area.
Project Description:	Improvements to be implemented under a restoration plan include: 1) wetland restoration and erosion control for a portion of Kawainui Marsh; 2) habitat restoration for native Hawaiian waterbirds, migratory shorebirds and waterfowl, and native fish species; 3) improvements to support DOFAW’s maintenance operations; and 4) some public access and passive recreational amenities.
Existing Use:	The wetland portion of the marsh consists of approximately 60 acres of wetland with Kahanaiki Stream extending through the site in a north-south orientation. Most of the wetland is overgrown with invasive vegetation. The upland area consists of riparian and forest area much of which is overgrown with invasive trees and other vegetation. There are no existing urbanized or recreational uses or activities occurring within the project area.
State Land Use District Classification:	Conservation District and Urban District
Ko‘olaupoko Sustainable Communities Plan:	Open Space/Preservation Area
Special Management Area:	The project area is within the Special Management Area.
City Zoning District:	P-1, Restricted Preservation, and P-2, General Preservation.

Exhibit 1.1 – Panoramic Photo Showing a Portion of the Kawainui Marsh Project Area

The project area within Kawainui Marsh has been established as a State regulated wildlife sanctuary under Title 13, Chapter 126, HAR. As a result, it is prohibited for any person to enter or remain in a wildlife sanctuary except as authorized by the BLNR or its authorized representative (DOFAW). For this project area, access is restricted to the perimeter marked trails and roads, or other marked trails or roads. No motorized vehicles are allowed. Commercial activities may be permitted in the wildlife sanctuary by the BLNR for up to 100 visitors per day, but currently no such activities have been permitted.

Kawainui Marsh has been identified by the FWS as a waterbird recovery area because it provides habitat for four endemic and endangered Hawaiian waterbirds. It also plays a unique role in the Ko‘olaupoko region watershed as an important source of flood control and sediment filtration protecting urbanized areas of Kailua and the Kailua Bay ecosystem through ground water recharge and improved water quality.

1.2.1 Applicant (DOFAW) Background

The Division of Forestry and Wildlife is one of eleven divisions under the State Department of Land and Natural Resources responsible for the management of public natural resources in the State of Hawaii. DOFAW’s mission is to enhance, protect, conserve and manage Hawaii’s unique and limited natural, cultural and historic resources held in public trust for current and future generations. This includes the people of Hawai‘i and visitors acting in partnership with others from the public and private sectors.

Effectively, DOFAW representatives are natural resource managers who play a pivotal role in protecting the State’s watersheds, unique forest resources, and threatened and endangered species. DOFAW has created and continues to manage several programs geared to these ends, some of which include the Na Ala Hele Hawaii Trails & Access System, the Hawaii Conservation Resource Enhancement Program, the Hawaii Forest Stewardship Program, the Hawaii Endangered Bird Conservation Program, the Plant Extinction Prevention Program, the Invasive Species Programs, and the Hawaii Youth Conservation Corps and Hunting Programs.

DOFAW has been working with Federal, State, and City agencies along with community groups to devise strategies, plans, and funding sources for the protection and management of the natural and cultural resources of Kawainui Marsh. Restoration and habitat enhancements planned under this project are part of an on-going progression of improvements being made to the Kawainui-Hāmākua Marsh complex beginning with the Coastal Wetlands Acquisition, Planning, Development and Management of Hāmākua Wetlands project in 1992. More recently, the U.S. Department of Army, Corps of Engineers will implement construction of the Kawainui Marsh Environmental Restoration Project adjacent to this DOFAW restoration project.

Under these efforts, DOFAW has developed a restoration plan for the project area intended to serve as a guide for the design and phased implementation of restoration improvements over several years. Future funding outside of this project's grant would also be pursued by DOFAW to implement additional restoration actions, drainage infrastructure, and accessory improvements.

1.2.2 DOFAW Kawainui Marsh Maintenance Operations

DOFAW maintenance operations at Kawainui Marsh are limited due to a shortage of available staff. Three full-time positions were initially established for maintenance of the area. However, three existing positions were subsequently cut due to the State's fiscal circumstances. This forced DOFAW to increase the responsibilities of existing personnel making it more difficult to achieve maintenance objectives for the marsh. Recent maintenance operations have focused on reducing the amount of invasive vegetation in the wetland and upland areas. Vegetation is mowed or cut to control weeds as necessary.

DOFAW maintenance operations average approximately 12 man-days per month depending on weather conditions. Consequently, most work takes place during dry summer months. Some staff utilizes excavators or other mechanical equipment for larger maintenance activities, while others, including prisoners from the State's work furlough program, use weed whackers.

Equipment maintenance is also a factor that affects the availability of staff and their ability to maintain the environment at Kawainui Marsh. Machinery needs to be serviced, oiled, and frequently parts are ordered for replacement. These activities reduce the amount of time actually spent clearing and removing invasive vegetation by DOFAW staff.

DOFAW has implemented a predator control program as part of its maintenance operations since 2008. The division has a contract with the U.S. Department of Agriculture to implement a trapping program. Cage traps are placed around the perimeter of the upper reaches of the project area, as well as in other areas of the marsh. Cage traps are the primary tool for controlling mongoose and feral cats.

1.3 REGULATORY OVERVIEW

The following is a summary of the Federal laws and consultations that are relevant to implementing the restoration project (Proposed Action), and are addressed in this environmental document.

National Environmental Policy Act

The proposed action is subject to compliance with the National Environmental Policy Act (NEPA) of 1969, 42 United States Code (USC) §4321, as implemented by the Council on Environmental Quality regulations, 40 Code of Federal Regulations (CFR) Parts 1500-1508 (40 CFR §1500 *et seq*.). The FWS has guidance documents (550 FW 1-3) to comply with NEPA requirements. This environmental document was prepared in compliance with these regulations and guidelines in coordination with the FWS.

National Historic Preservation Act

The National Historic Preservation Act (NHPA) of 1966, as amended (16 USC §470) recognizes the Nation's historic heritage and establishes a national policy for the preservation of historic properties as well as the National Register of Historic Places. Section 106 of the NHPA requires Federal agencies to take into account the effects of Federal undertakings on historic properties. The Section 106 process, as defined in 36 CFR §800, provides for the identification and evaluation of historic properties, for determining the effects of undertakings on such properties, and for developing ways to resolve adverse affects through the process of consultation.

Coastal Zone Management Act

The purpose of the Coastal Zone Management Act (CZMA) of 1972, as amended (16 USC §1451 *et seq.*) is to encourage States to manage and conserve coastal areas as a unique, irreplaceable resource. Federal agency activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone shall be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs. Chapter 205A, HRS, implements this program for the State, and the City's Special Management Area (SMA) regulations under Chapter 25, ROH specifies the procedures for reviewing a project's consistency with coastal zone management objectives and policies for the island of Oahu.

Endangered Species Act

The Endangered Species Act (ESA) (16 USC §1531 *et seq*.) establishes a process for identifying and listing species. It requires all Federal agencies to carry out programs for the conservation of federally listed endangered and threatened plants and animals, and prohibits actions by Federal agencies that may adversely affect listed species or adversely modify designated critical habitat

without formal consultation with the U.S. Fish and Wildlife Service or the National Oceanographic and Atmospheric Administration (NOAA). Section 7 of this Act specifies the consultation program conducted with these Federal agencies.

Clean Water Act

The Clean Water Act (CWA) of 1972 is the primary Federal law that protects the nation's waters, including lakes, rivers and coastal areas. The primary objective of the CWA is to restore and maintain the integrity of the nation's waters.

Section 401 of the CWA requires a Water Quality Certification (WQC) be obtained from the State (or territory) for actions that require a Federal permit to conduct an activity, construction or operation that may result in a discharge into waters of the United States. The State of Hawai'i Department of Health, Clean Water Branch (DOH-CWB) implements this program issuing WQC permits for activities affecting jurisdictional waters.

Section 402 of the CWA establishes a National Pollution Discharge Elimination System (NPDES) general permit process for point and non-point source discharges such as storm water discharges associated with construction activities. Such a permit would be required if construction activities disturb a land area of one acre or more and discharge storm water from the construction site to waters of the U.S. The DOH-CWB implements this NPDES for the State.

Section 404 of the CWA requires a permit for the discharge of dredged or fill material into a wetland, navigable water, or jurisdictional waters of the United States. The U.S. Army Corps of Engineers (USACE) issues a permit under these regulations.

Executive Order 11988 Floodplain Management

Executive Order 11988 requires Federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains. It also requires agencies to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. The Environmental Protection Agency (EPA) has policies and procedures for implementing this Order, and each federal agency is responsible for implementing these procedures.

Executive Order 11990 Protection Of Wetlands

Executive Order 11990 was issued to minimize the destruction, loss or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. This Order requires Federal agencies, in their planning actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided. The EPA has policies and procedures for implementing this Order, and each federal agency is responsible for implementing these procedures.

Executive Order 12898 Environmental Justice

Executive Order 12898 (Environmental Justice) issued in 1994 is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Federal agencies need to identify and address disproportionately high and adverse environmental effects from an action on minority and low-income populations.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act was enacted to protect fish and wildlife when Federal actions result in the control or modification of a natural stream or body of water. The Federal agency needs to take into consideration the effect that water-related projects would have on fish and wildlife resources, take action to prevent loss or damage to these resources, and provide for the development and improvement of these resources. This regulation is administered by the FWS and the National Marine Fisheries Service, as appropriate.

Land and Water Conservation Fund, Section 6(f)

Section 6(f) of the Land and Water Conservation Fund (LWCF) was enacted to ensure that the Federal investments in LWCF assistance are being maintained in public outdoor recreational use. This section assures that once an area has been funded with this assistance, it is continually maintained for public recreation use unless the National Park Service (NPS) approves substitution property of reasonably equivalent usefulness and location and of at least equal fair market value. The State DLNR, Division of State Parks administers this regulation in the State of Hawai‘i in coordination with the NPS.

American Disabilities Act

The Americans with Disabilities Act (ADA), signed into law in 1990 and later amended with changes in 2009, is a wide-ranging civil rights law intended to make American Society more accessible to people with disabilities, and prohibits discrimination based on disability under certain circumstances. The ADA is divided into five titles that cover: 1) employment; 2) public services; 3) public accommodations; 4) telecommunications; and 5) miscellaneous items. The State DOFAW would need to comply with these regulations by having new project improvements (e.g. pathways) meet the 2010 ADA standards for accessible design.

1.4 PROJECT LOCATION

The wetland restoration and habitat enhancement project area involves a total of about 80 acres, which comprises about 10 percent of the entire Kawainui Marsh. Figure 1.2 is another location map that identifies the 80-acre project area in relation to the entire Kawainui Marsh boundary. Notable land uses surrounding the restoration area include Le Jardin Academy to the west (*mauka*) and the Castle Medical Center and Pohakupu residential subdivision to the east (*makai*) as shown on that figure.

The project area is bounded on the west (*mauka* side) by Kapa‘a Quarry Road which runs in a north-south direction from its intersection with Kalaniana‘ole Highway. The highway forms the project’s southern boundary generally running in an east-west direction. Remaining areas of the project area are bordered by the marsh. An area known as Mokulana peninsula is situated across the highway’s intersection with Auloa Road. A portion of the marsh planned for the creation of ponds by the Department of Army, Corps of Engineers (COE) is located below (east) of the restoration project area.

1.4.1 General Site Conditions

The 80-acre project area can be characterized as consisting of approximately 60 acres of wetland with Kahanaiki Stream extending through the site in a north-south orientation. The remaining 20 acres consists of adjacent upland riparian and forested slopes situated above the wetland area and *makai* of Kapa‘a Quarry Road. Figure 1.3 is a vicinity map that includes an aerial photo of the project area and shows the general location of relevant streams. Additional photo documentation of existing conditions in the project area is provided in Appendix B.

Kawainui Marsh serves as an important flood control basin protecting the low-lying urbanized areas of Kailua Town and Coconut Grove subdivision that experienced flooding in 1988 when floodwaters breached the levee. The levee was constructed in 1966 along the northernmost edge of the marsh to enhance its flood storage capacity. It was later modified by the COE and City in 1997 raising its height and constructing a concrete floodwall to address the 100-year flood level estimated for Kawainui Marsh.

The marsh generally drains in a south to north direction from Kapa‘a Quarry Road and Kalaniana‘ole Highway toward the shoreline. Kahanaiki Stream is a perennial stream running through the project’s 60-acre wetland restoration area This stream is characterized as generally consisting of a shallow (generally less than 1-foot deep) flow of open stream water about four to seven feet wide. A short segment of Maunawili Stream enters the project area connecting to Kahanaiki Stream, and is the main source of surface water flowing into the marsh with Kahanaiki Stream providing most of the remaining flows. Other inflow to the marsh comes from peripheral drainages and smaller, non-perennial streams. Water from the marsh is discharged into the Kawainui Channel (also referred to as Oneawa Channel) which drains into Kailua Bay.

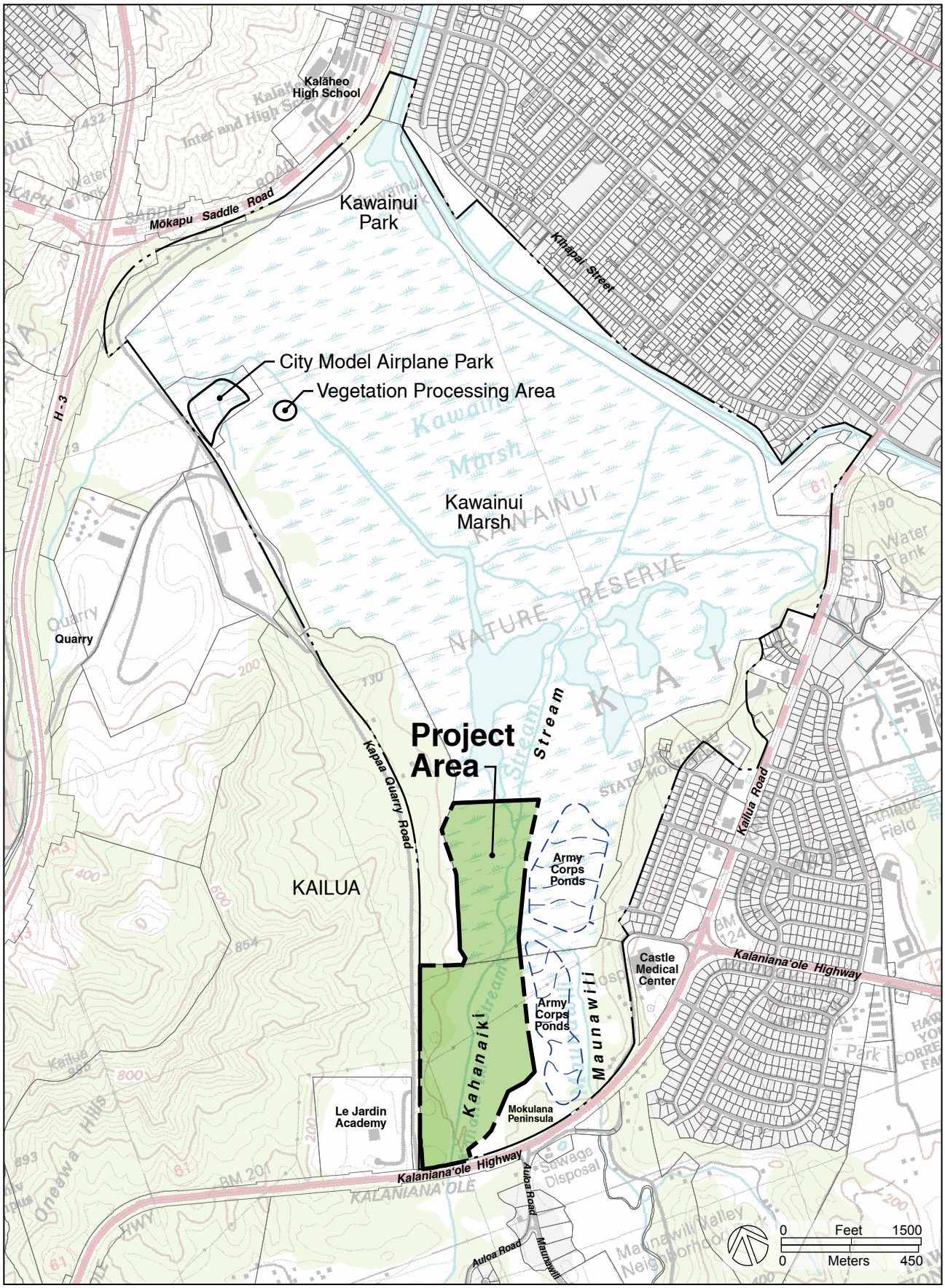


Figure 1.2
Kawainui Marsh Location Map

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

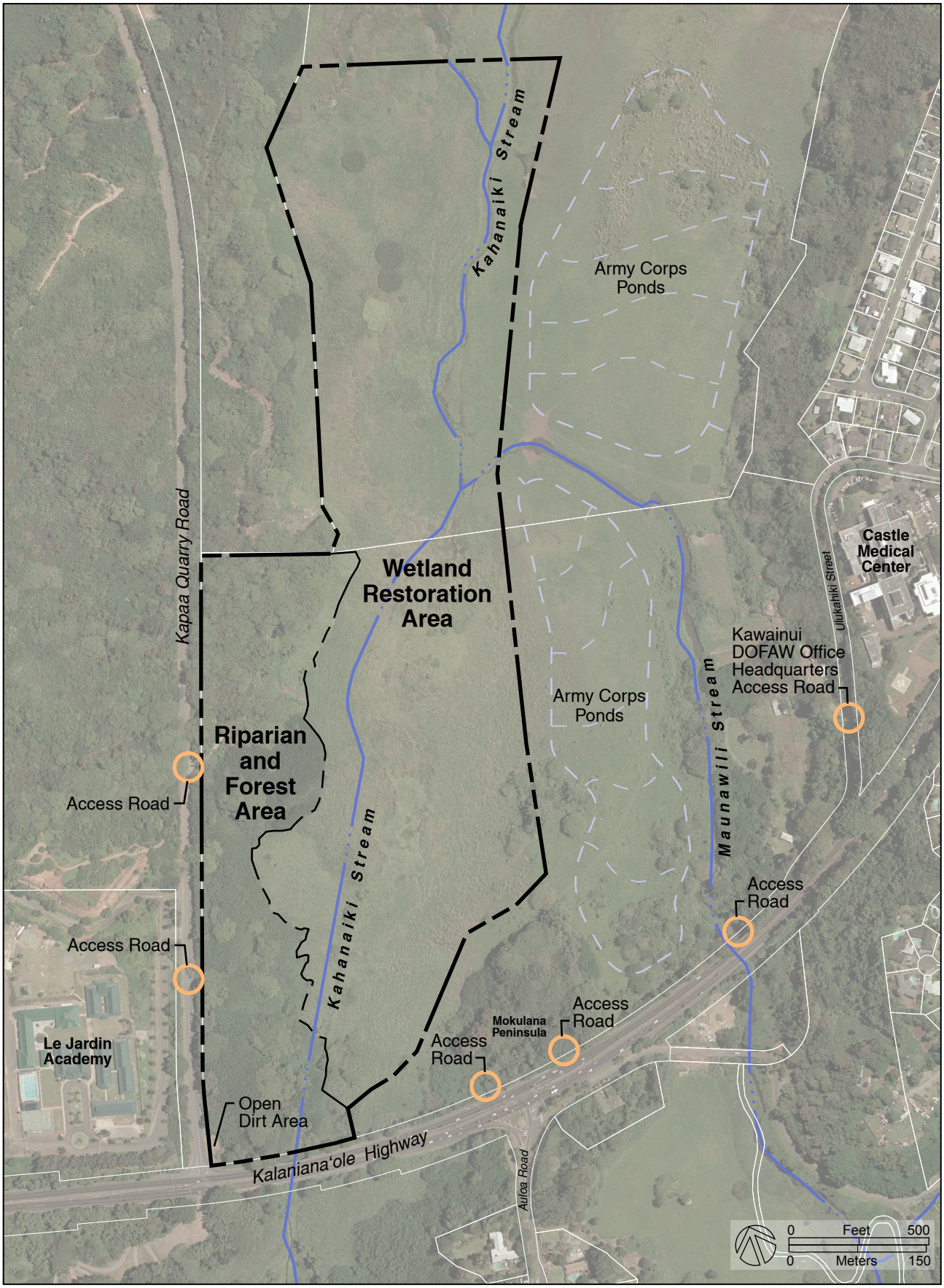


Figure 1.3
Project Vicinity Map

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Existing invasive vegetation has been encroaching the Kahanaiki Stream bank and reducing open-water flows and shallow-water habitat. An abundant growth of this invasive vegetation has formed a very thick layer of peat (partially decomposed plant matter that is saturated with anoxic water) along the stream. The vegetation mat has also filled most of wetland area associated with Kawainui Marsh in this project area. Figure 1.4 shows a southwest oblique aerial view of the Kawainui Marsh project area, and photos of existing site conditions are included in Appendix B.

The project's 20-acre upland riparian area hosts a variety of plants and several large trees (monkeypods and java plum) associated with an upland forest. The southern end near Kalaniana‘ole Highway is overgrown with trees and other invasive vegetation. The northern section has been cleared by DOFAW to provide an open grassed area, and a row of hau trees is located along a portion of Kapa‘a Quarry Road. The northern most portion of the area has a canopy of various trees.

1.4.2 DOFAW Access Locations

DOFAW currently has six (6) vehicular access locations to the project area that were previously shown on Figure 1.3. Access to the project area is restricted to DOFAW employees for management and maintenance operations along with contractors hired by DOFAW for support activities. Kawainui Marsh is a State regulated wildlife sanctuary under Title 13, Chapter 126, HAR. As a result, it is prohibited for any person to enter the sanctuary unless authorized by permit by the Board of Land and Natural Resources or DOFAW.

One access is from the DOFAW Kawainui Marsh Headquarters located behind Castle Medical Center along Ulakahiki Street. This location allows DOFAW to enter the lower (*makai*) portion of the project area between the two ponds being developed by the COE. A second location is referred to as the "Mokulana" access across from Auloa Road, which used to serve a former residence on the site. The third access along the highway is situated slightly east of the Mokulana access as shown on the figure. A fourth access is located further east near the highway's bridge serving Maunawili Stream. All these access points are gated.

The fifth access is from Kapa‘a Quarry Road about 620 feet north from the intersection with the highway. This access has been closed and is blocked off from use at this time. The sixth access is about 350 feet north of the entrance to Le Jardin Academy. This gated location provides access to a dirt road that runs through the northern upland area of the project.

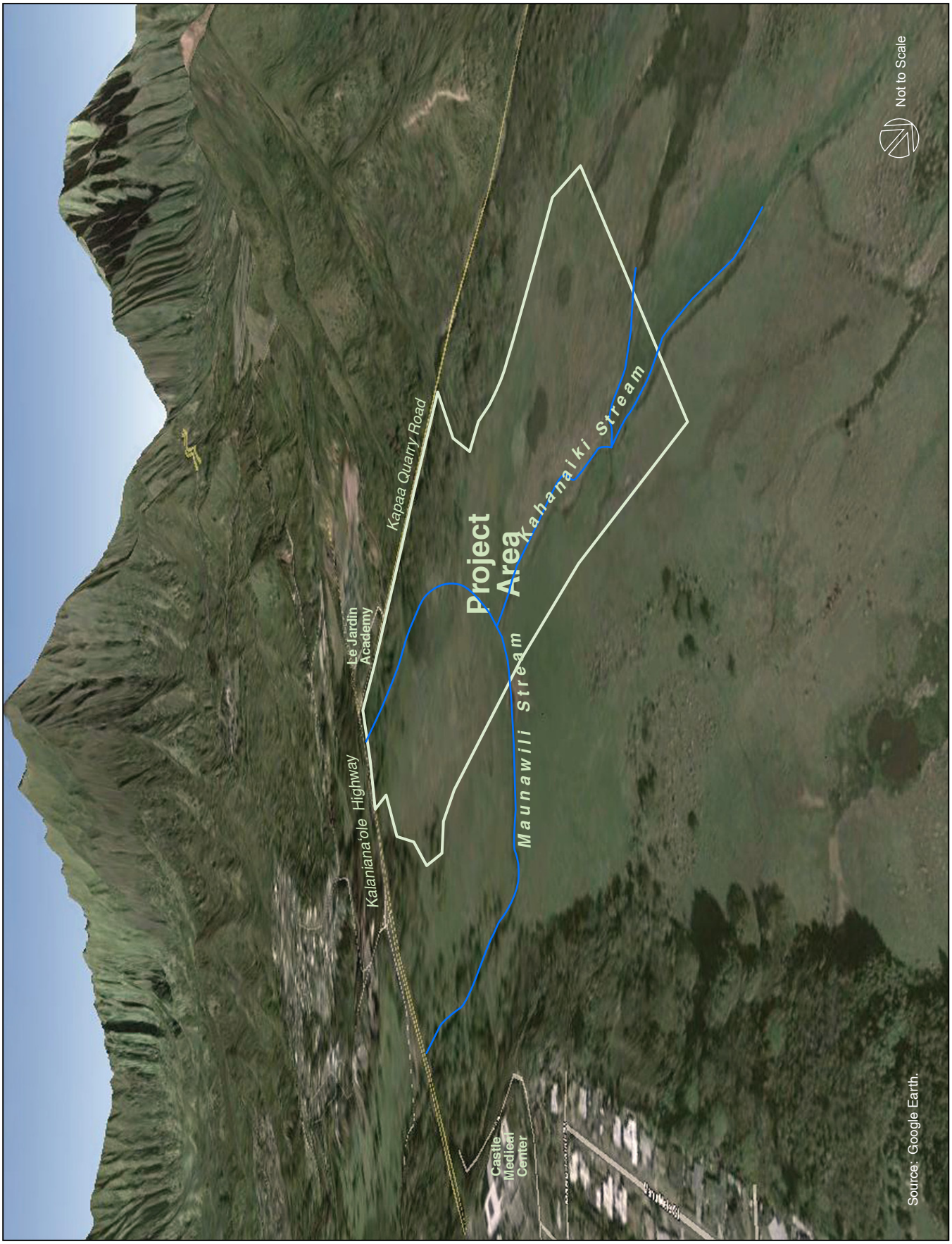


Figure 1.4
Oblique Aerial View of Project Area

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

1.5 PROPERTY INFORMATION

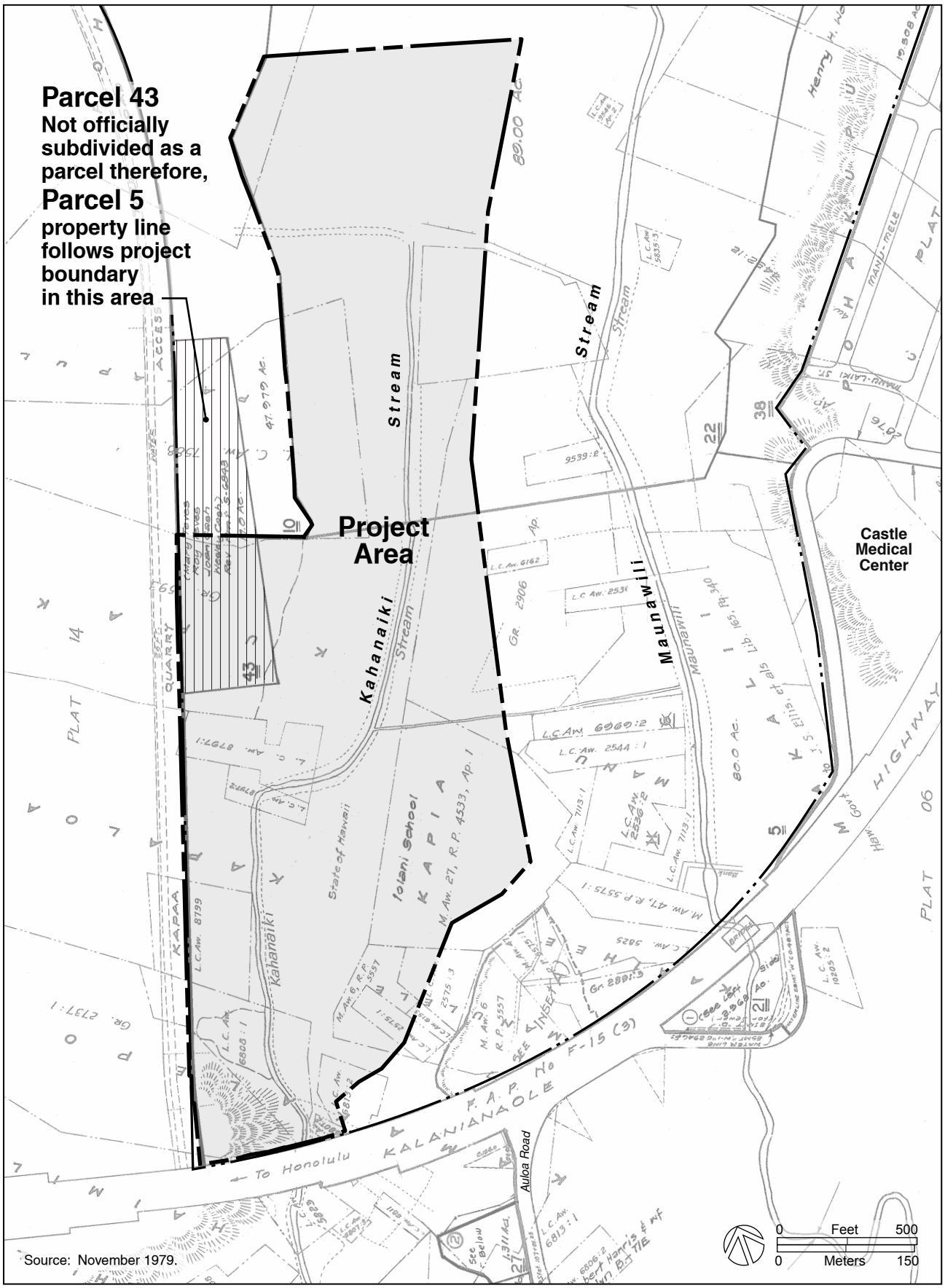
The project area is identified as Tax Map Key (TMK) No. (1) 4-02-013: portions of 005 and 022. These parcels are larger properties owned by the State of Hawai‘i, and are under the jurisdiction of the DOFAW. Parcel 5 was purchased by the State of Hawai‘i using federal assistance from the Land and Water Conservation Fund (LWCF). As a result, this parcel is subject to Section 6(f) of the LWCF Act that requires a public outdoor recreational use component such as pathways, viewing areas, boardwalks, etc. Figure 1.5 shows the project area in relation to the parcel boundaries based upon the Tax Map.

It should be noted that Parcel 43 shown on the TMK map was previously created for the intended issuance of a revocable permit, but has not been officially subdivided as a parcel. That revocable permit is no longer applicable and subdivision of that parcel is not required. Therefore, the correct boundary for Parcel 5 follows the project boundary up to Kapa‘a Quarry Road based upon a State survey map dated July 2, 2007 prepared under a Governor’s Executive Order 4102. Parcel 5 therefore consists of 97.224 acres based upon the State’s survey map. The Tax Map incorrectly identifies this parcel as being 80.0 acres. The Tax Map identifies Parcel 22 as consisting of 89.0 acres.

It is estimated that about 50 acres of the project area is situated within Parcel 5, and about 30 acres are situated within Parcel 22. A summary of these parcel and acreage information for the project area is provided below.

Tax Map Key Parcels:

(1) 4-02-013: 005	97.22 acres	(Project Area: 50 acres)
(1) 4-02-013: 022	89.00 acres	(Project Area: 30 acres)


Parcel 43
Not officially subdivided as a parcel therefore,
Parcel 5
property line follows project boundary in this area
Project Area
Castle Medical Center
Kahanaiki Stream
Maunawili Stream
Stream
Iolani School
State of Hawaii
KAPA
M. Aw. 27, R.P. 4533, Ap. 1
L.C.Aw. 8799
L.C.Aw. 6060:2
L.C.Aw. 2544:1
L.C.Aw. 2536:2
L.C.Aw. 6162
L.C.Aw. 2531
Gr. 2906
Gr. 2881:3
M. Aw. 47, R.P. 5575:1
M. Aw. 6, R.P. 5557
L.C.Aw. 5825
L.C.Aw. 6808:1
L.C.Aw. 6813:1
L.C.Aw. 9539:3
L.C.Aw. 7113:1
L.C.Aw. 9539:2
L.C.Aw. 9539:1
L.C.Aw. 9539:3

CHAPTER 2
PROJECT DESCRIPTION AND ALTERNATIVES

2.1 PROJECT NEED AND OBJECTIVES

Today, over 30 percent of Hawaii's natural lowland wetlands have been filled or converted to other land uses such as agriculture and urban expansion. O‘ahu’s windward coast wetlands are mostly small and isolated by topography and urban expansion. Long-term protection of the remaining wetlands is essential to ensure retention and preservation of native Hawaiian water birds, flood control, ground water recharge, and aesthetic values.

Kawainui Marsh is the largest remaining freshwater wetland in the State of Hawai‘i, and was recognized as a Ramsar Convention Wetland of International Importance in 2005 for its historical, biological, and cultural significance. The marsh also provides flood control and sediment filtration that protect urbanized areas of Kailua and the Kailua Bay ecosystem. It also accommodates important habitat for endangered endemic waterbirds and several species of migratory shorebirds and waterfowl, and contains cultural and historical resources. Kawainui Marsh’s intrinsic values therefore make it a critical location for wildlife protection, watershed interpretation and education, and an area rich in cultural and historical resources.

2.1.1 Project Need

Despite its rich environmental resources, challenges with its management and maintenance have resulted in an overgrowth of alien (non-native) and invasive vegetation contributing to limited wetland habitat suitable to support endangered Hawaiian waterbirds. The loss of wetland habitat is a primary cause for the decline of the Hawaiian waterbirds. Other factors contributing to the marsh’s present condition include erosion of upland areas around the marsh, limited public access, challenges with predator control, and minimal publically supported interpretive and educational programs. The need for wetland restoration improvements at Kawainui Marsh is discussed in further detail.

<u>Overgrowth of Invasive Vegetation</u>

The vegetative community of Kawainui Marsh has been significantly disturbed, and is now dominated by introduced and invasive plant species. The growth of invasive vegetation over decades within higher elevation areas beyond the marsh, cattle grazing within the marsh, agricultural use, increased storm water runoff, erosion, and sediment loading from surrounding urban development have contributed to the present condition. As a result, open water within the marsh is being reduced by the growth of invasive vegetation along with an accumulation of a floating mat of peat (partially decomposed plant matter that is saturated with anoxic water). Invasive vegetation accumulating in the marsh also threatens remaining native plant assemblages. These conditions reduce the function and value of Kawainui Marsh, diminishing its ability to provide suitable waterbird habitat along with floodwater retardation.

Kahanaiki Stream is a perennial stream running through the project area and serving as the primary source of water flow within this wetland area. This stream can be characterized as generally consisting of a shallow (less than 1-foot deep) flow of water about four to seven feet wide. Existing invasive vegetation has been encroaching into this stream and reducing open-water flows and shallow-water habitat. An abundant growth of this invasive vegetation has formed a very thick layer of peat along the stream.

Invasive vegetation in the wetland restoration area can be characterized as consisting of a California grass (*Urochloa mutica*) community, Elephant grass (*Pennisetum purpureuma*) stands, and some pasture lands typically dominated by California grass. The California grass community is dominant along with patches of Cattail (*Typha latifolia*), and bulrush and terrestrial vines (e.g. *Canavalia cathartica* and *Paederia scandens*) occur in some places. These dominant invasive plants have contributed to the reduction of open waterways and native emergent vegetation, and have severely curtailed habitat for endemic Hawaiian waterbirds to forage and nest.

The upland portion of the project area outside of the wetland is similarly dominated by invasive species of non-native vegetation that is gradually eliminating former native vegetation present in the area. Such plants include Java plum (*Syzygium cumini)*, Siris tree (*Albizia lebbeck*), Strawberry guava (*Psidium catteianum)*, Koa haole (*Leucaena leucocephala)*, and African tulip trees (*Spathodea campanulata*). Some photos of this area are included in Appendix B.

Need for Habitat Recovery for Endangered Waterbirds

Kawainui Marsh provides important habitat for four endangered species of native Hawaiian waterbirds and for migratory bird species. This project area also provides habitat for various migratory waterfowl, wintering shorebirds and a variety of resident and introduced bird species. Standing ponds, wet pastures, and open water areas serve as an attractive habitat for migratory waterfowl. Its waters also support a variety of introduced and indigenous aquatic wildlife. Therefore, the loss of open water areas and other wetland values affects the suitability of this area to serve as essential habitat for the recovery of endangered waterbirds.

Four species of endangered Hawaiian waterbirds found in Kawainui Marsh include the Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian moorhen (*Gallinule chloropus sandvicensis*), and Hawaiian duck (*Anas wyviliana*). Several migratory shorebirds identified include Pacific golden plovers (*Pluvialis dominica*), Ruddy turnstones (*Arenaria interpres*), Sanderlings (*Calidris alba*), and Wandering tattlers (*Heteroscelus incanus*).

The U.S. Fish and Wildlife Service identified Kawainui Marsh as a "primary habitat" for the recovery of these waterbird species due to the functional values associated with the wetland. The latest draft of the U.S. Fish and Wildlife Service recovery plan for Hawaiian waterbirds documents key findings as follows:

- Kawainui Marsh is listed as a "Core Wetland" which is an area providing habitat essential for supporting larger populations of Hawaiian waterbirds.
- Expansion of open water areas would facilitate use by all four endangered waterbird species, which now use the area only in small numbers.
- Recommended recovery actions include implementing management plans, securing water sources and managing water levels, managing vegetation, reducing and monitoring predator populations, minimizing human disturbances, monitoring and controlling avian disease, monitoring populations, and removing the threat of mallard-Hawaiian duck hybridization (FWS, May 2005).

Another factor affecting waterbird recovery within the project area is threats from various predators. Waterbirds are threatened by a wide variety of mammalian, avian, and amphibian predators that live within Kawainui Marsh or access the marsh from the surrounding areas. The small Indian mongoose (*Herpestes auropunctatus* or *javanicus*) is the most pernicious of the predators in the marsh and a prevalent predator to waterbirds. The roof rat (*Rattus rattus*) inhabits a wide range of environmental conditions, and has been identified as a predator of native birds.

Feral dogs (*Canis familiaris*) are present intermittently in the area and constitute a threat to ground-nesting birds. Dogs are known to kill significant numbers of ground nesting seabirds and waterbirds. Because of the proximity of urban communities, domesticated dogs also pose a threat to the Kawainui Marsh waterbirds when they are illegally walked through the marsh (wildlife sanctuary) with those not leashed posing the greatest threat. Feral cats (*Felis catus)* pose a similar threat to both ground nesting and arboreal nesting birds.

Other species have been observed consuming or endangering native waterbirds and therefore constitute a threat to their recovery at the marsh. The cattle egret (*Bubulcus ibis*), introduced in Hawai‘i in 1959 to control flies on cattle, is a predator on Hawaii‘s endangered waterbirds. Predation of waterbird chicks by the cattle egret and Black-Crowned Night Heron (*Nycticorax nycticorax*) has been documented at the Oahu National Wildlife Refuge (NWR).

Need for Erosion Control

Surface water runoff in the project area and *mauka* areas enter the marsh primarily from Kahanaiki and Maunawili Streams. Runoff from the highway also sheet flows into drainage culverts eventually discharging into these streams. Drainage culverts along Kapa‘a Quarry Road collect runoff from Le Jardin Academy and *mauka* areas before discharging into Kawainui Marsh.

Kawainui Marsh serves as a nutrient and sediment sink protecting the waters of Kailua Bay, by filtering and mitigating the effects of nutrients and chemicals discharged from upland areas. It also serves as an important flood basin slowing down surface runoff and protecting low-lying urbanized areas of Kailua. Sediment and other pollutants entering the marsh from the upper

watershed are deposited over the broad marsh basin where it is allowed to settle and reduce discharges into Kailua Bay. Therefore, there is a need to restore the marsh so that agricultural and urban contaminants (e.g. fertilizers, herbicides, pesticide, septic system discharges, etc.) can be better filtered within the marsh.

Storm water runoff from Kapa‘a Quarry Road at culvert locations has caused erosion of upland areas of the marsh contributing to increased discharges of sediment and other materials into the marsh. Therefore, improvements to these culverts and upland areas are needed to mitigate erosion and reduce discharge of sediments and other debris into the wetland.

Need for Public Access, Interpretive, and Educational Opportunities

The restoration project area within Kawainui Marsh is designated as a wildlife sanctuary regulated under Chapter 126, HAR. As a result, public access is presently restricted to perimeter marked trails and roads, and no motorized vehicles are permitted. With proposed restoration improvements, DOFAW will provide manageable public access within the upland area of the marsh while preventing indirect effects on endangered waterbirds from increased human activity.

Parcel 5 (TMK 4-02-013) was purchased by the State of Hawaii using federal assistance from the LWCF which requires the property to be maintained in public outdoor recreation use. There is a need to provide public access and recreational opportunities within Parcel 5 based upon requirements associated with Federal funding used to acquire the land which is part of the restoration project area.

Improving public access within the marsh would also support the development of interpretative and educational programs with schools and various organizations interested in Kawainui Marsh. Schools and organizations have expressed to DOFAW an interest to create such opportunities. By including a broad spectrum of community organizations and schools along with business and government agencies, the project can instill a sense of ownership by residents, educate the public and visitors, and help to encourage further habitat restoration efforts and support in Kawainui.

Improved access within the upland section of the project area is needed for DOFAW to conduct maintenance activities. DOFAW staff needs accessibility to areas for their maintenance vehicles to effectively transport staff and equipment for maintenance activities. Presently, there is limited access to most areas due to existing overgrowth of vegetation and absence of prior trails.

2.1.2 Project Objectives

DOFAW’s mission is to enhance, protect, conserve and manage Hawaii’s unique and limited natural, cultural and historic resources held in public trust for current and future generations. This includes the people of Hawai‘i and visitors acting in partnership with others from the public and private sectors.

DOFAW's *Hawai'i's Comprehensive Wildlife Conservation Strategy* (DLNR, October 2005) comprehensively reviewed the status of a full range of the State's native terrestrial and aquatic species. The report presented strategies for the long-term conservation of species and their habitats. Management actions and future needs identified for Kawainui Marsh include:

- Current Management Needs: Hydrologic studies, habitat restoration, including invasive plant removal, native wetland planting, and predator control.
- Future Needs: Secure adequate funding to support expanded management (increased predator control, invasive weed removal, habitat restoration, educational opportunities).

DOFAW Grant

In fulfilling this mission, DOFAW applied for and obtained a grant to implement improvements to a portion of Kawainui Marsh resulting in this restoration project. The grant includes Federal funding from the FWS, State of Hawai'i funds, and private funding from several partners.

The grant allows DOFAW to focus on restoring habitat for native Hawaiian waterbirds, migratory shorebirds and waterfowl, and native fish species within the 80-acre project area. Improvements would expand endangered waterbird habitat by restoring and enhancing wetland and stream areas currently choked with a heavy growth of invasive vegetation. Restoration plans would also improve the hydrologic function of the wetland and stream areas benefiting a wide range of native species and improving the educational opportunities of the site. It also includes community outreach efforts to local organizations, businesses, schools and government agencies to integrate the wildlife sanctuary into the fabric of the community.

Other improvements incorporated into the proposed restoration plan include public access and outdoor passive recreational amenities. However, funding for these improvements are not permitted within the requirements of the grant, and DOFAW would need to pursue additional funding to implement these improvements.

Project Goal and Objectives

The goal for the project is to restore habitat for native Hawaiian waterbirds, migratory shorebirds and waterfowl, and native fish species within the 80-acre project area at Kawainui Marsh. DOFAW's three primary management objectives for the area include: 1) control invasive vegetation; 2) control water flow into the marsh; and 3) manage public access. Objectives also involve support from local organizations, businesses, schools and City, State and Federal agencies in the process to integrate the wildlife sanctuary into the community and encourage further habitat restoration at this internationally recognized marsh.

DOFAW is committed to the preservation, protection, and enhancement of the natural and cultural resources of Kawainui Marsh. As a result, the project represents a first step to restore the marsh and enhance its habitat. The primary project objectives addressed by restoration actions include:

- Restore native wetland habitat and naturalize Kahanaiki Stream. After gradual removal of invasive vegetation, various types of native plants would be used to re-vegetate the wetland area and the upland slope along Kapa‘a Quarry Road.
- Restore native bird habitat and effectively control predation of native birds.
- Mitigate drainage failure and reduce erosion entering the marsh by addressing existing storm water runoff from Kapa‘a Quarry Road.
- Ensure efficient DOFAW maintenance operations and improve their maintenance capabilities to sustain a remediated native ecosystem.
- Accommodate public access to the study area for passive recreational enjoyment of the environment.

With restoration improvements, stilt use is projected to increase from four birds and no nests to 60 birds and 20 nests; moorhens should increase from 2 birds and 1 nest to 40 birds and 20 nests; and coots should increase from no birds to 12 birds and 6 nests. Koloa and migratory shorebirds and waterfowl should increase from no birds to a multi-species complex utilizing the wetland on a seasonal basis.

Numerous (approximately 1,000) native sedges and other native species will be planted in the 60-acre wetland portion of the project area. Upland slopes will be graded to address surface runoff discharging into the marsh, reduce erosion, and increase runoff detention prior to entry into the wetland area. Public access would be accommodated, and DOFAW’s access within the area increased to improve maintenance and management operations.

Native trees (approximately 1,000) will be planted on the upland slopes and riparian areas as part of erosion control efforts and replacing invasive vegetation. The project area would be fenced (about 8,500 linear feet) for predator control and other control efforts implemented to bring the number of rats, mongooses and feral cats down to remnant levels. In the future, coordination with Le Jardin Academy, other schools, and educational and cultural organizations would assist with programs and other research activities conducted at Kawainui Marsh.

2.2 PROJECT DESCRIPTION

Improvements described are based upon a *Wetland Restoration and Habitat Enhancement Plan; Kawainui Marsh* prepared for this restoration project (HHF, March 2011).

2.2.1 Restoration Plan Guiding Principals

A planning framework was established for the 80-acre project to ensure DOFAW's requirements for the funding grant were addressed, and were consistent with the agency's mission and objectives for the larger Kawainui Marsh area. Guiding principles were developed based on best use practices for the site, the specific elements of the grant application, existing references and studies published for Kawainui Marsh, consultations with government agencies and the community, and evaluation of existing site conditions.

A number of guiding principles were developed to guide preparation of the restoration plan for the project area. These principles were established based upon the planning references and documents, community and agency consultations, and evaluation of existing site conditions. These principles are listed below.

1. Removal of invasive vegetation within the wetland will be implemented in phases due to the size of the area and available DOFAW staffing.
2. Adaptive management concepts should be incorporated into the plan to provide DOFAW with options and flexibility to modify restoration activities.
3. Resource management information should be incorporated to support DOFAW efforts to maintain the study area after restoration activities are completed.
4. An extensive row of vegetation (hau trees) along Kapa‘a Quarry Road should be retained and enhanced with native vegetation to retain the visual buffer from the marsh. The northern section of upland area improved by DOFAW provides a canopy of trees that should be enhanced with selective tree removal and planting of native vegetation.
5. A variety of native plants should be identified as part of restoration plan for DOFAW's consideration and implementation of re-vegetation efforts.
6. A gully at the southern end of the study area that receives storm water runoff from the roadway should be improved to allow for detention of water flow and to reduce sediment and other materials from entering the wetland.
7. Re-evaluation of the drainage conditions along Kapa‘a Quarry Road should be conducted to identify improvements needed to improve storm water runoff discharging into the marsh since existing drainage culverts are structurally deteriorated.
8. Accessible paths for DOFAW maintenance vehicles should be provided along the upland area.

9. Provisions should be incorporated into the plan to minimize potential impacts on historic sites.
10. Passive outdoor recreational components that increase public access (e.g., parking area, viewing locations, signage, and pedestrian trails) should be incorporated to satisfy LWCF requirements.
11. Restoration improvements should minimize precluding future implementation of recommendations from other studies or plans.

2.2.2 Kawainui Marsh Conceptual Restoration Plan Overview

Restoration improvements will involve gradual removal of invasive vegetation covering most of the wetland in the project area and restoring it with native vegetation. This will allow Kahanaiki Stream to naturalize, open up surface water flows, and establish seasonal mud flats. A combination of mechanical methods and localized application of herbicide will be implemented to address removal of existing vegetation. Staging areas will be established as appropriate for temporary storage of biomass awaiting transport to a processing site.

The conceptual restoration plan illustrated in Figure 2.1 provides an overview of major project improvements. This involves restoration of approximately 60 acres of natural wetland and 20 acres of upland riparian forest. The wetland boundary designated by the U.S. Corps of Engineers (dated July 17, 2008) is also identified, and this distinguishes the jurisdictional wetland area from the upland area.

Restoring the wetland and naturalizing Kahanaiki Stream will enhance the natural habitat for endangered waterbirds, various species of migratory shorebirds, and waterfowl. Protective fencing will be installed around the project area and some adjacent lands to minimize intrusion by predators. The upland area near the intersection of Kapaʻa Quarry Road with Kalanianaʻole Highway will be cleared of most vegetation to allow for re-shaping the area (the site consists of landfill spoils from previous construction in the area), landscaping with native vegetation, public access, and parking. Actions proposed for other upland areas include selective replacement of non-native and invasive trees and vegetation with native vegetation.

Continuation of DOFAW maintenance operations will be supported by retaining direct access from Kapaʻa Quarry Road to the restored wetland area and adjacent uplands for maintenance vehicles (pickup trucks or smaller) and equipment. Public access to the site is proposed for passive outdoor recreational use and cultural and educational opportunities. Related improvements include a parking area, pedestrian trails, viewing sites, and interpretive signage.

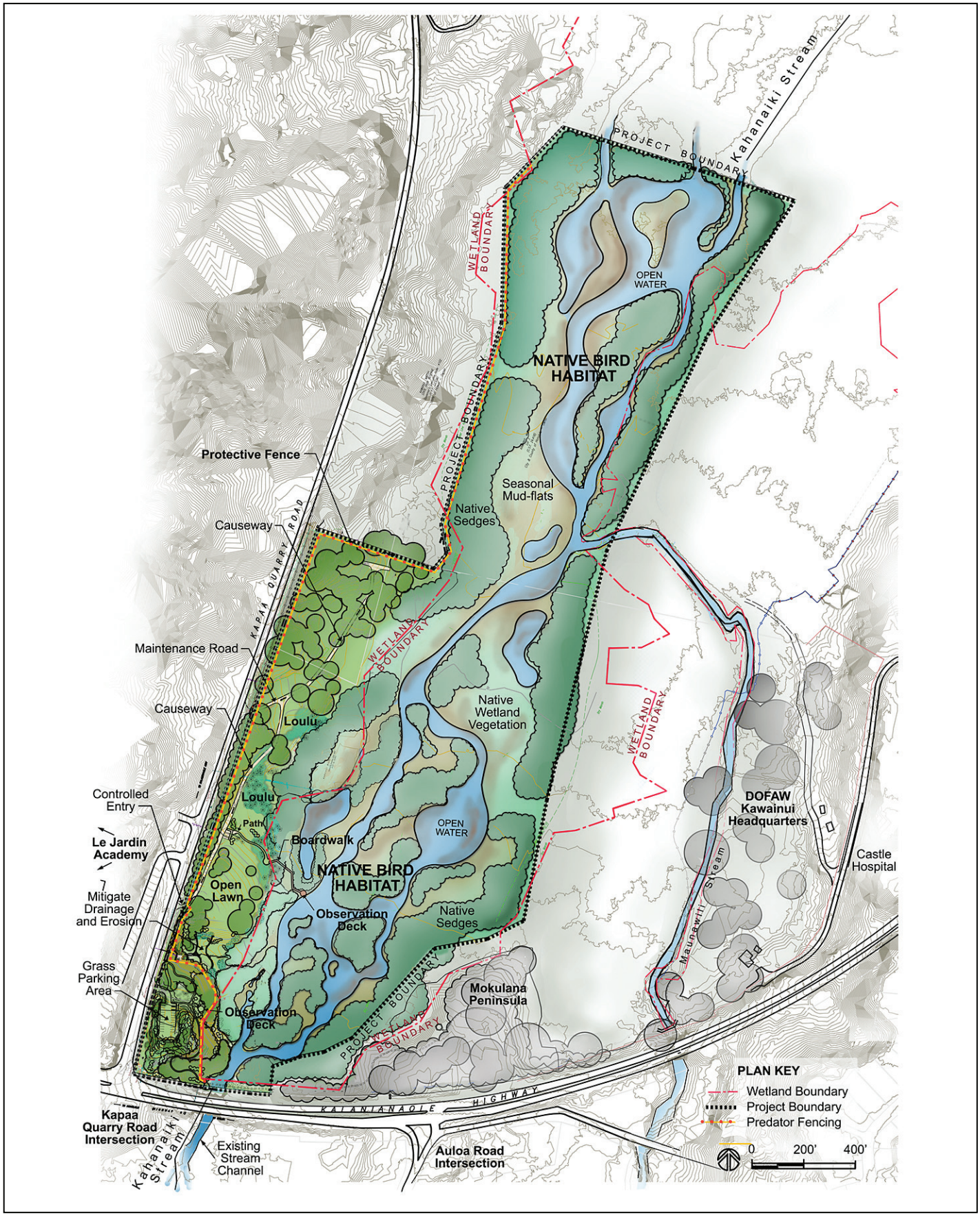


Figure 2.1

Kawainui Marsh Restoration Conceptual Plan

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

2.2.3 Wetland Restoration Program

Wetland restoration actions will involve phases over time based on seasonal conditions (wet and dry seasons) to allow Kahanaiki Stream and associated wetland areas to naturally re-establish within the project area. Figure 2.2 graphically illustrates the major components associated with specific actions that accomplish this objective. Restoration actions will also incorporate an adaptive management process to allow DOFAW flexibility to adapt and modify activities depending upon the progress of restoration efforts in alignment with resource issues (e.g., funding, available staff, etc.). The adaptive management process includes assessing the situation, implementing improvements, monitoring and evaluating results, and adjusting methods.

Existing invasive vegetation (e.g., California Grass, Cattail, etc.) will be removed along with dead vegetation that has formed a thatch layer. Below this vegetation is a contemporary soil layer of about 12 to 20 inches deep resulting from sediment transported by storm water runoff into the marsh over many years based on test excavations conducted as part of the COE's ponds project and recent archaeological subsurface testing performed under this project. A tractor, mower, or floating excavator will be used to cut or grub the vegetation and thatch layer up to a few inches below the soil level.

A tiller will be used to break up the soil to roughly 4-inches in depth to expose the invasive vegetation seed bank and to aerate the soil. These activities would be conducted predominantly during the dry season to allow efficient movement of equipment within the marsh. Areas would be worked in sections of about three to four acres in size or larger dependent upon site conditions and progress of work. These methods should minimize potential impacts on subsurface archaeological sites, such as an *'auwai,* since they should occur below the contemporary silt layer.

Invasive vegetation re-appearing in cleared areas will be mowed or sprayed with an herbicide approved for wetland use and compliant with State regulations. This process may be repeated over several months dependent upon the successful removal of invasive vegetation. Unimpeded surface water flowing into the area from Kahanaiki Stream would be allowed to re-establish its natural course through the area based on random changes in ground conditions. During the wet season, increased water flow through the area should establish seasonal mud flats along the stream's natural watercourse as it meanders through the project area. The stream's water depth would continue to vary typically from about four inches up to one foot in depth. Water habitat (shallow water and mud flats) along the stream would typically have a water depth of one to six inches. Exhibit 2.1 provides a representative photo of potential desired condition. Figure 2.3 shows a typical sectional view of the setting for the restored stream, wetland, and seasonal mud flats.

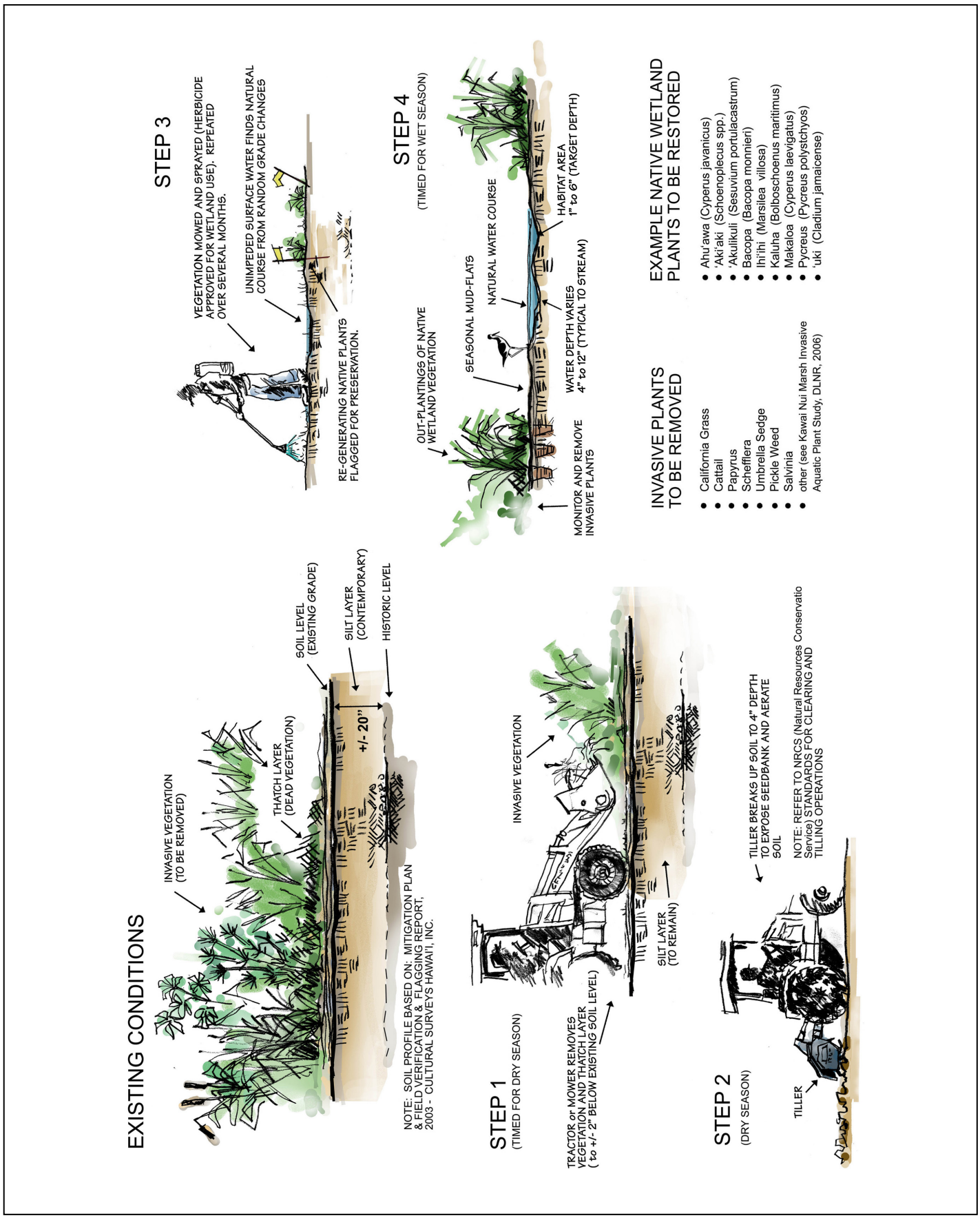


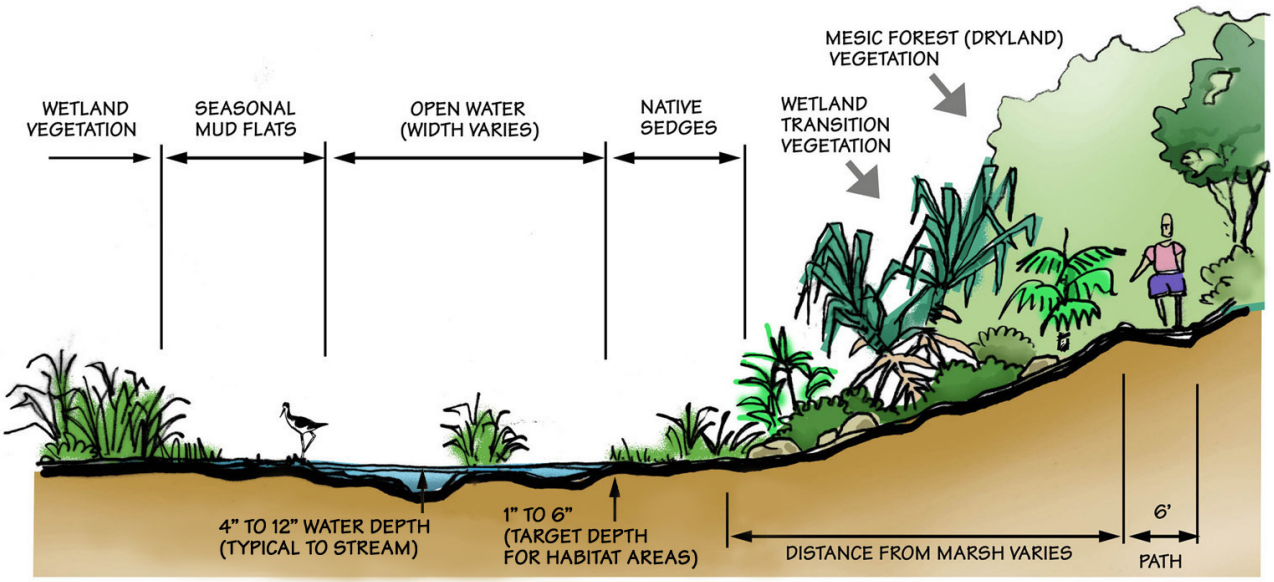
Figure 2.2
Wetland Restoration Process

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Boardwalk into Wetland

Variety of native wetland plants, open water, and mud-flats provides bird habitat.



WETLAND RESTORATION - SECTION

Figure 2.3
Wetland Restoration Typical Section View

Exhibit 2.1 Photo Showing Example of Wetland Being Restored and Waterbird Habitat

Native plants will be re-established in the wetland along with transitional sections to upland areas. Restored areas would be monitored to support re-establishment and minimize reoccurrence of invasive plants.

Vegetation mowed or grubbed will be left within the project area to decompose or temporarily stored in established staging areas within 20-acres of upland area available. Necessary best management practices would also be implemented for these staging areas. The locations of specific areas would be determined by DOFAW in consultation with the contractor implementing these improvements.

Adaptive management of this process may involve refining these plans based upon the progress of vegetation removal, material quantities, decomposition time, etc. Top soil removed during clearing and grubbing operations would be dispersed on-site in upland areas outside of the wetland. This will aid retention of storm water, and may be mixed with vegetation to enhance decomposition. As a result, the amount of biomass needing to be removed from the site should be minimized.

If required, vegetation will be transported to an existing vegetation processing site adjacent (south) to the City's Model Airplane Park on Kapa‘a Quarry Road. It will then be transported to the appropriate City refuse disposal site. This vegetation processing site of over 20 acres was previously established and used by the City in 1992 for this same type of activity as part of their efforts in completing an open waterway project for the marsh to increase flood storage capacity. This site consisted of areas for the processing of vegetation and sediment along with drying beds. Accessory facilities planned consisted of roadways around this processing area, a maintenance facility, and barge launch and off-loading area (M&E Pacific, Inc., June 1990). This vegetation processing site was also designated for similar use in the 1994 master plan developed for Kawainui Marsh.

2.2.4 Upland Reforestation Program and Improvements

Restoration actions in the upland area along Kapa‘a Quarry Road will re-establish the area as a native upland forest. DOFAW has begun clearing some trees and vegetation, resulting in limited open grassed areas. Proposed improvements will focus on enhancing the natural characteristics of each area, and continue efforts to reduce and remove invasive vegetation and selectively remove trees. A hybrid ecosystem model for forest restoration illustrated in Figure 2.4 will be implemented to allow native and existing non-native species to mix in a transitional period.

This hybrid ecosystem model benefits native biodiversity and aids the process of re-establishing a robust native forest. Since existing Hawaii forests have been heavily compromised by non-native invasive species, a restoration process using a direct approach of clearing non-native plants and replacing them with native species is not cost effective or even practical. By allowing some selective non-native plants to remain, particularly those with high canopies, other aggressive invasive species can be contained while understory plantings of native species can grow and mature. Once an appropriate density of native vegetation has been restored, remaining non-native species (high canopies) can be removed without allowing invasive species to return.

Existing non-native tree canopies can provide wind protection and reduce desiccation, and can slow water run-off that reduces erosion and increases water infiltration. Leaf litter from mature tree canopies provide useful organic mulch helping suppress weed growth and greatly benefits establishment of critical mycorrhizal fungi that many native plants require for growth. This also supports erosion control, reduces dislocation of existing forest birds, and reduces the potential of wildfires by reducing the density of grasses. Once native trees have reached maturity, non-native trees can be removed and additional native shrubs and groundcovers planted.

This upland area of the project site is divided into Area A and Area B; each having different natural conditions and types of vegetation. Improvements within each area are discussed.

2.2.4.1 Upland Area A Improvements

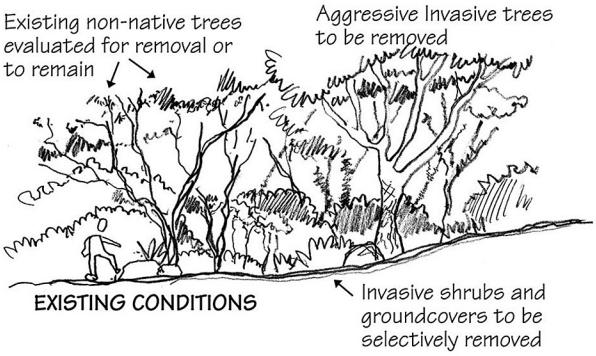
Area A is comprised of the upland area in the southwest corner of the project area from the intersection of Kapa‘a Quarry Road with Kalaniana‘ole Highway extending about 650 feet north. This area has dryland characteristics heavily covered with invasive vegetation and trees that will be replaced with native vegetation under the hybrid ecosystem model. A large gully is also part of this area as shown in Exhibit 2.2.

Figure 2.5 illustrates detailed restoration improvements planned for Area A. Improvements include a parking area, maintenance pathway, observation areas, and pedestrian trail. Invasive vegetation and trees will be cleared starting in the area where a parking lot is planned. Figure 2.6 provides a sectional view of reforestation concepts supporting a low mesic forest along with sample images.

Native Forest Restoration w/ Hybrid Ecosystem Model

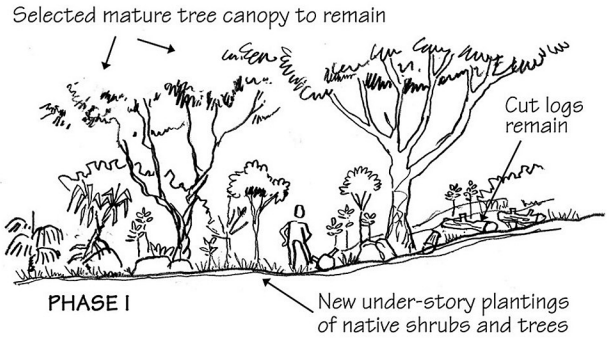
EXISTING NON-NATIVE FOREST

- Dominated by invasive species
- Complete removal of existing invasive plants is not practical



HYBRID ECOSYSTEM

- New native plantings co-exist with non-native over-story canopy
- Aggresive non-native plants are removed only around newly planted natives to allow good growth
- Existing non-native tree canopy helps to protect newly planted native under-story trees
- Non-aggressive weeds allowed to remain.
- Cut logs from removed trees are left in places to help cool soil, retain moisture, reduce erosion, and help encourage beneficial soil microbes and fungi.



NATIVE FOREST RESTORED

- Once maturity of native plants has been realized, remaining non-native plants are removed.
- Landscape is maintained to remove aggressive invasive plants as seedlings.

Invasive Plants to be Removed from Hybrid Ecosystem:

Java Plum
Albizia
Invasive vines
Strawberry Guava
Koa Haole
Brassaia
African Tulip Tree
Non-native Palms
All Non-native Seedling Trees

Mature Non-native Plants to Remain in Hybrid Ecosystem:

Monkeypod Tree
Banyan (selective removal)
Gun Powder Tree (selective removal)
Kukui
Hau (selective removal)
Opiuma
Mango
Kiawe (short thorn variety)

Figure 2.4
Native Forest Restoration with Hybrid Ecosystem Model

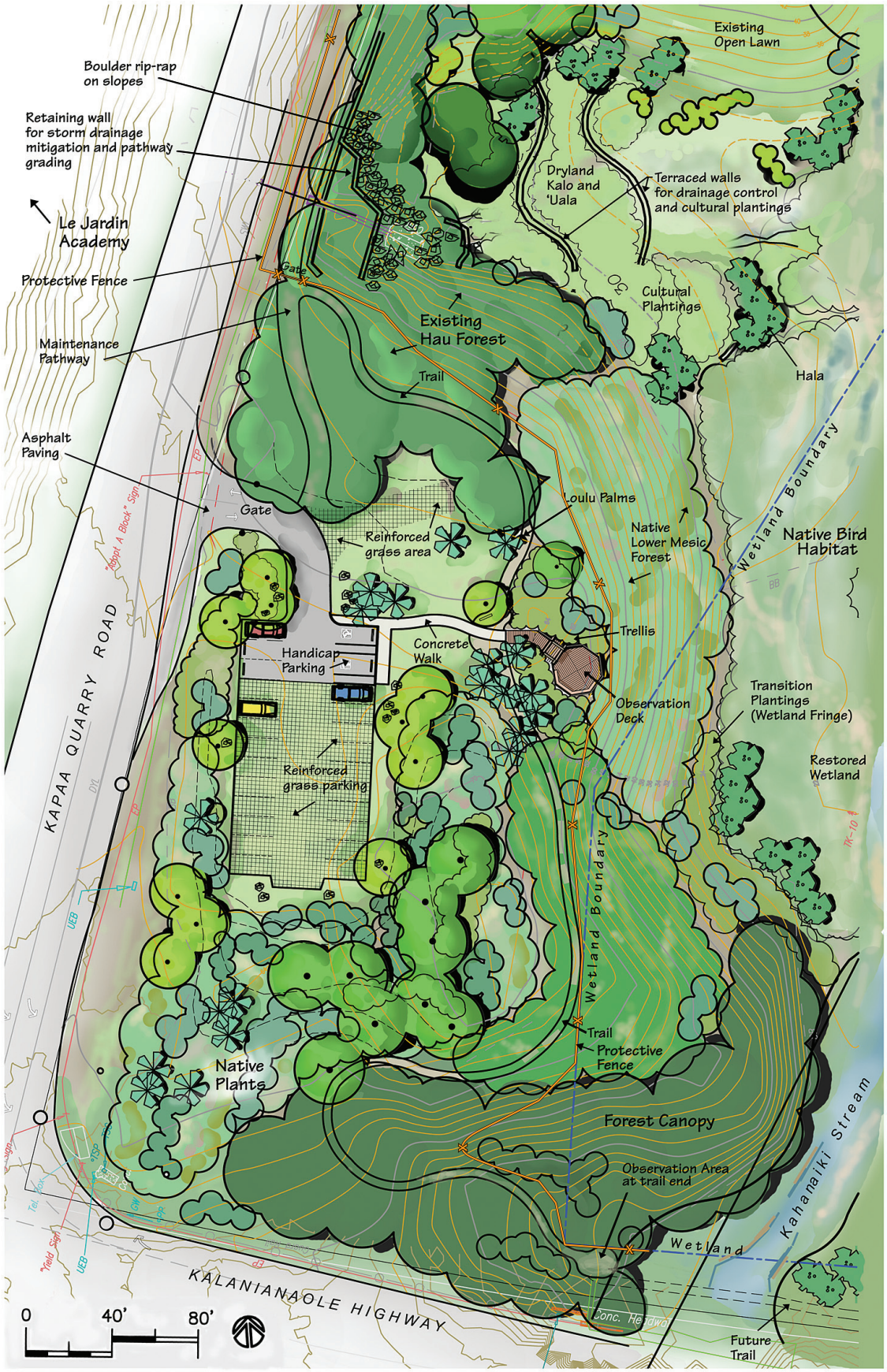


Figure 2.5

Conceptual Landscape Plan - Southwest Corner (Area A)

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Dryland Forest contains wide diversity of species

Sparse groundcovers during dry season. Heavy application of mulch for organic humis layer and soil erosion control.

Within diversity of plantings are strong massings of similar plants to create themes and to reinforce plant associations.

Transition plants between dryland forest and wetland areas could include Hala, Loulu Palm, and cultural plantings.

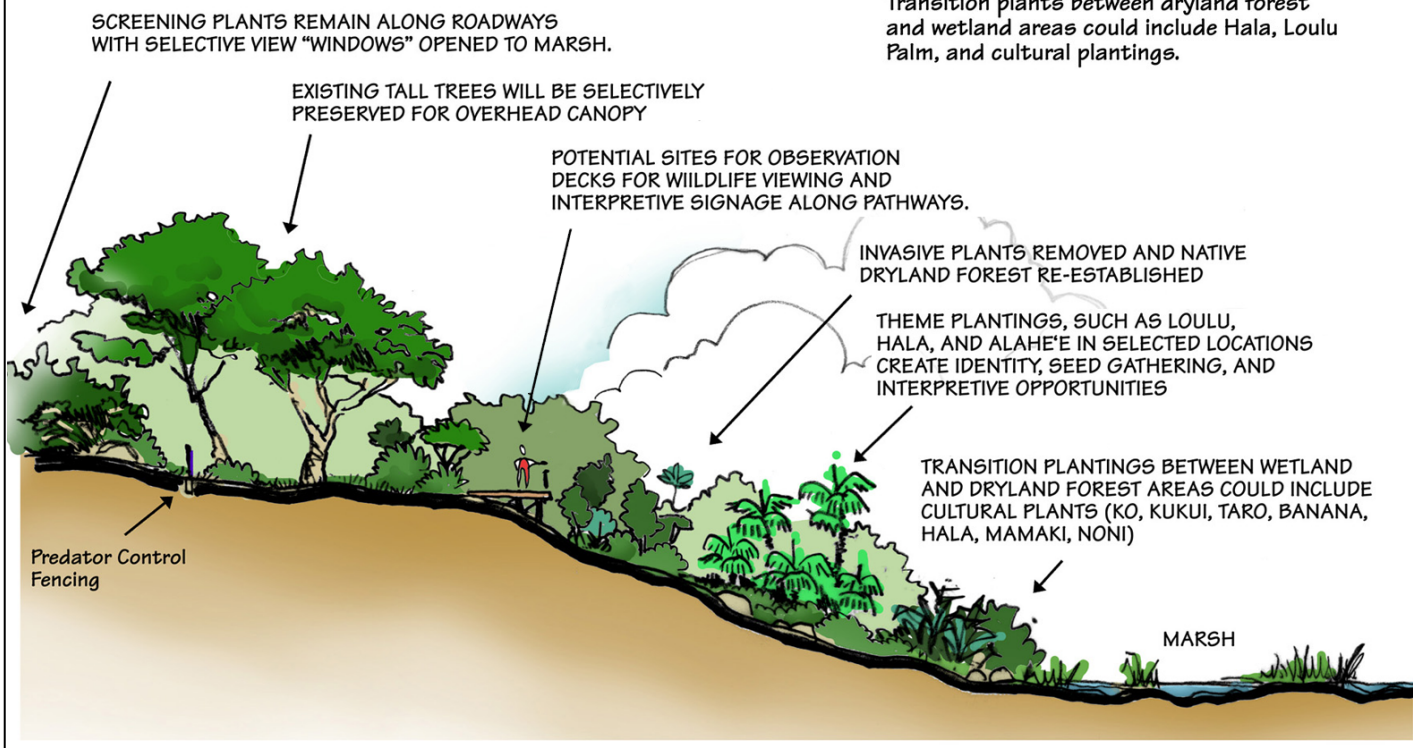


Figure 2.6

Sectional View of Reforestation Concepts - Low Mesic Forest

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Photo of Gully in Area A | Photo of Existing Site Conditions

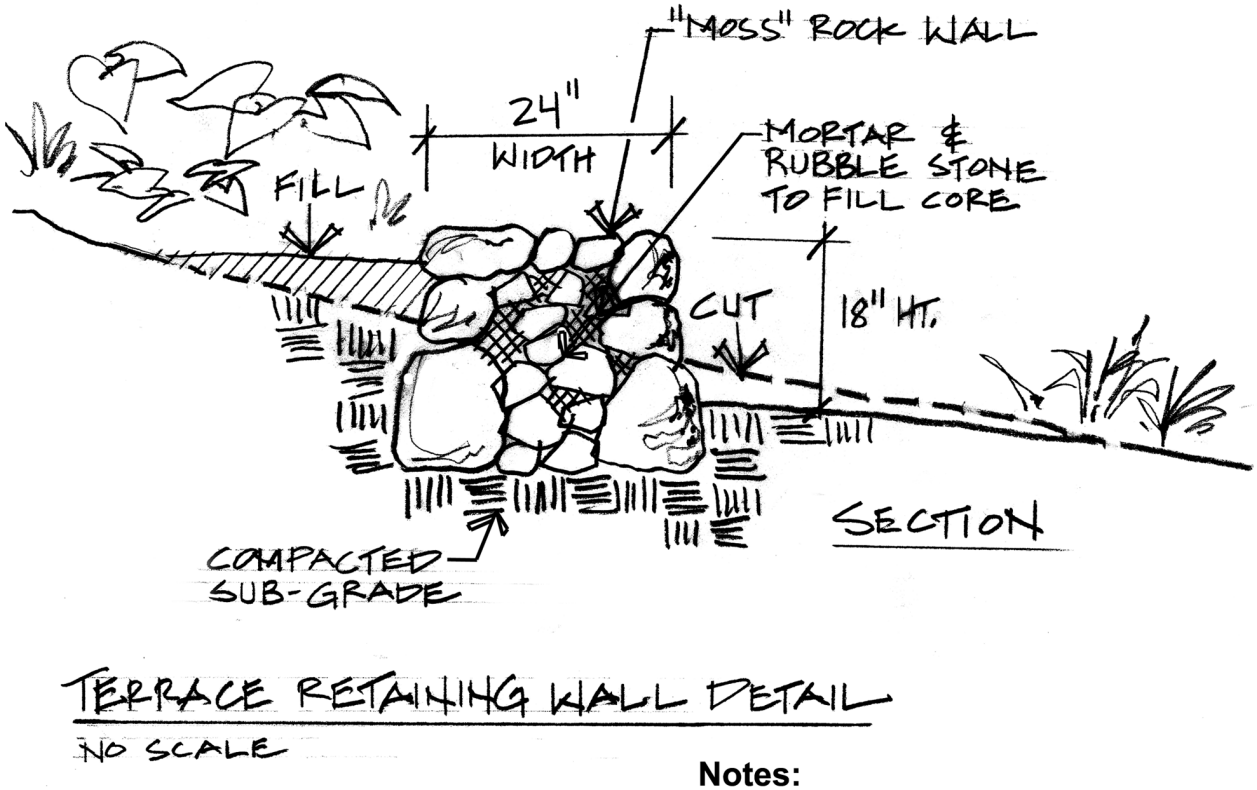
Exhibit 2.2 –Existing Conditions in Area A

Trees and vegetation along Kapaʻa Quarry Road will be selectively removed to retain a visual screen between the roadway and the marsh. Existing trees within the upland forest will also be selectively removed to continue the overhead canopy in this area, and other restoration efforts will be implemented using the hybrid ecosystem model. Various types of native vegetation will be used for the area similar to those being planted at Nā Pōhaku o Hauwahine north of the project area. Transitional plantings using cultural plants along with theme plantings will be incorporated between the wetland and low mesic forest areas. The forest canopy present along the highway will be retained during the initial phases of the restoration work. Future phases will involve replacement of this forest area with native vegetation under the hybrid ecosystem model.

An existing drainage culvert (identified as Culvert 1) along Kapaʻa Quarry Road that receives storm water runoff from Le Jardin Academy is in disrepair and discharges into a gully at the northern end of Area A. This culvert will be improved by replacing the existing junction box with a concrete drop manhole structure, installing a new 36-inch reinforced concrete pipe (RCP), and providing grouted rip rap protection downstream of this pipe. The gully downstream of the culvert will also be modified to mitigate storm water runoff by constructing terraced walls to detain water before being discharged into the marsh. Open areas created between these walls could be used for cultural plantings such as dryland *Kalo* and *ʻUala*. Figure 2.7 provides a conceptual section view of these terraced walls.

The southern corner area near the Kapaʻa Quarry Road intersection with the highway will be graded to create a level area for vehicle parking. A parking lot is planned to provide 25 parking stalls including 2 handicap stalls. The parking lot would be gated and closed at night. Vehicular access to the parking area will be from Kapaʻa Quarry Road, about 320 feet away from the intersection with Kalanianaʻole Highway. A right-turn storage lane is planned to transition cars turning into the driveway from Kapaʻa Quarry Road and minimize traffic delays.

"Moss Rock" Terrace Wall



Notes:

1. Low retaining wall slows storm water run-off, creating terraced settling basins.
2. Terraces act as areas for cultural plantings for dryland Kalo, sweet potato, Hawaiian sugar cane, or banana.
3. Wall should have the appearance of traditional "dry stack" technique.

Figure 2.7
Terraced Walls Sectional View

A separate reinforced grassed area extending from the driveway will be provided for DOFAW maintenance vehicles, trucks, a bus, or other large vehicles to park. The driveway and a portion of the parking lot will be paved with asphalt. The remaining parking area will be reinforced grass or gravel. This design would minimize the amount of new impervious areas and reduce storm water discharge.

A proposed concrete pathway from the parking lot will extend to the edge of a bluff overlooking the marsh where an observation deck is planned. A pedestrian trail made of crushed basalt rock will be routed within the area supporting the concept of a system of pathways that circle the marsh. These pathways would be designed to meet ADA requirements, as appropriate. The southern end of this area is planned to have another observation area overlooking Kahanaiki Stream. Directional and informational signage, information kiosks, and interpretive signage would be installed at selected locations. Figure 2.8 provides concepts and example images of an observation deck, typical pathways, and informational signage.

A DOFAW maintenance pathway about 10-feet-wide made of crushed basalt rock will extend from the parking lot northbound along Kapaʻa Quarry Road. The pathway is intended for DOFAW maintenance vehicle use only. Access will be restricted (chained) at the parking lot, but could be used for public pedestrian use.

2.2.4.2 Upland Area B Improvements

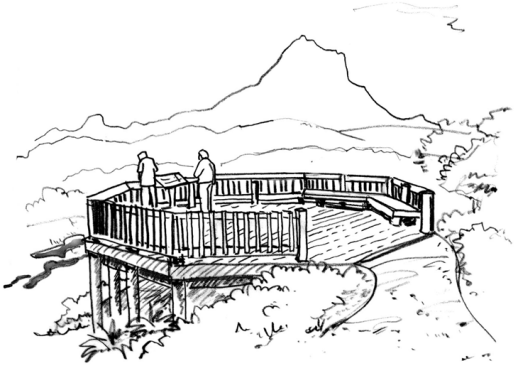
Area B includes the remaining upland area extending north from Area A. This section includes an open lawn area and canopy forest area. Since the area has already been improved by DOFAW, most of the future restoration actions focus on continued removal of invasive plants, implementing the hybrid ecosystem model, and enhancing conditions. Figure 2.9 shows a conceptual landscape plan for a portion of this area covering the open lawn area.

A hau forest along Kapaʻa Quarry Road will be retained to provide a visual screen from the roadway. The open lawn and large canopy trees will be retained, and certain trees selectively removed to open views of the marsh. Plants such as *Hala* and *Loulu* palms would be used as transitional vegetation separating the wetland from the low mesic forest area.

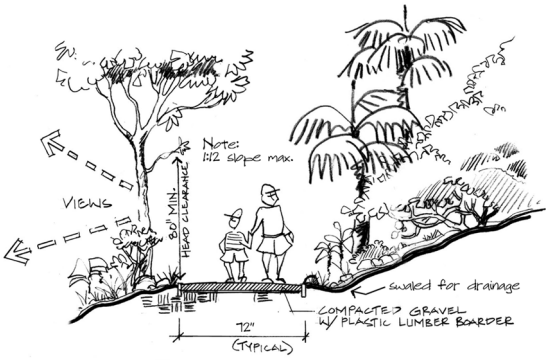
An existing driveway connection with Kapaʻa Quarry Road will be improved with a controlled entry. This will connect to the access road (dirt road) running parallel to Kapaʻa Quarry Road to provide DOFAW with more efficient access within the area. The existing hau forest covers most of the dirt road. Therefore, minor grading would be required to re-establish the alignment of the road while maintaining the existing forest. The access road (maintenance pathway) connects to the parking lot and extends north to the canopy forest area.

INFORMATIONAL KIOSK

INTERPRETIVE SIGNAGE



OBSERVATION DECK



TYPICAL PATHWAYS

DIRECTIONAL & INFORMATIONAL SIGNAGE

Figure 2.8

Kiosk, Signage, Observation Deck and Pathways Concepts

KAWAINUI MARSH WETLAND RESTORATION AND HABITAT ENHANCEMENT PROJECT
ENVIRONMENTAL ASSESSMENT
KAILUA, O'AHU

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

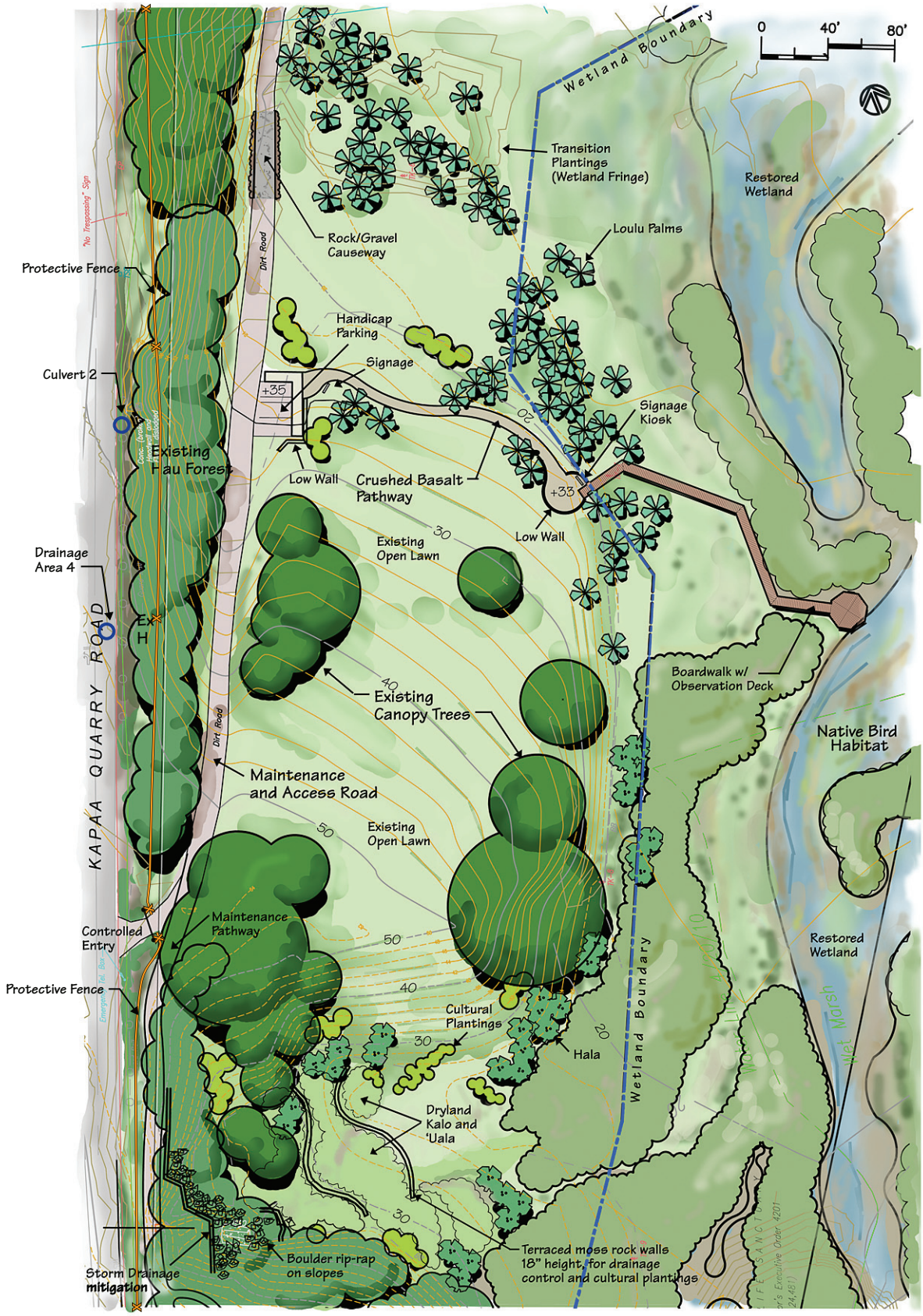


Figure 2.9

Upland Area B - Conceptual Landscape Plan

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

An existing culvert (identified as Culvert 2) and another drainage discharge point are located in this area. Culvert 2 is in poor condition and will be reconstructed and connected to a new 18-inch reinforced concrete pipe and concrete headwall. A grouted rip rap apron will be provided from the pipe and connect to the grassed drainage swale along the access road.

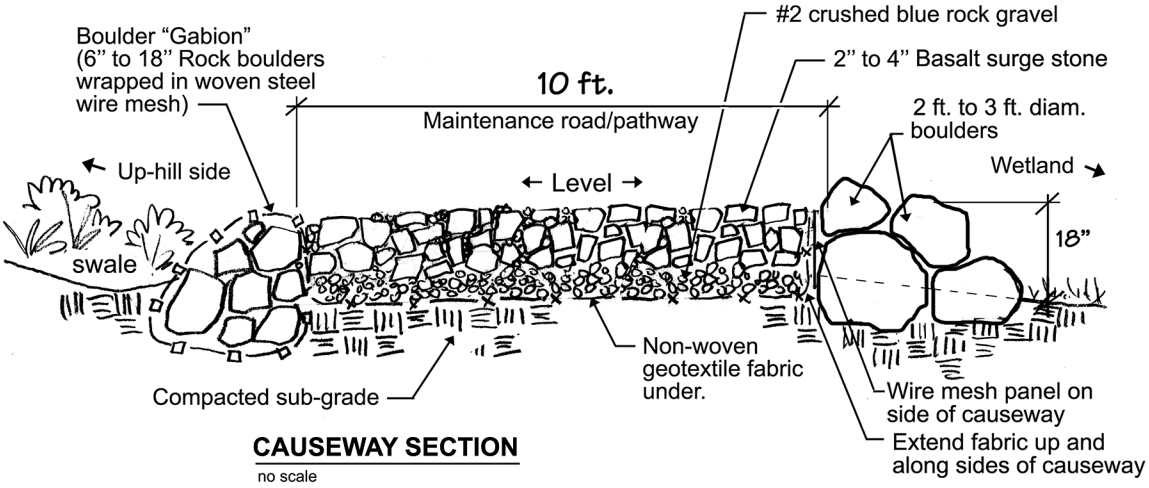
To mitigate runoff, a grassed drainage swale will be provided along the *mauka* (west) side of the access road to direct runoff into lower areas used as detention areas. A gravel causeway about 60 feet long is planned along the low point section of the access road. The causeway provides a stable surface allowing vehicle passage during wet conditions. It is normally dry, but allows storm water to sheet flow over it during larger storm events. This measure slows and widely disperses runoff, reduces its velocity, and increases retention and infiltration before entering the wetland. Runoff overflowing the causeway would settle in the open grassed lawn area. Figure 2.10 shows a sectional view of a typical causeway and proposed locations.

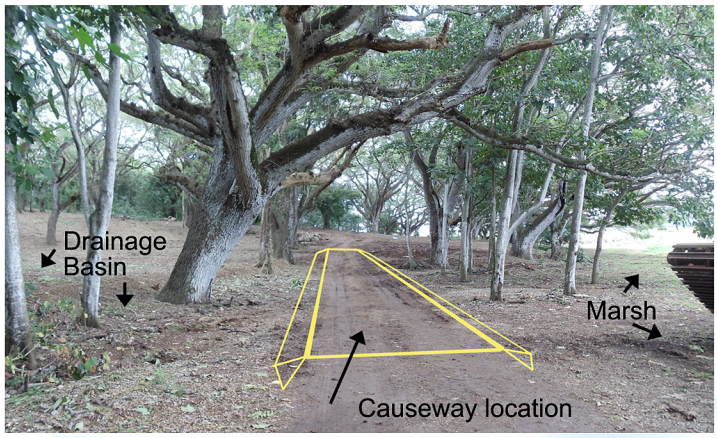
A small parking area for three vehicles will be provided along the dirt road within the open lawn area as previously shown on the Area B landscape plan (Figure 2.9). A pathway comprised of crushed basalt is proposed to extend from this parking area to the edge of the wetland where another observation area along with signage kiosks can be established. In the future, a boardwalk can be extended from the area into the wetland to an observation deck.

For the northern most section of Area B, the existing dirt road that extends to an area characterized as canopy forest will be retained for continued use by DOFAW. An existing gated driveway along Kapa‘a Quarry Road that connects to the dirt road will be retained. Improvements in this area will consist of implementing the hybrid ecosystem model for native forest reforestation. Additional trees may be selectively removed to open views or increase sunlight in the area. DOFAW will determine which trees may be removed or trimmed as restoration work progresses. Invasive plants will be replaced with native vegetation. Transition plantings can be added along the fringe of the wetland. There are existing large piles of debris and old asphalt present in the area that will be removed. Figure 2.11 shows a conceptual landscape plan for this section.

A third existing culvert (identified as Culvert 3) located north of the existing gated driveway will be improved. A grouted riprap apron, erosion mat, and grass will be installed on the downstream end of this culvert. Discharges from the culvert should follow an existing grass ditch toward an open area along the dirt access road used for detention and infiltration. A causeway will be created along a section of the access road.

Gravel/Boulder Causeway





Notes:

1. Provides a stable surface, allowing vehicle passage during wet conditions.
2. Slows and widely disperses storm water run-off, reducing velocity and increasing retention and settling prior to entry into wetland
3. Causeway is normally dry, but allows storm water to sheet flow over roadway during storm events.

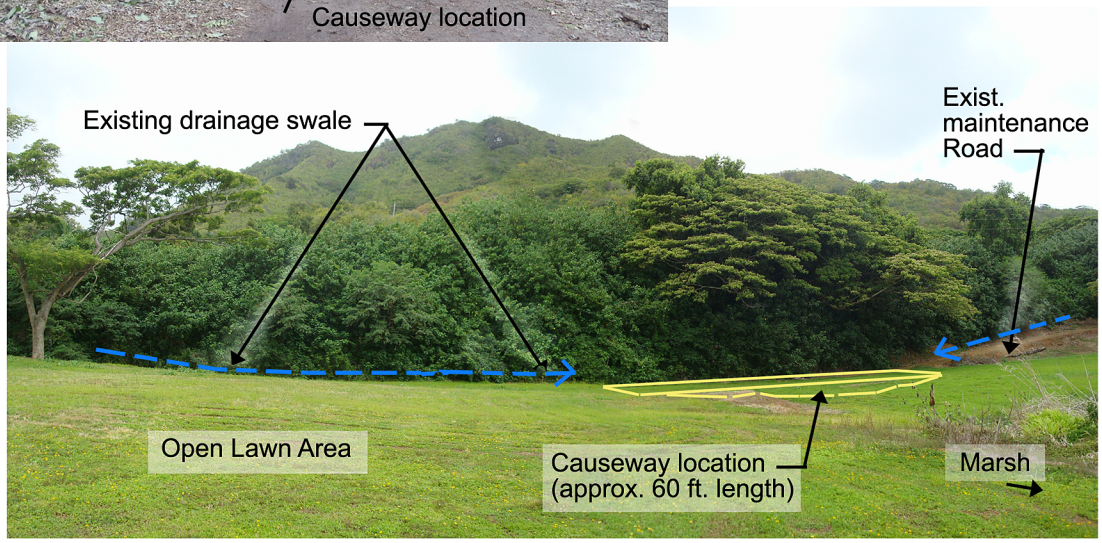


Figure 2.10
Gravel/Boulder Causeway Locations and Typical Section

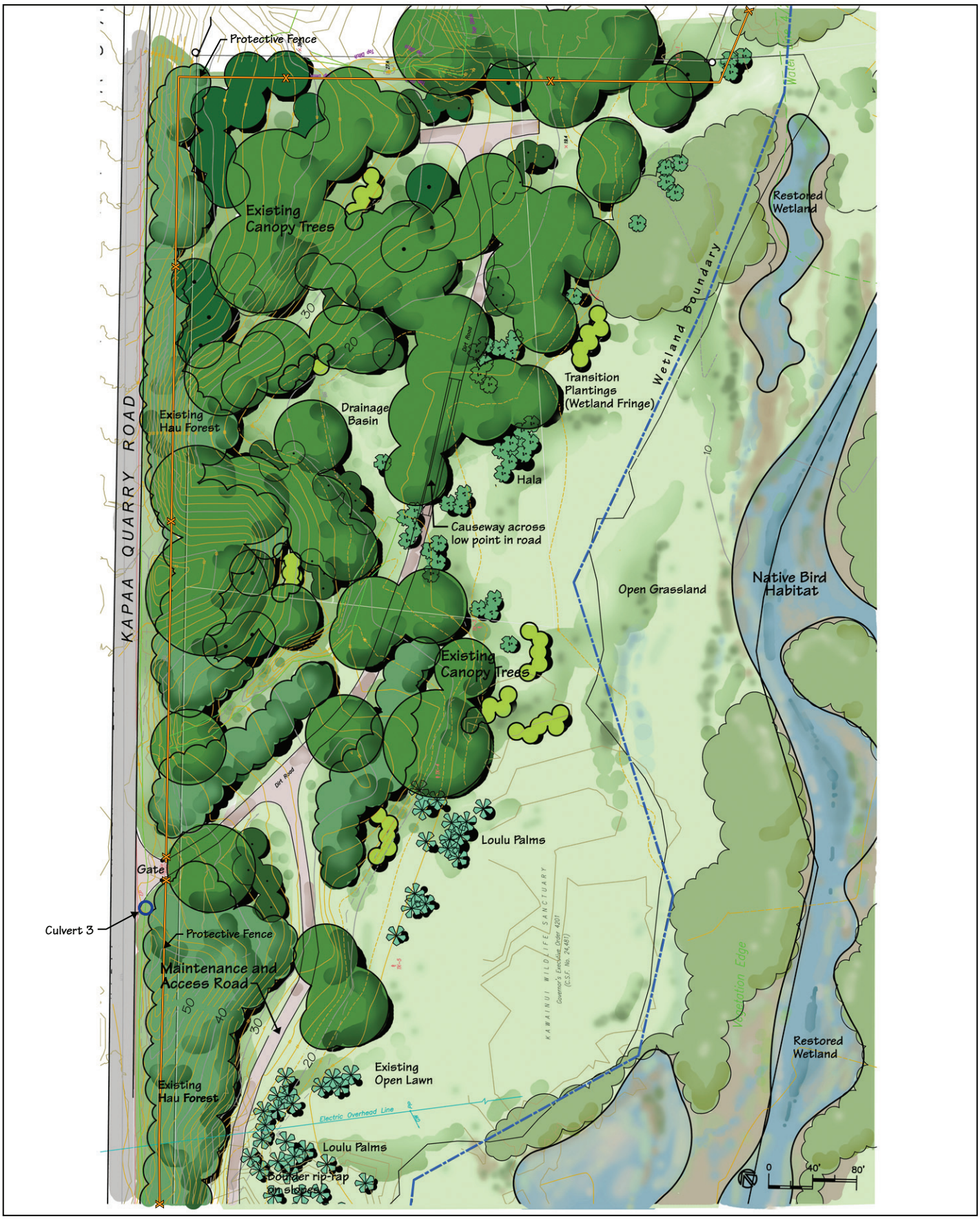


Figure 2.11

Canopy Forest Area B Conceptual Landscape Plan

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

2.2.5 Improvements Supporting DOFAW Maintenance

Improvements supporting DOFAW maintenance activities include providing a maintenance pathway for vehicles and equipment transport along the upland project area as previously shown on the conceptual landscape plans. This will support DOFAW's ability to conduct efficient maintenance operations within the project area. Given the organization's limited personnel, plus the extent of continued maintenance that will be required once the area is restored, the capability to perform regular maintenance in an efficient manner is critical to keep the area cleared of invasive plants. The maintenance path will predominantly consist of reinforced grass, gravel, or dirt.

A type of porous material such as Grasspave[2] or Gravelpave[2] can be installed at appropriate locations along this upland maintenance path to minimize impacts from DOFAW vehicles. The material could be installed along the maintenance path and then filled with gravel, dirt, or sand. The material allows for the growth of grass through it along with water percolation. It also provides a reinforced surface able to withstand structural loads to support maintenance vehicles such as a flat bed truck.

2.2.5.1 Predator Control Program and Perimeter Fencing

A predator control program initiated by DOFAW will continue after restoration improvements in the project area. This program's importance will increase due to waterbird habitat improvements that promote nesting activity and use. At this time, DOFAW plans to continue contracting the program to the USDA for implementation. In the future, DOFAW may implement the control program or in cooperation with another government agency or organization.

Traps will continue to be the primary predator control method utilized during the initial stages of restoration work to control mongoose and feral cats. Traps will be established around the perimeter of the upper reaches of the wetland and extend inland within the upland area. In the future, additional predator control methods could be implemented by DOFAW as habitats and waterbird activities increase within the project area. Monitoring by DOFAW should determine the appropriate timing and implementation of additional control methods.

A protective fence will be installed around the project area and marsh as applicable to keep out larger predators such as dogs and feral pigs. The Restoration Conceptual Plan (Figure 2.1) shows the general location for the fence planned at this time. However, the actual location of fence will be determined based upon site conditions, effectiveness of predator control, and other factors considered by DOFAW in their evaluation and monitoring of restoration progress and habitat enhancement. The fence route may also connect to a similar fence to be installed around the COE ponds, if practicable. Exhibit 2.3 provides an example of the type of fence that may be used for the project area. However, DOFAW may install alternative types of protective fence if determined more feasible and practicable in meeting their management objectives.

2.2.5.2 Adaptive Management and Monitoring

Exhibit 2.3 –Protective Fence Example

The long-term management of the project area will require adaptive management and monitoring of vegetation growth, water flow into the wetland from Kahanaiki Stream and upland areas, and waterbird nesting and activities. Kawainui Marsh is a natural resource influenced by various environmental conditions that change over time and result in the need for adaptive management by DOFAW. Therefore, DOFAW will retain flexibility in their decisions knowing that uncertainties exist and management actions could change resulting in modifications to the methods implemented for the wetland restoration and upland reforestation efforts. This will improve DOFAW's understanding of the marsh's ecological system and help future decision-making to improve restoration progress and effectiveness.

Under a FWS Biological Opinion issued to the COE for the construction of their ponds mitigation project, a Kawainui Marsh Restoration Area Management Plan must be developed by DOFAW in coordination with the FWS and COE. Therefore, components developed under the management plan will provide a framework applicable to the management and monitoring of both the COE ponds and Kawainui Marsh wetland restoration projects. The management plan includes the following:

1. A predator control program with Best Management Practices (BMPs) to minimize interactions with listed waterbirds and other environmental impacts.
2. A program to survey for and eradicate feral mallards and Hawaiian duck-mallard hybrids.
3. A revision of the *Management Plan for the Control of Avian Botulism at Kawainui Marsh, Oahu, Hawaii August 1997* to include surveillance for botulism outbreaks, response measures such as removal of carcasses, and post-outbreak population monitoring.
4. Waterbird population and breeding productivity monitoring.
5. Adaptive management recommendations to address habitat requirements for Hawaiian waterbirds.
6. Commitment of dedicated State biologists to manage, monitor and implement the Kawainui Marsh Restoration Area Management Plan.

2.2.5.3 Resource Management Principles

Future management and maintenance of restored areas at Kawainui Marsh will require dedicated staff to maintain the natural resources in the area. At least five (5) full-time staff will be required as follows:

1. A wildlife biologist;
2. An equipment operator;
3. Two forestry and wildlife workers; and
4. An outreach coordinator.

This level of staffing only allows DOFAW to maintain about four (4) acres a month of marsh and upland area. The wildlife biologist will manage DOFAW's maintenance and monitoring operations of the marsh and coordinate activities of the equipment operator and wildlife workers. The equipment operator will operate larger machinery such as a tractor, tiller, or floatable excavator. Forestry and wildlife staff will control vegetation by mowing, weed whacking, spraying herbicide, and other daily maintenance activities. These efforts generally involve removal of reoccurring invasive vegetation, re-establishing native vegetation, trimming trees and other vegetation, and monitoring wildlife activities and public access in the project area.

The outreach coordinator coordinates community projects and volunteers wanting to help maintain the marsh. DOFAW receives requests throughout the year from organizations and individuals wanting to volunteer for projects associated with the marsh. However, such projects cannot be accomplished now because of the existing conditions within the marsh and lack of available staff to coordinate volunteer efforts.

DOFAW requires semi-aquatic machines such as a small excavator for restoration activities and an amphibious track vehicle to allow staff easy access within the wetland for regular maintenance. Other items needed include a long-bed truck and equipment (e.g. chainsaws, weed whackers, protective equipment, etc.). Additional costs will be associated with periodic repairs and maintenance of equipment, fuel, tools, herbicides, and predator control activities. DOFAW will continue to contract with the USDA to implement a trapping program at Kawainui Marsh in the foreseeable future.

2.2.6 Project Phasing and Estimated Costs

The preliminary annual operating cost for resource personnel is estimated to be approximately $407,000 (in 2011 dollars). The estimated costs for equipment, restoration activities, and construction of project improvements is about an additional $4.2 million.

Funding from the grant obtained by DOFAW is available to implement basic wetland restoration and upland reforestation improvements. However, additional funding would need to be acquired to complete all restoration improvements along with implementing accessory improvements such

as pedestrian pathways, parking area, observation deck, etc. It is anticipated that DOFAW would pursue funding from Federal, State, and private sources.

Restoration improvements can be implemented once this environmental review process is completed and applicable land use entitlements are obtained. Necessary ministerial permits would similarly be obtained as part of the design and restoration implementation phase. This environmental review and entitlement process is planned to be completed by the Fall of 2012. Therefore, restoration improvements are anticipated to begin in 2012.

Restoration improvements would be implemented in phases over time, and will be subject to availability of additional funding. Primary wetland restoration and upland reforestation improvements will likely be implemented by both DOFAW staff along with contractors hired to implement certain work tasks or phases of improvements. Certain improvements could also involve participation by community organizations or volunteer efforts. Therefore, it is projected that the wetland restoration and upland reforestation improvements will be completed within five (5) years or by the end of 2017.

Implementation of other accessory improvements (e.g. pathways, observation decks, etc.) would be predominantly dependent upon obtaining additional funding and the results of wetland restoration efforts. Construction of these improvements would similarly be phased over time and is projected to be completed within seven (7) years or by the end of 2019.

2.2.7 Listing of Permits and Approvals

A listing of required discretionary land use approvals and ministerial permits for this project is provided.

Federal Permits and Approvals

U.S. Fish and Wildlife Service

- Section 7 Consultation, Endangered Species Act
- Section 106 Consultation, National Historic Preservation Act

National Park Service

- Section 6(f), Land and Water Conservation Fund

State of Hawai‘i Permits

Department of Health

- National Pollutant Discharge Elimination System (NPDES) Permit - Construction Activities
- Construction Noise Permit

State of Hawai'i Permits (continued)

Department of Land and Natural Resources, Historic Preservation Division
- Chapter 6E, HRS, Historic Preservation Review

Department of Land and Natural Resources, State Parks Division
- Section 6(f), Land and Water Conservation Fund

Department of Business, Economic Development and Tourism, Office of Planning
- Coastal Zone Management Act Consistency Determination

City and County of Honolulu

Honolulu City Council (Processed by Department of Planning and Permitting)
- Special Management Area Use Permit (Major)

Board of Water Supply
- Temporary Construction Water Meter

Department of Planning and Permitting
- Grading, Grubbing, Trenching Permits

2.3 ALTERNATIVES CONSIDERED

This section discusses alternatives associated with the Kawainui Marsh wetland restoration and habitat enhancement project that were identified and considered. Alternatives discussed include: 1) not implementing the restoration project, otherwise referred to as the No-Action Alternative, 2) proceeding with the proposed project, and 3) other alternatives considered but which have been eliminated for various reasons. Based upon the alternatives considered, the discussion of probable impacts in the remaining chapters of this document will address those associated with the No-Action Alternative and Proposed Project.

2.3.1 No Action Alternative

The No-Action Alternative would entail DOFAW not proceeding with any major wetland restoration improvements to Kawainui Marsh or implementing upland reforestation improvements. As a result, the present conditions within the project area would predominantly continue into the future with increased invasive vegetation reducing open water and wetland area, and further reducing habitat for endangered Hawaiian waterbirds.

Under this scenario, DOFAW would continue to implement some maintenance improvements to upland areas and the wetland based upon existing staffing. However, such efforts would be limited given existing resources and conditions, and no new funding would be available to hire a contractor to implement restoration improvements. Funding would not be available for new equipment or native vegetation plantings for restoration or reforestation efforts. No improvements would be made to repair existing drainage culverts and conditions within the

marsh. Public access within the marsh would continue to be limited due to no pathways, parking areas, or observation areas being available.

This alternative would therefore represent a future scenario "without the project." This "without the project" scenario provides a baseline of future environmental conditions to assess and evaluate probable impacts or changes resulting from the proposed restoration project. A study year of 2019 was used for this No Action alternative to correspond to the projected completion of restoration and accessory improvements.

2.3.2 Proposed Project

Under this alternative, the restoration improvements and accessory improvements described in Section 2.2 would be implemented as the Proposed Project. Impacts from this action would be identified and evaluated based upon without project conditions under the No Action Alternative.

2.3.3 Alternatives Eliminated From Consideration

Alternatives that were initially considered and eliminated from further consideration are presented in this section. These alternatives were eliminated based on their effectiveness in addressing project needs and meeting project objectives, conflicts with the physical environment, or feasibility and practicability of implementation.

Alternatives to the wetland restoration and habitat enhancement improvements were considered during the initial planning and evaluation of site conditions. Consultations with DOFAW staff were the basis used in developing wetland restoration and reforestation methods along with input received from various government agencies and community meetings. Consequently, eliminated alternatives identified are primarily associated with the type of improvements or methods to be implemented under this restoration plan.

2.3.3.1 Wetland Restoration Via Excavation and Grading

One method of wetland restoration considered was removing existing invasive vegetation primarily by excavating or grading areas using a tractor or other equipment. This method would remove vegetation along with soil layers beneath. Grading activities would also distribute much of the underlying soils. Materials removed would be stockpiled in upland areas for drying and decomposition after which it would be taken to the appropriate City refuse disposal site.

This method was eliminated from consideration because it would result in greater negative environmental effects. This method would have a greater chance of affecting potential subsurface archaeological sites that may be present such as historic *auwais* because it would disrupt deeper soil layers. Although prior subsurface test trenches have indicated a contemporary soil layer of about 20-inches deep, this method may extend well into this layer especially with grading activities.

A large amount of biomass from the invasive vegetation removed by this method would be created, and be temporarily stored within upland areas. Decomposition of this biomass in the many piles created would generate a likely strong and noticeable amount of nuisance odors. Le Jardin Academy is located across Kapa‘a Quarry Road from this project site, and odors generated may be a nuisance to schoolchildren and activities conducted there. The large amount of biomass created would also need to be disposed of and will contribute a fairly large amount of green waste to the City’s refuse disposal site. There would also be additional project costs generated resulting from contractors hired to collect, transport, and dispose of this biomass. Public comments received similarly expressed questions and concerns with the large amount of biomass that would need to be disposed of and associated odors generated.

2.3.3.2 Upland Reforestation Via Mass Clearing and Grading

A method of forest restoration considered was directly removing existing invasive vegetation and non-native trees within the upland areas by mass clearing, excavating, or grading areas using a tractor or other equipment. This method would remove vegetation and clear large areas in sections. Materials removed would similarly be stockpiled in upland areas for temporary storage after which it would be taken to the appropriate City refuse disposal site. After these vegetation removal activities, native vegetation would be planted to replace cleared areas.

This method was eliminated from consideration because it would result in greater negative environmental effects and was not determined to be a practicable or cost-effective approach due to increased costs. DOFAW will need to hire a contractor to implement this method of direct vegetation removal and clearing because they do not have the staff or large equipment necessary to complete this work. The mass clearing and grading would also add significant costs to the project due to the large area being covered and terrain. Additional project costs will also be generated for the contractor to transport and dispose of this material. The large amount of materials generated will also contribute a large amount of additional green waste to the City’s refuse disposal site.

Direct clearing of upland areas will result in negative environmental impacts that can be otherwise minimized by implementing alternative methods. Cleared areas would facilitate desiccation of areas due to increased sunlight exposure, and potentially increase soil erosion of areas from wind exposure and during large storm events. Extensive clearing operations of major vegetation would disturb soils such that the germination and growth of non-native weed seeds would be enhanced. Existing forest birds would also be affected due to the removal of trees and other vegetation that may presently be used for habitat.

Reestablishing native plants and trees in mass cleared and graded areas would be more difficult than under the proposed hybrid reforestation process. Leaf litter from mature tree canopies provide useful organic mulch helping suppress weed growth, and greatly benefits establishment of critical mycorrhizal fungi native plants require for growth. Retaining existing tree canopies as part of the hybrid process can also help to screen wind (reduce erosion) and cool ambient air

temperatures to the benefit of newly planted native material. Light shade from overhead canopies reduces aggressiveness of invasive grasses.

2.3.3.3 DOFAW Maintenance Path Across Wetland and Stream

Alternatives were developed to provide a DOFAW maintenance pathway for vehicles across the wetland and Kahanaiki Stream from their Kawainui Marsh headquarters to the upland area along Kapa‘a Quarry Road. The purpose for this maintenance path was to support DOFAW operations by providing a direct access for the transport of equipment and staff and minimize disruptions to traffic along Kalaniana‘ole Highway.

The maintenance path was intended to cross from the upland project area through the wetland and Kahanaiki Stream at an appropriate “shallow water” location as determined after removal of invasive plants during wetland restoration efforts. After traversing the wetland, the path would follow an existing dirt path within pastureland already being used by DOFAW staff. This alignment travels between the two ponds to be constructed by the COE to connect back with DOFAW’s headquarters. To minimize effects within the wetland and stream crossing, a type of porous material such as Grasspave[2] or Gravelpave[2] was planned for use at an appropriate location to minimize impacts from DOFAW vehicles.

Another alternative route considered was routing this maintenance path across the wetland and stream on the southern end of the project generally along Kalaniana‘ole Highway. The path would cross Kahanaiki Stream at its highway bridge location where the width of the stream is relatively wide (8 to 12 feet) and water levels are deeper (1 to 3 feet). The banks along this area of the stream are steep, and it would require a costly bridge structure. This southern path route would also require crossing Maunawili Stream resulting in similar improvements.

A DOFAW maintenance path across the wetland and Kahanaiki Stream was eliminated from consideration at this time because it was not determined to be practicable or cost-effective due to increased costs and permitting requirements. It was determined to be difficult to find a suitable location to cross the wetland and stream given this changing natural resource environment that will be restored. Permitting requirements for this path would be extensive, time consuming, and costly. Public comments from community meetings also expressed concern providing this path across the wetland and stream. As a result, it is more practicable now for DOFAW to continue transporting staff and equipment along the highway with access from Kapa‘a Quarry Road.

CHAPTER 3
DESCRIPTION OF AFFECTED ENVIRONMENT

Climate

The State of Hawai‘i climate is relatively moderate throughout the island chain, although some differences in these conditions may occur from one location to another due to the mountainous topography associated with each island. Annual and daily variation in temperature depends to a large degree on elevation above sea level, distance inland, and exposure to the trade winds. On O‘ahu, the Ko‘olau and Wai‘anae mountain ranges are oriented almost perpendicular to the trade winds, which account for much of the variation in local climatology. O‘ahu’s temperatures have small seasonal variation such that the temperature range averages only 7 degrees between the warmest months (August and September) and the coolest months (January and February) and about 12 degrees between day and night.

Kawainui Marsh in Kailua is located in the windward lowlands climatic region that is characterized as being moderately rainy with frequent trade wind showers, and temperatures nearly uniform and mild compared to other regions on the island. Historic data from a recording station in Kailua shows annual temperatures range from a low of 63 degrees to a high of 76 degrees Fahrenheit throughout the year. Annual rainfall averages about 119 inches per year making this district wetter than other regions. Historic monthly average rainfall varies from a low of about 6.5 inches of rainfall during the summer (June) to a high of 12.5 inches during fall (November) and spring (March) periods (WRCC 2010).

Winds are predominantly “trade winds” from the east-northeast except for occasional periods when “Kona” storms generate strong winds from the south, or when the trade winds are weak and land breeze to sea breeze circulations develop. Wind speeds typically vary between 5 and 15 miles per hour providing relatively good ventilation much of the time. Lower velocities (less than 10 mph) occur frequently when the usual northeasterly trade winds tend to fall giving way to light, variable wind conditions through the winter and on into early spring.

3.1 BIOGEOGRAPHY, TOPOGRAPHY AND SOILS

The Island Of Oahu is entirely volcanic in terms of geologic origin. Throughout time, the volcanic landscape of Oahu has been subject to the natural forces of erosion, and sedimentation, resulting in such physiographic features as beaches, reefs, coastal plains, saddles, dunes, uplands, cliffs and valleys. The Island of O‘ahu is a volcanic doublet, formed of the Wai‘anae Range on the west and the younger Ko‘olau Range on the east. Both are the eroded remnants of great shield volcanoes that have lost most of their original shield outlines and are now long narrow ridges shaped largely by erosion. The Kawainui Marsh restoration project area is generally situated inland from the coastline within an area geologically composed of limestone (reefs and dunes).

3.1.1 General Biogeography

Kawainui Marsh started as a basin during the Pleistocene ice ages (10,000 BC) created by receding sea levels that promoted valley deepening. Rising sea level then flooded the valley and created an embayment. A coral reef community developed within the embayment, and reef growth that proceeded fastest near the mouth of the bay eventually reached and maintained itself near the water surface as a barrier reef. The lagoon created behind this barrier reef was the basin that would ultimately transform into Kawainui Marsh.

Presently, Kawainui Marsh is an environment in change showing evidence of transition from both the process of terrestrialization along with transition into a bog within certain areas. The middle of the marsh appears to be forming a stable bog habitat, while around the perimeter of the marsh succession towards upland and terrestrial forest habitats is occurring.

Others have described Kawainui Marsh as a wetland that may be in the "process of terrestrialization" which is the sequence of physical changes converting an open body of water such as a pond into a marsh and ultimately into dryland or a terrestrial forest. Wetlands developed from infilling of geologic basins that were initially open water ponds. With the basin's surface hydrology being altered, a vegetation-covered marsh replaced the open water. Sediment accumulating in the basin or emergent vegetation creeping in from the margins created peat and facilitated this marsh's succession into a wetland combined with increasing dryland and upland areas (Oceanit, June 2006).

Another view of such transitions indicated there was very little evidence showing the actual succession of wetlands being completely replaced as uplands or a terrestrial forest. More often, a bog is the ultimate result of such changes. This appears to be the situation presently happening within the middle area of Kawainui Marsh with outlying areas transitioning into upland and forest areas with the expansion of invasive vegetation.

3.1.2 Topography

The topography associated with the restoration project area generally slopes in a north to northeast direction. The upland area has mild and moderate slopes while the wetland area is relatively flat. Elevations vary from a high of about 65 feet above mean sea level (AMSL) to a low of about 5 feet AMSL over this 80-acre project area.

The southwest corner of the project area at the intersection of Kapa‘a Quarry Road with the highway, is the highest point along Kapa‘a Quarry Road at about 65 feet AMSL. This southern upland area slopes eastbound from the roadway toward the wetland and forms a small plateau at about 48 feet AMSL. Upper areas near the road are steeper before it gradually slopes to the wetland area located at approximately 20 feet AMSL. The average slope for this upland area varies from 6 to 10 percent. A large gully is located in this southern area.

The northern section of the upland area similarly slopes in an eastbound direction towards the wetland. The area along the roadway is about 42 feet AMSL and has fairly steep slopes and a drop off which gradually slopes toward the wetland located at about 16 feet AMSL.

The wetland area is generally flat sloping in a north direction from Kalaniana‘ole Highway. Elevations in the southern end of this wetland area start at about 22 feet AMSL and gradually decrease to 6 feet AMSL in the northern end of the project area.

3.1.3 Soils

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service, formerly the Soil Conservation Service (SCS), classifies soils within the project site. The project area is comprised of the Hanalei, Alaeloa, Lolekaa, and Pearl Harbor Series. Figure 3.1 graphically shows the soils classification for this area based upon State Geographic Information System (GIS) data. A description of this soil type based upon the SCS's *Soil Survey of Islands of Kaua‘i, O‘ahu, Maui, Moloka‘i, and Lāna‘i, State of Hawai‘i* (SCS, 1972) study is provided below. As shown on this figure, the Hanalei and Pearl Harbor Series make up the wetland portions.

The Pearl Harbor series consists of very poorly drained soils on nearly level coastal plains. These soils developed in alluvium overlying organic materials.

- Pearl Harbor Clay, (Ph). This soil is on low coastal plains adjacent to the ocean, and it is level or nearly level. The representative profile of this soil had a surface layer that was very dark gray, and mottled clay about 12 inches thick. The subsoil, about 19 inches thick, was very dark gray and very dark grayish-brown mottled clay. The soil was neutral in the surface layer and mildly to moderately alkaline in the subsoil. Permeability was very slow, runoff very slow to ponded, and the erosion hazard no more than slight. Workability was very difficult.

The Hanalei series consists of somewhat poorly drained to poorly drained soils on bottom lands. These soils developed in alluvium derived from basic igneous rock.

- Hanalei Silty Clay, 0 to 2 Percent Slopes, (HnA). This soil is on stream bottoms and floodplains. The representative profile of this soil had a surface layer about 10 inches thick, and was dark-gray and very dark gray silty clay that had dark-brown and reddish mottles. The subsurface layer was very dark gray and dark-dark gray silty clar about three inches thick. The soil was strongly acid to very strongly acid in the surface layer and neutral in the subsoil. Permeability was moderate, runoff very slow, and the erosion hazard no more than slight. Roots penetrate to the water table, and flooding was a hazard.

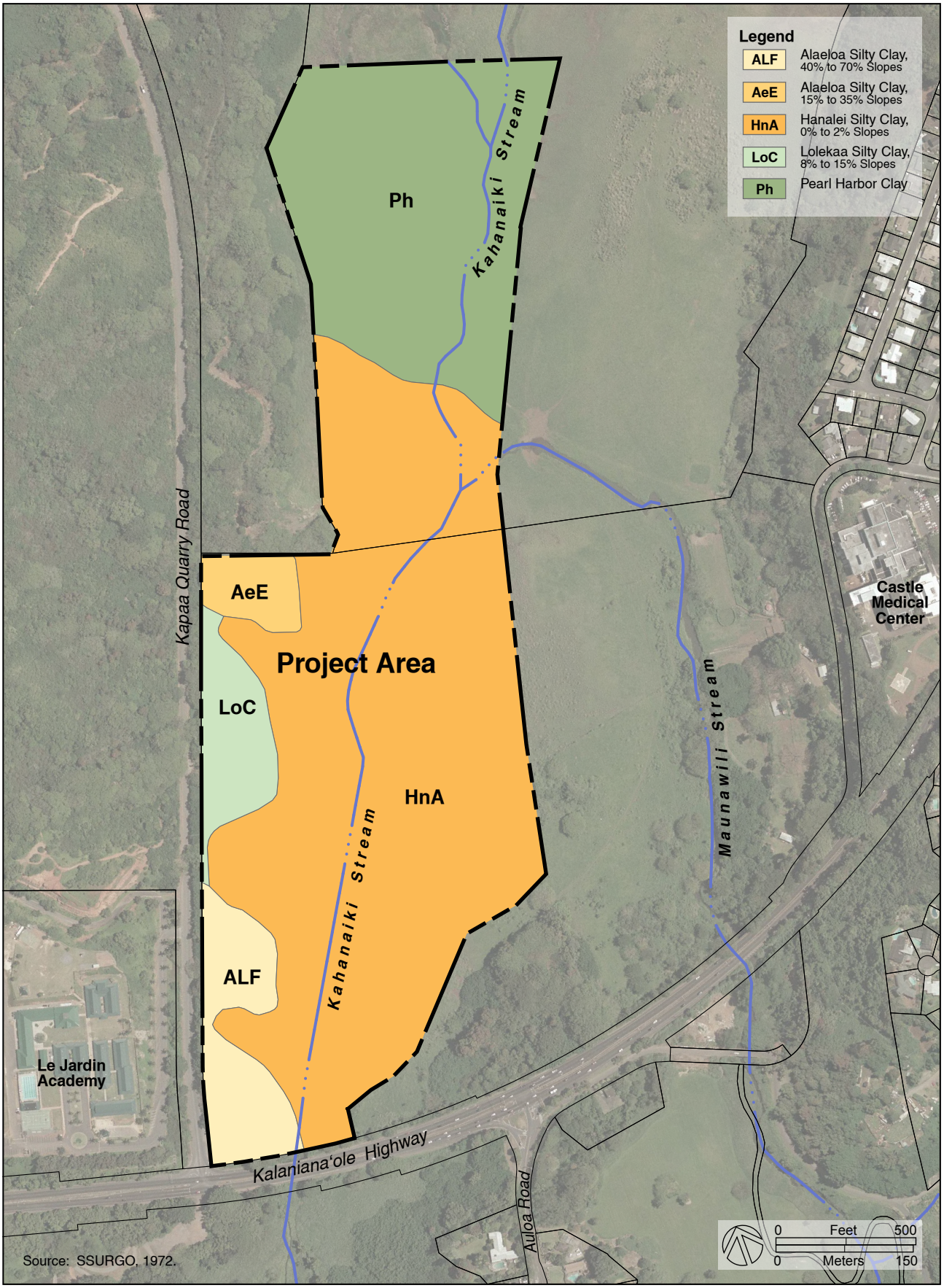


Figure 3.1
Soil Survey Map
Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

The Alaeloa series consists of well-drained soils on uplands. These soils developed in material weathered from basic igneous rock.

- Alaeloa Silty Clay, 15 to 35 Percent Slopes, (AeE). This soil occurs on smooth side slopes and toe slopes in the uplands. The representative profile of this soil had a surface layer about 10 inches thick, and was dark reddish-brown silty clay. The subsoils were about 48 inches thick, and was dark-red and red silty clay. The soil was medium acid in the surface layer and strongly acid in the subsoil. Permeability was moderately rapid, runoff was medium, and the erosion hazard was moderate. Roots penetrate to a depth of five feet or more, and workability was difficult because of the slope.
- Alaeloa Silty Clay, 40 to 70 Percent Slopes, (ALF). The most common slope range was 45 to 53 percent. Runoff was rapid to very rapid, and the erosion hazard was severe.

The Lolekaa series consists of well-drained soils on fans and terraces on the windward side of the island. These soils developed in old, gravelly colluvium and alluvium.

- Lolekaa Silty Clay, 8 to 15 Percent Slopes, (LoC). This soil occurs on terraces and fans. The representative profile had a surface layer about 10 inches thick, and was dark-brown silty clay. The subsoils were 46 to more than 70 inches thick, and the upper portion was dark-brown silty clay and the lower portion was dark yellowish-brown loam. The soil was strongly acid in the surface layer and strongly acid to extremely acid in the subsoil. Permeability was moderately rapid, runoff was slow to medium, and the erosion hazard was slight to moderate. Workability is slightly difficult because of the slope (SCS, 1972).

Land Study Bureau Classification.

The University of Hawai‘i, Land Study Bureau’s (LSB) *Detailed Land Classification-Island of O‘ahu* classifies land type for all lands other than those in the urban district, which are not considered to have the potential to produce crops. Land type classifications provide for an overall crop productivity rating, with and without irrigation, and for selected crop productivity ratings for seven crops. Overall LSB ratings range from A to E, with A representing the class of highest productivity and E the lowest.

Figure 3.2 graphically shows the LSB ratings established for the project area. As shown on the figure, most of the upland project area is designated as “N” (not classified) because it is within Urban District areas. The majority of the approximately 60-acre wetland portion is classified as having a fair suitability rating of C while the northern end is very poorly suited for productivity with a rating of E.

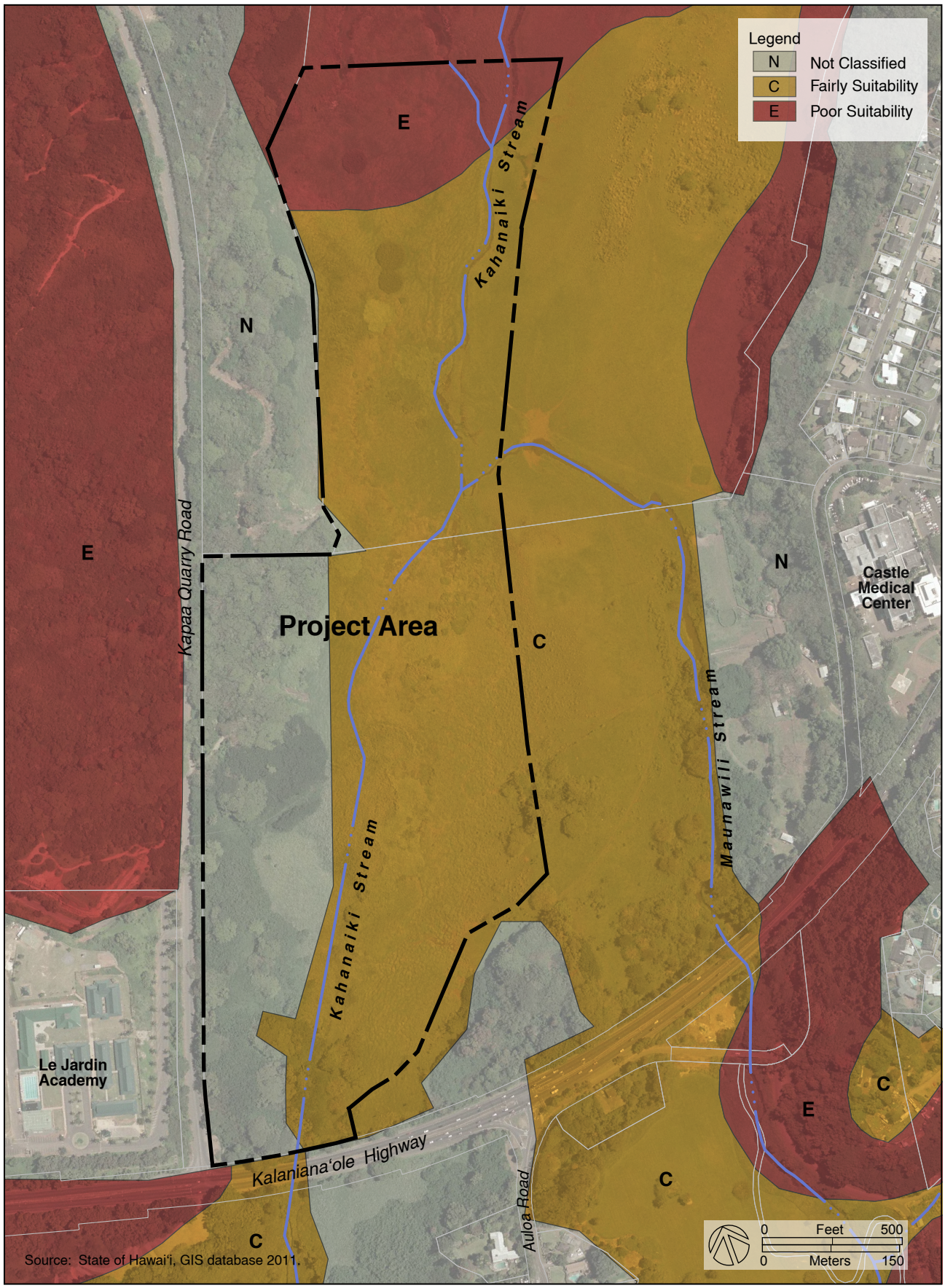


Figure 3.2
Land Study Bureau Detailed Land Classification Map
Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Agricultural Lands of Importance to the State of Hawai‘i.

The State Department of Agriculture's Agricultural Lands of Importance to the State of Hawaii (ALISH), established a classification system for identification of agriculturally important lands to the State of Hawai‘i. Three classes of lands are established which are: 1) prime, 2) unique, and 3) other. Lands not included under this system are "unclassified." Figure 3.3 graphically shows the ALISH ratings established for the project area.

As shown on the figure, the majority of the project area is classified as "Other Lands" which are not prime or unique agricultural land. A small portion of the northern section of upland area is classified as "Prime Land."

3.2 NATURAL HAZARDS

This section addresses natural hazards applicable to the project. Of the potential natural hazards, only earthquakes, hurricanes, and tsunami flooding hazards are applicable.

3.2.1 Earthquake Hazards

Earthquakes in the State are mainly associated with volcanic eruptions resulting from the inflation or shrinkage of magma reservoirs beneath which shift segments of the volcano. Earthquakes may occur before or during an eruption, or from the underground movement of magma toward the surface. However, earthquakes also occur due to the shifting of tectonic plates. Except for the Island of Hawai‘i, the Hawaiian Islands are generally not situated in a high seismic area subject to numerous large earthquakes (Macdonald, Abbott & Peterson, 1983).

The central region encompassing the islands of Maui and O‘ahu are subject to seismicity generally related to tectonic activity on the seafloor near the Hawaiian Islands. Tectonic activity capable of generating hazardous earthquakes is related to seafloor fractures and suspected faults around the islands. The largest seismic areas pertinent to Oahu are the Molokai Seismic Zone and the Diamond Head Fault as shown on Exhibit 3.1.

The Diamond Head Fault passes through Koko Crater and extends along the seafloor northeast of O‘ahu. Several earthquakes of 4.0 to 5.0 magnitude were detected along this fault. The Molokai Fracture Zone is an extension of a transform fault from the East Pacific Rise that extends from Molokai to the Gulf of California. This fracture is tectonic in origin and suspected to contribute to central region seismicity associated with an active seafloor. Because two known earthquakes (1871 and 1938) have occurred along the fracture, it is referred to as the Molokai Seismic Zone (USGS 2002).

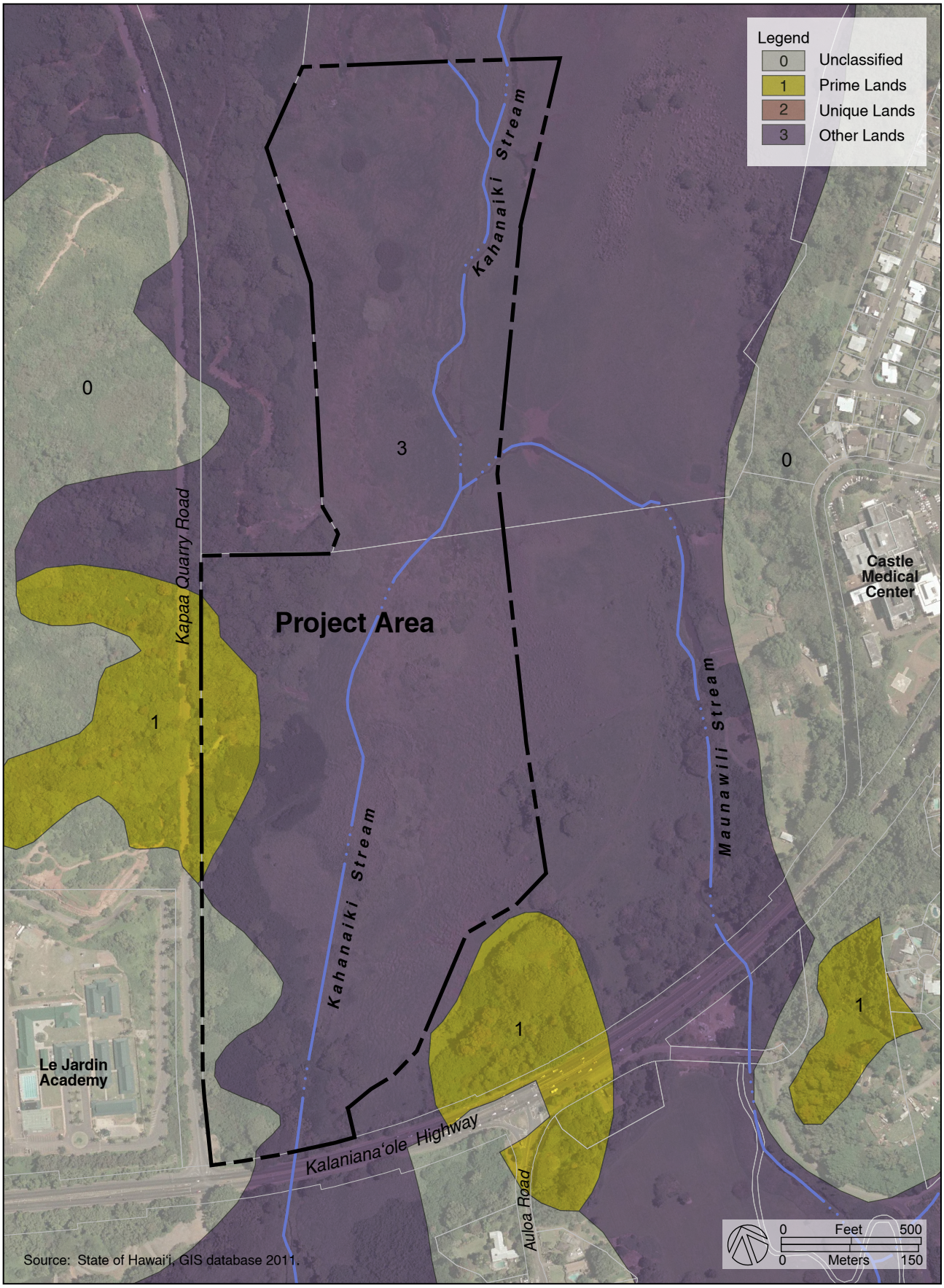


Figure 3.3
ALISH Classification Map
Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
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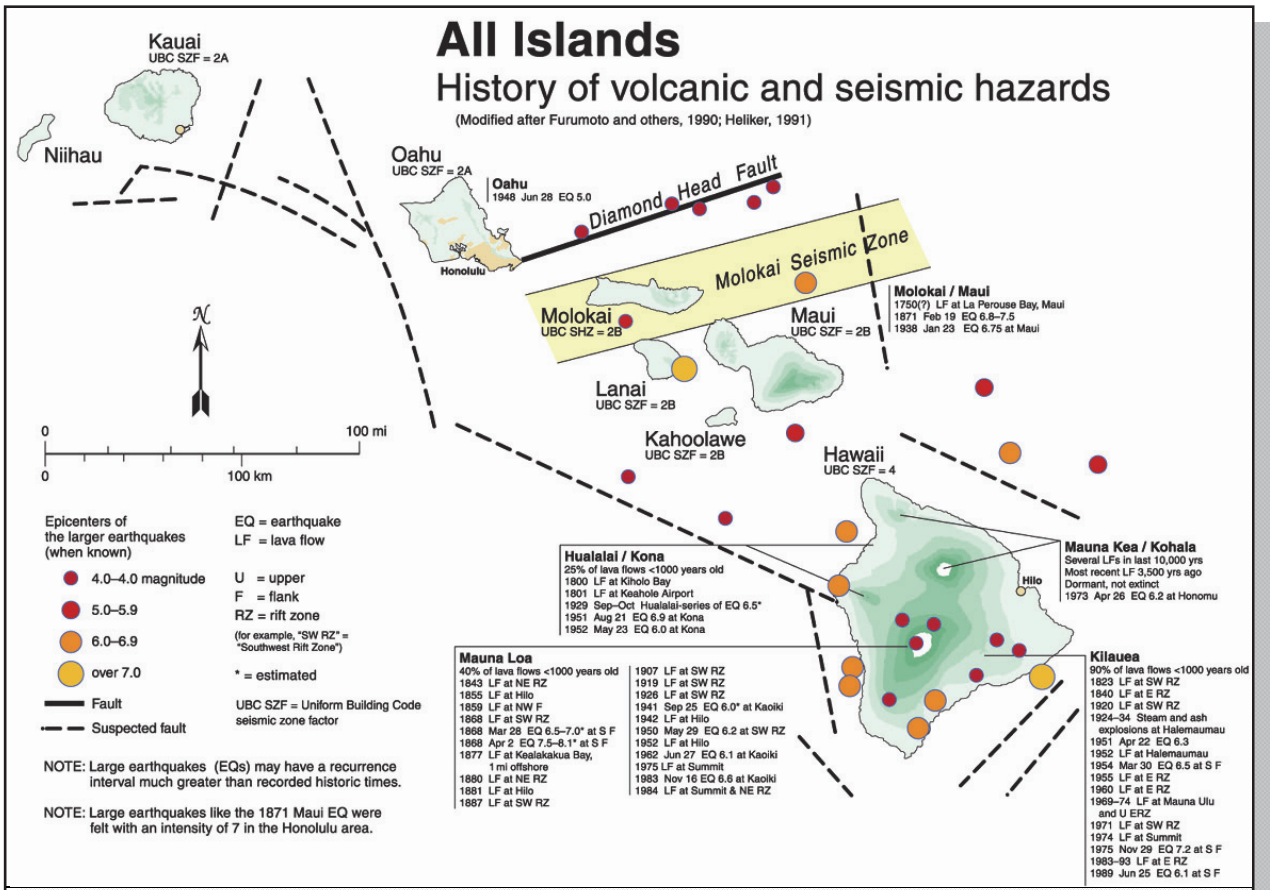


Exhibit 3.1 History of Volcanic and Seismic Hazards (USGS, 2002)

Most of the earthquakes that have occurred in the past have been volcanic earthquakes causing little or no damage to the other islands. Available historical data indicates that the number of major earthquakes occurring have generally been fewer and of lower magnitude than those on other islands such as Hawai‘i. Strong earthquakes of magnitude 5 or higher, based on the Richter Scale, can cause property damage and endanger lives. The exhibit identifies the recent (since 1950) significant earthquakes occurring in the Hawaiian Islands (USGS 2002).

The U.S. Geological Survey's *Atlas of Natural Hazards in the Hawaiian Coastal Zone* (USGS, 2002) assigned seismic hazard intensity ratings for all islands on a scale from 1 to 5 with 1 representing lowest hazard and 5 the highest. The southern half of O‘ahu extending from Makaha east around Diamond Head and Makapuu Head and north up to Kaneohe Bay was assigned a volcanic/seismic risk ranking of 3 due to the proximity to the Moloka‘i Seismic Zone. The remainder of the island is ranked a 2 with respect to the volcanic/seismic hazard (USGS 2002). The Kawainui Marsh project area is therefore situated within this southern half and has a risk ranking of 3 similar to other uses in the eastern half of the Windward district.

3.2.2 Hurricane Hazards

Hurricanes are one type of tropical cyclones affecting the State that also include tropical storms and tropical depressions. Hurricanes are tropical storms with winds equal to or greater than 74 miles per hour. They have affected every island in the State and can cause major damage and injury usually resulting from high winds, marine over-wash, heavy rains, and other intense small-scale winds and high waves.

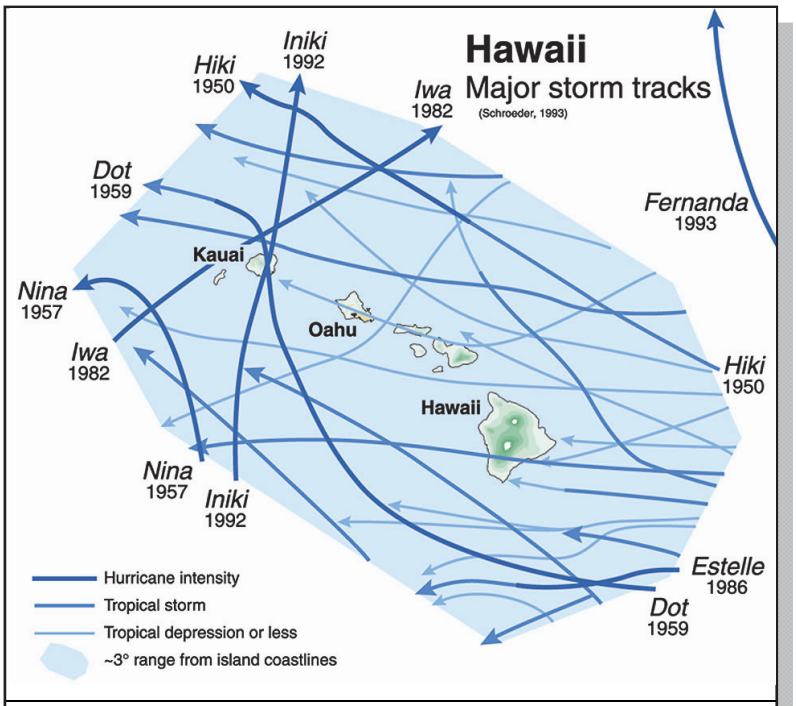


Exhibit 3.2 Major Storm Tracks (USGS, 2002)

Between 1970 and 1992, 105 tropical cyclones were identified in the central Pacific region resulting in an average of 4.5 storms per year. Not all of these storms directly pass thru the State, and actual hurricane strikes on the Hawaiian Islands are relatively rare in the modern record. More commonly, near-misses that generate large swells and moderately high winds causing varying degrees of damage are the result of hurricanes passing close to the islands (USGS 2002). Exhibit 3.2 graphically shows the paths of hurricanes affecting the Hawaiian Islands.

A hazard mitigation report prepared by the Federal Emergency Management Agency (FEMA) determined that nine hurricanes approached within 300 nautical miles (about one day's travel time) of the Hawaiian Islands' coastlines between 1970 and 1992. Most hurricanes affecting the islands have focused on 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).

3.2.3 Tsunami and Flood Hazards

Tsunamis are caused by a sudden movement of the seafloor that generates a series of waves which travel across the ocean until they reach a coastline. Seafloor movements may include faulting, landslides, or submarine volcanic eruptions. Landslides originating either under the sea or above sea level and then sliding into the water may also generate a tsunami. Tsunamis manifest themselves as either large breaking waves, often largest around headlands where they are concentrated by wave refraction, or as rapidly rising sea level like a flooding tide. The high degree of volcanism and seismic instability in and around the Pacific Ocean has contributed to a history of tsunami occurrences.

The coastline of the Hawaiian Islands is under the continuous threat of tsunami inundation because this region is one of the most geologically active regions on Earth. The geography of the shoreline often plays an important role in the form of the tsunami. Tsunami waves may be very large in an embayment, actually experiencing amplification in long funnel-shaped bays. Fringing and barrier reefs appear to have a mitigating influence on tsunamis by dispersing the wave energy (USGS 2002). In March 2011, a tsunami was generated from a large earthquake generated off of Japan which affected O‘ahu. No known damages to Kawainui Marsh resulted from this tsunami, and damages to urban areas along Kailua Bay were minimal compared to other areas of the island.

The City Department of Emergency Management has updated their tsunami evacuation maps for O‘ahu last year. Based upon this updated map, the current tsunami evacuation zone does not extend up to the Kawainui Marsh project area. The evacuation zone generally extends up to North Kainalu Drive within Kailua town that is well away from the project area.

Flooding

Floods caused by heavy rainfall and strong winds normally occur during the winter months. However, historic rainfall data for Kailua shows the most frequent rainfall occurs from November to April with March having the highest average. Heavy rainfall can also be associated with the tropical storm and hurricane season between the months of June and October. Areas subject to recurrent rainstorm floods are generally the coastal plains and flood plains (USGS 2002). The Flood Insurance Rate Map (FIRM) prepared by FEMA for this project area is FIRM No. 15003C0290F (revised September 30, 2004). Figure 3.4 graphically shows the project area in relation to the FIRM for the area.

The figure identifies flood areas occurring within the wetland portion of the project area. The area is designated as Zone A that is a special flood hazard area subject to the 100-year flood. There are no base flood elevations determined for this area. The southern portion of the project area, which includes the entire upland area, is designated as Zone D. The designation is for unstudied areas where flood hazards are undetermined, but flooding is possible. Because Kahanaiki Stream flows through the wetland area, most of this lower lying area would likely be subject to the 100-year flood.

3.3 HAZARDOUS MATERIALS

A Phase I Environmental Site Assessment (ESA) was conducted by the COE for about 693 acres of Kawainui Marsh in 2008 (Wil Chee, 2008). This study area generally encompasses most of the wetland portion of the restoration project site, and provides background information on potential hazardous materials. The purpose of this Phase I ESA was to identify recognized environmental conditions (REC) in connection with the study area.

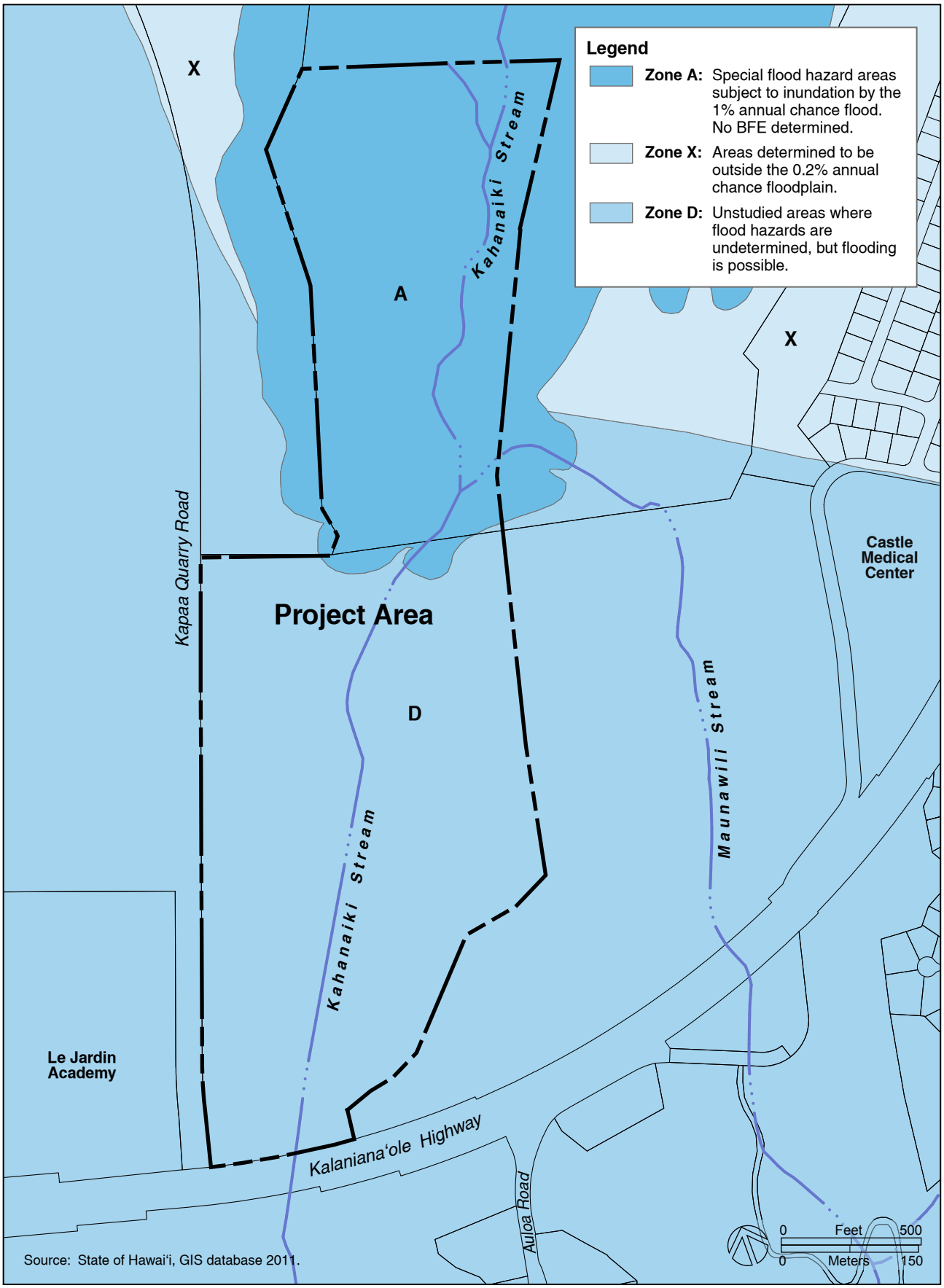


Figure 3.4
Flood Insurance Rate Map

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Identification includes the range of contaminants designated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and petroleum products. The scope of the study included: 1) review of environmental and historical records that pertain to the property and to adjoining properties; 2) a site reconnaissance to observe conditions; and 3) interview of people knowledgeable with the property.

3.3.1 Records Review Results

Searches of standard Federal and State government databases of known or potential sources of hazardous materials or waste was conducted, and a summary of the results is provided. Those sites identified from the databases were predominantly associated with businesses and sites located within the Kailua commercial town area.

- EPA National Priorities List (NPL). No NPL or proposed NPL sites were found within 1.0 mile of the marsh property.
- Resource Conservation and Recovery Act (RCRA) Corrective Actions Facilities (CORRACTS). No RCRA CORRACTS sites were found within 1.0 mile of the marsh property.
- RCRA-Treatment, Storage, & Disposal (TSD) Facilities. No TSD facilities were found within 0.5 mile of the marsh property.
- RCRA-Large and Small Quantity Generators. One Large Quantity Generator was identified within 0.25 mile and there were no reported violations listed. Twenty Large Quantity Generators were identified within 0.25 miles, and only two generators had violations recorded but posed no realistic threat to the marsh property.
- Comprehensive Environmental Response, Compensation & Liability Information System (CERCLIS). No CERCLIS sites were found within 0.50 miles of the marsh property.
- State Hazardous Waste Sites (SHWS). The SHWS list indicated there were seven sites located within 1.0 mile of the marsh property. Three sites had a status of "no further action" and were not suspected to have an adverse environmental impact on the marsh property. Three of the remaining four sites were not suspected to have an adverse environmental impact on the property due to their distance away and location down gradient from the marsh. The remaining facility was not suspected to have an adverse environmental impact on the subject property due to the nature of the reported release (i.e., soil only).
- Permitted Solid Waste & Landfills. One permitted solid waste landfill was identified within 0.5 mile of the property. The Kapa‘a Sanitary Landfill, located *mauka* (west) of the marsh across Kapa‘a Quarry Road is a municipal solid waste landfill owned and operated by the City. This landfill is currently closed. The City needed to implement a groundwater monitoring and leachate characterization plan in accordance with the recommendations of a groundwater task force (Wil Chee, 2008).

- Leaking Underground Storage Tank (LUST). Nineteen LUST sites were identified within 0.5 mile of the property. Fourteen of the sites have a status of "Site Cleanup Completed", and are therefore not suspected to have an adverse environmental impact on the property. One site has a status of "Disconfirmed Release", and therefore does not adversely impact the property. The remaining four sites have a status of "LUST Cleanup Initiated – Petroleum". These sites were not suspected to have an adverse environmental impact on the property due to their distance away and being down gradient from the marsh. Two of them had a status of no further action, and one site had remedial actions properly put in place.
- Underground Storage Tank (UST). Thirty-one facilities with registered USTs were identified within 0.25 mile of the property. Of these UST sites, 13 also appear on the LUST database and were previously addressed. None of the remaining UST sites were suspected to have an adverse environmental impact on the marsh property based on the absence of a reported release.
- Emergency Response Notification System (ERNS). The database search revealed that the marsh property is not a listed ERNS site.
- Brownfields and Voluntary Response Program (VRP) Sites. No Brownfields or VCP sites were identified within 0.5 mile of the property.
- State Spills List. There were no reported hazardous material releases at the marsh property.
- Drinking Water Wells. The State database identified five (5) wells, although none were drinking water wells, within a 1.0 mile radius of the property. No USGS wells were identified within a 1.0 mile radius of the property (Wil Chee, 2008).

3.3.2 Site Reconnaissance Results

Site reconnaissance was conducted of the marsh and adjacent areas in November 2007 and October 2008 to investigate the presence of potential hazards and conditions on ground surfaces occupied by permanent or semi-permanent structures. This would identify potential CERCLA impacts that may affect Kawainui Marsh and surrounding areas.

The site reconnaissance determined that no potential on-site contamination sources existed within Kawainui Marsh. The survey did not find evidence of hazardous materials storage, storage tanks or evidence indicating the existence of such tanks, unidentified substance containers, petroleum, oil, and lubricant substances, and visual evidence of hazardous solid waste disposal on the marsh property. There were no pole-mounted electrical transformers present on the site, but two transformers were observed on adjacent streets. These Hawaiian Electric Company facilities were on Ulukahiki Street and at the Kapaʻa Quarry Road intersection with Mōkapu Boulevard. Both transformers were PCB-free, and were in good condition with no visible evidence of leakage or staining (Wil Chee, 2008).

3.3.3 Phase 1 Findings

The records review determined that Kawainui Marsh was generally not subject to adverse environmental impact from known or potential sources of hazardous materials. Of those sources identified from various databases, the majority of them were located within the Kailua town area, have been addressed, and situated down gradient from the marsh. Site reconnaissance of the marsh also determined that no potential on-site contamination sources existed.

Two sites having recognized environmental conditions were the City's Kapaʻa Street Light Storage Yard and Kapaʻa Sanitary Landfill both of which are situated north of the restoration project area. The Phase 1 report indicated the City was addressing both sites in consultation with the State DOH. Implementation of soil sampling, groundwater sampling, and analysis to characterize the lateral and vertical extent of contaminants were being initiated for the storage yard. Groundwater monitoring was being initiated for the landfill site, and the City was considering also conducting an ecological risk assessment of the marsh.

One data gap from the Phase 1 ESA was the prior existence of an abandoned vehicle dump site along Kapaʻa Quarry Road located at the north end of Kawainui Marsh (north of restoration project area) reported from interviews conducted. This dump site was reportedly in operation from about 1945 and contained thousands of derelict vehicles that were believed to be removed in the late 1970's. An aerial photograph from 1975 depicted what appeared to be a portion of this dump site at the north end of the marsh. Visual observations of the site as part the Phase 1 ESA revealed no physical evidence of environmental stress associated with the former dump site (Wil Chee, 2008).

3.4 HYDROLOGY AND WATER QUALITY

This section discusses the regional hydrology present in the project area which includes ground water and surface water resources.

3.4.1 Hydrogeological Resources

The State Department of Land and Natural Resources (DLNR), Commission on Water Resource Management (CWRM) has established groundwater hydrologic units to provide a consistent basis for managing groundwater aquifers. Under the State's Water Resource Protection Plan, an aquifer coding system classifies the island's aquifers to identify and describe these aquifers. The system is comprised of Aquifer Sectors, and then Aquifer Systems located within these sectors.

The Kawainui Marsh project area is within the Windward Aquifer Sector (306) which is further divided into four aquifer systems that include Koʻolauloa, Kahana, Koʻolaupoko, and Waimānalo. The project area is located within the Waimanalo Aquifer System (30604) which is predominantly high-level groundwater (CWRM 2008). This system generally spans in a mauka-

makai direction from the ridgeline of the Koʻolau Mountains to the shoreline, and from Waimānalo to the beginning of Kāneʻohe. The Windward Aquifer Sector has an estimated sustainable yield of 91 million gallons per day (mgd) and the Waimanalo Unit has a sustainable yield of 10 mgd (CWRM 2008). Kawainui Marsh presently serves as a basin for surface water flows into the wetland and allows for some groundwater infiltration into the aquifer system.

Groundwater Hydrology

The most abundant form of groundwater on Oʻahu is the basal aquifer which is a lens of fresh to brackish water that floats on seawater. The basal aquifer occurs principally in the thin, bedded lava layers of volcanic flanks. In the Kawainui Marsh area, groundwater in the basal aquifer is confined by the overlying caprock and is under pressure.

Another type of aquifer found on Oʻahu is the caprock aquifer, which consists of various kinds of unconfined and semi-confined groundwater. The caprock in the area of Kawainui Marsh is a relatively thick (probably greater than 700 feet) sequence of permeable limestone interbedded with nearly impermeable clay layers. This thick sequence of impermeable clays separates the caprock aquifer from the basal aquifer. These clays and the artesian nature of the basal aquifer severely restrict the downward migration of groundwater from the upper caprock aquifer (Wil Chee, 2008).

Groundwater beneath the marsh consists of a sedimentary caprock aquifer resting on a basalt aquifer. The caprock aquifer is classified as a basal, unconfined, sedimentary aquifer. The protection status for the caprock aquifer corresponds to groundwater that is used, but not as an ecological or drinking water source, is replaceable, and has a high vulnerability to contamination. The basalt aquifer is classified as a basal confined, flank aquifer. The protection status for the basalt aquifer corresponds to groundwater that is currently used, but not as an ecological or drinking water source, is irreplaceable, and has a low vulnerability to contamination (Wil Chee, 2008).

Recharge of the aquifer occurs in the interior mountainous areas that experiences higher rainfall. Groundwater then flows from the recharge areas to coastal discharge areas. Frictional resistance to flow causes the groundwater to accumulate within the island until it attains sufficient hydraulic head to overcome the friction. Therefore, basal groundwater always slopes toward the shoreline. The hydrological gradient within the Kawainui Marsh area is anticipated to be toward the northeast. Groundwater in the restoration project area would flow from the southern end of the marsh along Kalanianaʻole Highway toward Kawainui Canal and Kailua Bay.

3.4.2 Surface and Coastal Waters

The State DLNR, Division of Aquatic Resources (DAR) has established watershed areas for the island and the project area is located within the Kawainui watershed (DAR Watershed Code 32013). The watershed has an area of 11.3 square miles and extends from the shoreline on the northern end of Kailua Bay, thru Maunawili and Olomana, and up to the Koʻolau Mountains. Figure 3.5 graphically shows the watershed area.

The watershed is characterized as being medium in size, steep in the upper watershed, and with little embayment. Several streams occur within the watershed with Kahanaiki and Maunawili Streams being most pertinent to the project. As shown on the figure, the project area is designated being within the "lower reach" area of the watershed which generally extends throughout the entire Kawainui Marsh (DAR 2008).

Kawainui Marsh serves as an important flood control basin protecting the low-lying urbanized areas of Kailua Town and Coconut Grove subdivision that experienced flooding in 1988 when floodwaters breached the levee. The levee was constructed in 1966 along the northernmost edge of the marsh to enhance its flood storage capacity. It was later modified by the COE and City in 1997 raising its height and constructing a concrete floodwall to address the 100-year flood level estimated for Kawainui.

The marsh generally drains in a south to north direction from Kapaʻa Quarry Road and Kalanianaʻole Highway toward the shoreline of Kailua Bay. In the project area, Maunawili Stream is the main source of surface water flowing into the marsh with Kahanaiki Stream providing most of the remaining flows. Other inflow to the marsh comes from peripheral drainages and smaller, non-perennial streams. Surface runoff from upland areas sheet flows across Kapaʻa Quarry Road discharging into the marsh. Drainage systems within Kapaʻa Quarry Road along with Kalanianaʻole Highway also carry surface runoff into the marsh and Kahanaiki Stream. Water from the marsh discharges into the Kawainui Channel (also referred to as Oneawa Channel) which eventually drains into Kailua Bay.

Previous studies have estimated inflow from all sources in the marsh ranging from a low of 6.8 million gallons per day (mgd) to as much as 13.1 mgd. A 1994 assessment of the Maunawili Stream and Kawainui Marsh system used stream flow data to estimate flow from Maunawili and Kahanaiki Streams into the marsh at 12.3 mgd and estimated 0.3 mgd from other sources. Outflow from the marsh was estimated at approximately 4.6 mgd by evapotranspiration and 8.0 mgd through surface outlets and groundwater seepage (COE 2008). Other sources have estimated total flows into the marsh ranging from 6.8 to 9.5 mgd. Of this total, 6.3 mgd discharged into Kailua Bay through the Kawainui Channel and 3.2 mgd was lost to evapotranspiration (Wil Chee, 2008). These estimates from various studies therefore indicate that about 65 percent of the flows into the marsh are discharged into Kailua Bay with the remaining 35 percent of flows being lost to evapotranspiration and groundwater seepage.

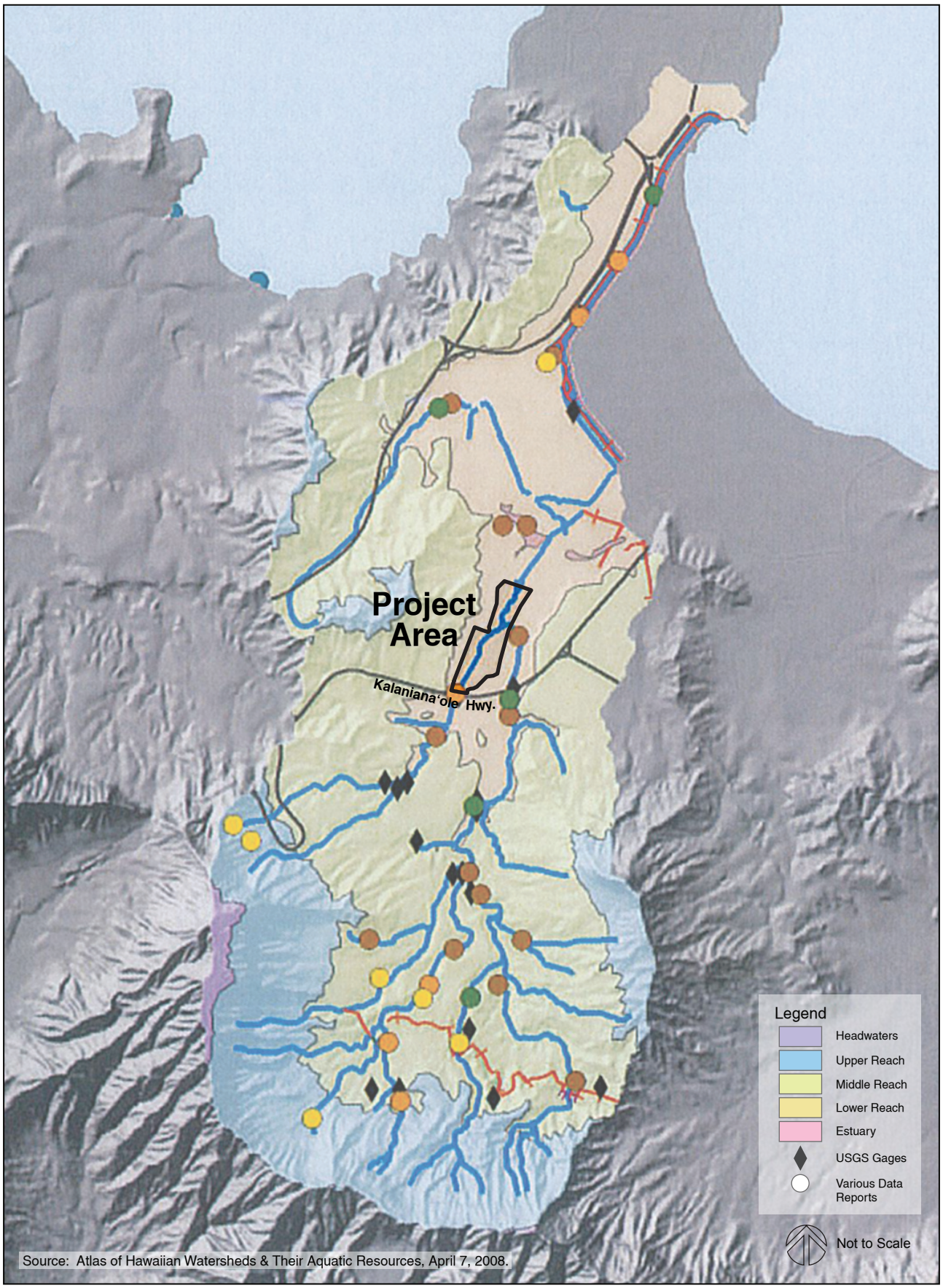


Figure 3.5
Kawainui Marsh Watershed Area

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Streams

Kahanaiki Stream is a perennial stream running through the project's approximately 60-acre wetland area, and continues northbound through Kawainui Marsh. This stream is not subject to tidal influence within the project area being located well inland from the coastline and about 1.5 miles inland from Kawainui Canal. This stream is characterized as generally consisting of a shallow (less than 1-foot deep) meandering flow of water that varies in width from between four to seven feet wide through the southern section of the project area. Exhibit 3.3 shows photos of Kahanaiki Stream in the southern area of the project site and Appendix B includes more photos.

Northbound View of Kahanaiki Stream | Southbound View of Kahanaiki Stream

Exhibit 3.3 Photos of Kahanaiki Stream within Restoration Project Area

Invasive vegetation has been encroaching onto the stream and reducing open-water flows and shallow-water habitat as shown on the photos. An abundant growth of this invasive vegetation has formed a very thick layer of peat (partially decomposed plant matter that is saturated with anoxic water) within the wetland area surrounding this stream. Thus, the bed and banks of this stream in the southern portion of the project area are more defined by the growth of vegetation up to the open water.

Further north, Maunawili Stream enters the project area and connects with Kahanaiki Stream as it proceeds northbound within the marsh. Kahanaiki Stream has a more easily visible and defined path of open water with banks north of its confluence with Maunawili Stream. Exhibit 3.4 is an aerial photo showing the area of confluence between these two streams, and shows the visible distinction in the open water area of Kahanaiki Stream before and after the confluence.

Maunawili Stream is a perennial stream running through Kawainui Marsh in a northerly direction eventually connecting with Kahanaiki Stream. The majority of this stream is located outside the restoration project area as it is routed between the COE's ponds project. However, about 250 feet of it enters the project area where it connects to Kahanaiki Stream. The character

of this stream is similar to Kahanaiki Stream generally consisting of a shallow (about 1 to 2 feet deep) flow of water varying in width. The majority of surface water flow into the marsh is associated with this stream.

Existing invasive vegetation also encroaches into this stream affecting open-water flows and shallow-water habitat particularly near its confluence with Kahanaiki Stream. However, the amount of invasive vegetation and peat affecting this stream is less because most of the surrounding area consists of open grassland that has been used for cattle grazing by the Knott Ranch. Exhibit 3.5 has a photo of this stream near its confluence with Kahanaiki Stream.

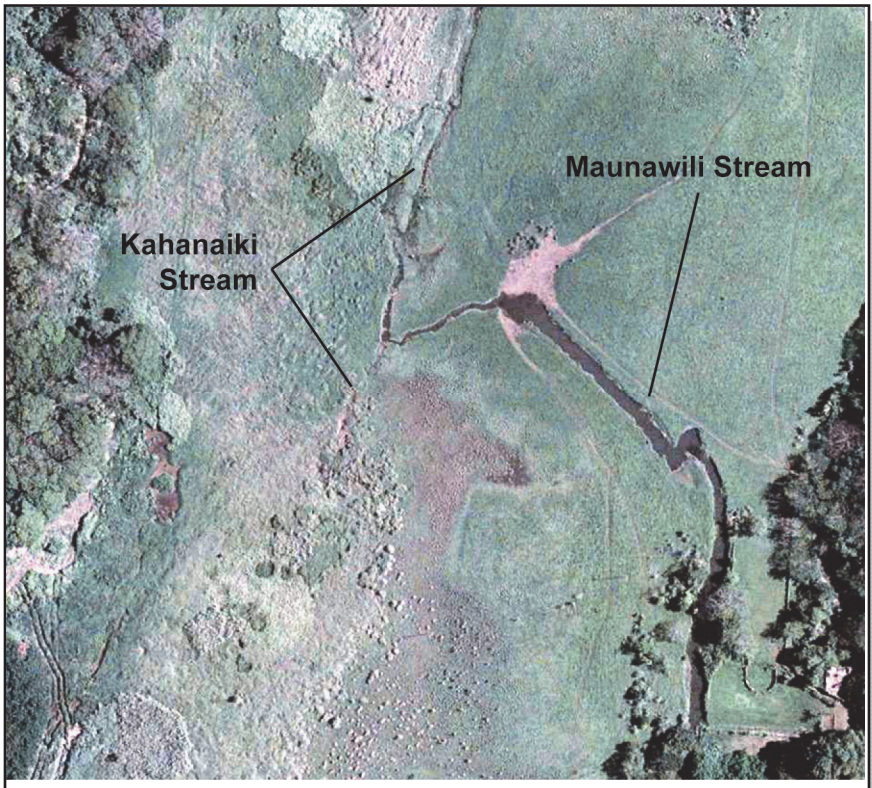


Exhibit 3.4 Aerial View of Kahanaiki and Maunawili Streams

3.4.3 Wetlands

Wetlands perform several functions that include floodwater storage, water quality improvement, habitat for fish and wildlife, aesthetics, and biological productivity. Kawainui Marsh's wetlands contribute to water storage by functioning like natural tubs or sponges, storing water and slowly releasing it. This process slows the water's momentum and erosive potential, reduces flood heights that may affect Kailua town, and allows for ground water recharge. Kawainui Marsh also serves as a source of water filtration by having the slowed runoff

Exhibit 3.5 Photo of Maunawili Stream Near Kahanaiki Stream Confluence

water move around plants, allows suspended sediment to drop out and settle, and filter nutrients and other pollutants. Wetlands are some of the most biologically productive natural ecosystems by their vegetative productivity and diversity of species they can support as habitats for fish and wildlife.

Kawainui Marsh was designated as a Wetland of International Importance under the Ramsar Convention in 2005 adding importance to the need for conservation of this wetland resource. Geographic information system (GIS) data (updated June 2010) from the FWS National Wetlands Inventory classifies the majority of the wetland area as freshwater emergent wetland. Figure 3.6 shows the wetland designation in relation to the project area.

Emergent wetlands are characteristically dominated by herbaceous (non-woody) plants such as grasses, sedges, and forbs (broad-leaved plants) that "emerge" from the water. A portion of Kahanaiki Stream entering the marsh across the highway is classified as freshwater forested/shrub wetland. Shrub wetlands are characteristically dominated by low, woody plants and forested wetlands are dominated by large trees (over 20 feet tall). The portion of Maunawili Stream within the project area along with Kahanaiki Stream on the northern end is classified as freshwater pond.

The National Resources Conservation Service (NRCS) and the COE jointly conducted a wetland delineation study in June 2008 as part of the COE's ponds improvements located adjacent (*makai*) to the project area. The boundary establishes the COE's jurisdictional wetland boundary. Figure 3.6 showed the boundary in relation to the restoration project area.

3.4.4 Water Quality

Wetlands protect water quality by trapping sediments and retaining excess nutrients and other pollutants such as heavy metals. Sediments, nutrients, and chemicals enter wetlands primarily by way of discharges from stormwater runoff. In the project area, Kalaniana‘ole Highway's drainage system discharges stormwater into Maunawili and Kahanaiki Streams. Stormwater runoff from Le Jardin Academy and from surrounding undeveloped mauka areas either discharge into drainage systems or sheet flow across Kapa‘a Quarry Road before entering the marsh.

Stormwater runoff associated with the larger Kawainui watershed area discharges into Maunawili and Kahanaiki Streams that eventually flow into Kawainui Marsh. This watershed extends up to the Ko‘olau Mountains and generally includes predominantly undeveloped areas, agricultural uses, a golf course, and the Maunawili residential community.

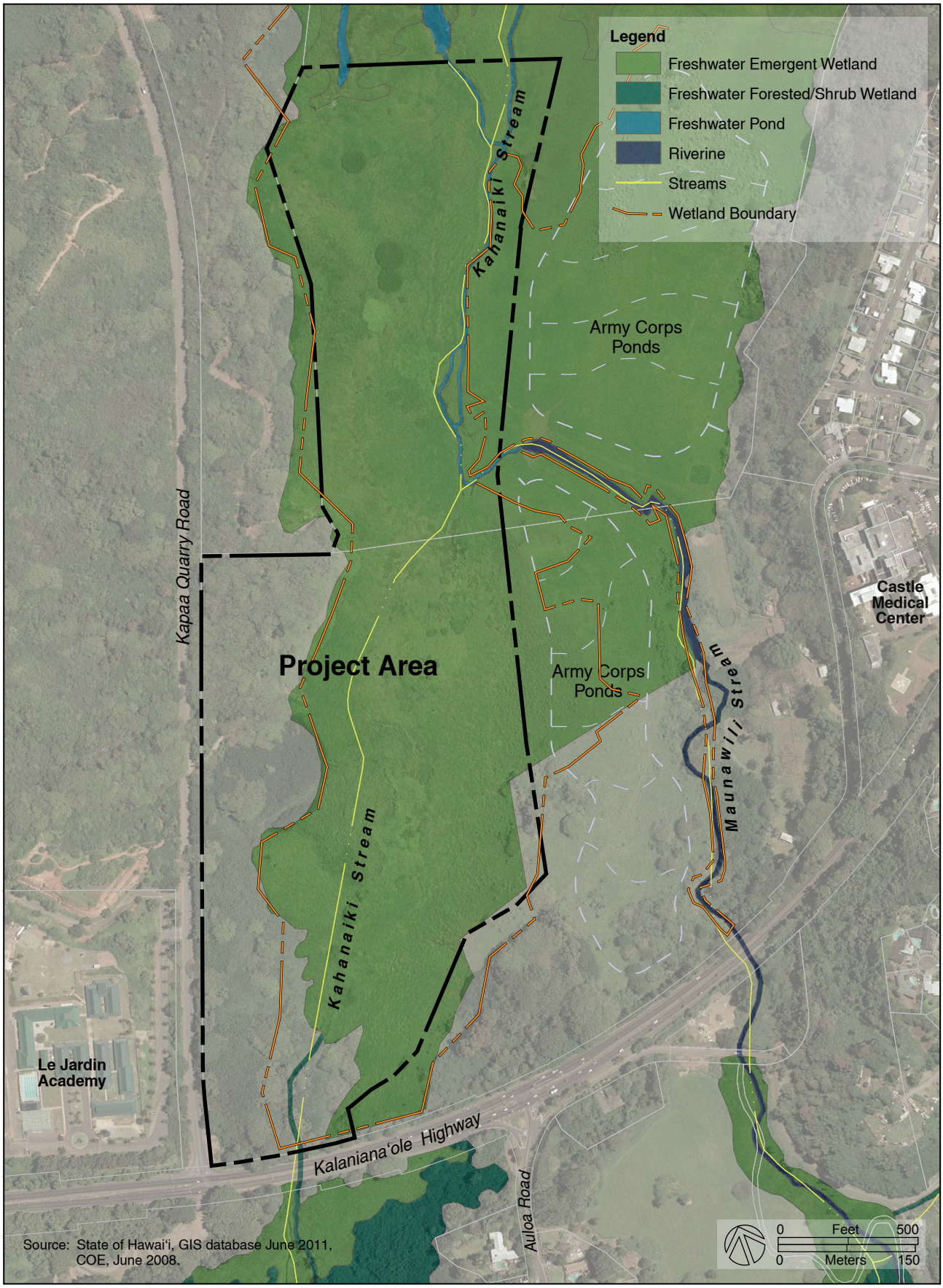


Figure 3.6
Wetland Map
Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Runoff from the Maunawili community, golf course, and Le Jardin Academy would be expected to consist of pollutants typical of residential and other urbanized areas such as sediment, pesticides, fertilizers, and other pollutants. Runoff from agricultural areas would include sediment along with pesticides and fertilizers if these have been applied to the land. Sediments, which are particles of soil, would settle into streambeds and Kawainui Marsh. Other pollutants, such as heavy metals, are often attached to sediments.

Wetlands remove these pollutants by trapping the sediments and holding them. The slow velocity of water in wetlands allows sediments to settle to the bottom where wetland plants hold the accumulated sediments in place. Wetlands protect surface waters by removing excess nutrients, some of which are taken up and used by wetland plants, and some of which are converted to less harmful chemical forms in the soil. Heavy metals are removed by wetlands in a similar manner as nutrients by trapping and burying these pollutants or even converting some of them to less harmful forms.

State Water Quality Standards

The Kawainui Marsh project area encompasses inland waters designated as "Class 1" based upon the State Department of Health's Water Quality Standards (Chapter 11-54, HAR). This is confirmed in a State DOH comment letter dated November 9, 2010 and included in Appendix A. The area can be further classified as both Class 1.a. or 1.b., Inland Waters based upon Kawainui Marsh's designation as a regulated wildlife sanctuary and its State land use designation as "protective subzone" under the Conservation District.

Due to characteristics such as decomposing vegetation, low flow rates, and removal of sediments and pollutants, water quality parameters in wetlands cannot be compared with streams or ocean conditions. For this classification only, there are no specific water quality criteria that must be met, just the basic water quality criteria for all waters. The basic water quality criteria prescribed under Chapter 11-54-4, HAR are applicable to the wetlands of Kawainui Marsh. Under the State DOH's Water Quality Standards, the objective of Class 1 water use is to allow waters to remain in their natural state with minimum pollution from human caused sources. The wilderness character of these areas should be protected. Activities resulting in a demonstrable increase in levels of point or nonpoint source contamination are prohibited (State of Hawai‘i, 2004).

For Kahanaiki and Maunawili Streams, the inland water quality standards for streams under Chapter 11-54-5.2, HAR is applicable and are shown on Table 3.1. The wet season occurs from November 1st through April 30th.

The State DOH's *2006 State of Hawai‘i Water Quality Monitoring and Assessment Report* identified Kawainui Marsh as a major wetland component of a stream network. The marsh is a Tier II decision unit from the upstream tributary segment of Kapa‘a Stream and the downstream receiving segment of Kawainui Stream. The marsh is classified as an elevated wetland and is

listed as a Water Quality-Limited Segment under Section 303(d) of the Clean Water Act. States review existing available surface water quality data and related information to compare against the State's Water Quality Standards, and after applying listing criteria, determine the level of impairment for that water body. The marsh will be subject to comply with Total Maximum Daily Loads (TDML) when eventually established by the State DOH.

Table 3.1
State Water Quality Standards (Chapter 11-54-5.2, HAR)

Parameter	Geometric Mean Not to Exceed		Not to Exceed More Than 10%		Not to Exceed More Than 2%	
	Wet	Dry	Wet	Dry	Wet	Dry
Total Nitrogen (ug N/L)	250.0	180.0	520.0	380.0	800.0	600.0
Nitrate + Nitrate (ug [NO3+NO2] – N/L)	70.0	30.0	180.0	90.0	300.0	170.0
Total Phosphorus (ug P/L)	50.0	30.0	100.0	60.0	150.0	80.0
Total Suspended Solids (mg/L)	20.0	10.0	50.0	30.0	80.0	55.0
Turbidity (N.T.U.)	5.0	2.0	15.0	5.5	25.0	10.0
pH	5.5 – 8.0					

Water Quality Information

Prior studies of Kawainui Marsh have included taking water quality samples of both Kahanaiki and Maunawili Streams. AECOS, Inc. collected samples at the head of Oneawa Canal to estimate nutrients and sediments at Kawainui Marsh in 1981. AECOS, Inc. conducted another water quality study in 1989 (samples taken during wet season) in various locations of Kawainui Marsh as part of a Final Environmental Impact Statement (Final EIS) prepared for the City's Kawainui Marsh flood damage mitigation project. The 1989 data confirmed trends reported in the 1981 study regarding nutrient and suspended solids removal by the marsh. The marsh controlled floods by slowing down and absorbing stormwater runoff, then released the stored water at a slower rate downstream. Suspended solids were then allowed to settle, decompose, oxidize or made available for uptake by the roots of wetland plants (COE 2008).

A comparison of samples taken in 1989 at both Kahanaiki and Maunawili Streams near the highway along with samples taken near the confluence of these streams showed that there was little change in the nutrient content of the water occurring as they flowed through this southern portion of the marsh. Table 3.2 includes the results of these measurements taken.

Suspended solids and turbidity measured showed that the variation in different areas of this marsh was not large. Measurements of pH showed that the water was close to brackish at the confluence of both streams (7.00 and 7.01 ntu), but turned acidic (6.52 to 6.92 ntu) as it moved northeast thru the marsh toward Kawainui Channel. This change was due to the addition of

organic acids leached into the water from decomposing vegetation. Water draining from the marsh was yellow-brown in color as a further indication of dissolved organics leaching from the decomposing vegetation. Measurements of chloride near the project area were low (<30 mg/L) indicative of more freshwater conditions versus seawater conditions (M&E 1990).

Table 3.2
Results of 1989 Water Quality Measurements from City FEIS (1990)
(Samples Taken During Wet Season)

Sampling Stations	Total Nitrogen (ug N/L)	Nitrate + Nitrate (ug [NO3+NO2] – N/L)	Total Phosphorus (ug P/L)	Total Suspended Solids (mg/L)	Turbidity (N.T.U.)
1. Maunawili Stream by Highway	395	179	34	15.7	4.6
2. Kahanaiki Stream by Highway	327	199	40	6.9	4.6
3a. Streams Confluence (April)	376	181	43	9.2	5.4
3b. Streams Confluence (March)	242	89	54	6.5	9.6
4. Kahanaiki Stream North of Confluence	314	54	51	5.5	8.6

Source: M&E 1990

Oceanit Laboratories, Inc. conducted water quality samples of Maunawili Stream at locations identified as upstream and downstream of a test well associated with the COE's ponds project, and these results were included in the 2008 Supplemental Environmental Assessment document. In general, their results indicated that Maunawili Stream water quality measurements were comparable to the State's water quality standards (COE 2008). Table 3.3 shows these results.

Table 3.3
Results of 2008 Water Quality Measurements
from COE Final Supplemental Environmental Assessment (2008)

Sampling Locations (Multiple Samples Taken)	Total Nitrogen (ug N/L)	Nitrate + Nitrate (ug [NO3+NO2] – N/L)	Total Phosphorus (ug P/L)	Total Suspended Solids (mg/L)	Turbidity (N.T.U.)
1. Maunawili Stream Upstream Samples	227	60	42	3.9	5.67
	341	50	71	12.9	10.4
2. Maunawili Stream Downstream Samples	3260	10	245	24.5	12.4
	1350	5	289	42.9	112.0

Source: COE 2008

Sediment samples from the 1989 study also indicated that the marsh contained the presence of heavy metals including chromium (Cr), lead (Pb), and mercury (Hg). With the exception of cadmium (Cd) and mercury, both of which occur generally in same concentrations in the samples, the heavy metal presence in the upper marsh sediment was substantially greater than that in the lower marsh sediments. However, nickel (Ni) was found in greater concentration at

Station No. 8. Table 3.4 shows the results of the sediment samples collected which also include arsenic (As), copper (Cu), silver (Ag), and Zinc (Zn). Samples of vegetation mat, consisting of stems, leaves, and roots of marsh vegetation and debris in various stages of decomposition, were also analyzed for various heavy metals, and the results are included in Table 3.4.

Table 3.4
Results of Sediment Heavy Metals from Kawainui Marsh
(mg/kg)

Sampling Stations	As	Cd	Cu	Cr	Hg	Ni	Pb	Ag	Zn
2. Kahanaiki Stream by Highway	0.50	0.35	9.2	9.8	0.03	17.0	6.0	0.36	6.8
3a. Streams Confluence (April)	1.44	0.34	35.9	56.7	0.08	53.0	12.4	0.28	35.2
3b. Streams Confluence (March)	1.42	0.35	34.8	53.3	0.06	48.0	12.0	0.34	30.8
8. Northwest Area of Marsh	0.40	0.38	41.4	48.5	0.03	86.6	6.8	0.45	33.2
Vegetation Mat Samples									
Sample 1	0.13	0.20		10.2	0.032		13.9	0.20	
Sample 2	0.016	0.20		14.9	0.016		7.5	0.49	
Sample 3	0.063	0.30		34.4	0.024		8.0	0.23	

Source: M&E 1990

Sediment samples were also analyzed for a variety of other chemical properties that are shown on Table 3.5. These include pesticides and PCBs, and for polynuclear aromatic hydrocarbons (PAH) and phenols using EPA methodologies. The results of pesticides and PCB analyses on the samples were all less than reporting limits. Therefore, none of these potentially hazardous organic compounds was detected in the sediment samples (M&E Pacific, Inc., June 1990).

Table 3.5
Miscellaneous Analyses of Sediments from Kawainui Marsh
(mg/kg)

Sampling Stations	TOC	Total CN-	Total S-	Oil & Grease	Pet. HydroC
2. Kahanaiki Stream by Highway	96,000	<1	17	<100	<100
3a. Streams Confluence (April)	86,000	<1	33	<100	<100
3b. Streams Confluence (March)	38,000	<1	32	180	<100
8. Northwest Area of Marsh	11,000	1.4	81	320	<100

Source: M&E 1990

A number of metals do occur naturally in the environment at relatively high concentrations. Usually, these metals are combined in insoluable forms and are therefore not very mobile in that they do not move readily into solution in the aquatic environment. The toxicity of these adsorbed forms is not very great under normal circumstances encountered in aquatic environments because they remain bound to the sediment so long as the pH is neutral or slightly

basic. They become soluable only if the pH shifts to acidic. These metals would tend to release more into solution at a pH 5 as compared to a pH range of 6 to 8 which is typical of the waters in Kawainui Marsh.

In comparison with other O‘ahu watersheds, this was not considered unusual due to heavy metals being naturally present in weathered basalt and would be expected in sediments derived from erosion of this material. As an example, chromium appears to be naturally concentrated in weathered basalt, becoming less concentrated as soil is eroded and carried into streams and then added as coastal deposits. Lead is complexed in the fine deposits of stream and particularly estuarine sediments, where its concentration rises. The State DOH study found a relative abundance of nickel, zinc, chromium, lead, and copper in estuarine sediments, and concluded that metal concentrations in general appear to be influenced by soil mineral composition and weathering of Hawaiian basalts (M&E Pacific, Inc., June 1990). Sediment sample data found that the levels of heavy metals were lower than the maximum concentration of contaminants for characteristics of EP Toxicity, CFR 40-261 (COE 2008).

Coastal Water Quality

The coastal area of Kailua Bay where Kawainui Channel discharges surface water from Kawainui Marsh is designated as “Class A” marine waters under the State DOH’s Water Quality Standards (Chapter 11-54, HAR). Under these standards, the objective of Class A water use is to allow their use for recreational purposes, and aesthetic enjoyment is protected. Any other use is permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. These waters must not act as receiving waters for any discharge that has not received the best degree of treatment or control compatible with the criteria established for this class.

3.5 BOTANICAL, FAUNAL, AND AQUATIC RESOURCES

3.5.1 Botanical Resources

Kawainui Marsh formerly encompassed about 400 acres of open water based upon early descriptions of the area. This has been significantly reduced to only about 40 acres at present. A significant amount of the wetland now supports plant assemblages characterized as either dominated by alien (non-native) species or invaded by non-native species (including many upland species normally not associated with wetlands). However, a large proportion of the vegetation does consist of native wetland plants. Native species dominated assemblages cover 52 percent of the approximately 890-acre marsh with the two indigenous species Saw-grass (*Cladium jamaicense*) and Neke fern (*Cyclosorus interruptus*) accounting for this (Oceanit Laboratories, Inc., June 2006).

Most of the historic mix of vegetated marsh and open water is now covered with vegetation supported by a floating mat of peat. Sample plots measured within the marsh determined the thickness of the peat layer ranged from 0 to 8 feet in depth, the majority of plots were between 0 and 4 feet, and the average thickness was 4.1 feet deep. Neke fern was widely distributed in the wetland and was a significant contributor to the peat layer. Native Saw-grass covered extensive areas of peat, sometimes combined with Neke fern.

Prominent invasive species within the marsh consist of California grass (*Urochloa mutica*), Water Hyacinth (*Eichhornia crassipes*), Kariba Weed (*Salvinia molesta*), Cattail (*Typha latifolia*), Papyrus (*Cyperus papyrus*), Umbrella Sedge (*Cyperus involucratus*), various trees particularly Hawaiian dwarf umbrella plant (*Schefflera*) and Fiddlewood (*Citharexylum*), *Vigna luteola*, and *Paederia foetida*. Invasive plant species are affecting the marsh by reducing open water and through its progressive intermingling with affiliated loss of native plant dominated areas, increased accumulation of organic matter (peat), and subsequent reduction of many wetland functions and values (Oceanit Laboratories, Inc., June 2006).

An aquatic plant study of Kawainui Marsh prepared for the COE developed vegetation assemblages. The assemblages constitute general mappable areas based upon dominant plant species. These assemblages tend to evolve as a unit, or are characterized by a regular succession of species replacing one another until relative stability is achieved. Figure 3.7 shows the plant assemblages established for the restoration project area. Based upon the figure, vegetation in the restoration project area is dominated by assemblages of California grass. Other dominant assemblages consist of Elephant grass and pasture lands. Patches of Papyrus are also present. A summary of these vegetation assemblages is provided:

1. California Grass Assemblage. This assemblage dominates many areas of the marsh, though it is often mixed with various vines and/or cattail and bulrush. California grass is a component of both the Cattail and Bulrush assemblages, and intermixing of these species produces some uncertainty with specific boundaries.
2. Elephant Grass Assemblage. This assemblage covers a large area in the upper marsh and consists of a mostly monotypic stand of elephant or Napier grass (*Pennisetum purpureum*). Its tall stature makes it distinguishable and the grass is prominent along the entrant streams where the tree cover is open.
3. Pasture Land Assemblage. This assemblage occupies the upper Kawainui marsh area makai of Kahanaiki Stream, and consists primarily of California and Hilo grasses grazed by cattle. In general, grazing cattle stop at the edge of streams or where the ground is too mucky to support their weight.
4. Papyrus Assemblage. This assemblage is easily defined by the unique circular patches of papyrus found in the project area. Exclusion of all other species in these papyrus "rings" is probably due to shading and the massive size of this sedge compared with all others in the marsh.

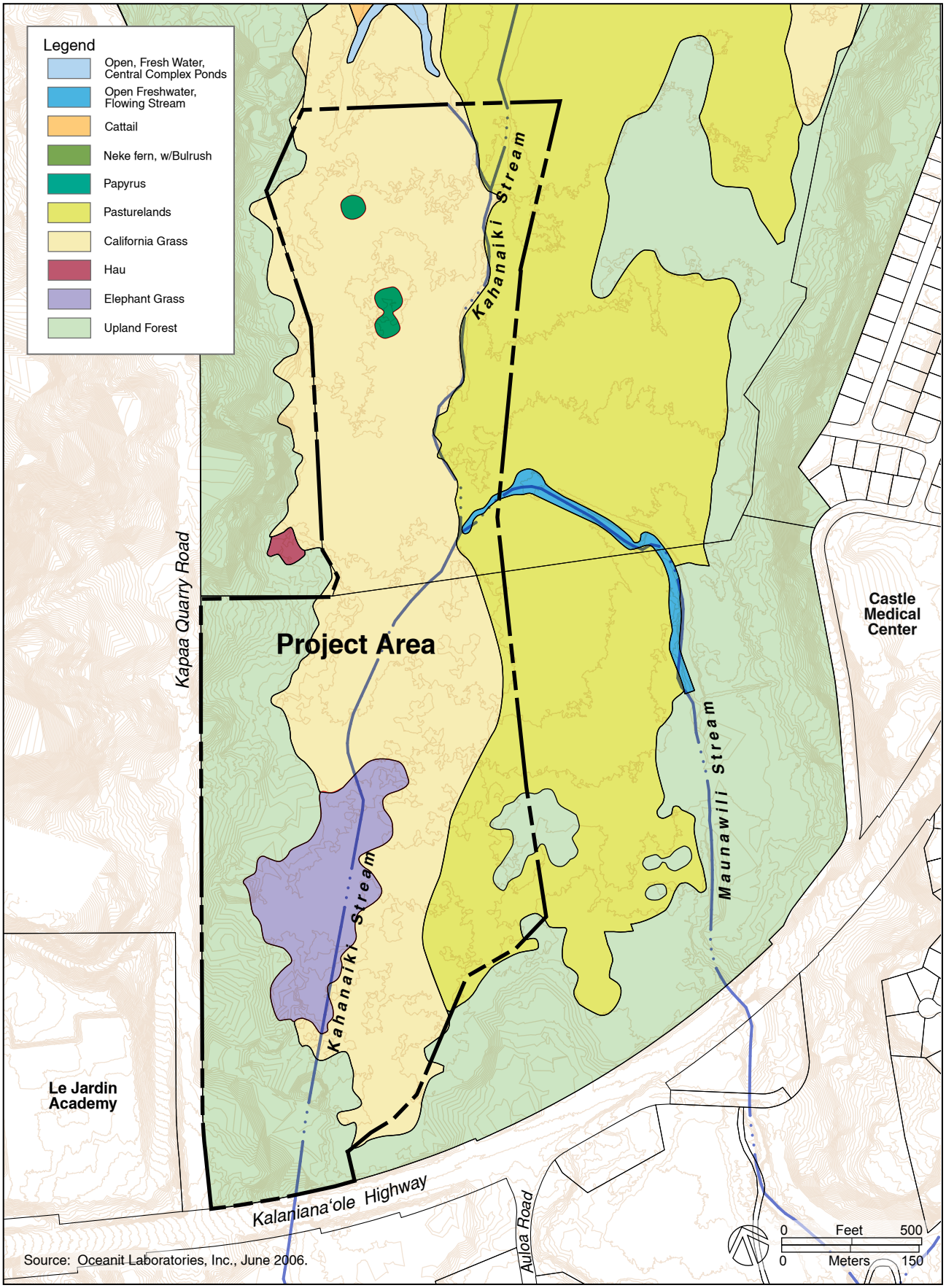


Figure 3.7
Vegetation Assemblages for Project Area
Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

The upland project area located mauka of the wetland was identified as upland forest assemblage. The area hosts a variety of plants and several large trees (monkeypods and java plum) associated with an upland forest. The southern end near Kalaniana‘ole Highway is overgrown with trees and other invasive vegetation. The northern section was cleared by DOFAW to provide an open grassed area, and a row of Hau trees is located along a portion of Kapa‘a Quarry Road (see Exhibit 3.6). The northern most section of the area has a canopy of various trees (see Exhibit 3.7). Photos of these areas are provided in Appendix A.

Exhibit 3.6 – Northbound Photo of Open Grass and Trees Along Kapa‘a Quarry Road

None of the vegetation within the restoration project area is known to be Federal or State-listed threatened or endangered, or candidate threatened or endangered botanical species. As discussed in this section, the vast majority of plants present are non-native species and most are invasive to the area.

Exhibit 3.7 – Photo of Canopy Forest in Northern Upland Project Area

3.5.2 Avifauna and Faunal Resources

<u>Avifauna Resources</u>

Kawainui Marsh provides habitat for various migratory waterfowl, wintering shorebirds and a variety of resident and introduced bird species. Standing ponds, wet pastures, and open water areas are attractive habitat for migratory waterfowl during the rainy season. Migratory waterfowl are found within the small ponds in the wet pasture and the larger open water areas of the marsh during winter months.

Migratory geese and ducks reported include Northern Pintail (*Anas acuta*), Northern Shoveler (*Anas clypeata*), Mallard (*Anas platyrhynchos*), Canada Goose (*Branca canadensis*), Emperor Goose (*Chen canagica*), Ring-necked Duck (*Aythya collaris*), Lesser Scaup (*Aythya affinis*), Green-winged Teal (*Anas crecca*), American Widgeon (*Anas americana*), and Redhead (*Aythya*

americana). Migratory shorebirds reported include the Lesser Golden Plover (*Pluvialis dominica*), Ruddy Turnstone (*Arenaria interpres*), Sanderling (*Calidris alba*), and Wandering Tattler (*Heteroscelus incanus*).

The Black-crowned Night Heron (*Nycticorax nycticorax hoactli*) is commonly seen within the open water areas and potholes within the wet pasture (COE, July 1992). The Cattle Egret (*Bubulcus ibis*), introduced in Hawai‘i in 1959 to control flies on cattle, is present within the marsh and is common within the surrounding area. The Black-crowned Night Heron and Cattle egret are also predators on Hawaii‘s endangered waterbirds particularly waterbird chicks.

Endangered Waterbird Species Present

Kawainui Marsh provides important habitat for four endangered species of native Hawaiian water birds. It was identified by the U.S. Fish and Wildlife Service as a “primary habitat” for the recovery of these water bird species (FWS, May 2005). Four species of endangered Hawaiian waterbirds found in Kawainui Marsh include the Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian moorhen (*Gallinule chloropus sandvicensis*), and Hawaiian duck (*Anas wyviliana*).

The Hawaiian stilt is a slender wading bird, black above (except for the forehead), white below, and with distinctive long, pink legs. The bird uses a variety of aquatic habitats but is limited by water depth and vegetation cover. Stilts require wadable mudflats or early successional marshlands with a water depth less than nine (9) inches and perennial vegetation that is limited and low growing, or exposed tidal mudflats. Because suitable shallow habitat is limited in and around Kawainui Marsh, State bi-annual waterbird counts have resulted in few stilt observations. These observations have ranged from 0 to 10 individuals recorded on counts conducted from 1991 to 2007 with an average of 1.4 during the winter (FWS 2009).

Hawaiian coot adult males and females have a black head, a slate gray body with white undertail feathers, and a prominent white frontal shield and bill. Their feet are lobed rather than webbed and are greenish-gray. Hawaiian coots prefer more open water, will nest in fresh and brackish ponds, and construct floating nests of aquatic vegetation in open water or semi-floating nests anchored to emergent vegetation. Hawaiian coots typically feed close to their nesting area but will travel long distances when food is not available. An average of eight coots have been observed in winter months and nine birds observed during summer on State waterbird counts taken between 1991 to 2007. These observations have ranged from 0 to 60 individuals recorded on counts (FWS 2009).

The Hawaiian moorhen is a dark gray bird with a black head and neck, and white feathers on their flanks and on their undertail coverts. They have a very distinctive red frontal shield, and their bill tip is yellow with a red base. These birds are the most secretive of the native Hawaiian waterbirds, preferring to forage, nest and rest in dense late serial vegetation. Most birds

encountered in open or exposed areas will quickly seek cover when disturbed. An average of six (6) Hawaiian moorhen was observed during State bi-annual waterbird counts from 1991 to 2007. These observations have ranged from 0 to 23 individuals recorded during counts (FWS 2009).

The Hawaiian duck is one of two extant native duck species found in Hawaii and is closely related to the well-known, but non-native mallard. Both sexes are mottled brown overall similar in appearance to a female mallard. Adult males have darker heads, with distinctive brown chevrons on the breast, flank and back feathers, and olive bills. Adult females are similar but are smaller than males on average and slightly lighter in color, with plainer, buff colored chin and back feathers.

Hawaiian ducks are now most commonly observed around open waterways and channels. In recent years, State-led biannual waterbird counts in Kawainui Marsh indicated very low observation numbers with only a few individuals recorded during each count. These observations have ranged from 0 to 7 individuals recorded from 1991 to 2007 with an average of 1.4 during the winter. Between 2001 and 2007, on only one occasion were two birds recorded. The Hawaiian ducks have been declining primarily due to hybridization with mallard ducks (FWS 2009).

Mammal Resources

Wide varieties of mammalian resources live within Kawainui Marsh or access the marsh from the surrounding areas, and these species serve as predators to waterbirds. The small Indian mongoose (*Herpestes auropunctatus* or *javanicus*) is the most pernicious of the predators present within the marsh and a key predator to waterbirds. DOFAW implements a trapping program at Kawainui Marsh to try to keep the number of mongoose down. The roof rat (*Rattus rattus*) inhabits a wide range of environmental conditions, and has been identified as a predator of native birds.

Feral dogs (*Canis familiaris*) are present in the area intermittently and constitute a threat to ground-nesting birds. Because of the proximity of urban communities, domesticated dogs are present and pose a threat to waterbirds, particularly when dogs are walked through the marsh. Feral cats (*Felis catus)* are present within the marsh and surrounding area, and pose a threat to both ground nesting and arboreal nesting birds.

3.5.3 Aquatic Resources

The waters of Kawainui Marsh support a variety of introduced and indigenous aquatic wildlife. In the upper reaches of the marsh, Kahanaiki and Maunawili Streams are dominated by introduced species such as tilapia (*Oreochromis mossabmica* and *Sarothorodon melanotheron*), mosquito fish (*Gambusia affinis*), guppy (*Poecilia spp*.), carp (*Cyprinus carpio*), Chinese catfish (*Clarias fuscus*), swordtail (*Xiphophorus heller*), bronze catfish (*Corydoras aeneus*) and

smallmouth bass (*Micorpterus dolomieui*). Native fish have been found in the marsh in low densities. These include the endemic goby (*Awaous guamensis*), an indigenous goby (*Stenobobius genivittatus*) and an endemic eleotrid (*Eleotris sandwicensis*).

There are several invertebrates within the marsh. Some of the introduced species include the Tahitian prawn (*Macrobrachium lar*), crayfish (*Procambarus clarkia*), damselfly (*Ischnura ranburii*), apple snail (*Pomacea sp*.), and pond snails (*Melanoides sp*.). Native invertebrates include the native shrimp (*Atyoida bisculata* and *Marcrobrachium grandimanus*) (U.S. Army COE, December 2008).

3.6 AIR QUALITY

Federal ambient air quality standards (AAQS) have been established by the U.S. Environmental Protection Agency (EPA) for six criteria pollutants: carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), lead (Pb), ozone (O3), and concentrations of particulate matter less than 10 microns (PM10) and 2.5 microns (PM2.5). For selected criteria pollutants, the State of Hawaii has established ambient air quality standards that are somewhat more stringent than the federal standards under Title 11, Chapter 59, HAR. Table 3.6 presents a summary of federal and Hawaii ambient air quality standards that apply to the proposed project area.

Table 3.6
State and Federal Ambient Air Quality Standards

Air Pollutant	Averaging Time	Hawaii AAQS	Federal (NAAQS)	
			Primary	Secondary
Carbon Monoxide (CO)	1-hour	9 ppm	35 ppm	--
	8-hour	4.4 ppm	9 ppm	--
Lead (Pb)	Quarterly	1.5 μg/m^3	1.5 μg/m^3	1.5 μg/m^3
Nitrogen Dioxide (NO_2)	Annual	0.04 ppm	0.053 ppm	0.053 ppm
Ozone (O_3)	8-hour	0.08 ppm	0.075 ppm	0.075 ppm
Particulate Matter ≤10 micrometers in diameter (PM_{10})	Annual	50 μg/m^3	--	--
	24-hour	150 μg/m^3	150 μg/m^3	150 μg/m^3
Particulate Matter ≤2.5 micrometers in diameter ($PM_{2.5}$)	Annual	--	15 μg/m^3	15 μg/m^3
	24-hour	--	35 μg/m^3	35 μg/m^3
Hydrogen Sulfide (H_2S)	1-hour	0.025 ppm	--	--
Sulfur Oxides (SO_2)	Annual	0.03 ppm	0.03 ppm	--
	24-hour	0.14 ppm	0.14 ppm	--
	3-hour	0.50 ppm	--	0.50 ppm

Source: State Department of Health, 2008

Air quality in the State can be generally characterized as relatively clean and low in pollution. Excluding exceedances of pollutants due to the continuing volcanic eruption on the Island of Hawaii, the State of Hawaii was in attainment of all National ambient air quality standards in

2008 (DOH, 2009). Tradewinds that are predominant throughout the year typically carry emissions and other air pollutants from inland areas out toward the ocean.

Present air quality in the Kawainui Marsh restoration project area is primarily affected by vehicle emissions, and to a lesser extent by natural sources and distant industrial sources. Much of the particulate emissions on O‘ahu originate from area sources such as mineral products industry and agriculture. Sulfur oxides are emitted almost exclusively from point sources such as power plants and refineries. Nitrogen oxides emissions emanate predominantly from industrial point sources.

Air quality within the project area is affected by vehicular-related emissions in the form of carbon monoxide (CO) generated by traffic along Kapa‘a Quarry Road and Kalaniana‘ole Highway. Vehicular traffic along Kapa‘a Quarry Road is fairly light with about 360 to 400 vehicles traveling along this road (total traffic northbound and southbound) at the intersection with the highway during the commuter peak hours. Kalaniana‘ole Highway has much higher traffic volumes with about 3,400 to 3,800 vehicles (total both direction) during the commuter peak hours. However, the signalized intersection of Kapa‘a Quarry Road with Kalaniana‘ole Highway operated at good levels-of-service (LOS B) in 2009 (SD&C January 2011).

Traffic congestion is not likely to occur at this intersection that would generate increased concentrated emissions of CO. Any emissions are not expected to exceed the State’s one hour AAQS for CO (9 ppm), and should be well within the National AAQS. Therefore, present carbon monoxide emissions from vehicular traffic should not be an issue affecting air quality associated with the project area and immediate area.

3.7 NOISE

Existing dominant noise sources within the project area would consist of the wind, occasional distant aircraft flybys, vehicular traffic, and human voices. The only existing urban use near the project area is Le Jardin Academy situated inland (mauka) of Kapa‘a Quarry Road. Noise generated from educational activities occurring there should be minimal due to the distance between classrooms and activity areas from the wetland portion of the marsh (about 750 feet).

Vehicular traffic along Kapa‘a Quarry Road and Kalaniana‘ole Highway would be the primary noise sources generated at the project area. Traffic noise levels estimated further north of the project area at the intersection of Kapa‘a Quarry Road with Kapa‘a Quarry Access Road (leading into the industrial area) was 60 decibels (dB) L_{dn} (SD&C January 2011).

3.8 VISUAL RESOURCES

This section identifies existing visual resources that are associated with the Kawainui Marsh project area. Various references were used to assist in identifying visual resources associated with area along with public viewing locations. Sources identified consisted of the City's *Ko'olau Poko Sustainable Communities Plan* (DPP August 2000) and *Coastal View Study* (Chu and Jones 1987).

3.8.1 Visual Resources References

The City's *Ko'olau Poko Sustainable Communities Plan*, adopted under Ordinance 00-47, presents guidelines, polices, and conceptual schemes that serve as a policy guide for more detailed zoning, maps, and regulations. Panoramic views of natural features and landmarks identified under this plan depict the vantage points and orientation of major panoramic views of resources within Ko'olaupoko. Kawainui Marsh was identified as an important wetland and wildlife habitat resource under the plan. Scenic views of this open space resource were identified consisting of the following.

1. *Continuous northbound view of marsh from Kalaniana'ole Highway between Kapa'a Quarry Road and Castle Medical Center.*
2. *Continuous northwest view of marsh from Kailua Road between Hāmākua Drive and Hanale Place.*

Of these two views from roadways, the view of the project area from the highway is most pertinent. Views from Kailua Road are primarily of other areas of the entire 830-acre marsh.

A *Coastal View Study* (DLU, 1987) was completed for the City's Department of Land Utilization (now known as the Department of Planning and Permitting) that inventoried significant coastal views and coastal land forms which together make up the scenic shoreline resources on O'ahu. The study identified views from public viewing points and coastal roadways within the City's Special Management Area, which includes Kawainui Marsh. This study identified two roadway views associated with Kawainui Marsh that are identified below.

1. KP-9. *Mauka and makai view corridors at Kawainui Canal*.
2. KP-10. *Lateral views into Kawainui Marsh from the highway.*

Mauka views of Kawainui Canal (KP-9) occur along North Kalaheo Avenue and do not allow any views of the restoration project area within the marsh. Lateral views of the marsh (KP-10) generally corresponds to the same view corridor along Kailua Road that was identified under the City's *Ko'olau Poko Sustainable Communities Plan*. This occurs from Castle Medical Center toward Hāmākua Drive.

3.8.2 Existing Views

Existing views from the highway toward the marsh are very limited due to the presence of tall and thick vegetation, mainly non-native, that line the highway. Actual views of the wetland area within the marsh are screened by this thick vegetation. Therefore, there are currently no continuous views of the marsh available from the highway as indicated in the reference documents above. Exhibit 3.8 provides a photo of this condition at the highway's intersection with Kapaʻa Quarry Road. Existing views of the project area along Kapaʻa Quarry Road are similarly screened by existing trees and vegetation.

Exhibit 3.8 – Photo of Vegetation Along Kalanianaʻole Highway

3.9 HISTORIC, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

An archaeological reconnaissance survey with limited subsurface testing for Kawainui Marsh was conducted by Cultural Surveys Hawaiʻi, Inc. (CSH) in accord with State Historic Preservation Division (SHPD) rules governing standards for archaeological reports (HAR 13-13-276). A copy of the report is included in Appendix C. The scope of work for this archaeological reconnaissance survey was developed and implemented in consultation with the SHPD. The survey consisted of the following methods: 1) reconnaissance survey; 2) limited subsurface testing; and 3) sediment coring.

The scope of the archaeological investigation included historical research of archival sources, historic maps, Land Commission Awards (LCA) and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near the project area. The reconnaissance-level pedestrian survey of the project area was performed to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. However, surface visibility was generally poor due to dense vegetation growth dominated by California grass (*Brachiaria mutica*) in the wetland and *hau* (*Hibiscus tiliaceous*) in the upland area along Kapaʻa Quarry Road. All surface historic properties were documented with a detailed written description including an evaluation of function, interrelationships, and significance, photographs, and scale drawings when appropriate.

Limited subsurface testing within the project area consisted of the excavation of 12 test trenches (Trench 1-12) that were monitored by archaeologists. Sediment coring was also conducted within the project area and consisted of the manual extraction of two core samples (Core Locations 1 and 2). The stratigraphic profile of each backhoe test trench and each sediment core sample was drawn and photographed.

3.9.1 Results of Background Research

This section discusses the results of background research conducted of the project area which is comprised of a summary of the region's history and prior archaeological studies conducted for the area. More details on the traditional and historical background of the Kailua region are documented in Appendix C.

Summary of Kailua Region History

The history of the Kailua region has been documented in a number of studies. All of these studies detailed the legendary history and oral traditions, the legendary rulers and personalities, the early historic accounts, land ownership and utilization changes during and following the *Māhele*, and the changes in land use from traditional to modern times. Appendix C provides more information associated with this background.

Early Historic Period

The drastic depopulation of the Hawaiian Islands following the introduction of Western disease has been documented in a number of sources. One estimate indicated the population of Hawaiians and part-Hawaiians fell from approximately 300,000 in 1778 to 82,593 by 1850. Population counts from the 1830s place the population of Kailua at approximately 760 individuals. Westerners passing through Koʻolaupoko in the mid 1840s made note of the cold and flu symptoms among the native Hawaiians and that much formerly productive land appeared abandoned.

Mid- to Late-1800s

It appears that Kailua, Kāneʻohe, and Waimānalo were considered choice locations at the time of the *Māhele* as these *ahupuaʻa* were awarded to the Crown, the royal family, and then to important *aliʻi*. The LCA records for Kailua document a thriving cultural landscape of garden areas clustered along its approximately 18 permanent and intermittent streams. The Maunawili/Kahanaiki Stream delta was a large, marshy low-lying area, with fertile soils along streambeds with many taro *loʻi*.

The settlement pattern within the Kawainui Marsh project area during the mid 1800s was dominated by irrigated agriculture. Agricultural lands included numerous spring and stream watered pond fields (*lo'i*). Dryland agriculture would have dotted the hill slopes above the marsh. Crops included traditional Hawaiian economic plants as well as Western introduced economic plants, such as fruit trees. House lots would have been dispersed on the higher grounds surrounding the marsh.

An 1899 Wall map showed more accurately the true complexity of ownership with the large land divisions of Kupaka, Kapalo, and Makalepo extending down from the summit of the Oneawa Hills to the west edge of the marsh and a large number of Land Commission Awards and later grants within the project area. A somewhat braided network of water flow between Kahanaiki Stream (on the west) and Maunawili Stream (on the east) was indicated. A small house structure appeared to be shown near the southeast side of the project area.

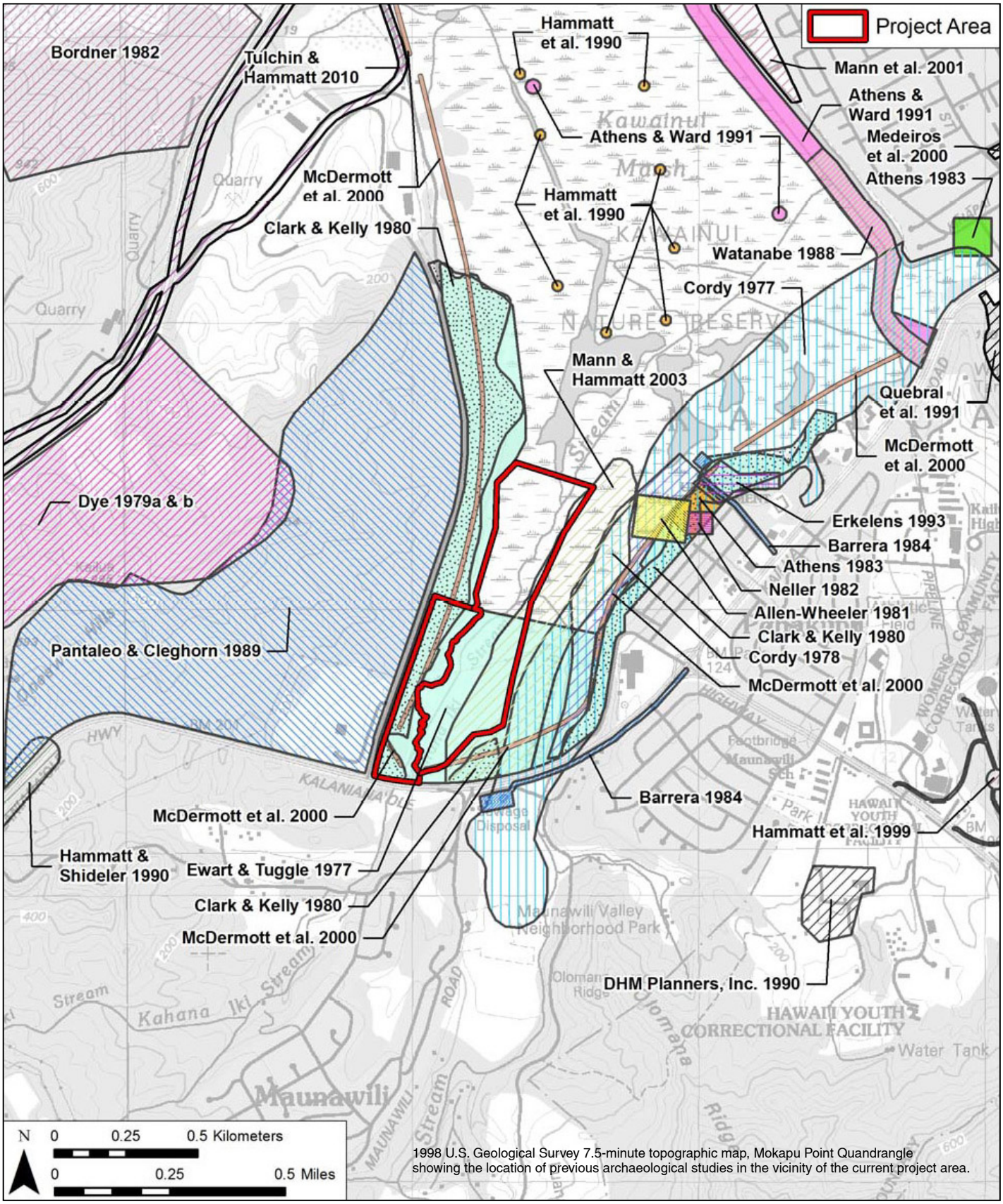
1900s

In the early 1900s, Kāneohe Ranch came to dominate land holdings in the Kailua and Kāne'ohe area. Included within this acreage was much ranch land that has been bought, sold, and used as ranch land by numerous parties since the mid-1850s. Cattle, sheep, and horses, were thus allowed to roam through many parts of Kailua, and would have destroyed many gardens and abandoned habitation areas. Kāneohe Ranch also grew pineapple and sugarcane. With the decline of rice farming around the margins of Kawainui, cattle stock moved onto the abandoned agricultural lands.

Previous Archaeological Research

Twentieth century archaeological findings from inventory surveys, data recovery projects, and inadvertent finds are the main source of knowledge about the archeological record in Kailua. Archaeological work in Kailua over the past 25 years was fairly extensive, and were primarily concentrated along the margins of Kawainui Marsh and within Maunawili Valley. This was largely due to most of the makai portions of the *ahupua'a* being developed prior to the implementation of State and Federal historic preservation rules. Previous archaeological studies conducted of the Kawainui area is graphically shown on Figure 3.8.

Remains of upland terraces show that taro was grown extensively and intensively in Kailua since the 13th or 14th century, and possibly earlier. Studies have documented the mix of irrigated and dryland agriculture that was carried out in Kailua during prehistory and continuing into the historic period. Dryland agriculture, including yams, gourds, and sweet potato, would have been carried out on slopes and on drier flat-lands.



1998 U.S. Geological Survey 7.5-minute topographic map, Mokapu Point Quandrangle showing the location of previous archaeological studies in the vicinity of the current project area.

Figure 3.8

Previous Archaeological Studies of the Project Area

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

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Modifications to the landscape would have been variable, ranging from none at all to the construction of terraces and mounds for planting. The beach barrier at Kailua (current day Coconut Grove) was famous for its production of sweet potatoes, grown in small mounds. Irrigated agriculture would have been carried out along streams and below springs. Associated landscape modifications would have included construction of terraces and/or pond fields, *'auwai*, and earthen and stacked-stone berms. These types of dryland and irrigated agricultural features have been found in Maunawili and along the margins of Kawainui Marsh.

Previous archaeological investigations in Kailua have located dispersed prehistoric habitation remnants. This was in keeping with observations of early Westerners in Hawai'i that the settlement pattern for the most part was dispersed habitations scattered across the landscape amid agricultural fields. As previously mentioned, settlement data is absent from the lowland, beach berm areas of Kailua due to early development of these areas prior to historic preservation rules.

Eight heiau were reported within the *ahupua'a* of Kailua, and it is reasonable to conclude there were several more of which informants had no knowledge. This is consistent with Kailua's status as a productive *ahupua'a* and the residence of *ali'i*. The three known heiau closest to the project area are: 1) Pahukini Heiau (State Site #359), 2) Holomakani Heiau (State Site #360); and 3) Ulupō Heiau (State Site #371). Pahukini Heiau and Holomakani Heiau are both located mauka of Kapa'a Quarry Road with Pahukini Heiau located in the area of the Kapa'a industrial (quarry) area and outside of the project area. Ulupō Heiau is situated next to the Kailua YMCA off of Kailua Road east of the restoration project area.

3.9.2 Results of Current Fieldwork

Fieldwork began with a reconnaissance survey to identify any historic properties and to examine specific areas indicated in the historic research (specifically house sites and Land Commission Awards) as more likely to have subsurface deposits. The only traditional artifact observed was a grinding stone about 260 feet southwest of the southeast corner of the former LCA 7588. These grinding stones are somewhat characteristic traditional Hawaiian artifacts of the Kawainui slopes. This grinding stone in the project area lies at the base of a break in slope under a particularly large noni (*Morinda citrifolia*) tree.

Only two archaeological sites (both described as terraces) have been reported in the vicinity near the margin of Kawainui Marsh, and these are identified as Ewart and Tuggle's (1977) "Site 7" and Clark's (1980) "Cluster 12". Two Bishop Museum studies concluded that "Site 7" and "Cluster 12" were the same site despite the fact that they indicated the position of these two sites as being more than 1,600 feet apart.

CSH attempted to locate "Cluster 12" in the field, and used a Global Positioning System (GPS) unit to locate the site. This location was in fairly dense brush north of an area previously cleared by DOFAW from maintenance activities. Several areas of densities of scatter boulders and

cobbles were observed, but no clear archaeological feature was discerned. Overlays of structures documented on historic maps and aerial photographs indicate roads and a circa 1928-1943 house in this area. It was concluded that it is highly probable that both "Site 7" and "Cluster 12" relate to extensive early twentieth century activity including grading for a road, agricultural field preparation and seemingly four houses in this immediate area (shown on 1928 & 1943 maps and a 1949 aerial photograph). Figure 3.9 shows the locations of these post-Contact features identified.

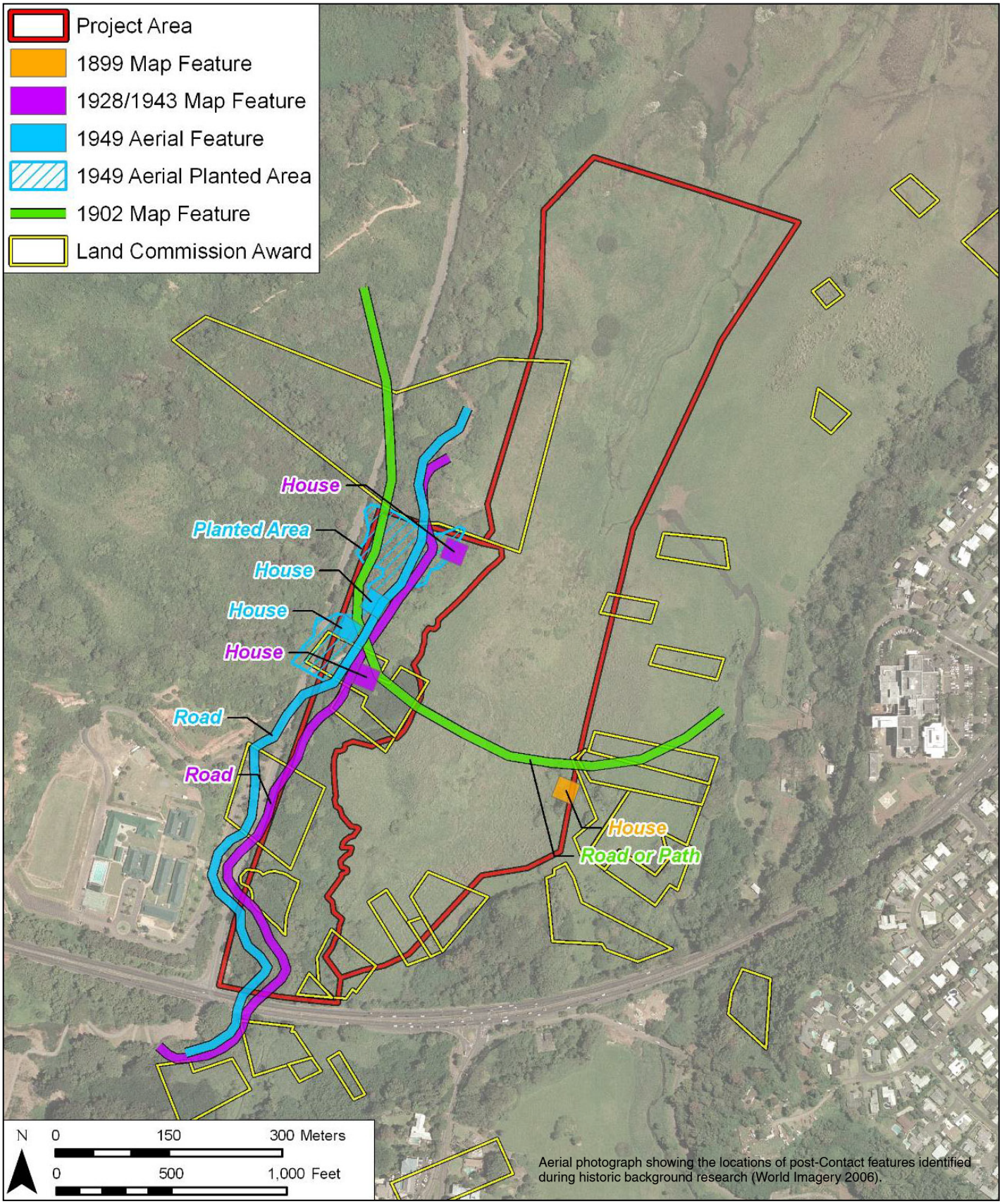
Limited Subsurface Testing

Limited subsurface testing within the project area consisted of the backhoe-assisted excavation of 12 test trenches. Figure 3.8 shows the locations of these test trenches that were positioned at or near the location of post-Contact features as indicated by historic background research. Many of the Land Commission Awards were determined to be unsuitable for subsurface testing due to the high water table, thick *hau* vegetation, or the results of modern fill activities.

Subsurface testing within the project area failed to identify any formal habitation-related subsurface structures. However, the presence of stratigraphic anomalies within Trench 2 and Trench 11, and sparse historic and traditional Hawaiian artifacts within several trenches, provide some evidence for pre-Contact or early post-Contact and historic land-use within the project area.

One small area of loose basalt cobbles was identified within the southwestern end of Trench 2 near the present ground surface (approximately 0.6 to 2.3 feet below surface). The loose cobble concentration is likely the remnant of a historic or modern fill event, but does not appear to be related to a house foundation or infrastructure. Additional testing in the immediate vicinity (Trench 3) indicated that the cobble concentration is an isolated anomaly and not part of a linear or expansive structure. The loose cobble concentration identified was not considered a remnant of a historic structure, and therefore was not designated as a historic property.

One basalt boulder was indentified within the northern end of Trench 11, near the base of excavation (about 2.0 feet below surface). The basalt boulder, along with several other basalt boulders that were observed on the present ground surface near Trench 11, may represent the remnants of a stone construction or possible house foundation although no stacking or alignments were discernable. A roughly rectangular stand of non-native bamboo at the location of the possible 1899 house lot also seemed indicative of landscaping associated with a house, yard, or garden. This evidence provided the basis for inclusion of the possible 1899 house lot area as a component of the Kawainui Marsh archaeological-cultural-historical complex (SIHP 50-80-11-2029).



Aerial photograph showing the locations of post-Contact features identified during historic background research (World Imagery 2006).

Figure 3.9
Locations of Post-Contact Features Identified

Additional evidence for historic habitation within the project area included sparse diagnostic and non-diagnostic historic artifacts that were identified within several test trenches at or near the present surface. Diagnostic historic artifacts included a glass jug and jar fragments collected from Trench 6 with a range of manufacture dating from 1947 to 1963. Evidence for traditional Hawaiian land use within the project area included: 1) the presence of two basalt flakes within Trench 2 (within possible footprint of 1928 house lot); 2) one basalt flake within Trench 11 (within possible footprint of 1899 house lot); 3) one volcanic glass flake within Trench 12 (also within possible footprint of 1899 house lot); and 4) one basalt adze fragment that was surface-collected along the edge of the bulldozed road near Trench 8. A complete inventory and analysis of historic artifacts identified within the project area is provided in Appendix C.

The presence of scattered traditional Hawaiian and historic artifacts at the location of the possible 1899 house lot provided additional evidence for early historic habitation and the inclusion of the footprint as a component of SIHP 50-80-11-2029. Subsurface testing conducted at or near the boundaries of LCAs also failed to identify subsurface architectural remnants, which were considered to potentially consist of minimally constructed, low-profile *lo'i* walls. No cultural material or stratigraphic anomalies were observed.

Stratigraphy within the project area consisted of dryland environmental sequences and fill events at the locations of possible historic house lots along Kapa'a Quarry Road and the wetland environmental sequences of Kawainui Marsh at the locations of LCA boundaries, the possible 1899 house lot, and within extracted sediment cores.

Radiocarbon Analysis Results from Sediment Coring

Two sediment cores (Core Sample 1 and 2) were manually extracted from locations within the project area. Core Sample 1 was located near the southern boundary of the project area and Core Sample 2 was located near the northwestern corner of the project area. Three sediment sub-samples were collected from three discrete locations along each sediment core for radiocarbon dating and pollen analysis.

Three sediment sub-samples were analyzed from Core Sample 1 (Sample 1A to 1C) and Core Sample 2 (Sample 2A to 2C) as discussed in Appendix C. Analysis of Sample 1A, Sample 1B, and Sample 2A concluded that the datable material within each sample contained more Carbon-14 (radiocarbon) than did the modern reference standard, suggesting that these samples have a modern (post-1950) origin. Analysis of Sample 1C yielded a date range of A.D. 420 to 580. Analysis of Sample 2B yielded two possible date ranges with a date range of A.D. 1430 to 1530 (82.8%) being the most probable. Analysis of Sample 2C yielded a date range of A.D. 880 to 1020.

Pollen Analysis Results

Pre-Contact to Post-Contact Environmental Change

Generally, what was expected was a decrease in the pollen of native trees and shrubs as one moves from pre-Contact to post-Contact times. There appears to be clear evidence supporting the loss of native plant species moving into post-Contact times. The distribution of Anacardiaceae pollen (cashew, mango family) in three pre-Contact samples reflects the pre-Polynesian vegetation community on O‘ahu. Loss of native plants is represented in Antidesma (most likely *Hame* trees) pollen seen in two of the three pre-Contact samples and then not present in any of the three modern samples. Other similar results occurred for Colubrina (most likely ‘*Anapanapa* shrubs), Myoporum (most likely *Naio* trees), Brousssaisia/Artemisia (most likely *Kanawao* trees), and Claoxylon (most likely *Po‘olā* trees).

Native-species type pollen that does extend into modern times is also noted. Hibiscus pollen (most likely mostly *Hau, Hibiscus tiliaceus*) is about the same in pre-Contact sample as in post-Contact sample. Possibly, the general abundance of *hau* at Kawainui has not changed much. Pandanus (*Hala*) and Coconut (*Niu, Cocos nucifera*) are only shown as present in modern times. This possibly reflects modern treads such as the historic development of the “Coconut Grove area” and domestic landscaping.

As a generalization, the trend occurring from late Pre-Contact times to modern times is a general decrease in Cyperaceae (sedges) and a general increase in Poaceae (grasses). This would appear to reflect a general trend towards eutrophication and the conversion of the marsh to a meadow due to increasing nutrient loading and siltation resulting from environmental changes of the uplands starting in late pre-Contact times but intensifying in modern times. This is also reflected in the large percentage of the cores recovered that are “modern”. Modern sediment accumulation in Core 1 appears to accounts for a relatively thick top (about 20 inches) of sediment, and in Core 2 modern sediment accumulation accounts for a relatively thick top (about 12 inches) of sediment.

Pre-Contact Environmental Change

There is re-thinking regarding the likely timeframe of first Polynesian settlement in Hawai‘i with a belief toward later settlement perhaps as late as circa A.D. 1,000 according to some. It seems probable that the A.D. 420-580 pollen record reflects a pristine pre-human island eco-system or a time of very early Polynesian settlement. Some archaeologists now believe that the timeframe of A.D. 880-1020 could reflect a time of very early Polynesian settlement or even a pristine pre-human island eco-system.

Microscopic charcoal was identified in significant concentrations in all samples. This could support a hypothesis of Hawaiian occupation and burning for field creation as early as the A.D.

420-580 timeframe, but one cannot rule out downwards migration due to tidal flux. The microscopic charcoal concentrations in the A.D. 880-1020 timeframe appear strong, suggesting burning for field creation. This definitely calls into question a prior study conclusion that fire has had little or no effect on natural vegetation communities in the Kawainui Basin watershed.

The pattern indicated in the samples from A.D. 420-580 and A.D. 880-1020 of decreasing *Cyperaceae* (sedges), increasing *Poaceae* (grasses), and increasing microscopic charcoal show what one would expect as a reflection of Polynesian land clearing activity favoring a trend from marsh to meadow due to environmental degradation, increased siltation and nutrient loading. Surprisingly, these trends appear to reverse as time moves from A.D. 880-1020 to A.D. 1430-1630. Others have noted that the sedge pollen curve begins a steep rise after about A.D. 1000 and that it resulted from the shallowing of Kawainui in a transition from open water to marsh, and the development of a peat layer that improved sedge habitat. The CSH pollen data also shows this steep rise in sedge pollen after about A.D. 1000, but also shows that there had been a steep drop in the prior 500 years calling into question the explanation of marsh transition by others.

A key marker pollen species, Pritchardia (*loulu* palms) has been suggested to reflect pre-Contact Polynesian environmental change. Direct human consumption of fruits for food, wood for timber and fuel, ancillary impacts of human use of fire for land clearing, and the effects of Polynesian-introduced pigs, dogs, and rats appear to have decimated native stands of *loulu* palms in pre-Contact times. This appears to be supported by the trend of apparent radical reduction of Pritchardia pollen between the A.D. 880-1020 to A.D. 1430-1630 timeframes. However, no reduction of Pritchardia in the interval from the A.D. 420-580 timeframe to the A.D. 880-1020 timeframe is indicated by this data.

Lack of Cultigens

The only clear identification of Native Hawaiian cultigens are Coconut (*Niu, Cocos nucifera*) and *Saccharum* pollen (representing sugarcane) present in the modern samples. *Saccharum* pollen was reported from Sample 1C (A.D. 420-580) and Sample 2B (A.D. 1430-1630). This suggests that sugarcane may have been a more important cultigens (useful as a windbreak as well as for sweet carbohydrates) in pre-Contact Kailua than previously appreciated.

The striking absence of *Colocasia* (taro or *kalo*) pollen recovered is also noted, since it is usually observed in very small quantities. The over-production of *Cyperaceae* (sedge) pollen may have obscured this pollen. In addition, no core food plants pollen (yam, sweet potato, taro, breadfruit, banana) was observed at all. Possibly, the concept of Kawainui as a “former breadbasket” of Polynesian-introduced cultigens may have been overemphasized. Athens and Ward (1991) in their work at Kawainui also noted that their pollen record for the presumed Polynesian-introduced species was very sparse.

Salt Water Intrusion at Kawainui

Recovery of a large quantity of *Cyperaceae* (sedge) pollen in Sample 1C dated to A.D. 420-580 indicated that this location was a marsh at the time this sediment accumulated. It appears that Kawainui has been a marsh since at least as far back as the A.D. 420-580 timeframe and hence probably for the entire history of human experience of the vicinity. This is consistent with earlier conclusions that Kawainui was cut off from the ocean at an earlier date.

Independent relatively close timeframe estimates for Kawainui's transitioning from a marine to largely freshwater basin have been suggested for B.C.E. 295 to A.D. 12 or perhaps slightly earlier circa B.C.E. 394-91. Foraminifera, indicating possible saltwater intrusion, were noted in two samples: 1) 1B (modern); and 2) 2B (A.D. 1430-1630). This possibly relates to relatively brief periods of tsunami or natural hazards that induced saltwater inundation rather than any period of embayment or true circulation with Kailua Bay.

3.9.3 Description of Affected Properties

Historic properties identified within the project's area of potential effect consist of: 1) the Kawainui Marsh Archaeological-Cultural-Historical Complex; and 2) remnant of a historic road.

Kawainui Marsh Archaeological-Cultural-Historical Complex

SIHP# 50-80-11-2029

Site Type:	Kawainui Marsh Archaeological-Cultural-Historical Complex
No. of Features:	1
Functional Interpretation:	Indeterminate
Probable Age:	Pre-Contact to Historic
Overall Dimensions:	Indeterminate
Topography:	Level to Steeply Sloping

State Inventory Historic Property (SIHP) 50-80-11-2029 is the Kawainui Marsh Archaeological-Cultural-Historical Complex, and was deemed eligible for listing on the National Register of Historic Places in 1979. The historic property complex has been identified and documented in several previous archaeological studies of this marsh.

Two archeological studies conducted by Cordy (1978) and Allen-Wheeler (1981), consisted of subsurface test excavations, and both investigations documented basalt-boulder alignments. The alignments ranged in depth from visible on the ground surface to 24 inches below ground surface. Cultural deposits consisting of basalt and volcanic glass flakes were also recovered at a depth of 22 to 50 inches below surface.

A Mann and Hammatt (2003) subsurface archaeological study, located just east of the restoration project area, also identified lithic debitage, volcanic glass flakes and a basalt adze at 28 to 38 inches below surface just above the water table. A mound of river cobbles may represent a local adaptation to water control utilizing immediately available resources (mounding river cobbles).

The information gathered from these three subsurface studies suggests that intact cultural deposits consistent with *lo'i* and rice agriculture still remain both on the surface, as well as buried beneath sediment deposits. The present study conducted by CSH for this restoration project identified additional components of the SIHP 50-80-11-2029 complex that include a grinding stone and remnant components associated with historic habitation. Figure 3.10 provides an aerial photo of the project area identifying these components.

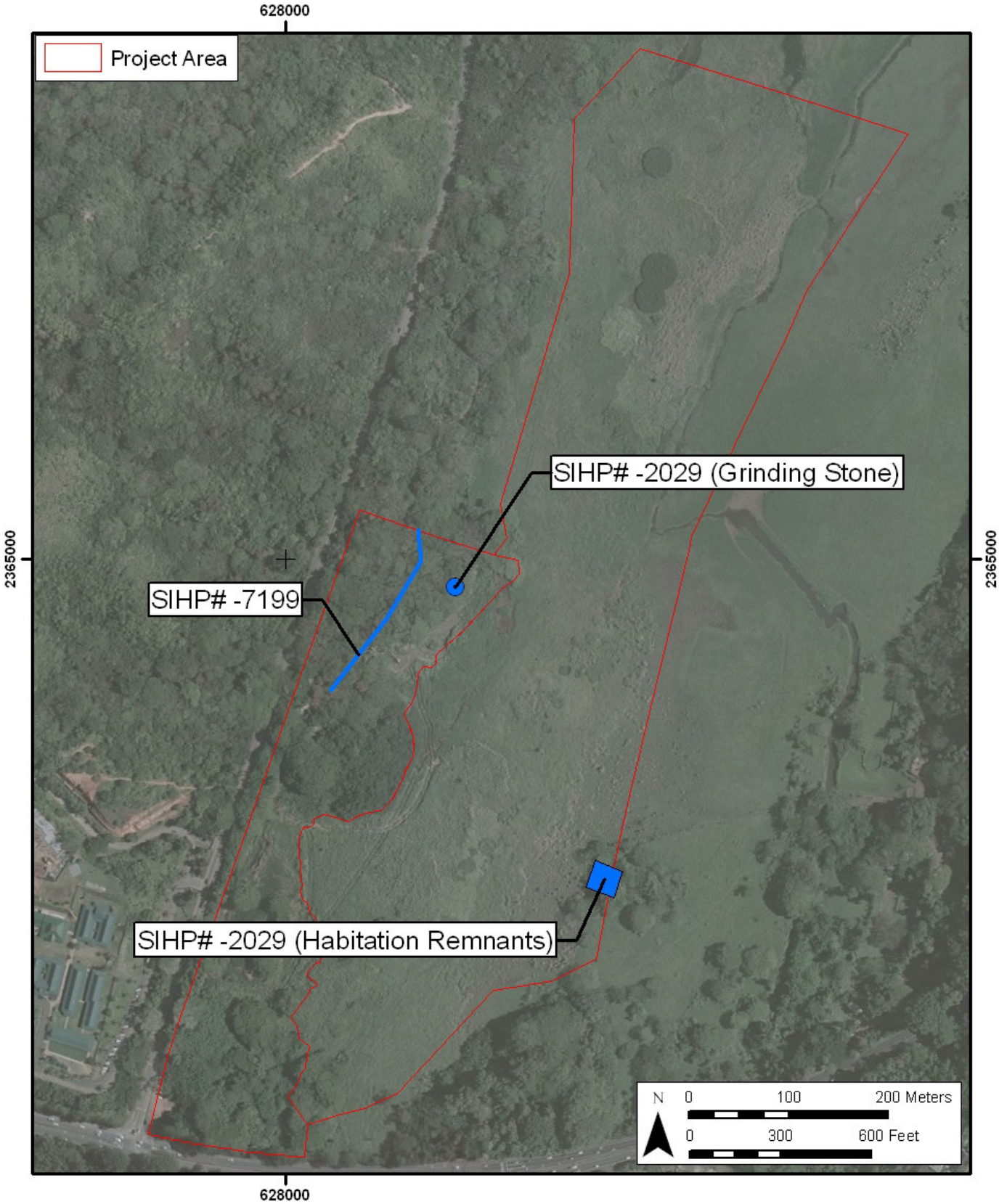
Grinding Stone

The grinding stone is located approximately 260 feet to the southwest of the posited southeast corner of the former LCA 7588. The grinding stone is somewhat characteristic of a traditional Hawaiian artifact of the Kawainui slopes. This grinding stone lies at the base of a break in slope under a particularly large *noni* (*Morinda citrifolia*) tree which is a type of tree mentioned in supporting documents for LCAs in the area but was an uncommon tree in the general vicinity today.

Historic Habitation

The remnant components associated with historic habitation on the margins of Kawainui Marsh include a large rectangular stand of non-native bamboo, several pieces of lumber, and a post and barbed-wire fence line. Subsurface excavation of trenches within this area yielded sparse traditional Hawaiian artifacts that included one basalt flake (Accession #14), one volcanic glass flake (Accession #15), as well as several non-diagnostic historic artifacts. Additionally, one basalt boulder was indentified within the northern end of Trench 11, near the base of excavation approximately 2 feet below surface. The basalt boulder, along with several other basalt boulders observed on the present ground surface near Trench 11, may represent the remnants of a stone construction or possible house foundation although no stacking or alignments were discernable.

A review of historic maps indicates that the surface habitation remnants and subsurface findings are located within or adjacent to a building or house that was depicted on an 1899 map by W. E. Wall. The presence of subsurface traditional Hawaiian and historic artifacts, a stand of non-native bamboo, several pieces of lumber, and a post and barbed-wire fence line at the location of the possible 1899 house lot provided evidence for early historic habitation and the inclusion of the footprint as a component of SIHP 50-80-11-2029.



Aerial photograph showing the location of SIHP# 50-80-11-2029 (Kawainui Marsh Archaeological-Cultural-Historical Complex) grinding stone and habitation remnants features and the SIHP# 50-80-11-7199 Road (remnant) within the current project area.

Figure 3.10

Locations of Components within SIHP 50-80-11-2029 (Kawainui Marsh Archaeological-Cultural-Historical Complex)

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Historic Road Remnant

SIHP# 50-80-11-7199

Site Type:	Road (remnant)
No. of Features:	1
Functional Interpretation:	Transportation
Probable Age:	Historic
Overall Dimensions:	Extends approximately 1,310 feet within the project area
Topography:	Steep to moderate slope

SIHP# 50-80-11-7199 (shown in Figure 3.10) consists of a presently in-use section of roadway that extends roughly parallel to the western edge of Kawainui Marsh along the western boundary of the project area. The extant portion of this roadway remnant measures approximately 1,310 feet within the current project area. Present vehicular access to this road is provided from a connecting modern entry road that extends from the southwestern end of this site west to connect with Kapa‘a Quarry Road. SIHP# 50-80-11-7199 is comprised of an unpaved and unimproved worn road surface with no associated construction or infrastructure.

While SIHP# 50-80-11-7199 appears to be related to a modern access point to Kawainui Marsh, a review of historic maps indicates that this site closely aligns with a section of roadway depicted on the 1928 U. S. Geological Survey map and the 1943 War Department Map. The historic unpaved road extends from the present alignment of Auloa Road (former access corridor to the Pali Road) north along the base of the slope within the western portion of the project area. The historic road tapers into a cart road or trail just north of Core Location 2 along the western slope leading into Kawainui Marsh. SIHP# 50-80-11-7199 is likely a segment of a roadway that was constructed prior to 1928, and is therefore considered an historic property.

3.10 SOCIAL AND ECONOMIC FACTORS

Information on the existing social characteristics of the project area was obtained from the U.S. Census Bureau’s Census 2010 data. Employment and income data was compiled from the 2000 Census because 2010 data has not been published yet.

Census Information

The Kawainui Marsh project area is located within the Honolulu Census Designated Place (CDP), but it has its own census tract identified as 9810. There was no census data available for this tract. The Kailua CDP and Maunawili CDP are located near the Kawainui Marsh project area. The Maunawili CDP consists of the predominantly residential community south of the marsh with a total population of only 2,040 persons in 2010 as compared to the Kailua CDP that includes a more diversified and urbanized community with a total population of 38,635 persons. Therefore, demographic characteristics were assembled using the Kailua CDP in comparison

with the Honolulu County CDP. The Kawainui census tract in relation to the Kailua CDP, which is made up of several tracts, is graphically shown on Exhibit 3.9.

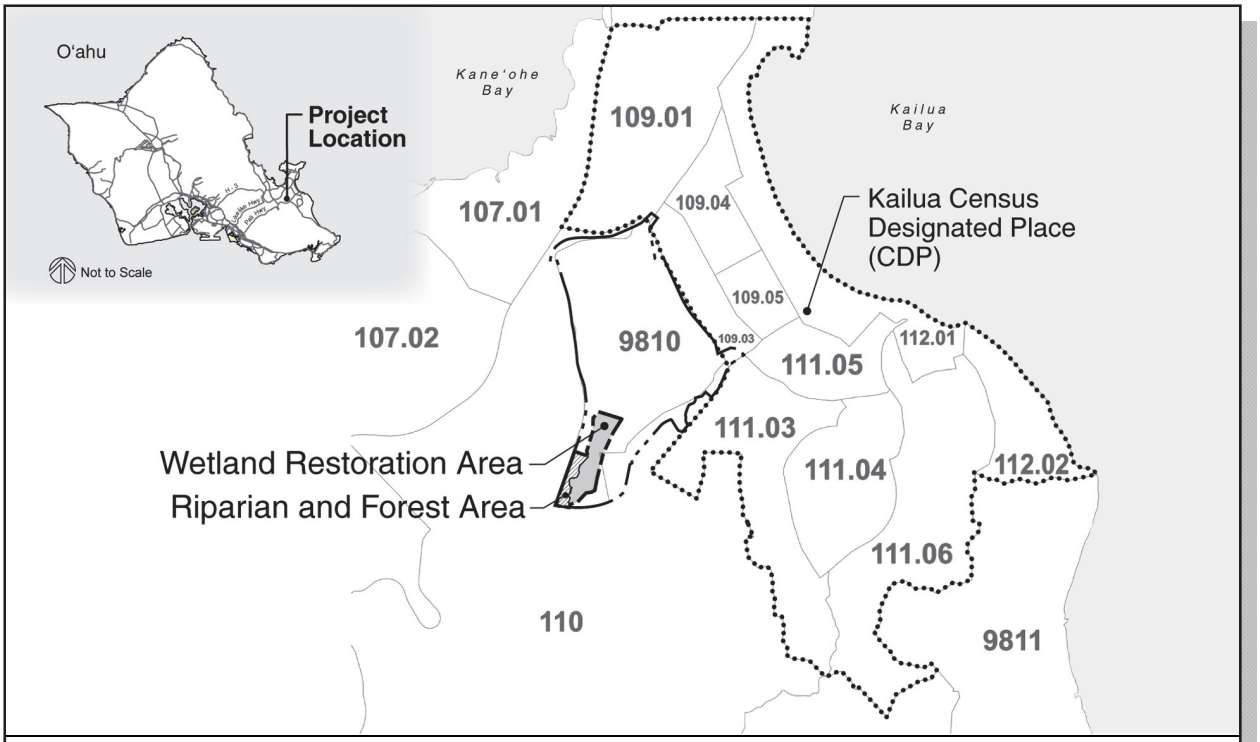


Exhibit 3.9
Kawainui Marsh and Kailua U.S. Census Designated Place

3.10.1 Population and Housing

Demographic characteristics from the 2010 Census assembled of the Kailua CDP in comparison with the Honolulu County CDP is shown on Table 3.7. The census data shows that the Kailua CDP population comprises a little over 4 percent (38,635 persons) of the Honolulu County (island of O‘ahu) population. Kailua has an older population than O‘ahu with a median age of 42.8 years compared to 37.8 years, respectively. This is reflected in a slightly higher percentage of persons 65 years and older living in Kailua than O‘ahu.

The resident population in Kailua is comprised of a higher percentage of White (more than double) and lower percentage of Asian (less than half) as compared to the rest of the island as shown on the table. Kailua has a lower percentage of Native Hawaiian or other Pacific Islander is present, but a higher percentage of persons of two or more races.

Table 3.7
Summary of U.S. Census Demographic Data (2010 and 2000)

Description of Demographic Data	Kailua CDP		Honolulu County CDP	
	Number	Percent	Number	Percent
POPULATION (2010)	**38,635**		**953,207**	
AGE				
Under 5 years	2,072	5.4	61,261	6.4
5 to 17 years	5,844	15.1	149,239	15.7
18 to 64 years	24,390	63.1	604,217	63.4
65 years and older	6,329	16.4	138,490	14.5
Median age	42.8		37.8	
RACE				
White	17,015	44.0	198,732	20.8
Black or African American	224	0.6	19,256	2.0
American Indian and Alaska Native	91	0.2	2,438	0.3
Asian	7,827	20.3	418,410	43.9
Native Hawaiian or Other Pacific Islander	2,581	6.7	90,878	9.5
Some other race	364	0.9	10,457	1.1
Two or more races	10,533	27.3	213,036	22.3
HOUSEHOLDS	**12,921**		**311,047**	
Family households	9,653	74.7	217,842	70.0
Non-family households	3,268	25.3	93,205	30.0
Households with individuals under 18 years	4,313	33.4	108,131	34.8
Households with individuals 65 years and over	4,452	34.5	96,947	31.2
Average household size	2.98		2.95	
Average family size	3.31		3.48	
HOUSING OCCUPANCY AND TENURE				
Total housing units	13,650		336,899	
Occupied housing units	12,921	94.7	311,047	92.3
Vacant housing units	729	5.3	25,852	7.7
Occupied housing units	12,921		311,047	
Owner-occupied housing units	6,994	54.1	174,387	56.1
Renter-occupied housing units	3,246	45.9	136,660	43.9
EMPLOYMENT STATUS (2000 Census)				
Population 16 years and older	28,818		691,015	
In labor force	19,681	68.3	447,320	64.7
Not in labor force	9,137	31.7	243,695	35.3
INCOME (in 1999) (2000 Census)				
Households	12,238		286,731	
Less than $10,000	435	16.1	20,886	7.3
$10,000 to $49,999	3,354	54.7	116,228	40.5
$50,000 to $99,999	4,552	21.0	97,546	34.0
$100,000 or more	3,897	8.2	52,071	18.2
Median household income	$72,784		$51,914	

Source: U.S. Census Bureau, Census 2010 and Census 2000

The number of housing units in Kailua represents about 4 percent (13,650 housing units) of the total units in the Honolulu CDP. The district has a higher percentage of family households compared to O‘ahu, but has a similar average household size of 2.98 persons per unit. There is also a slightly higher percentage of households with individuals 65 years and over at 34.5 percent compared to 31.2 in Honolulu.

Kailua’s resident population can be characterized as being predominantly White and comprised of a relatively older community compared to the island which is reflective of it being a more established community. The higher percentage of family households in this district supports these characteristics along with having a higher percentage of individuals 65 years and older because residents have lived there for many years.

3.10.2 Employment and Household Income

Based upon the 2000 census, Kailua had population employed at a slightly higher percentage than O‘ahu. The district had a notably higher percentage of households with low income (less than $10,000) and those between $10,000 and $49,999 at 54.7 percent compared to 40.5 percent for the island. Kailua did have lower percentages of households earning incomes of $50,000 and up, however, median household income was considerably higher at $72,784 compared to just $51,914 for O‘ahu.

The community was also more affluent with a notably higher median household income as compared to O‘ahu based upon the 2000 Census. This trend is expected to continue when the results of the 2010 Census data becomes available.

3.10.3 Character of Kailua Community

Kailua can generally be characterized as consisting of a large well-established residential community made up predominantly of single-family homes. Multi-family developments are concentrated near Kailua’s business area along with being spread out through the community. This community is known to be active in voicing comments concerning new developments, changes, and issues that arise, and residents are active in participating in various business and community activities and events. The community has an annual “I Love Kailua” town party which is a fundraiser held in the center of town that includes booths for arts, crafts, and foods along with entertainment. There is also a 4th of July parade and fireworks celebration show that has been a tradition since 1948.

Various periodic community events are also conducted at Kawainui Marsh. Some consist of clean-up events by volunteers collecting trash along Kapa‘a Quarry Road and within the upland area of the marsh. Other community events have involved removing invasive vegetation from the marsh.

The business and commercial center of Kailua is situated near the entrance into Kailua town within an area generally occurring Oneawa Street, Kuulei Road, and along and between Hāmākua Drive and Kailua Road. Other commercial areas consist of community shopping centers in Enchanted Lakes and ‘Aikahi. Kailua town’s main commercial center has recently been undergoing redevelopment with several older buildings and properties being renovated or redeveloped.

At the Kawainui Marsh project site, the surrounding character of the community and land uses is quite different compared to Kailua. There are no housing developments established within this Kawainui Marsh census tract. There is an existing ranch (V.O. Ranch) present north of the project area along Kapa‘a Quarry Road used as a residence. As previously discussed in Chapter 2, the surrounding area is generally undeveloped consisting of the marsh, undeveloped areas along Kapa‘a Quarry Road, and along Kalaniana‘ole Highway. Le Jardin Academy is the only existing use in the immediate vicinity of the project site. Further south of the site is the residential community of Maunawili, and to the east is Castle Medical Center along with residential communities at the entrance to Kailua town.

3.10.4 Environmental Justice Target Populations

A *Hawai‘i Environmental Justice Initiative Report* (Kahihikolo 2008) was prepared for the State Environmental Council to ensure that principles of environmental justice are systematically included in all phases of the environmental review process. It is intended to ensure that all agencies and applicants fulfill their duty to identify and address at the earliest possible time any disproportionately adverse human health, environmental, or cultural effects on Native Hawaiian, minority, and/or low-income populations that would be caused by a proposed action or by an agency’s policies, programs, and activities. It also defined environmental justice in the unique context of Hawai`i which states:

> *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.*

Project Related Target Populations

Census data was evaluated to identify potential environmental justice target populations in the vicinity of the project. Table 3.8 shows 2000 Census data on income distribution and poverty levels for households and families in both the Kailua and Maunawili CDPs in relation to the Honolulu CDP.

Table 3.8
Summary of Income Distribution and Poverty Levels (2000)

Description of Demographic Data	Maunawili CDP	Kailua CDP	Honolulu CDP
Household and Family Median Income			
Household Median Income	$82,148	$72,784	$51,914
Family Median Income	$82,294	$79,118	$60,118
Total Households	1,474	12,238	286,731
Percent of Families in Households	82.8%	76.7%	72.2%
Poverty Status (Below Poverty Level)			
Families / Percentage	18 / 1.5%	312 / 3.3%	14,477 / 7.0%
Families with Female Householder / Percentage	12 / 5.3%	147 / 10.7%	6,616 / 19.2%
Individuals / Percentage	114 / 2.5%	1,972 / 5.4%	83,937 / 9.9%

Source: U.S. Census Bureau, Census 2000

Based upon Table 3.8, both the Kailua and Maunawili CDPs have significantly lower percentages of families and individuals with incomes below the poverty status than compared with the island of O‘ahu (Honolulu CDP). This corresponds to the household and family median incomes for these communities also being significantly higher than island wide averages. This reflects the more affluent nature of the Kailua district that includes the Maunawili community. Therefore, these communities should not be environmental justice target populations of concern based upon income.

The Federal Executive Order 12898 addressed environmental justice for minority and low-income populations. Recognized minorities under this Federal policy include African Americans, American Indians, Alaskan Natives, Asians, Hispanics, Native Hawaiians, and Other Pacific Islanders. The racial composition of Hawai‘i’s population differs greatly from that of the United States where Whites represent a clear majority accounting for about 74 percent of the population. In contrast, no racial group in Hawai‘i comprises even half of the total population (Kahihikolo 2008).

Based upon the 2010 Census data on Table 3.7, Asians make up the largest racial group on O‘ahu (43.9%) with those being of two or more races (22.3%) and Whites (20.8%) making up the next largest groups. The Kailua CDP showed Whites made up the largest racial group (44.0%) with those being of two or more races (27.3%) and Asians (20.3%) making up the next

largest groups. Although not shown on Table 3.7, the Maunawili CDP similarly showed Whites being the largest racial group (36.0%) with Asians (33.1%) and those of two or more races (24.3%) making up the next largest groups.

The O‘ahu Metropolitan Planning Organization (OMPO) used Census data to identify environmental justice populations based on income and race. An OMPO report identified a total of 78 out of 435 census block groups as environmental justice block groups. Of this total, 70 block groups were selected because of race and 17 because of low income. Nine block groups were selected for both minority and low-income populations (OMPO 2004). Only one block group in Kailua (Ulupaina Street) was identified in this study, and was based upon race. This block group was identified to have 38 persons (1.5%) of American Indians or Alaskan Natives race out of a block population of 2,512. However, the number comprised a high population percentage when factored using Federal Highway Administration criteria.

3.11 INFRASTRUCTURE FACILITIES

3.11.1 Water Facilities

The City Board of Water Supply (BWS) provides potable water service to the island via a network of water transmission mains and booster pumps connected to water sources supplied by water reservoirs and other sources. The Windward O‘ahu region is serviced by several water systems one of which is the Maunawili water system that includes the project area. The system provides potable water service to residences in the Maunawili community, and extends to Olomana and northward towards Kawainui Marsh.

A 36-inch transmission main is located along Kapa‘a Quarry Road providing water service to Le Jardin Academy and the Kapa‘a industrial area. The transmission main is also routed along Kalaniana‘ole Highway heading into Kailua. There is no potable water service currently being provided to the Kawainui Marsh project area because the area is undeveloped.

3.11.2 Wastewater Facilities

The City Department of Environmental Services (DES) provides municipal wastewater collection and treatment in the Kailua district and project area via a system of wastewater pump stations and sewer lines (force mains and gravity fed lines) that are processed at the Kailua Regional Wastewater Treatment Plant (RWTP). This Kailua Regional RWTP is located along Kāne‘ohe Bay Drive in the ‘Aikahi community, and has an existing capacity of 28.0 million gallons per day (mgd).

The City’s Maunawili Park Wastewater Pump Station (WWPS) is situated near the intersection of Kalaniana‘ole Highway and Auloa Road. Sewer lines serving Le Jardin Academy and the Maunawili residential area connect to the pump station. From the station, a 12-inch sewer force main is routed along the highway heading toward Kailua town. There is no sewer line currently

routed along Kapaʻa Quarry Road. The Kawainui Marsh project area does not have any facilities generating wastewater needing to be collected and treated.

The restoration project area along with immediate surrounding areas are situated below (*makai*) the State Department of Health's underground injection control (UIC) line which designates an area where the underlying aquifer is not considered a drinking water source. This UIC line designation changes further south of the highway generally in the Maunawili community.

3.11.3 Drainage Facilities

Surface water runoff in the restoration project area enters the marsh primarily from Kahanaiki and Maunawili Streams. Runoff from the highway sheet flows into drainage culverts eventually discharging into these streams. A State Department of Transportation (DOT) drainage ditch runs along the northern side of the highway from the intersection of Kapaʻa Quarry Road discharging into Kahanaiki Stream at the bridge crossing. The drainage ditch is within the State DOT's highway right-of-way and outside of the project area.

For areas *mauka* of Kapaʻa Quarry Road past Le Jardin Academy, runoff from higher elevations generally sheet flows across the roadway at low points and discharges into the marsh because there is no established drainage system serving this undeveloped area. Le Jardin Academy has an existing drainage system that was initially established as part of the former Kailua Drive-In Theater. The system had three discharge points, one of which was onto the State highway. The other two discharge points are situated north and south of the present driveway entrance.

A preliminary engineering report evaluating drainage culverts discharging into the restoration project area and identifying conceptual drainage improvements was prepared by AECOM. A copy of this report is included in Appendix D. The site investigation identified four discharge points within the project area. Three existing drainage culverts convey storm water across Kapaʻa Quarry Road from Le Jardin Academy and discharge into the marsh. One location collects overland sheet flow across the road from Le Jardin Academy. Over time, these four discharge locations have experienced heavy erosion due to poor existing conditions and deteriorated drainage structures. In some areas, continuous erosion may have begun to undermine the structural stability of Kapaʻa Quarry Road (AECOM, May 2011). Figure 3.11 shows the locations of these discharge locations.

<u>Drainage Culvert 1</u>

Drainage Culvert 1 is a 36-inch reinforced concrete pipe (RCP) conveying storm water from Le Jardin Academy across Kapaʻa Quarry Road and into a concrete masonry unit (CMU) junction box structure. Water flow enters a 36-inch corrugated metal pipe and discharges onto a swale, then into a gully within Kawainui Marsh. The existing junction box is broken in numerous areas

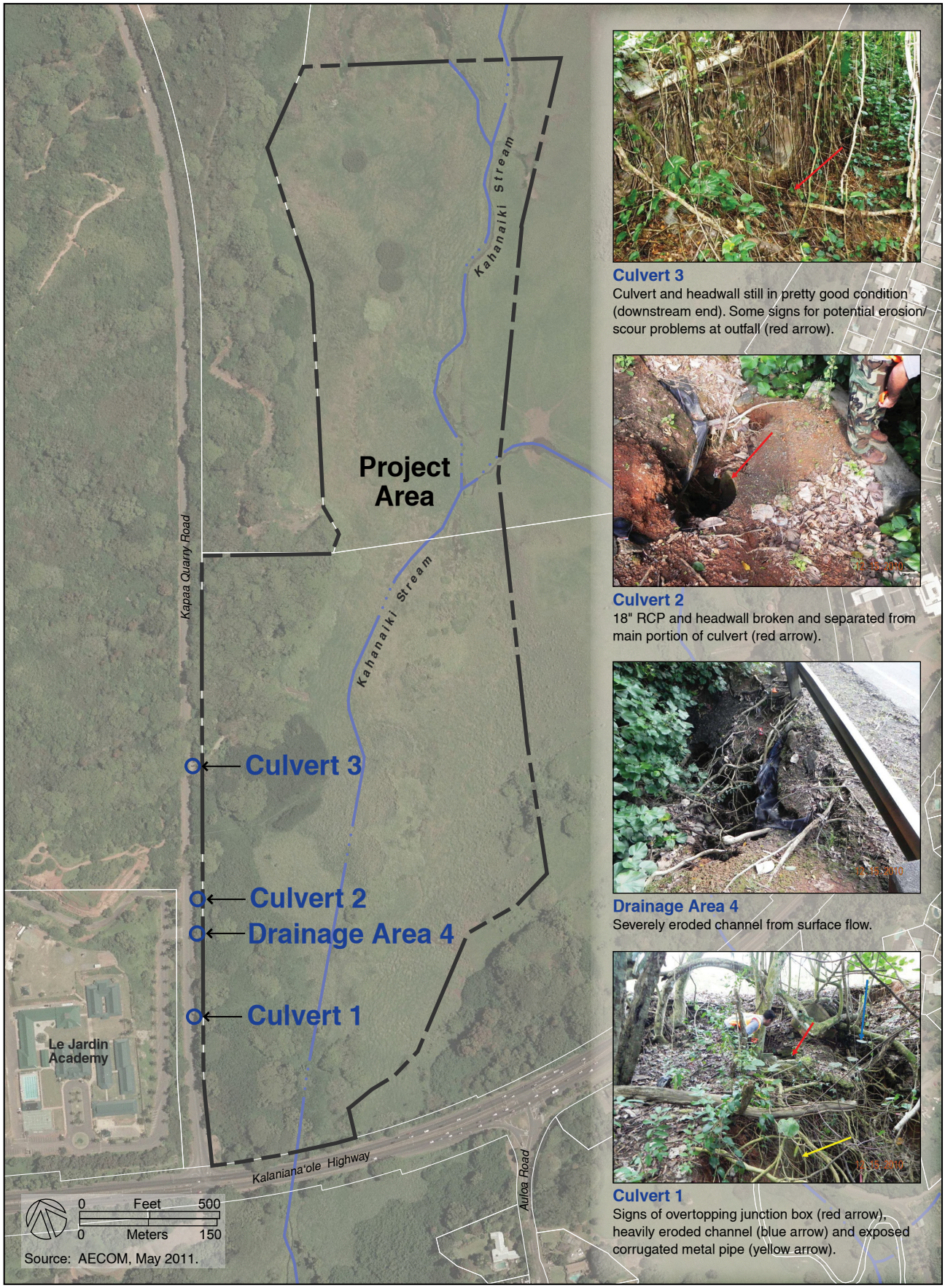


Figure 3.11
Existing Drainage Facilities

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

with signs of storm water overtopping. Existing trees and roots in the area have also contributed to undermining the structural stability of this junction box. Overtopping of the junction box has contributed to erosion around the box and has exposed the existing 36-inch metal pipe.

Drainage Culvert 2

Drainage Culvert 2 is an 18-inch RCP conveying storm water across Kapa‘a Quarry Road and discharges directly into Kawainui Marsh. Storm water from this culvert comes from an existing catch basin on the *mauka* side of Kapa‘a Quarry Road that is fed by a portion of Le Jardin Academy. Due to heavy erosion and soil instability, an existing portion of RCP, headwall, and concrete apron have separated about one foot away from the main portion of the pipe. Areas on the *mauka* side of this culvert also show signs of erosion.

Drainage Culvert 3

Drainage Culvert 3 is a 30-inch RCP conveying storm water across Kapa‘a Quarry Road and discharges directly into the marsh. Storm water comes from a large area of undeveloped forested terrain located mauka of the roadway. Both the concrete rubble masonry headwalls as well as pipe culvert are in good condition. However, there are some signs of erosion on the side slopes of the upstream end and at the outlet on the downstream end of this culvert.

Drainage Area 4

Drainage Area 4 is a small area on the Kawainui Marsh side that collects surface runoff sheet flowing across Kapa‘a Quarry Road from Le Jardin Academy’s driveway. There is no existing drainage structure in this area. Inspection of the drainage discharge area showed major signs of erosion. Based upon site investigations and evaluations, it appears the contributing surface flow area comes from a portion of Le Jardin Academy. Storm water is conveyed down the school’s steep driveway entrance, sheet flows across Kapa‘a Quarry Road, and finally discharges over the unprotected slope into Kawainui Marsh.

3.11.4 Solid Waste Facilities

The City Department of Environmental Services’ Refuse Division provides municipal solid waste curbside collection for all single-family residences and a limited number of multi-family properties, non-residential customers, and City agencies on the island. Bulky items are collected on a monthly basis and either recycled or delivered to the Waimanalo Gulch Landfill.

The Waimanalo Gulch Landfill located in Kapolei is owned by the City and is the only permitted landfill accepting solid waste on O‘ahu. This landfill accepts: 1) non-combustible municipal solid waste; and 2) ash and residue from the H-POWER facility. Construction and demolition waste are not permitted at either H-POWER or the Waimanalo Gulch Sanitary Landfill, and is

taken to the privately-owned PVT Nānākuli Construction and Demolition Material Landfill in Nānākuli.

The Honolulu Program of Waste Energy Recovery (H-POWER) energy recycling plant is a waste-to-energy (WTE) facility operated by the City located in the Campbell Industrial Park in Kapolei. Approximately 90 percent of the volume and 70 to 75 percent of the weight of solid waste received at H-POWER is diverted from the landfill, and converted into renewable electric energy. The ash and residue from H-POWER are delivered to the Waimanalo Gulch Landfill (R.W. Beck, Inc., October 2008).

The Kapaʻa Refuse Transfer Station located along Kapaʻa Quarry Access Road is one of the City's three municipal transfer stations. These transfer stations consolidate waste from collection trucks into large transfer trailers for more efficient transport to H-POWER or the landfill. The transfer station has staff consisting of supervisors, equipment operators, truck drivers, scale attendants, and ramp attendants, and operates seven days a week from 7:00 a.m. to 6:00 p.m. The primary customers are the Refuse Division haulers, private haulers, public self-haulers, commercial self-haulers, and small contractors. Waste types received include residential, commercial, institutional (small), and combustible construction and demolition materials (R.W. Beck, Inc., October 2008).

The Kawainui Marsh project area is located within the City's Koʻolaupoko collection district. The district includes generators along the entire windward coastline from Waimānalo to Kahuku. There is presently no residential or commercial waste generated within the project area that is collected by the City or private haulers for disposal. Any green waste generated from DOFAW maintenance activities is either left on the project site to decompose or taken to an approved green waste facility.

Green Waste Disposal

The City provides curbside collection of green waste twice per month to households on the island. Approximately two-thirds of the households place green waste in bags and bundles at the curb utilizing a manual collection system while remaining households utilize the City's automated green-bin collection system. Green waste generated by commercial and government sources is banned from disposal pursuant to City ordinances (Chapter 9, ROH). Trucks hauling commercial and government waste are limited to a maximum of ten percent green waste per load at H-POWER and at City transfer stations.

An existing vegetation processing site of over 20 acres located adjacent to the City's Model Airplane Park can be used is necessary since it was previously established and used by the City in 1992 for this same type of activity. The processed vegetation can then be transported to the appropriate City refuse disposal site. Residential green waste, along with commercial green waste and food waste can also be taken to Hawaiian Earth Products (HEP). HEP is a private

producer of compost that accepts residential and commercial green waste to process it into soil amendment products. HEP has two sites on O‘ahu with one site on Kapa‘a Quarry Road.

3.11.5 Transportation Facilities

The primary roadways serving the project area are Kalaniana‘ole Highway and Kapa’a Quarry Road. Kalaniana‘ole Highway (State Highway 61) is a State Department of Transportation’s (DOT) highway generally running in an east to west direction at this intersection. Kalaniana‘ole Highway in the vicinity of the project area is a four-laned (two lanes in each direction) divided highway providing regional vehicular access in the Kailua district from the Pali Highway to Waimānalo. The posted speed limit in this project area is 45 miles per hour (mph).

Kapa‘a Quarry Road is a privately owned road in the vicinity of the restoration project area (part of TMK 4-02-014: 002). The road is a two laned (one lane in each direction) roadway running in a north-south direction along the Kawainui Marsh property from its intersection with the highway. The road provides a connection between Kalaniana‘ole Highway to the south and Mōkapu Boulevard to the north of the marsh. The posted speed limit along this road is 25 mph, however, vehicles frequently travel at higher speeds. A left-turn storage lane is provided on the roadway at the entrance to the Le Jardin Academy campus.

Kapa‘a Quarry Road forms a signalized T-intersection with Kalaniana‘ole Highway at the southwest corner of Kawainui Marsh. At this intersection, Kapa‘a Quarry Road has two southbound left-turn storage lanes for vehicles traveling into Kailua town, and a separate right-turn lane. Kalaniana‘ole Highway has a left-turn storage lane for eastbound vehicles turning onto Kapa‘a Quarry Road. A right-turn storage lane is provided for westbound vehicles on this highway turning onto Kapa‘a Quarry Road. Appendix B provides photos showing the intersection and roadways.

DOFAW Driveways Access

As discussed in Chapter 1, DOFAW has six (6) vehicular access locations to the project area. Two driveway locations connect with Kapa‘a Quarry Road, and three driveway connections are along Kalaniana‘ole Highway. The last access is from the DOFAW Kawainui Marsh Headquarters located behind Castle Medical Center along Ulakahiki Street.

One driveway access with Kapa‘a Quarry Road is situated about 620 feet north from the intersection with the highway. This access has been closed and is blocked off from use at this time. It would be re-opened under this project. The other access along this roadway is about 350 feet north of the entrance to Le Jardin Academy. This gated location presently provides access to a dirt road that runs through the northern upland area of the project.

Access locations along the highway consist of: 1) DOFAW's "Mokulana" access situated across from Auloa Road; 2) a second access situated slightly east of this Mokulana access; and 3) a third access located further east near the highway's bridge serving Maunawili Stream. All these access points are gated, and access to the project area is restricted to DOFAW employees for management and maintenance operations along with contractors hired by DOFAW for support activities. As a result, no public vehicular access is permitted at these driveway locations.

Existing Traffic Conditions

The intersection of Kalaniana'ole Highway with Kapa'a Quarry Road operates at good levels-of-service during the weekday commuter peak hours. A traffic study analyzing this intersection determined it operated at Level-of-Service B during both morning and afternoon peak hours in 2009 and had volume to capacity ratio of 0.78 (SD&C, January 2011).

About 400 vehicles traveled along Kapa'a Quarry Road (235 cars travelling southbound and 165 cars travelling northbound) during both morning and afternoon weekday peak hours. A total of 3,160 vehicles and 3,565 vehicles traveled along Kalaniana'ole Highway during the morning and afternoon peak hours, respectively. The directional split was 62 percent and 64 percent for cars traveling in the peak direction during the morning (toward Honolulu) and afternoon (toward Kailua) peak hours, respectively.

Traffic flow along Kapa'a Quarry Road near DOFAW's two driveway access locations also operates at good levels of service due to the relatively low volume of traffic occurring along this road. The only exception would be temporary increased traffic occurring at the entrance to Le Jardin Academy before the start of school and when school gets out. Presently, very minimal traffic enters and exits DOFAW's gated driveway access north of the school's entrance on a daily basis.

3.12 PUBLIC FACILITIES AND UTILITIES

3.12.1 Educational Facilities

The project site is within the State Department of Education's (DOE) Kailua-Kalaheo Complex Area which is further divided into the Kailua and Kalaheo complexes. The Kalaheo complex has five elementary schools and Kailua Intermediate School which feed into Kalaheo High School. The Kailua complex has six elementary schools, Waimānalo Elementary and Intermediate School, and Kailua High School. Olomana School (grades 7 to 12) services adjudicated youth statewide.

Maunawili Elementary School and Olomana school are the closest public schools to the restoration project site located on Ulupi'i Street about 0.70 miles away. Kailua High School is located about 0.75 miles away situated along Ulumanu Drive. Figure 3.12 shows these schools.

Figure 3.12
Existing Public Facilities
Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Le Jardin Academy is private school located along Kapa‘a Quarry Road *mauka* of the project area. This school services children from grades Pre-Kindergarten to 12th grade and an enrollment of over 400 students. Their facilities include 48 classrooms, two libraries, sports fields, and a gymnasium.

3.12.2 Medical Facilities

Castle Medical Center is the primary major medical facility serving the Windward side of the island. The medical center is located in the vicinity of the project site situated at the intersection of Kalaniana‘ole Highway with Kailua Road about 0.25 miles away as shown on Figure 3.12. The facility is a full-service medical center offering a wide range of inpatient, outpatient, and home-based services. The medical center is a 160-bed facility with more than 1,000 employees, and is staffed by 248 physicians.

3.12.3 Recreational Facilities

There are several major recreational facilities located in the larger Kailua district, however, only a few recreational facilities are within the vicinity of the Kawainui Marsh restoration project area. There are currently no recreational facilities including trails or bike paths provided within the project site. As discussed in Chapter 1, this project area is a State regulated wildlife sanctuary, therefore, it is prohibited for any person to enter or remain in a wildlife sanctuary except as authorized by the Board of Land and Natural Resources or DOFAW. Figure 3.12 shows the location of recreational facilities in the area, and a summary of them is provided below.

1. Kawainui Model Airplane Park. This City park site is located along Kapa‘a Quarry Road north of the project area across from Kapa‘a Quarry Access Road. The site consists of about 5 acres of graded area for use by enthusiasts to fly radio controlled model aircrafts.
2. Maunawili Valley Neighborhood Park. This City park site is located on Maunawili Road in the Maunawili residential community. The park has two lighted tennis courts, a parking lot, open grassed area, and children’s play equipment.
3. Maunawili Neighborhood Park. This City park site is located on Ulupi‘i Street next to Maunawili Elementary School in the Olomana residential community. The park has two lighted basketball courts, a volleyball court, a parking lot, restroom facility, open grassed area, and children’s play equipment.
4. Pohakupu Mini Park. This City park site of about 3.5 acres is located at the intersection of Kalaniana‘ole Highway with Kailua Road. The passive park site has a large water fountain, benches, open lawn area, and a some children’s play equipment.
5. Kawainui Neighborhood Park. This City park of about 4.8 acres is located at the end of Kaha Street. The park has a parking lot and large open grassed area used for youth soccer and other activities.

6. YMCA Windward Branch. The YMCA is located along Kailua Road further north of the Castle Medical Center. It offers a wide range of programs and activities such as a fitness center, child care programs, swim lessons, and group exercises.

The flood control levee improved by the COE also provides a trail for the public through the lower end Kawainui Marsh. The structure extends about 6,300 feet from Kailua Road to the Kawainui Marsh Canal. Portions of the pathway are both paved and gravel-covered providing recreational opportunities for residents that may want to walk, jog, or bicycle along this pathway.

3.12.4 Police and Fire Protection

Police Protection

The Honolulu Police Department provides police protection services to the Kailua district through their District 4 operations bureau. The district encompasses the entire Windward Oʻahu region from Makapuʻu Point to Kahuku. The main station is located in Kāneʻohe, and full-service substations are located in Kailua and Kahuku. The Kailua substation is located along Kuulei Road.

Officers have been proactive and innovative in areas of crime prevention and criminal apprehension such as using all-terrain vehicles to reduce crime at parks and beaches. The District maintains strong ties with the community and organizations having 108 Neighborhood Security Watches, 3 Business Watches, 14 Citizen Patrols, and 2 Mobile Patrols (HPD, no date). No police patrols currently occur within the State's Kawainui Marsh restoration project site. The property is undeveloped and difficult to access for officers, it has no public roadways or vehicular access within the site, and it is comprised mostly of wetland.

Fire Protection

The Honolulu Fire Department (HFD) has three fire stations located in the Kailua area. The fire station located in the vicinity of the Kawainui Marsh project area is on Kalanianaʻole Highway next to Maunawili Elementary School. A second station is located in Kailua town along Kuulei Road. A third fire station is located in the Aikahi community.

Most of the restoration project area is located within a co-op response area shared by the HFD and DOFAW. The project area near the intersection of Kapaʻa Quarry Road and highway is designated as a HFD primary response area. Primary response areas include most urbanized areas.

3.12.5 Electrical and Communication Facilities

Electrical services are provided to the project site's surrounding areas via Hawaiian Electric Company's (HECO) distribution lines. Electrical lines serving the project area are brought in via overhead sub-transmission lines located on utility poles along Kapa‘a Quarry Road and Kalaniana‘ole Highway. There are no existing facilities within the project site requiring electrical service from HECO.

There are no existing facilities within the project site requiring telecommunication or cable television services. These services are provided to urbanized uses in the surrounding area by Verizon Hawaii and Oceanic Time Warner Cable, respectively. These services are transmitted via overhead lines situated on electrical sub-transmission poles routed along roadways in the project area.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

This chapter discusses the environmental consequences associated with implementing the Kawainui Marsh wetland restoration project. Discussion of probable impacts addresses the No Action Alternative and the Proposed Project. The No Action Alternative represents a future scenario "without the project" providing a baseline of future environmental conditions to assess and evaluate probable impacts or changes resulting from the proposed restoration project.

4.1 BIOGEOGRAPHY, TOPOGRAPHY AND SOILS

4.1.1 Biogeography

No Action Alternative

Under the No Action Alternative, Kawainui Marsh's environment would continue changing through the process of terrestrialization with the middle of the marsh forming a stable bog habitat while the perimeter of the marsh changes towards dry land habitat. Open water areas would continue transitioning into a marsh and ultimately into a terrestrial forest with expansion of the existing upland areas. Such changes would negatively affect the marsh by reducing the size of the wetland and eliminate important habitat for endangered waterbirds.

Proposed Action

The Proposed Action would have a positive effect by reversing the current process of terrestrialization of Kawainui Marsh. Restoration activities would create more open water areas by removing invasive vegetation and mat of peat. These improvements facilitate restoring Kawainui Marsh and habitat for endangered waterbirds.

Upland drainage improvements should support restoration efforts by mitigating erosion and reducing soils from entering the wetland. Upland reforestation improvements should have a positive effect by replacing invasive vegetation with native vegetation. Accessory passive recreational amenities (parking, paths, observation areas, etc.) provided should have minimal effect on the existing terrestrialization process occurring, and will be designed to complement and support restoration improvements.

4.1.2 Topography

No Action Alternative

Under this scenario, there would be no major changes to existing topographic conditions of the wetland. The upland area would continue to experience erosion occurring at drainage discharge points from Kapa'a Quarry Road. The existing topography of these affected areas would gradually change over time resulting in a minor to moderate impact.

Proposed Action

Wetland restoration improvements would not significantly change the existing topography because such efforts would primarily occur within the top foot of the surface associated with the removal of invasive vegetation. Upland reforestation efforts would similarly have minimal effect because the existing topography would essentially remain the same. The creation of some terraced walls is planned within a gully as part of drainage mitigation, and would have a positive effect to reduce erosion occurring in that area.

With the exception of the southern corner of this project site, no large-scale grading activities are planned on upland areas. Minor reshaping of certain portions of this area would occur to accommodate a maintenance path for DOFAW vehicles, pedestrian pathways, and observation areas. There are no unique or significant geological land formations present on the property that could be affected. No major cut or fill activities are also anticipated that would significantly alter present geologic land forms.

This southern corner would have some grading activities to support a parking area and to reshape the area to provide a bluff overlooking the wetland. However, this modification should not significantly impact this area's topography, and existing soils are comprised mainly of fill material from prior development of inland areas. Therefore, this project should not have a significant long-term impact on the site's existing geology and topography.

4.1.3 Soils

No Action Alternative

The upland area would continue to experience erosion occurring at drainage discharge points from Kapa‘a Quarry Road resulting in soil loss that could worsen over time. Soils would be transported into the wetland contributing to process of terrestrialization and impact wetland values and habitat.

Proposed Action

Hydric soils associated with the wetland area should not be negatively impacted by restoration efforts because activities would focus on removing existing invasive vegetation. No filling activities are planned to occur within the wetland area during restoration activities. Upland reforestation activities should similarly not have a negative impact on existing soil conditions because it would involve removing invasive vegetation and replanting native vegetation.

Construction activities for other accessory improvements such as drainage, parking area, paths, etc. would inevitably involve some temporary land-disturbing activities that may cause minor short-term effects. No nuisance effects are expected because there are no urban uses present within Kawainui Marsh. Such effects may be associated with soil erosion during periods of

heavy rainfall or high winds. Soils within the project's upland area are Alaeloa Silty Clay (AeE) and Lolekaa Silty Clay (LoC) which have moderately rapid permeability and slow to medium runoff decreasing potential soil erosion. Therefore, construction activities should not have a significant impact on the environment, and standard construction best management practices are available to mitigate such effects.

Various mitigation measures will be incorporated into the project's design to minimize potential short-term erosion impacts during construction activities. These measures will be instituted following site-specific assessments, incorporating structural and non-structural Best Management Practices (BMPs), as deemed appropriate. Erosion control measures considered may include: stationing water trucks nearby during construction to provide sprinkling in active areas; use of temporary silt fencing, sand bags, or screens; or thorough watering of disturbed areas after construction activity has ceased for the day.

However, the actual measures implemented will be developed during the final design of project improvements, and would comply with the City's erosion and sedimentation control regulations. Design plans will be submitted to pertinent City agencies for ministerial review and approval as applicable. The majority of plans review will occur with the State because the project area is owned by the State. If applicable, State Department of Health (DOH) National Pollutant Discharge Elimination System (NPDES) permits along with Department of Army permits (e.g. COE Nationwide Permit) would be obtained.

The contractor will work with DOFAW to determine an area to be used for staging. The contractor will also implement necessary measures such as temporary chain-link fences to protect materials and construction-related equipment from theft or vandalism. Construction areas would be clearly marked and temporary fences used to keep unauthorized persons out.

4.2 NATURAL HAZARDS

The Proposed Action will not significantly increase the risk of human health or property due to existing exposures to natural hazards. The Kawainui Marsh project area is undeveloped and improvements primarily consist of wetland restoration and reforestation activities. New facilities planned are associated with passive outdoor recreational activities such as pathways, observation decks, signage, etc. that are less of concern with damages from a natural hazard compared to other structures such as residential homes.

4.2.1 Earthquakes

Under the No Action Alternative, the marsh project area would not be susceptible to any additional hazards associated with an earthquake of sufficient magnitude because there are no buildings or other major structures present.

With the Proposed Action, wetland restoration and upland reforestation improvements would not be susceptible to significantly more damages from an earthquake than under future conditions without the project. Although difficult to predict, an earthquake of sufficient magnitude may result in damages to accessory improvements planned such as observation decks, signage, and pathways. However, most of the earthquakes that have occurred in the State were volcanic earthquakes causing little or no damage on the Island of Oahu. These structural improvements would be designed and constructed in accordance with the City's building code. Therefore, the susceptibility of being damaged from an earthquake would be no different from other structures or buildings present in the surrounding area.

4.2.2 Hurricanes

The three major elements making a hurricane hazardous are: 1) strong winds and gusts, 2) large waves and storm surge, and 3) heavy rainfall (FEMA 1993). Impacts from hurricanes can thus be severe and lead to beach erosion, large waves, high winds, and marine over-wash despite the fact that the hurricane may have missed a particular island (USGS 2002). Study of the aftermath of Hurricane Iniki found that a significant threat related to hurricane overwash along the coastline in the Hawaiian Islands is due to water-level rise from wave forces rather than wind forces.

No Action Alternative

A hurricane of significant strength and high winds passing directly over or close to the Island of O'ahu could damage existing trees and vegetation within the restoration project area. No existing structures are located within the project area that could be damaged from high winds. As a result, the significance of potential damages from a hurricane would be low in comparison to other urbanized areas in Kailua.

Proposed Action

The project area is not located near the shoreline, and therefore would only be affected by strong winds and heavy rainfall from a hurricane. The primary focus of project improvements would be wetland restoration and upland reforestation, therefore, the effects from a hurricane would be similar to the without project (No Action) condition.

Structural improvements associated with passive outdoor recreational amenities planned (e.g. signage, observation decks, etc.) could be damaged from strong winds along with heavy rainfall because one of the functions of the marsh is for flood control. However, these structures are a minor component of the overall project, and should not pose a significant environmental hazard to this marsh. To minimize potential hurricane damages, structures would be designed and constructed in conformance to applicable building codes. Therefore, the risk of potential damage should be no greater than the risk of damage than other residential, schools, and commercial buildings in the surrounding area.

4.2.3 Tsunami and Flooding

Under the No Action Alternative, the project area would not be susceptible to any significant hazards associated with a tsunami and flooding. The area is situated a considerable distance away from the shoreline and is not within the City's tsunami evacuation area. The marsh serves as a basin for flood control, and it would continue serving this purpose under a severe flood.

With the Proposed Action, improvements should not be affected by a tsunami. Wetland restoration and reforestation improvements may experience some damage from severe flooding. However, flood control is a function of the wetland and vegetation will grow back. Recreational amenity improvements should not be significantly damaged from flooding because these structures and pathways would be situated within the upland area outside of the wetland and floodplain.

To minimize potential damages from flooding, new structures and improvements would be designed and constructed in conformance to applicable building codes. Therefore, the risk of potential damage from these hazards should be minimized and of no greater risk of damage than other residential homes or schools in the surrounding area.

4.3 HAZARDOUS MATERIALS

No Action Alternative

There would be no change to the potential exposure of hazardous materials to Kawainui Marsh under this alternative because the project site would remain undeveloped. Potential sources of hazardous materials were predominantly located within the Kailua town area that is situated down gradient from the marsh. The City's Kapa‘a Street Light Storage Yard and Kapa‘a Sanitary Landfill sites are located further north of the restoration project site, and sampling and monitoring measures are being implemented by the City to address those sites.

Proposed Action

The Proposed Action should not create a significant adverse impact on the marsh associated with hazardous materials. The Phase 1 ESA conducted in 2008 determined that Kawainui Marsh was generally not subject to adverse environmental impact from known or potential sources of hazardous materials. Potential sources were located further north of the project site or down gradient of the marsh in Kailua town.

Outdoor recreational amenities planned should not be sources of new potential hazardous materials (e.g. storage tanks, PCB transformers, etc.) or involve activities that would pose a significant threat of exposure. Activities occurring on the project site's upland areas would consist of passive outdoor recreational activities that are permitted with this wildlife sanctuary. Reforestation of the upland area would involve removing invasive trees and vegetation, and

replacing them with native vegetation. These types of landscaping activities are not expected to expose the marsh to hazardous materials that may significantly impact the environment. Contractors would implement best management practices in accordance with regulatory requirements that will further minimize effects on the environment.

Wetland restoration activities will involve cutting and removing existing invasive vegetation. Most of these activities are anticipated to occur at or below less than a foot from the surface. These activities would disrupt some sediment at this surface that did contain heavy metals based upon a prior study. However, the levels of heavy metals were lower than the maximum concentration of contaminants for meeting the definition of EP Toxicity (being characterized as a regulated hazardous material). Also, it was not considered unusual for heavy metals being naturally present in weathered basalt and would be expected in sediments derived from erosion of this material that eventually discharges into the marsh. Therefore, disturbing this sediment as part of wetland restoration activities should not have a significant impact on Kawainui Marsh or downstream (northbound) areas.

4.4 HYDROLOGY

4.4.1 Hydrogeological Resources

No Action Alternative

Under the No Action Alternative, there would be no change to current effects on the underlying aquifer system because the project site would remain undeveloped and function as a wetland with upland area.

Proposed Action

The Proposed Action should have minimal effect on the underlying aquifer because improvements predominantly consist of wetland restoration and reforestation activities. The aquifer below the project area is not considered a drinking water source because it is located below (*makai*) the State DOH's underground injection control line. Some impervious surfaces would be created due to recreational amenities planned such as portions of the vehicle parking area and pedestrian pathways. However, this change is expected to be negligible and ultimately inconsequential to the overall function of the area's natural hydrological system. As a result, the project should not have long-term impacts adversely affecting the sustainable yield of the underlying aquifer system nor contaminate potable water sources.

4.4.2 Surface and Coastal Waters

No Action Alternative

Kawainui Marsh would continue serving as an important flood control basin protecting the low-lying urbanized areas of Kailua Town and Coconut Grove subdivision under this alternative. However, invasive vegetation would continue expanding into the wetland area, reducing its size, and expanding the scrub vegetation and forest areas. Kahanaiki Stream and the section of Maunawili Stream within the project area would likely be affected with further reduction of open water areas due to the expanding growth of invasive vegetation and peat mat.

Proposed Action

Restoration improvements would have a beneficial impact by increasing open water areas for both Kahanaiki Stream and Maunawili Stream by removing invasive vegetation and peat. These efforts would have the long-term effect of reducing invasive vegetation to a more manageable level for DOFAW and allow for seasonal mud flats to occur. Improvements would also support Kawainui Marsh's function as a flood control basin.

The proposed wetland restoration methodology would not impound water or involve grading of wetland areas, and therefore should not disrupt or significantly change the direction of flow by Kahanaiki Stream and Maunawili Stream. These streams would generally continue to meander along their present routes with increased open water areas, and follow the natural drainage patterns that are currently impacted by the growth and encroachment of invasive vegetation. The amount of inflow into these streams and Kawainui Marsh would not be changed by the restoration improvements, and water depth should continue to be rather shallow at between one to two feet deep.

Wetland restoration involves a form of maintenance for this area by DOFAW because it primarily involves the removal of invasive vegetation from the area, and these activities are not planned to occur within the bed and banks of Kahanaiki and Maunawili Streams. The banks of Maunawili Stream are more easily defined along with Kahanaiki Stream north of it confluence with this stream. Kahanaiki Stream south of this confluence is more defined by the extent of vegetation growth up to open water flows. Restoration work would include field inspections of this stream prior to implementing removal of vegetation with equipment to make sure such activities do not encroach into the stream's banks. As a result, a Stream Channel Alteration Permit from the State Commission on Water Resource Management should not be required for wetland restoration work.

Restoration improvements planned should not have a significant adverse impact on the coastal waters of Kailua Bay due to the nature of activities planned. This consists of removing invasive vegetation and peat, and re-establishing growth of native wetland plants and vegetation within this project area. These activities would not generate a significant new source of urban

pollutants into the marsh that would eventually discharge into Kawainui Channel and Kailua Bay. The project should have a positive beneficial impact on the water quality by removing the extensive peat mat and invasive vegetation and subsequently reduce the amount of organic acids being leached into the water. Upland culvert and drainage improvements planned would further reduce sediment and other materials from entering the marsh and streams. Restoration activities are not expected to cause a significant discharge of sediment from this project area that could be discharged into Kailua Bay.

4.4.3 Wetlands

No Action Alternative

Under this alternative, invasive vegetation and accumulation of peat would continue expanding within the wetland area and reduce its size. Areas would continue transforming gradually to scrub vegetation and allow for expansion of forest areas. Open water areas associated with Kahanaiki Stream and Maunawili Stream would become more confined. The existing wetland boundary delineated by the COE in 2008 would change by probably becoming much smaller over time. This condition would also negatively impact Kawainui Marsh's designation as a Wetland of International Importance under the Ramsar Convention because the functions and values of this wetland would be diminished which includes the loss of habitat for endangered waterbirds, diversity of native plants, and transformation of nutrients.

Proposed Action

Wetland restoration improvements planned under this project would have a positive beneficial impact on the wetland by removing invasive vegetation and the extensive floating mat of peat. These efforts would increase open water areas of Kahanaiki Stream and Maunawili Stream and improve water flow through this wetland better supporting its functions and values. Increased open water areas and seasonal mud flats created would provide better habitat for endangered waterbirds to breed and forage within this marsh. Replacing invasive vegetation with native wetland vegetation would further support the restoration of Kawainui Marsh. With restoration improvements, the wetland area within this marsh can be increased from its present status. These improvements would therefore support Kawainui Marsh's Ramsar's designation as a Wetland of International Importance.

4.4.4 Water Quality

No Action Alternative

Water quality under this alternative would likely continue as under present conditions or slowly worsen. Surface water would continue being brackish at the confluence of both streams, but turn acidic as it moved thru the marsh toward Kawainui Channel due to the addition of organic acids leached into the water from decomposing vegetation (e.g. peat mat). Water draining from the

marsh would remain being yellow-brown due to dissolved organics leaching from the decomposing vegetation.

This alternative would not support the State DOH's Water Quality Standards for this marsh which is Class 1. These waters are supposed to remain in their natural state with minimum pollution from human caused sources, and the wilderness character of these areas should be protected. With no improvements to existing drainage culverts discharging into the marsh, water quality would continue to be impacted from surface runoff discharged from inland areas. Continued erosion of discharge areas along Kapa'a Quarry Road would further the transport of sediment and other materials into the marsh.

Proposed Action

Wetland restoration improvements planned should have a positive beneficial impact on the water quality by removing the extensive peat mat and invasive vegetation. This would reduce the amount of decomposing vegetation present and subsequently reduce the amount of organic acids being leached into the water. Surface water would continue being brackish at the confluence of both streams, however, water draining from the marsh should be improved with less dissolved organics leaching from the decomposing vegetation. These efforts would improve the coastal water quality of Kailua Bay where Kawainui Channel discharges surface water from Kawainui Marsh.

Drainage improvements associated with improved culverts planned along Kapa'a Quarry Road would mitigate existing erosion occurring at these discharge points. Terraced walls for drainage control at a gully along with causeways planned will further mitigate surface water discharging into this marsh by slowing down flows and allowing sediments and other materials to settle within upland areas before discharging into the wetland. These efforts should improve water quality and support the State DOH's Water Quality Standards for Kawainui Marsh by improving conditions toward a more natural state with reduced pollution from human caused sources.

Wetland restoration, upland reforestation improvements, and construction activities associated with outdoor recreational amenities (e.g. pathways, observation decks, etc.) should not cause significant short-term impacts on the water quality of Kawainui Marsh along with coastal resources (Kailua Bay). Best management practices would be included in the design and construction of outdoor recreational amenities and drainage improvements as they are implemented in phases dependent upon funding availability. Such measures would include silt fencing or other appropriate measures to mitigate storm water runoff into the wetland.

Vegetation mowed or grubbed as part of wetland restoration efforts will either be left in open upland areas within the project site to decompose or temporarily stored in established staging areas within these upland areas. Soil removed during clearing and grubbing operations would be dispersed on-site in areas above the wetland. This will aid retention of storm water, and it may be mixed with vegetation to enhance decomposition. If necessary, the existing vegetation

processing area next to the model airplane park would be used for larger scale processing of vegetation before being properly disposed off. Use of this existing processing site further supports these efforts because this site has already been created to conduct these types of activities.

Sediment samples indicated that the marsh contained heavy metals including chromium, lead, and mercury. However, this was not unusual in comparison with other O‘ahu watersheds due to heavy metals being naturally present in weathered basalt and would thus be expected in sediments derived from erosion of this material. The concern with heavy metals is that the runoff from vegetation and sediments removed should not be allowed to acidify. Metals are entombed in the sediments and concentrated through plant update into fibrous tissue in the biomass. Concentrations obtained from tests in 1989 did not warrant characterizing the sediments or vegetation as EPA toxic wastes for landfill purposes. In addition, the analysis of sediments for pesticides and PCB’s did not include the presence of these types of compounds at concentrations above the reporting limits (M&E Pacific, Inc., June 1990).

Continuous monitoring of the sediment and vegetation removed from the marsh should not be required under environmental rules and regulations. EPA notification requirements should only apply if test results from representative samples exceed Federal requirements. Therefore, periodic testing under a maintenance program can be conducted to monitor and control runoff quality. Testing of the pH of return water that has drained after vegetation removal can be implemented, and the application of lime can be added if the pH falls below 6.0. This will provide return water of comparable acidity to that removed from the marsh.

It is expected that the contractor or DOFAW staff will minimize stormwater runoff during construction by implementing best management practices in accordance with project design plans and applicable regulations. Plans developed would be reviewed and approved by pertinent agencies prior to construction and restoration activities. Therefore, impacts on coastal waters and water quality should be minimal or minor because approved measures will be employed to minimize runoff from construction areas along with complying with other related permit conditions.

The State DOH’s Class A marine waters designation for the coastal area of Kailua Bay should not be compromised by this restoration project. Under these standards, the objective of Class A water use is to allow their use for recreational purposes, and aesthetic enjoyment is protected. Any other use is permitted as long as it is compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation in and on these waters. The project would be consistent with the objective of this class designation for coastal waters.

4.5 BOTANICAL AND FAUNAL RESOURCES

4.5.1 Botanical Resources

No Action Alternative

Under this alternative, the project area would continue being negatively impacted by the continued growth and expansion of invasive plants and accumulation of peat. Alien (non-native) species with the wetland and continued invasion by many upland non-native species not normally associated with wetlands would continue expanding within the wetland area further reducing open water areas associated with Kahanaiki Stream and Maunawili Stream. The floating mat of peat would continue covering open water and increasing in thickness. Native botanical species would be gradually removed by this invasive vegetation. Areas would continue transforming gradually to scrub vegetation and allow for expansion of forest areas.

This condition would also negatively impact Kawainui Marsh's designation as a Wetland of International Importance under the Ramsar Convention because the functions and values of this wetland would be diminished which includes the loss of habitat for endangered waterbirds, diversity of native plants, and transformation of nutrients.

Proposed Action

The project would have a positive beneficial impact on botanical resources by removing invasive vegetation and peat accumulating in and impacting stream flows and the wetland. Removing the various non-native and invasive vegetation present would improve the functional values of the Kawainui Marsh wetland by opening up water flows from Kahanaiki and Maunawili Streams. Native wetland vegetation is planned to be re-established in this area particularly along with wetland fringes, and the project's restoration plan identified several types of wetland plants that can be used by DOFAW. Wetland restoration would also enhance the habitat for endangered waterbirds by removing the overgrow of invasive plant species, creating seasonal mudflats, and more open water areas.

Reforestation of upland areas would also have a positive beneficial impact on botanical resources by removing non-native and invasive vegetation, and replacing them with native vegetation. The restoration plan identified several types of native plants that can be used by DOFAW. The hybrid ecosystem model proposed for forest restoration efforts will allow native and existing non-native species to mix in a transitional period. This benefits native biodiversity, aids the process of re-establishing a robust native forest, and is a more cost effective and practical approach because the area has been heavily established by non-native invasive species.

None of the vegetation within the restoration project area are known to be Federal or State-listed threatened or endangered, or candidate threatened or endangered botanical species. The vast majority of plants present consists of non-native species and most are invasive to the area. Therefore, the project should not have an adverse effect on threatened or endangered, or

candidate threatened or endangered botanical species. The project would also support Kawainui Marsh's designation as a Wetland of International Importance under the Ramsar Convention because the functions and values of this wetland would be enhanced.

4.5.2 Fauna and Avifaunal Resources

No Action Alternative

The project area would continue being negatively impacted by the continued growth and expansion of invasive plants and accumulation of peat that do not provide suitable habitat for endangered waterbirds and for migratory bird species. Four species of endangered Hawaiian waterbirds found in Kawainui Marsh include the Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian coot (*Fulica alai*), Hawaiian moorhen (*Gallinule chloropus sandvicensis*), and Hawaiian duck (*Anas wyviliana*). Standing ponds, wet pastures, and open water areas serve as an attractive habitat for migratory waterfowl. What is remaining of these conditions would be further reduced and diminished by expansion of invasive vegetation and peat.

Kawainui Marsh has been identified as a "primary habitat" for the recovery of these waterbird species due to the functional values associated with the wetland. Therefore, the no action alternative would not support efforts to improve this marsh so that it can better serve as habitat for endangered waterbirds. Waterbird recovery within the project area would continue to be threatened and impacted by various mammalian, avian, and amphibian predators that live within Kawainui Marsh or access the marsh from the surrounding areas. These include the small Indian mongoose (*Herpestes auropunctatus* or *javanicus*), roof rat (*Rattus rattus*), feral dogs (*Canis familiaris*) and cats (*Felis catus).*

Proposed Action

The project would have a positive beneficial impact on faunal and avifaunal resources particularly the four species of endangered Hawaiian waterbirds found in Kawainui Marsh. Wetland restoration removing invasive plants would create more open water areas allowing Kahanaiki and Maunawili Streams to flow and meander through the area following natural topographic conditions. Improvements would create seasonal mud flats along and within the meandering open water flows and allow native wetland vegetation to become more established particularly along wetland fringes.

DOFAW's experience with other wetlands has found this type of restoration efforts to be beneficial for enhancing habitat for endangered Hawaiian waterbirds. The improvement should increase the number of endangered waterbirds using the marsh for nesting and foraging, which is the primary purpose and need for this project. Hawaiian stilts are limited by water depth and vegetation cover, and require wadable mudflats or marshlands with a water depth less than 6 inches and perennial vegetation that is limited, low growing, or exposed tidal mudflats. Wetland restoration efforts would create this type of habitat suitable for stilts.

Hawaiian coots prefer more open water, and will nest in fresh and brackish ponds. They construct floating nests of aquatic vegetation in open water or semi-floating nests anchored to emergent vegetation, and typically feed close to their nesting area. Restoration activities will create increased open water with aquatic vegetation by removing peat and invasive vegetation supporting habitat for coots. Hawaiian moorhen prefer to forage, nest, and rest in dense late serial vegetation. Hawaiian ducks are now most commonly observed around open waterways and channels. Restoration improvements would create a diverse environment of both open water and vegetation to support these species.

The FWS, as a funding participant and the Federal Agency responsible for this document's compliance with NEPA, is preparing a Biological Opinion for this project under Section 7 of the ESA. Similar to the COE's adjacent pond's development, the restoration project may have some risks to listed waterbirds that were identified in a Biological Opinion issued for the COE's project. Such risks may consist of: 1) displacement during implementation of restoration activities; 2) attraction into hazardous areas during restoration activities; 3) perpetuating feral mallard hybridization problems by increasing waterfowl habitat; and 4) the unintentional capture of Hawaiian moorhen in predator traps (FWS 2009).

However, the restoration project will have an overall beneficial effect by enhancing wetland habitat within Kawainui Marsh that will ultimately benefit endangered Hawaiian waterbirds. Threats will be controlled through fencing, predator control and other management activities allowing for successful nesting opportunities for Hawaiian waterbirds. DOFAW is developing a Kawainui Marsh Restoration Area Management Plan for the COE's pond project, and this management plan would be modified to include management activities for the restoration project area identifying how threats will be controlled and managed.

Human activity will increase at Kawainui Marsh during wetland restoration, reforestation, and construction of upland area improvements. Hawaiian stilts foraging within the bare ground habitats and Hawaiian coots, moorhens, and ducks foraging within the streams could be affected during these activities due to increased noise and human activity. During the Hawaiian stilt nesting period, there is potential for the inadvertent loss of a nest because stilt nesting coincides with the dry season when most wetland restoration work will be conducted. However, if waterbirds are observed frequenting the area, nest searches by DOFAW biologist would be conducted prior to any work being conducted and after any subsequent delay in work of three or more days.

Wetland restoration and construction of accessory improvements represent a temporary action, and the avoidance of wetlands habitats by waterbirds as a result of these activities represents a temporary loss in potential nesting, breeding, feeding, and resting habitat for these birds. Birds avoiding the project area due to this disturbance would likely disperse to other suitable habitats currently found in other areas of Kawainui Marsh, Hāmākua Marsh and at the nearby Nuʻupia Ponds Wildlife Management Area at Marine Corps Base Hawaii. Therefore, the temporary loss in foraging habitat would not result in injury or death to any of the Hawaiian waterbirds.

The Hawaiian ducks have been declining primarily due to hybridization with mallard ducks. Therefore, a DOFAW program of survey and eradication established to address these incursions of these hybrid duck at the COE's ponds will be expanded to include the wetlands of this Kawainui Marsh restoration project. There is a potential that the Hawaiian moorhen may be accidentally caught in the predator live traps due to the inquisitive nature of these birds. However, DOFAW will monitor these traps and may implement a banding programming that will provide information on the status of these birds. Mitigative measures to address these conditions would be identified and implemented under DOFAW's Kawainui Marsh Restoration Area Management Plan that would be modified to include management activities for the restoration project area. This management plan would be coordinated with the FWS to ensure potential effects are properly mitigated.

4.6 AIR QUALITY

No Action Alternative

Under this alternative, there would be no long- or short-term impacts on air quality because conditions at the Kawainui Marsh project area would essentially remain as present.

Proposed Action

Minor short-term impacts on air quality from restoration activities and other construction related activities would predominantly be associated with fugitive dust emissions and to a lesser extent exhaust emissions from on-site construction equipment. Minimal fugitive dust emissions are expected from wetland restoration activities due to the wet characteristics of the hydric soils, and activities would mainly consist of mowing invasive vegetation and grubbing ground conditions.

There are also no existing sensitive land uses (e.g. homes) in the immediate vicinity of the wetland area that may be affected. Surrounding areas consist of Kapa‘a Quarry Road and upland forested areas situated at higher elevations (35+ feet) above the wetland. Le Jardin Academy is situated *mauka* of Kapa‘a Quarry Road, but school buildings are located well away from the wetland and at a much higher elevation (70+ feet). Areas to the north and *makai* of the project site consist of acres of more wetland associated with Kawainui Marsh.

Reforestation of upland areas and construction of recreational amenities may also contribute to short-term impacts on air quality from fugitive dust emissions and to a lesser extent exhaust emissions from on-site construction equipment. Fugitive dust emissions would generally arise from dirt moving activities associated with vegetation removal, some site clearing and grading activities. Such emissions are expected to be limited because construction would involve relatively minimal grading activities, and there is extensive vegetation present along Kapa‘a Quarry Road serving as a buffer, and Le Jardin Academy buildings are situated at a much higher elevation (30+ feet).

State air pollution controls prescribed under the DOH's rules (Chapter 11-59, 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 that will be prepared and implemented by the contractor will allow compliance with these regulations. Dust control measures could include implementing a watering program or using wind screens. Other measures include good construction management practices at the job site (e.g. road cleaning or tire washing program), and using rocks for bare areas used for access or operational areas when practicable. Engine exhaust emissions from construction vehicles can be minimized via the proper operation and maintenance of all equipment.

Restoration and construction related activities will result in some increased vehicle traffic on Kapa‘a Quarry Road. However, the number of construction workers and associated vehicles occurring should not be large due to the nature of restoration activities. Increased traffic is not expected to cause severely congested conditions at the intersection of Kalaniana‘ole Highway with Kapa‘a Quarry Road that may result in carbon monoxide concentrations exceeding State standards. Therefore, construction vehicle traffic resulting from the project should not result in a significant short-term impact on air quality.

In addition, Federal air pollution control regulations require new motor vehicles to be equipped with emission control devices that reduce emissions significantly compared to several years ago. Amendments to the Clean Air Act required further emission reductions which have been phased in since 1994. The added restrictions on emissions from new motor vehicles will lower average emissions each year as more and more older vehicles leave the State's roadways.

4.7 NOISE

Noise from construction activities is regulated under Title 11, Chapter 46 (Community Noise Control) of the State DOH's Administrative Rules (State of Hawai‘i, 1996) . The zoning district classification and maximum permissible sound levels are summarized in Table 4.1 below. The project falls under the Class A zoning district category that applies to properties zoned for preservation and conservation types of land uses. The maximum permissible noise level for this site under Class A is 55 dBA at the property line during daytime and 45 dBA during nighttime.

No Action Alternative

Under this alternative, there would be no long- or short-term impacts on ambient noise levels because conditions at the Kawainui Marsh project area would essentially remain as present.

Table 4.1
State DOH Community Noise Level
Classification of Zoning Districts and Maximum Permissible Sound Levels

Zoning District	Maximum Permissible Sound Levels (dBA)	
	Daytime (7 a.m. to 10 p.m.)	Nighttime (10 p.m. to 7 a.m.)
Class A: Includes all areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type.	55	45
Class B: Includes all areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.	60	50
Class C: Includes all areas equivalent to lands zoned agriculture, country, industrial, or similar type.	70	70

Proposed Action

The project should not generate significant long-term impacts on noise levels because work primarily involves wetland restoration and reforestation activities. Noise from vehicles and human voices would be generated from passive outdoor recreational amenities included in the project. However, these noise sources should have minimal if any impact. The only existing land use in the immediate vicinity of these recreational amenities is Le Jardin Academy located *mauka* and above Kapa‘a Quarry Road.

The project would have some minor short-term noise generated from restoration and construction activities which are not planned to be scheduled at night. Such activities will temporarily increase ambient noise levels within the vicinity of the work area. The project would generate some noise primarily from equipment used for restoration activities (e.g. mowing, grubbing, etc.) along with construction activities that may be audible at the property line. Actual noise levels produced would depend on the methods employed throughout restoration and construction activities. Earthmoving equipment such as bulldozers and diesel-powered trucks would probably be the loudest equipment used during construction. Typical ranges of construction equipment noise vary between 70 and 95 dBA. Measures to control construction noise include the use of mufflers on power equipment and vehicles.

Construction activities are expected to be limited to regular workday hours (7:30 a.m. to 4:30 p.m., Monday through Friday). Therefore, restoration and construction activities should not result in a significant noise impact on surrounding uses which predominantly consist of undeveloped land and other areas of Kawainui Marsh. If necessary, a community noise permit for construction activities would be obtained from the State DOH to allow these activities. This permit includes restrictions to help mitigate the potential noise impacts resulting from short-term construction activities.

4.8 VISUAL RESOURCES

No Action Alternative

Under this alternative, there would be no real change to existing views of Kawainui Marsh from Kalaniana‘ole Highway and Kapa‘a Quarry Road. Existing views from the highway would continue to be very limited or further diminished due to continued growth of non-native and invasive trees and vegetation along this highway screening views. Views of the marsh along Kapa‘a Quarry Road would similarly continue to be screened or further diminished by growth of existing trees and invasive vegetation. This condition would also not support the City's *Ko‘olau Poko Sustainable Communities Plan* which identified views of the marsh from Kalaniana‘ole Highway as a scenic view due to the extensive growth of trees and vegetation.

Proposed Action

The concepts established in characterizing visual quality from the City's *Coastal View Study* (Chu 1987) were used to assess the visual impacts resulting from this restoration project. Visual qualities associated with scenic resources were evaluated using three factors that were: 1) visual vividness, 2) unity, and 3) intactness. Using these criteria, the visual impact of the project was evaluated based upon the degree of change to an existing view or alteration of a scenic resource. These criteria are briefly described below:

1. Visual Vividness. The memorability of a landscape is derived from contrasting landscape components as they combine to create striking and distinctive visual patterns, taking into account form, line, texture and color.
2. Visual Unity. The degree to which the visual resources of a landscape scene join together to form a coherent, harmonious and visual pattern; a balanced composition between manmade and natural elements.
3. Visual Intactness. The extent to which the landscape is free from visually encroaching features (Chu 1987).

Upland reforestation improvements planned under this project would improve views of Kawainui Marsh from Kalaniana‘ole Highway and Kapa‘a Quarry Road because existing non-native and invasive vegetation and trees would be replaced with native vegetation. Vegetation would still be provided along these roadways to serve as partial screens and buffers; however, viewing corridors would be created and the thickness of vegetation thinned to provide views of the marsh that are now essentially non-existent.

Wetland restoration efforts would remove existing invasive vegetation and peat mat to create more open water and seasonal mud flats. Native plants would be used to replace non-native and invasive plants, and themed plantings would be implemented as transition areas from the wetland to upland areas. These efforts would create views of a more native Hawaiian character associated with Kawainui Marsh.

Restoration improvements should have a beneficial impact by improving this marsh as a scenic resource, and improving views of it from the highway and Kapa‘a Quarry Road. The visual vividness of the marsh should be improved because the contrast of open water, mud flats, and wetland vegetation with themed native plantings on upland areas would create a more striking and distinctive visual pattern than currently existing. Improvements should create a more memorable landscape of the marsh supporting its international designation as a Ramsar Wetland.

The visual unity of the marsh should also be enhanced by restoration and reforestation concepts proposed under this plan to create a more harmonious visual pattern of the wetland leading to a transitional area and then to native upland forest areas. Finally, the visual intactness of the marsh would be enhanced as views of the wetland area are improved by removal of invasive vegetation that visually encroaches on Kahanaiki Stream.

Viewing areas such as observation decks and pedestrian paths planned would provide new viewing opportunities for the public of the restored wetland. Access to the marsh is presently restricted, but the project would provide limited public access via passive outdoor recreational amenities planned. These improvements would have a beneficial impact for the public supporting educational, cultural, and recreational opportunities associated with the marsh.

4.9 HISTORIC, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

Under State regulations (§13-13-276, HAR), there are two possible effect determinations for projects under historic preservation review: 1) “no historic properties affected” and 2) “effect, with proposed mitigation commitments.” The assessment of the restoration project’s effect was thus conducted using these regulations.

The “area of potential effect” (APE) on historic sites was established based upon the improvements planned, and includes the area within which the project that may directly or indirectly cause alterations to the use of a historic property. Based on restoration improvements planned, the project will not have visual, auditory, or other environmental impacts to any known archaeological historic properties located outside the project area. Therefore, the area of potential effect, or APE, is the same as the project area of about 80 acres.

No Action Alternative

Under this alternative, no wetland restoration, upland reforestation, or accessory improvements would be implemented to the project site. Although invasive vegetation and accumulation of peat would continue expanding within the wetland, potential subsurface historic resources would not be affected. Similarly, reforestation efforts for upland areas would not occur and thus not affect historic properties identified consisting of the Kawainui Marsh Archaeological-Cultural-Historical Complex and components (grinding stone, historic habitation area) and remnant of a historic road (SIHP# 50-80-11-7199).

Proposed Action

Proposed project improvements will occur within the Kawainui Marsh Archaeological-Cultural-Historical Complex and involve areas along the remnant of a historic road. Therefore, "effect, with proposed mitigation commitments" is the proposed determination under State regulations. Wetland restoration improvements along with other accessory improvements planned within the project area should not result in an adverse effect on historic sites. The reconnaissance survey completed within the project area identified two historic properties including components of SIHP# 50-80-11-2029, the previously identified Kawainui Marsh archaeological-cultural-historical complex, and SIHP# 50-80-11-7199, an in-use, early 20th century road remnant.

Limited subsurface testing within the project area identified a sparse amount of historic and traditional Hawaiian artifacts, some of which appear to be linked with habitation within the possible footprint of a house lot that appears on an 1899 map, and considered to be components of SIHP# 50-80-11-2029. Limited subsurface testing did not expose subsurface cultural deposits or modification within the project area. The documentation of backhoe test trenches that were excavated along LCA boundaries and within possible 20th century house lots failed to identify any associated rock or sediment walls (*lo'i* walls), foundations, or associated features.

Sediment coring at two locations within Kawainui Marsh has provided additional palynological and radiocarbon data. Pollen analysis has indicated that Kawainui sediments still hold pollen data that can refine and expand our knowledge of Polynesian settlement and pre-Contact change. Some earlier conclusions have been supported and others have been called into question based upon the pollen analysis.

Radiocarbon analysis suggested that the uppermost stratum within the project area consists of deposits of decomposed plant matter overlying relatively modern alluvium. Radiocarbon analysis of Core Sample 1 indicated that, minimally, the upper 27 inches of the 32-inch core sample (upper 85%) was composed of modern-aged sediment. Radiocarbon analysis of Core Sample 2 indicated that, minimally, 14 inches of the 40-inch core sample (upper 35%) was composed of modern-aged sediment. The relative vertical thickness of modern-aged deposition within Kawainui Marsh indicates that the proposed project's subsurface impact, which includes restoring certain areas of shallow (6 to 12 inches deep) open water on the west side of the south end of Kawainui Marsh, should pose little or no impact on subsurface historic properties within the project area.

In terms of cultural resources, this restoration project should not significantly affect traditional native Hawaiian cultural practices or resources. The project area is part of the Kawainui Marsh Archaeological-Cultural-Historical Complex that has considerable cultural value as documented in the mythological and traditional accounts section of the archaeological reconnaissance survey report (Appendix C). However, the project involves wetland restoration and reforestation efforts that will improve the marsh resource and its function as habitat for endangered waterbirds supporting its cultural value.

The project would not restrict access to surrounding areas outside of the project area that may potentially be used for traditional native Hawaiian cultural practices such as Ulupō Heiau. Accessory passive outdoor recreational improvements would also improve public access to this area that is presently restricted due to existing conditions and a lack of adequate facilities. Consultations with community organizations and the public, as discussed in Chapter 7, have not raised significant cultural issues associated with this restoration project.

Proposed Mitigative Measures

No further archaeological work is recommended for SIHP# 50-80-11-7199 (road remnant). Based on the results of the archaeological reconnaissance survey with limited subsurface testing report, the following mitigative measures are proposed:

1. An archaeological monitoring program would be developed to address the impact of subsurface disturbance within the project area.
   - The monitoring plan would include provisions for the post-review of historic properties if any are encountered during construction activities. As an example, data recovery work would be conducted if historic walls were found, and this would be documented in a data recovery report prepared and submitted to SHPD. A synthesis evaluating historic properties encountered in relation to this Kawainui Marsh historic site should be included in the data recovery report.
2. Preservation, in the form of avoidance and protection, be considered for the two components of SIHP# 50-80-11-2029 (grinding stone and habitation area) that were identified during the current project.
   - A strand of bamboo about 12 feet wide present at the habitation site would be avoided if possible from restoration activities. The habitation site with bamboo area was about 0.25 acres in size.

4.10 SOCIAL AND ECONOMIC FACTORS

4.10.1 Economic and Fiscal Factors

No Action Alternative

Under this alternative, restoration improvements would not be implemented and other accessory recreational amenities planned would not be constructed. There would be no effect on the City and the State of Hawai‘i’s finances in terms of tax revenue. No new jobs or income would also be created.

This would also have a negative impact on the State DOFAW and FWS because the grant funding obtained from these agencies will not be expended and would subsequently lapse. The State portion of the grant would be returned to the General Fund, and future funding for Kawainui Marsh may be more difficult to obtain and justify because of this. Funding from the

FWS would similarly lapse and be returned to the Federal government for likely use by other States. This would likely have a negative effect in the State's ability to obtain future funding grants from the FWS because of the competition nationally with other States for similar funding.

Proposed Action

This section discusses the effects of project improvements on both the City and State's economic and fiscal factors. Construction of this project will have different effects in relation to the City and the State of Hawai'i's finances. This project would not generate any new permanent full-time jobs. Therefore, the primary economic and fiscal effects would be associated with short-term construction jobs that will generate a small minor positive economic impact.

The estimated construction cost for this project of $4.2 million would create construction jobs during the duration of restoration and construction activities, as well as support industries that service construction activities directly and indirectly. Three broad types of jobs are distinguished below:

- 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 economy.
- Induced jobs are created as workers spend their income for goods and services.

Direct construction jobs would typically consist of on-site laborers, landscapers, tradesmen, mechanical operators, supervisors, etc. These new jobs created would also generate additional personal income for construction workers that are the wages paid directly to them or operational employees associated with project improvements. Direct construction jobs created would also stimulate indirect and induced employment and spending of wages within other industries located in the Kailua district and on the island such as retail, restaurants, material distributors, and other related businesses supporting the construction industry. These construction jobs would likely be filled by residents from the Island of O'ahu employed within the construction industry.

Based upon the construction budget and a 5-year timeframe for completion, the project is estimated to create a total of about 4 to 6 direct new jobs annually over the construction period. Because this restoration project is different from a typical development oriented construction project, the number of direct new jobs would not be spread out over the 5-year period. Most of the restoration work would likely be initiated within the first two years with other reforestation efforts implemented in phases. In addition, restoration work would be limited during the winter season and spring due to increased rainfall. Therefore, a higher number of jobs would initially be generated within the first few years with a lower number likely generated for other phases. Additional funding would also be required to construct outdoor recreational amenities planned to occur in later phases of the project.

The project could generate a total of about 25 new direct construction jobs. This would generate another approximately 25 indirect and induced jobs over the entire construction period or about 4 to 6 jobs annually. Therefore, a total employment impact of about 50 jobs (direct, indirect, induced) could be generated by this project over the entire implementation period. These jobs would create a relatively small but positive impact in employment for the island.

These new construction jobs would generate additional personal income for construction workers totaling about $1.6 million over the entire project. Indirect and induced income would also be generated on the order of $1.4 million over the entire project. This additional income would have a relatively minor positive impact to residents on O‘ahu. The potential additional jobs created from construction activities would provide additional personal income to individuals that would also support indirect and induced employment within the City from the spending of these wages. However, these indirect and induced effects would be rather minimal and thus not generate a significant effect on the local economy

Fiscal impacts would primarily involve additional tax revenue generated to the State from construction of this project. Tax revenue sources for State government are composed primarily of general excise taxes (GET) on development costs and construction materials, along with corporate income tax, and personal income tax from construction workers. The $4.2 million project construction budget expended is estimated to generate about $730,000 in tax revenue to the State. These construction related tax revenues would have a minor positive effect on the State’s fiscal condition because of the short-term increase in revenue associated with construction activities.

City revenues generated are primarily limited to tax revenues on privately-owned property and improvements, and to a lesser extent fees charged for various activities such as water, sewer, permits, etc. The two parcels associated with the project site are owned by the State, therefore, no property tax is presently paid by the State. However, a portion of one parcel is leased to a private entity for ranching operations that generates about $560 a year in taxes. The restoration and associated recreational amenity improvements constructed may slightly increase the property’s assessed value. However, no additional City revenues would be generated because it is a State-owned property. Therefore, this project should have minimal or no effect on the current or future levels of City tax revenues being generated.

4.10.2 Social Factors

No Action Alternative

The existing character of the Kawainui Marsh project area would remain essentially the same under this alternative. The landscape character would continue being dominated by non-native invasive vegetation and trees, and this vegetation would likely spread further eliminating remaining native Hawaiian vegetation. This situation would have a negative impact because the

value of the marsh as a wildlife sanctuary would continue to be diminished and these conditions would not support its designation as a Ramsar wetland of international importance.

The number of housing and visitor units in the Kailua district and surrounding areas would not be affected because such units would not be developed within Kawainui Marsh. There would be no change to the existing resident population or the existing population characteristics of the Kailua district as well. There would be no affect on environmental justice target populations.

Proposed Action

Improvements planned under the restoration plan will not impact the number of housing units in the Kailua district and surrounding community areas such as Maunawili because no housing units are included under this project. There are also no new visitor units included with this project, and no in-migration of individuals to Oahu would result due to the project. Therefore, this project will not impact the existing resident population or the existing population characteristics of the Kailua district.

There should be no impact on environmental justice target populations that consists of only one census block area identified in Kailua (Ulupaina Street) by the OMPO study, and this area is located well north of the project site. Construction related nuisance effects from restoration improvements would not cause any disproportionately adverse human health or environmental impacts on this population that is different from that which may be experienced by other surrounding residential areas or land uses (e.g. Le Jardin Academy). Necessary mitigative measures would be implemented by the contractor and monitored by DOFAW as discussed in previous sections to minimize such effects.

Project improvements consisting predominantly of wetland restoration and upland reforestation activities would also be consistent with the environmental justice definition created for the State. No one segment of the population or geographic area would be disproportionately burdened by environmental impacts caused by restoration improvements, construction of accessory improvements, or DOFAW's operational management of this important resource. Enhancement of this wildlife sanctuary would allow for increased public access at this site along with educational, cultural, and recreational opportunities that could be experienced by all persons of various race or income status. The public involvement process implemented along with this environmental review process provides opportunities for all persons to have meaningful involvement and input into the development of plans and decisions. Such efforts have included consultations with native Hawaiian organizations.

The restoration project will change Kawainui Marsh's project area by improving the landscape character through removal of invasive vegetation, opening water flow of Kahanaiki Stream, and re-establishing native plants in both the wetland and upland areas. The present landscape would change from being overgrown and dominated by non-native invasive vegetation to a landscape dominated with native Hawaiian vegetation and trees with more open water and mud flats.

These changes would have a beneficial impact within the project area but will not change the overall character of the surrounding environment outside of Kawainui Marsh. Project improvements should have minimal impact on Le Jardin Academy located across of Kapa‘a Quarry Road, and other surrounding areas consist of undeveloped area and Kalaniana‘ole Highway. Therefore, the character of these existing uses would not be changed or adversely impacted by the project.

Restoration improvements will enhance Kawainui Marsh’s value as a wildlife sanctuary and support its designation as a Ramsar wetland of international importance. Outdoor amenities planned under this project such as observation decks, pathways, etc. will have a positive effect by providing increased opportunities for public access to this area of Kawainui Marsh. Restoration efforts and amenities would have a positive impact by supporting cultural and educational opportunities that could occur. Public access to this area will still need to be regulated, properly managed, and periodically evaluated by DOFAW for public safety and to make sure such access doesn’t impact their objectives for this marsh.

4.11 INFRASTRUCTURE FACILITIES

4.11.1 Water Facilities

No Action Alternative

There would be no long- or short-term impacts on municipal water facilities because conditions at the Kawainui Marsh project area would essentially remain as present under this alternative.

Proposed Action

The project does not include facilities or structures generating potable water demands such as residential units or restroom facilities. The project will also not have any structures needing fire protection. Signage and observation decks planned as amenity improvements should not require fire protection.

However, some water will be required to support upland reforestation efforts in establishing native Hawaiian plants used to replace non-native invasive vegetation. Water for this effort will be used on a temporary basis in establishing reforested areas and may involve some type of drip irrigation system that is turned on during certain timeframes on various days. At this time, an average daily demand of about 5,000 gallons per day (gpd) is estimated. To obtain this water service, a temporary construction water meter would be applied for from the City BWS. This water meter would be similar to construction projects or roadway landscaping projects that require a water meter to irrigate landscaping on a temporary basis.

The new demand generated by this project should not have a significant impact on the City BWS’s water system and ability to provide water service in the area. A connection to an existing 36-inch transmission main routed within Kapa‘a Quarry Road would be used to obtain water

service. Design plans will be coordinated with the BWS for review and approval during the design phase and necessary ministerial permits will be obtained. The DOFAW would be required to pay for water use along with any applicable water system facilities charges when water is made available for this project.

4.11.2 Wastewater Facilities

No Action Alternative

Under this alternative, there would be no long- or short-term impacts on municipal wastewater facilities because conditions at the Kawainui Marsh project area would essentially remain as present.

Proposed Action

No wastewater facilities are planned under this project, therefore, no wastewater will be generated from the project site. Therefore, the project should have no impact on the City's existing municipal wastewater facilities or sewer lines.

4.11.3 Drainage Facilities

No Action Alternative

Under this alternative, no improvements would be made to the three existing drainage culverts along Kapa‘a Quarry Road or the drainage area discharging into the marsh from the driveway entrance into Le Jardin Academy. As a result, this would result in negative impacts to drainage facilities because the existing problems and condition of disrepair associated with these culverts will remain causing continued erosion of upland areas and at these culverts. There would be no improvements to the amount of sediment and other materials discharged by surface runoff which will continue flowing directly into the wetland. Undermining of portions of Kapa‘a Quarry Road would likely occur as current conditions show the start of this problem.

Proposed Action

The project would improve the three existing drainage culverts along Kapa‘a Quarry Road as part of mitigative measures to address current deficiencies with existing drainage facilities. Measures would also be implemented for the drainage area across from Le Jardin Academy's driveway entrance. Another drainage mitigation measure consisting of creating terraced walls to detain runoff discharging into a gully from Culvert No. 1 as shown on the project's conceptual plans (Chapter 2). Gravel causeways will also be created to allow detention of surface runoff in upland areas before entering the wetland, and these causeways were described in Chapter 2.

These measures will have a moderately positive impact by improving drainage facilities and conditions within Kawainui Marsh. Reducing sediment and other materials along with the velocity and volume of water discharging into the wetland portion of the marsh will have a beneficial effect on the function of Kawainui Marsh.

Details of the effects of drainage improvements are discussed below and are included in a drainage report in Appendix D of this document. Hydrologic calculations were performed using the Rational Method in conformance with the City Storm Drainage Standards for a 50-year design storm.

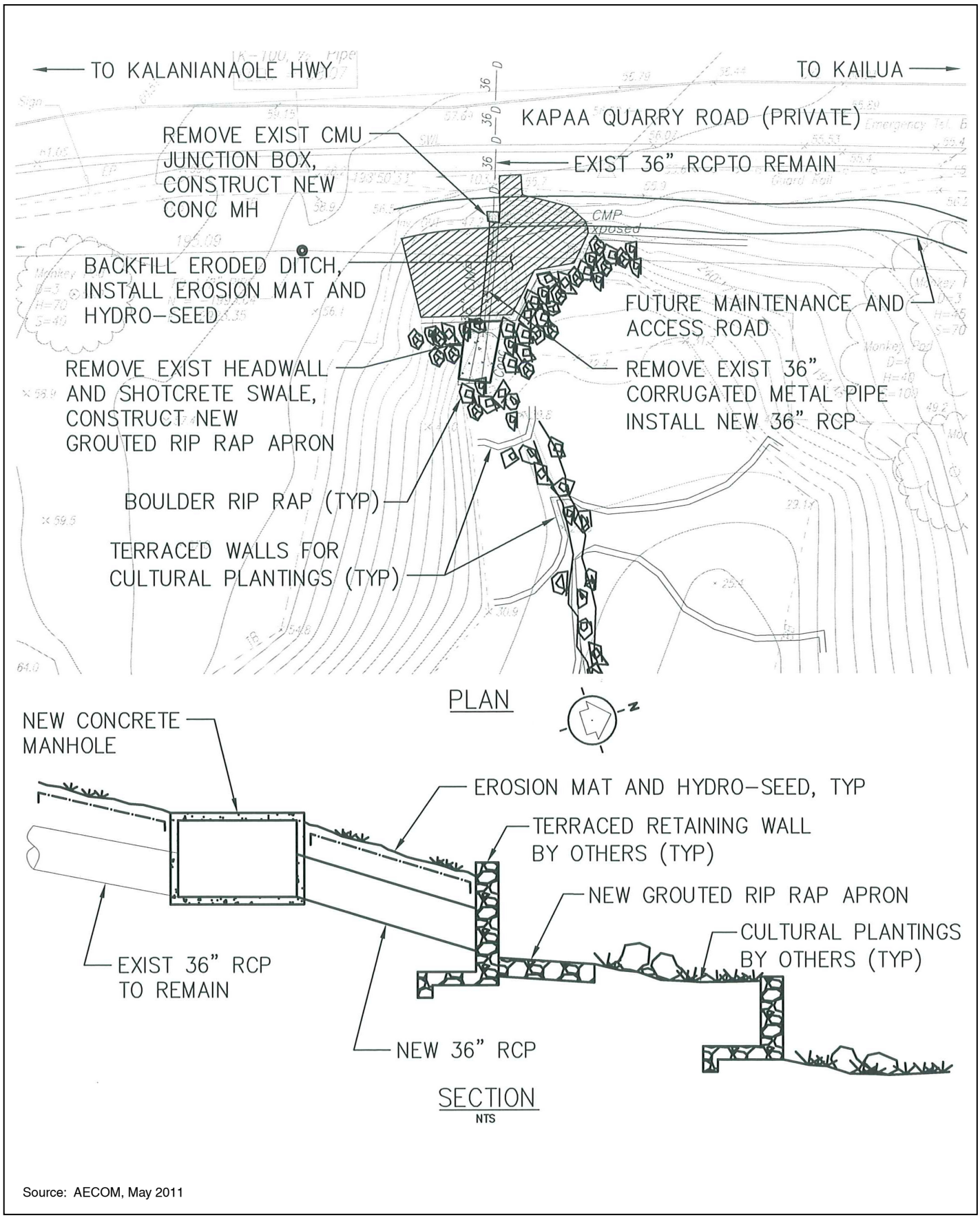
1. Drainage Culvert 1. The storm water contributing area for Culvert 1 comes from an existing catch basin fed by the majority of Le Jardin Academy. The design peak discharge was calculated to be 58.46 cubic feet per second (cfs). Hydraulic calculations determined a normal depth and full flow capacity of 1.23 ft and 166.07 cfs, respectively. These calculations indicate that the existing 36-inch RCP for this culvert is adequate to handle the peak flow from a projected 50-year storm. Surface runoff was evaluated to have relatively minimal impact on erosion as compared to the current overtopping of the existing broken CMU junction box.

   This culvert will be improved by replacing the existing junction box with a concrete drop manhole structure, installing a new 36-inch RCP, and providing grouted rip rap protection downstream of this pipe. Figure 4.1 shows proposed improvements to this culvert.

2. Drainage Culvert 2. The design peak discharge was calculated to be 9.97 cfs, and the culvert has a normal depth and full flow capacity of 0.56 feet and 33.38 cfs, respectively. These calculations indicate that the existing 18-inch RCP is adequate to handle the peak flow from a projected 50-year storm. However, surface runoff over the unprotected slope, large vehicles, and poor soil conditions may have contributed to the progressive weakening and separating of the existing 18-inch RCP.

   Culvert 2 will be reconstructed and connected to a new 18-inch reinforced concrete pipe and concrete headwall. A grouted rip rap apron will be provided from the pipe and connect to the grassed drainage swale along the project's access road. Surface flow will then be conveyed to an open grassed settling basin area. Figure 4.2 shows these improvements.

3. Drainage Culvert 3. The design peak discharge was calculated to be 125.91 cfs, and the culvert has a normal depth and full flow capacity of 1.92 feet and 134.16 cfs, respectively. These calculations indicate that the existing 30-inch RCP is adequate to handle the peak flow from a projected 50-year storm. Some indications of erosion may be attributed to the unprotected inlet and outlet areas of the culvert.

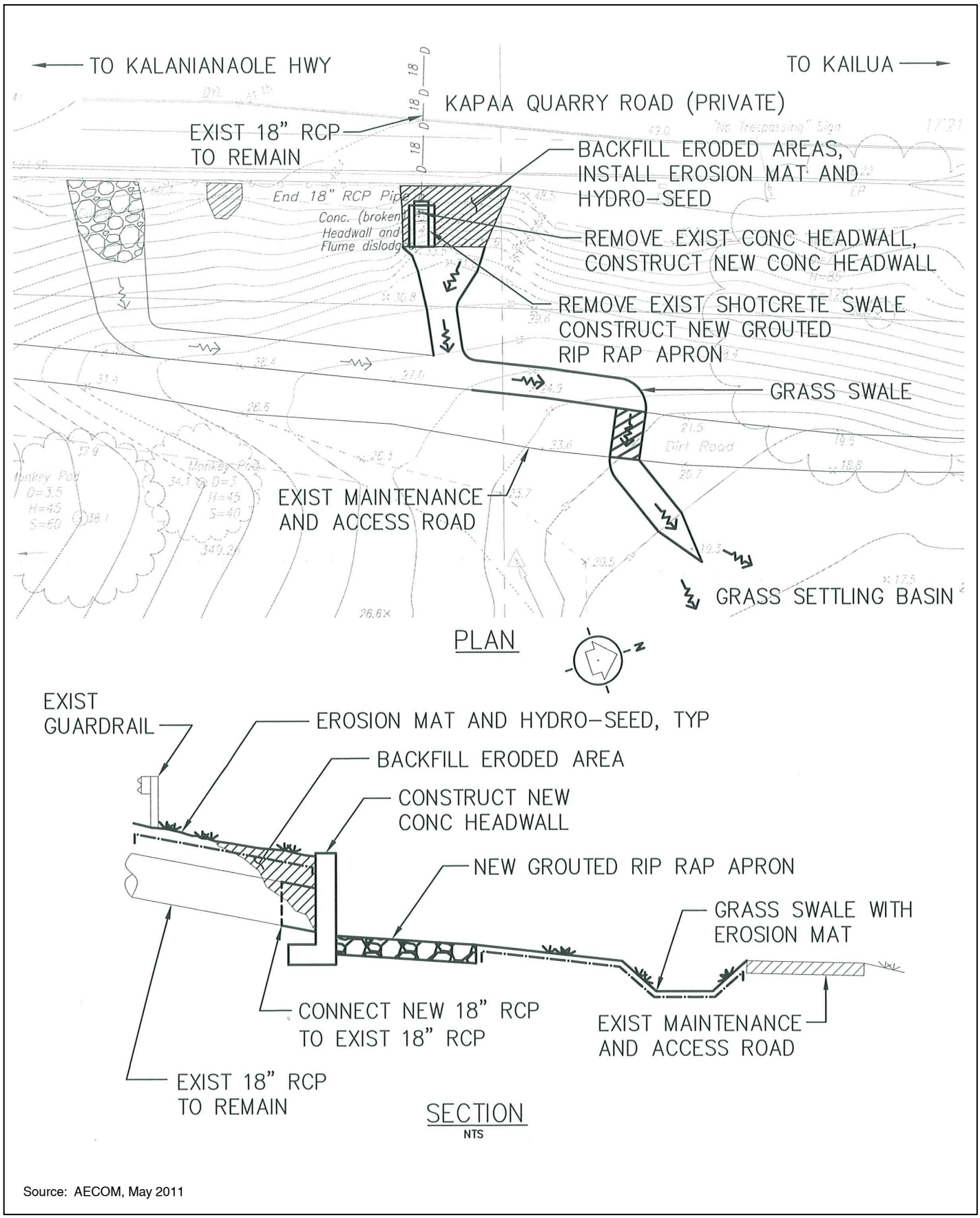


Source: AECOM, May 2011

Figure 4.1
Drainage Culvert 1 Improvements

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office



Source: AECOM, May 2011

Figure 4.2
Drainage Culvert 2 Improvements

Culvert 3 will have a grouted rip rap apron, erosion mat, and grass installed on the downstream end of this culvert. Discharges from the culvert should follow an existing grass ditch toward an open area along the dirt access road used for detention and infiltration. Figure 4.3 shows these improvements.

4. Drainage Area 4. The design peak discharge was calculated to be 7.14 cfs. Over time, this peak surface flow has caused serious erosion issues for this unprotected area of slope. Mitigation for this area would consist of backfilling the eroded ditch, installing grouted rip rap slope protection, install erosion mat, and grass the adjacent slope areas. A grass swale would be constructed downstream of the rip rap that would convey runoff to Drainage Culvert No. 2.

4.11.4 Solid Waste Facilities

No Action Alternative

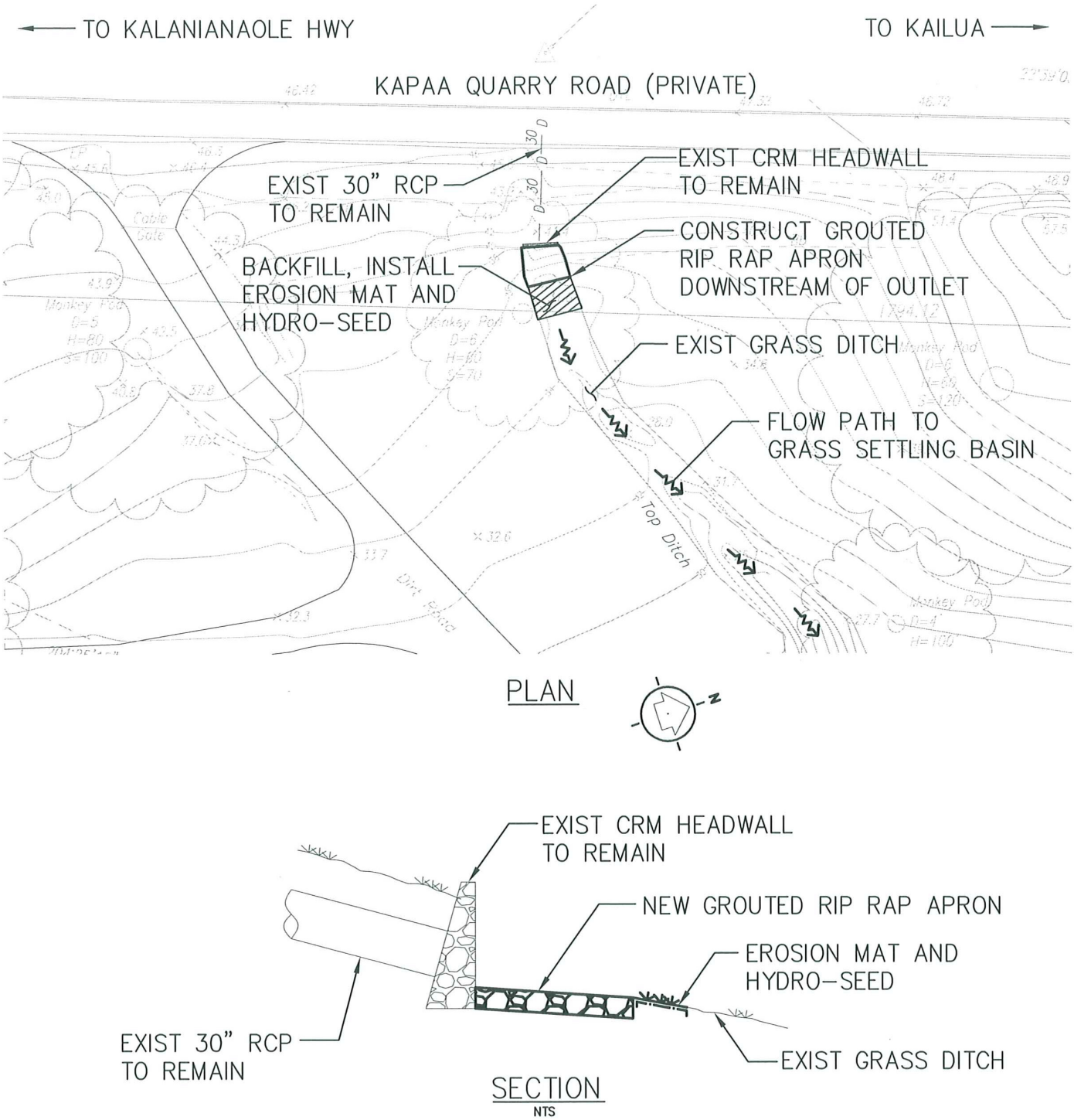
Under this alternative, there would be no long- or short-term impacts on the City's solid waste facilities because conditions at the Kawainui Marsh project area would essentially remain the same as current.

Proposed Action

Typical municipal solid waste, such as residential waste consisting of organics (food), paper, and plastics, should not be generated by this restoration project. However, if such waste were generated, it would need to be collected by a private company for disposal. Therefore, solid waste generated by this project would primarily be associated with green waste from restoration activities and short-term construction activities for improvements such as drainage culverts and accessory amenities. These activities would not affect the City's collection operations because this project is associated with a government source. Therefore, the project should have only minimal or a minor impact on the City's solid waste facilities, operations, and landfill.

Wetland restoration and upland reforestation improvements will generate a fair amount of waste predominantly in the form of vegetation and associated materials removed from activities. Wetland vegetation removed is planned to be set aside in nearby areas of the project area to allow it to decompose, or the existing vegetation processing site would be used. Vegetation left in trash bins can lose about 50 percent of its volume within 6 months, therefore, up to about 75 percent of the volume may decompose within a year's timeframe.

Larger vegetation and trees would be mulched and used for reforestation landscaping activities. Other green waste could be taken to Hawaiian Earth Products, or HEP, for processing. HEP accepts residential and commercial green waste and processes it into soil amendment products.



Source: AECOM, May 2011

Figure 4.3
Drainage Culvert 3 Improvements

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Construction of project amenities (e.g. pathways, signage, etc.) will generate solid waste that is typical of construction-related activities. Construction waste generated would be disposed of by a contractor in conformance with agency regulations at the privately-owned PVT Nānākuli Construction and Demolition Material Landfill if not permitted at either H-POWER or the Waimanalo Gulch Sanitary Landfill.

4.11.5 Transportation Facilities

No Action Alternative

Under this alternative, there would be no long- or short-term impacts on the State's highway facilities or the privately-owned Kapaʻa Quarry Road because conditions at the Kawainui Marsh project area would essentially remain the same as current.

Proposed Action

The project's restoration improvements and construction of associated amenities will inevitably result in some short-term and temporary disruptions to traffic along Kapaʻa Quarry Road, Kalanianaʻole Highway, and other surrounding roadways in the immediate vicinity of the project area. Construction related traffic may occur as a result of the movement of slow-moving heavy construction vehicles and equipment. Additional traffic would occur from construction workers traveling to and from the job site.

However, any additional traffic delays due to construction traffic should be minimal because the number of workers anticipated should be very little (about 5 or less per day). This additional traffic generated is expected to have minimal if any noticeable impact on traffic facilities or the operation of intersections particularly Kalanianaʻole Highway with Kapaʻa Quarry Road. Construction workers would also generally leave before the weekday afternoon peak hour starts typically about 4:00 p.m. There would be no lane closures required during restoration or construction activities as well.

Non-restoration improvements planned such as a parking lot and new driveway access along Kapaʻa Quarry Road would create a primary location for vehicular access to the site by the public. Additional vehicle trips generated to the site would typically occur after the morning commuter peak hour and thus have minimal impact on roadways and intersections. Vehicle trips, predominantly leaving the site, during the afternoon commuter peak should be low and similarly have minimal impact on roadway facilities. DOFAW will close the parking lot entrance at the end of the day.

Kawainui Marsh is a wildlife sanctuary that is not expected to generate a high number of vehicular traffic throughout the day as compared to other major traffic generators such as commercial uses. A right-turn storage lane is planned along Kapaʻa Quarry Road to minimize delays for northbound traffic. Traffic counts taken during peak hours along Kapaʻa Quarry Road

also showed it being relatively light (400 vehicles in both directions). Therefore, this project should have minimal impacts on the State's highway facility and privately-owned Kapa'a Quarry Road.

4.12 PUBLIC FACILITIES AND UTILITIES

4.12.1 Educational Facilities

No Action Alternative

There would be no long- or short-term impacts on existing educational facilities in the surrounding area under this alternative because conditions at the Kawainui Marsh project area would essentially remain the same. No educational opportunities associated with Kawainui Marsh would similarly occur due to the condition of the marsh.

Proposed Action

Restoration improvements and associated project amenities planned are expected to have no negative long-term impact on educational facilities in the surrounding area. The project does not involve any new housing units that may generate new students attending schools in the area. Therefore, the project will not increase student enrollment or place additional demands on existing school faculty and administration.

Restoration improvements will create opportunities for schools or community organizations to participate in educational programs or other activities associated with Kawainui Marsh in coordination with DOFAW. Observation decks, parking, and pedestrian pathways would provide safer and more convenient accessibility for the public and students to access designated areas of the marsh to conduct educational activities.

Le Jardin Academy is located across the street of the project site, but school buildings and facilities are located a sufficient distance away and at a considerably higher elevation than the wetland and upland area of the project. Restoration activities and construction of other improvements planned may generate some construction noise that could be audible. However, such effects would be temporary and probably not significantly audible due to the distance away and elevation of buildings from the project site. Similarly some fugitive dust emissions may be generated from construction activities, but are not expected to significantly impact school activities because of the soil type associated with wetlands and type of improvements planned. The contractor would need to comply with State DOH regulations and any permit conditions to mitigate such emissions. Some odors from decomposing vegetation may occur, but such nuisance effects should not be significant and DOFAW will monitor conditions to minimize effects on the school and other uses in the vicinity.

4.12.2 Medical Facilities

No Action Alternative

There would be no long- or short-term impacts on existing medical facilities (Castle Medical Center) in the surrounding area under this alternative because conditions at the Kawainui Marsh project area would essentially remain the same.

Proposed Action

Restoration improvements and associated project amenities planned are expected to have no negative long-term impact on Castle Medical Center or other medical facilities in the surrounding area. The project does not involve any new housing units that would generate new residents that may increase demands on medical service from such facilities.

Castle Medical Center is located about 0.25 miles away which is a moderate distance away from the project site, and should not be adversely affected by any short-term construction related activities. Restoration activities and construction of other improvements planned may generate some construction noise that would probably not be audible at this medical center which is air conditioned. Similarly some fugitive dust emissions may be generated from construction activities, but are not expected to impact this medical center or activities because of the soil type associated with wetlands, type of improvements planned, and distance away. The contractor would also need to comply with State DOH regulations and any permit conditions to mitigate such emissions. Some odors from decomposing vegetation may occur, but such nuisance effects should not be significant and DOFAW will monitor conditions to minimize effects on the medical facility and other uses in the vicinity.

4.12.3 Recreational Facilities

No Action Alternative

There would be no long- or short-term impacts on existing recreational facilities in the surrounding area under this alternative because conditions at the Kawainui Marsh project area would essentially remain the same. However, public access to the Kawainui Marsh project area would continue to be restricted due to existing conditions. There would be no safe and convenient facilities to support public access in the project area such as parking and pedestrian paths, and the area would continue to be overgrown with invasive vegetation and trees.

Proposed Action

Restoration improvements and associated project amenities planned are expected to have no negative long-term impact on recreational facilities in the surrounding areas. Activities conducted at the Kawainui Marsh project site should not have an impact on the other recreational

facilities and park sites identified in Chapter 3 because they are located considerable distances away and project activities would not disturb activities conducted at those sites.

Project improvements would allow public access into the area that would need to be managed and regulated by DOFAW. Passive outdoor recreation improvements such as observation decks, pedestrian pathways, and parking would have a positive impact on this site by providing facilities supporting safer and convenient access to the area. Wetland and upland restoration would improve the visual landscape of the area for visitors and enhance habitat for native waterbirds that may be viewed. Signage and other amenities implemented should also support public education of Kawainui Marsh and its resources.

Construction related activities may generate some short-term construction noise from equipment that should not be audible at the various park sites. Maunawili Neighborhood Park is the closest park situated over 1,500 feet away and across of Kalaniana‘ole Highway. Similarly, any fugitive dust emissions generated from construction activities should not impact park sites or activities because of the soil type associated with wetlands, type of improvements planned, and distance away. The contractor would also need to comply with State DOH regulations and any permit conditions to mitigate such emissions. Some odors from decomposing vegetation may occur, but such nuisance effects should not impact recreational facilities that are located considerable distances away. However, DOFAW will monitor conditions to minimize effects on various uses in the immediate vicinity.

4.12.4 Police and Fire Protection

4.12.4.1 Police Protection

No Action Alternative

There would be no long- or short-term impacts on existing police facilities or their department’s operations under this alternative because conditions at the Kawainui Marsh project area would essentially remain the same.

Proposed Action

This project should have minimal impact on the police department’s operations and their ability to provide adequate protection services to the Kailua district either during construction or upon completion of the restoration improvements. Public access created within the project area by improvements (e.g. parking lot, pedestrian paths, etc.) may create the potential for emergency calls to the police department, however, such calls are expected to be infrequent. The DOFAW manages Kawainui Marsh and would have staff in the area working and providing a source for the monitoring of activities along with public assistance if required. No police patrols currently occur within Kawainui Marsh and this would continue with the project. The parking area will be chained at the end of the day by DOFAW as is done at other wildlife sanctuaries, so there will not be any activities occurring at night.

The hiring of off-duty police officers to assist in directing traffic during restoration and construction activities should not be required for this project. The majority of the construction activities will occur within the wetland area of the project site. Other improvements should not require the closure of any roadway lanes along Kapa‘a Quarry Road. However, the contractor would be responsible to prepare and implement traffic management plans if required during construction activities which would be reviewed and approved by the City.

4.12.4.2 Fire Protection

No Action Alternative

There would be no long- or short-term impacts on existing fire facilities or their department's operations under this alternative because conditions at the Kawainui Marsh project area would essentially remain the same.

Proposed Action

This project should have minimal impact on the HFD's operations and their ability to provide adequate fire protection services to the Kailua district either during construction or upon completion of the restoration improvements. Project improvements planned such as signage and observation decks would not involve structures requiring fire protection. The majority of improvements consist of wetland restoration and landscaping improvements (reforestation) of upland areas.

Public access created within the project area by improvements (e.g. parking lot, pedestrian paths, etc.) may create the potential for emergency calls to the HFD, however, such calls are expected to be infrequent. Most of the restoration project area is located within a co-op response area shared by the HFD and DOFAW. DOFAW manages Kawainui Marsh and would also have staff in the area working and providing a source for public assistance if required.

4.12.5 Electrical and Communication Facilities

No Action Alternative

There would be no long- or short-term impacts on existing electrical or communications facilities in the project area under this alternative because conditions at Kawainui Marsh would essentially remain the same.

Proposed Action

Project improvements would not require electrical or communication facilities. Therefore, there should be no impact on HECO, Verizon Hawai‘i, and Oceanic Time Warner Cable facilities distribution lines or their operations.

4.13 SECONDARY AND CUMULATIVE IMPACTS

4.13.1 Secondary and Cumulative Effects Under No Action Alternative

Under the No Action Alternative, the project would not contribute to secondary or cumulative effects on the surrounding environment. Thus, any impacts occurring would be directly associated with the activities conducted by other developments implemented in the area. Environmental impacts associated with those developments or activities would be addressed by environmental documents prepared for them.

4.13.2 Secondary Effects with Proposed Action

Secondary effects, also referred to as indirect effects, are effects caused by a project, but occur later in time or farther removed in distance than direct impacts but are still reasonably foreseeable. Such effects may include impacts on environmental resources or public facilities that occur from a project's influence on land use. For example, a new housing development would have a secondary impact on nearby schools in that area by increasing student enrollments. Secondary impact assessments are concerned with impacts that are sufficiently "likely" to occur and not with the speculation of any impact that can be conceived of or imagined.

The proposed restoration project is expected to have no secondary impacts on the resident population, and minimal if any effects on land use patterns and public and infrastructure facilities in the immediate and surrounding areas. The project involves wetland restoration and upland reforestation improvements with limited passive outdoor recreational amenities to support public access of this area of Kawainui Marsh.

These improvements do not include additional residential housing or visitor units that will increase the resident or visitor population in the area. As a result, the project would not significantly affect public facilities such as schools, parks, etc. due to new residents in a community. With the exception of temporary water use, no other infrastructure facilities serving this area would be adversely impacted. No improvements to increase the capacity or expand existing infrastructure systems should also be required due to this project as discussed in previous sections of this document.

The project would not influence changes to the existing land use pattern of the immediate area. Much of this area is comprised of other portions of Kawainui Marsh and inland (*mauka*) areas above Kapa'a Quarry Road is designated as Conservation District land restricting development. Any future changes to land areas south of Kalaniana'ole Highway (Maunawili community) would be due to economic reasons and not due to project related wetland restoration improvements.

Construction of this project will generate limited short-term construction jobs that are not expected to result in any permanent in-migrating of workers to the Island of O‘ahu to fill these jobs. It is anticipated that qualified local contractors on Oahu would be used for the project’s construction. Therefore, construction of the project should not contribute to significant secondary impacts associated with in-migration of workers.

4.13.3 Cumulative Impacts with Proposed Action

Cumulative impacts are typically defined as the effects on the environment that result from the incremental impact of a project when added to past, present, and reasonably foreseeable future actions within the study year. The estimation of future impacts is important for cumulative impact analysis. However, the focus must be on “reasonably foreseeable” actions that are those likely to occur or probable rather than those that are merely possible or subject to speculation. The prediction of reasonably foreseeable impacts thus requires judgment based on information obtained from reliable sources such as approved development or construction plans, entitlements, and similar documents.

The discussion of impacts presented within this document has provided information to assist in addressing the applicable cumulative effects associated with the project and other reasonably foreseeable future actions being implemented. The Kawainui Marsh restoration improvements should not have significant cumulative impacts on the surrounding environment. Most of the effects are confined to the marsh project site, the project would not require off-site infrastructure improvements, and are short-term (construction effects).

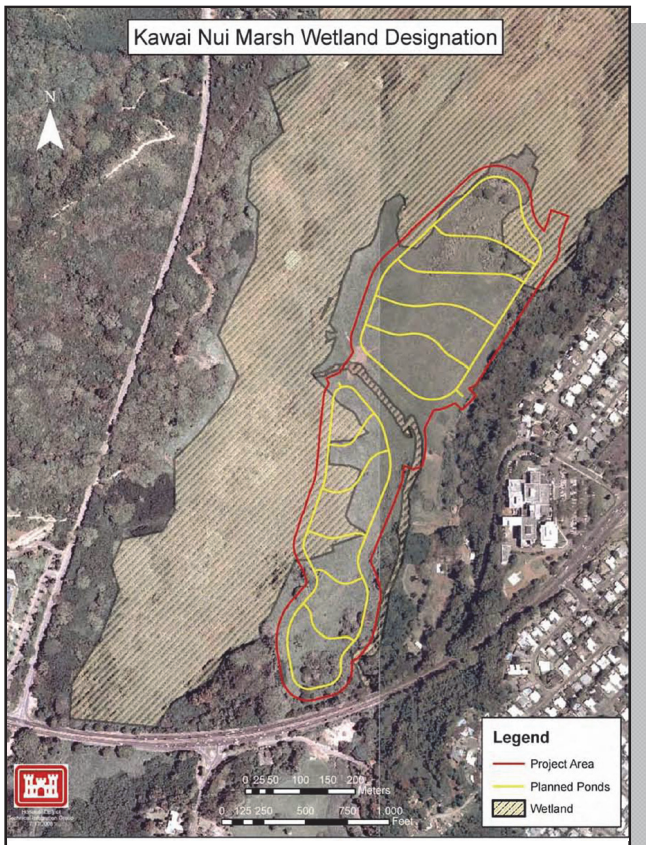


Exhibit 4.1 – Wetlands Designation Map
Source: COE, December 2008

The only other known approved development occurring within the project area that would be completed before 2019 is the adjacent ponds being developed by the COE (refer to Figure 1.2). The COE initiated project includes creation of 24 acres of mudflats and shallow ponds, installation of 8,040 linear feet of predator control fencing, implementation of a trapping program, and construction of two access roads to construct, operate and maintain the two pond systems that will be bisected by Maunawili Stream. The total project area will encompass 37.8 acres, and only a small percentage of this actually involves delineated wetland area as shown on Exhibit 4.1 (COE, December 2008).

Short-Term Construction Related Effects

Some cumulative impacts would be associated with temporary construction activities because the timing of the COE's work would likely occur concurrently with the DOFAW restoration project. This situation would contribute to increased short-term nuisance effects such as increased noise from activities and equipment, and fugitive dust emissions. Increased disruptions to roadways may also occur from construction worker traffic.

These nuisance effects would be temporary and the project should not generate a significant impact on the environment. The area affected by the COE's ponds and DOFAW restoration project is large covering about 118 acres, and activities would be conducted in phases only affecting certain areas at a time. Therefore, noise levels would be dissipated over this area and existing land uses (e.g. residences, schools) are located considerable distances away. Fugitive dust emissions would be limited in the restoration project area due to the hydric soils present in the wetland and reforestation methods planned for upland areas as discussed in this document. Best management practices would be implemented by the COE's project, therefore, fugitive emissions should not be significant. Increased construction worker traffic would be dispersed given the location of the two affected project areas, and the number of workers anticipated to be generated for the restoration project would be minimal.

Land-disturbing activities, particularly associated with the COE's pond activities, may result in some soil erosion during periods of heavy rainfall or high winds. However, Kawainui Marsh already functions as a source for flood protection and thus any runoff should not have a significant impact on the environment. Various mitigation measures in the form of site specific best management practices will be incorporated into the COE's design plans to minimize short-term erosion impacts during construction activities. Contractors would also comply with other regulations and agency requirements (e.g. DOH noise regulations, etc.). Therefore, the cumulative effect from these activities should not be significant and would be short-term.

Effects on Physical and Natural Environment

Both projects would result in some changes to the physical environment of Kawainui Marsh, however, the restoration project should not have a cumulatively adverse impact when evaluated with the COE's project based upon the COE's environmental document and this assessment. The COE would create shallow ponds within both wetland and dryland areas associated with Kawainui Marsh to improve habitat for waterbirds. Similarly, DOFAW's restoration project would restore wetland habitat and reforest upland areas with native vegetation that is now overgrown with non-native invasive vegetation. These changes would cumulatively improve habitat for native waterbirds and improve the function of this wetland.

Botanical resources would be improved through the replacement of non-native invasive plants with native vegetation. Improvements would not adversely impact this flood area, soil conditions, or the area's topography. Ground water and surface water flows would not be significantly impacted by these projects. To minimize potential effects on archaeological resources that may be present, mitigative measures will be implemented consisting of archaeological monitoring for the DOFAW project and data recovery work for the COE's ponds.

Other mitigative measures and best management practices as discussed in the various environmental documents would also be implemented during construction activities further minimizing impacts. A Biological Opinion issued by the FWS for the COE's ponds included conservation and post-construction measures such as a management plan for Kawainui Marsh to further minimize impacts on resources. Therefore, the restoration project should not result in a significant impact on the various physical resources and natural environment when evaluated cumulatively with the COE's ponds project.

Effects on Social and Economic Factors

Both projects would contribute to the economic environment by creating temporary construction jobs and wages that will have a small but nevertheless positive impact on the State's fiscal factors and other businesses related to the industry such as manufacturers and distributors. City property values would not be affected because the improvements occur on State-owned property, and improvements should not influence property values of surrounding areas. Most of the surrounding area consists of additional portions of Kawainui Marsh and undeveloped land designated as Conservation District (State land use).

These projects would have minimal if any cumulative effect on the resident or visitor population because they do not involve adding new housing or visitor units. They would not induce changes to the surrounding land use patterns, the character of the Kailua and Maunawili communities, or cause significant social impacts as discussed in this document. Therefore, the restoration project should not contribute to significant cumulative impacts on these social factors.

Effects on Infrastructure and Public Facilities

The COE's ponds and DOFAW restoration projects would have minimal impact on existing infrastructure facilities serving the Kawainui Marsh and immediate areas as discussed in this document and the COE's environmental document. These improvements would generate minimal impacts on the potable water system, wastewater collection and treatment facilities, and surrounding drainage systems. Transportation facilities would only be affected from short-term construction related traffic because only traffic from DOFAW staff maintaining these areas would occur once the improvements are completed. No major off-site infrastructure improvements would be required from these projects.

No significant cumulative impacts are expected on existing school facilities, medical facilities, recreational facilities, and police and fire protection services. These improvements would not generate additional residents migrating to O‘ahu and thus not create additional demands on these facilities or the activities and services provided by respective agencies or organizations. Therefore, the DOFAW restoration project should not have significant cumulative impacts on these public facilities or existing infrastructure facilities serving the area.

CHAPTER 5
CONFORMANCE WITH EXISTING STATE AND COUNTY PLANS, POLICIES, AND CONTROLS

This chapter discusses the project's conformance with the State Land Use District regulations, State Environmental Policy (Chapter 344, HRS), and the regulations, policies, and goals set forth by the City's Koʻolau Poko Sustainable Communities Plan, Special Management Area (Chapter 205A, HRS), and Land Use Ordinance.

5.1 STATE LAND USE DISTRICT

Pursuant to Title 13, Chapter 205 (Land Use Commission), HRS, all lands in the State of Hawaiʻi are classified by the State Land Use Commission (LUC) into four major districts which are referred to as State Land Use Districts. These four land use districts are the Urban, Rural, Agricultural, and Conservation Districts. Permitted uses within the State Land Use Districts are prescribed under Title 13, Chapter 205, HRS, and the State LUC's Administrative Rules prescribed under Title 15, Subtitle 3, Chapter 15, HAR.

The State LUC's Land Use District Boundary Map for Kailua indicates that the proposed Kawainui Restoration project site and immediate surrounding areas are classified as being within both the State's "Urban District" and "Conservation District." Figure 5.1 shows the project site in relation to the State Land Use District designations for the area.

5.1.1 State Urban District

As shown on Figure 5.1, the Urban District area includes a majority of the project's upland area planned for reforestation and passive outdoor recreation amenities. A portion of the delineated wetland area is also extends within this district. This Urban District boundary also extends further north generally encompassing upland areas of Kawainui Marsh.

Permitted uses or activities within the Urban District are provided by ordinances or regulations of the county within which the Urban District is situated. Therefore, Urban District lands on the Island of Oʻahu are regulated by the ordinances and regulations of the City and County of Honolulu.

5.1.2 State Conservation District

Conservation District designated lands fall under the jurisdiction of the State Board of Land and Natural Resources (BLNR). The BLNR has the authority to establish zones (also known as subzones) within lands designated as Conservation District. Permitted uses within subzones are delineated in the BLNR's Administrative Rules, Section 13-5-23 of Title 13, Chapter 5, HAR.

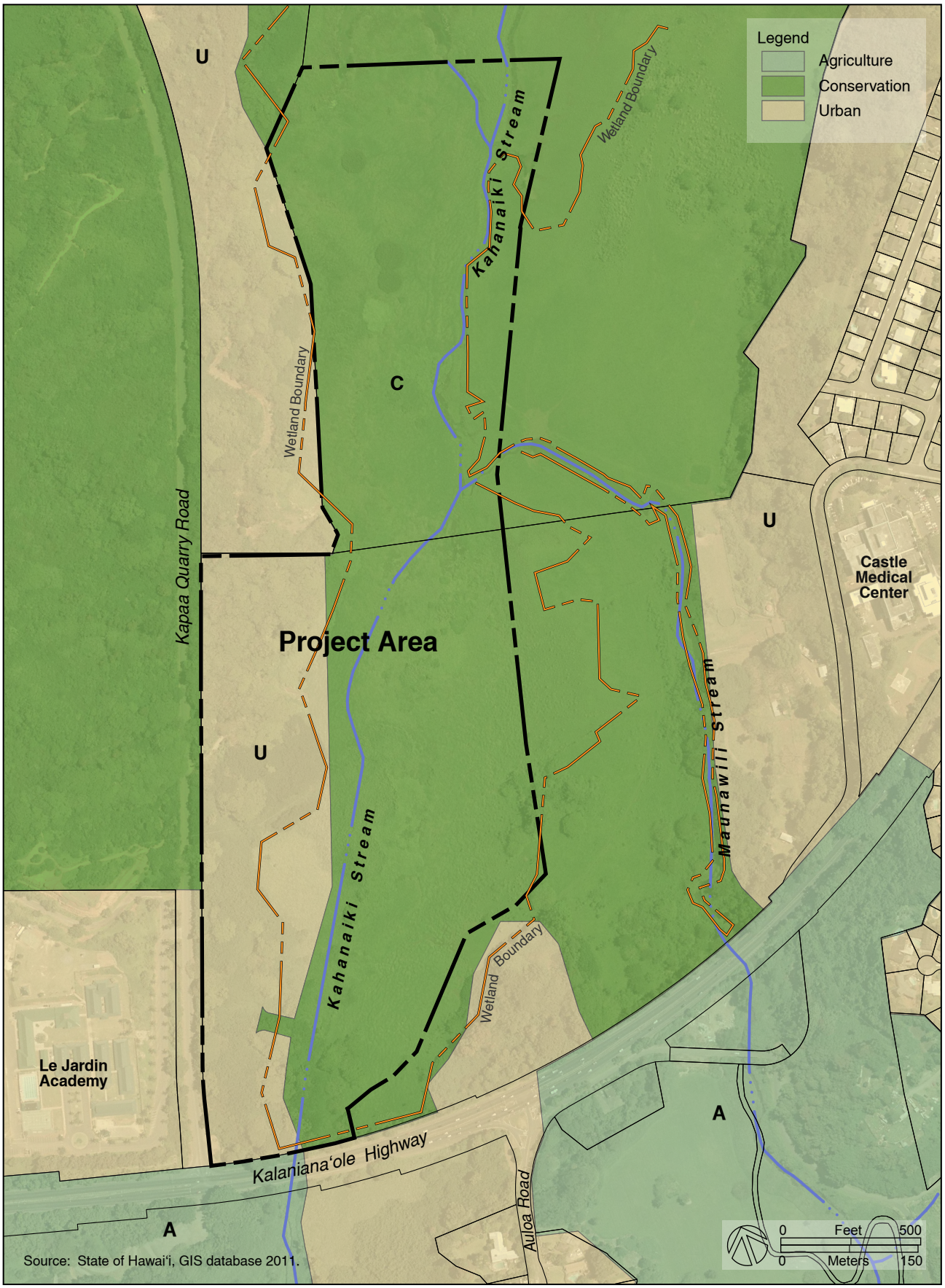


Figure 5.1
State Land Use District Map
Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

The Conservation District area of the project is classified as the "Protective" subzone. Figure 5.2 includes a figure showing subzone designations for the project area. The objective of the "Protective" subzone is to protect valuable resources in designated areas such as restricted watersheds, marine, plant and wildlife sanctuaries, and other designated unique areas. Land uses permitted in this subzone most pertinent to this restoration project include public purpose uses and sanctuaries that are identified below. There are other various types of permitted uses that are also applicable to DOFAW's maintenance and management of Kawainui Marsh and this project such as data collection, landscaping and removal of noxious plants, signs, construction of accessory structures, and tree removal.

1. Public Purpose Uses. Land uses undertaken by the State of Hawai'i or the counties to fulfill a mandated government function, activity, or service for public benefit and in accordance with public policy and the purpose of the conservation district. Such land uses may include transportation systems, water systems, communications systems, and recreational facilities.
2. Sanctuaries. Plant and wildlife sanctuaries, natural area reserves, and wilderness and scenic areas, including habitat improvements under an approved management plan.

Conservation District Use Permit OA-3068

A Conservation District Use Permit (CDUP) OA-3068 was issued by the BLNR to the Land Division of DLNR for a management plan proposed for Kawainui Marsh in January 2002. The CDUP was issued for the continued management of marsh resources based upon a 1983 resource management plan that was the basis for an Environmental Assessment the department completed in 2000 (Land Division, March 2000). The resource plan identified goals, objectives, policies, and recommended actions to implement and maintain measures to manage the economic, ecological and cultural resources of the marsh.

The management plan had the following primary objectives: 1) to provide a comprehensive and coordinated management plan for existing and future land and water uses; 2) to protect, maintain and enhance wildlife species, their habitats and related ecological systems; and 3) to protect, preserve and enhance cultural, educational and recreational values. The CDUP allows future plans for the marsh to be developed, changed, and implemented pursuant to this management plan's goals and objectives. The DLNR, Land Division also proposed that the development, operation and maintenance of ranching, agricultural activities, wildlife habitat and vegetation buffer, flood control, and fire control areas are ongoing and would continue.

Subsequent improvements proposed that meet these objectives will not require the submittal and processing of a new Conservation District Use Application (CDUA). However, approval of the BLNR Chairperson must be sought for any major changes from existing goals or objectives. The ponds project proposed by the COE met the primary management objectives for Kawainui Marsh and subsequently was not required to submit a new CDUA.

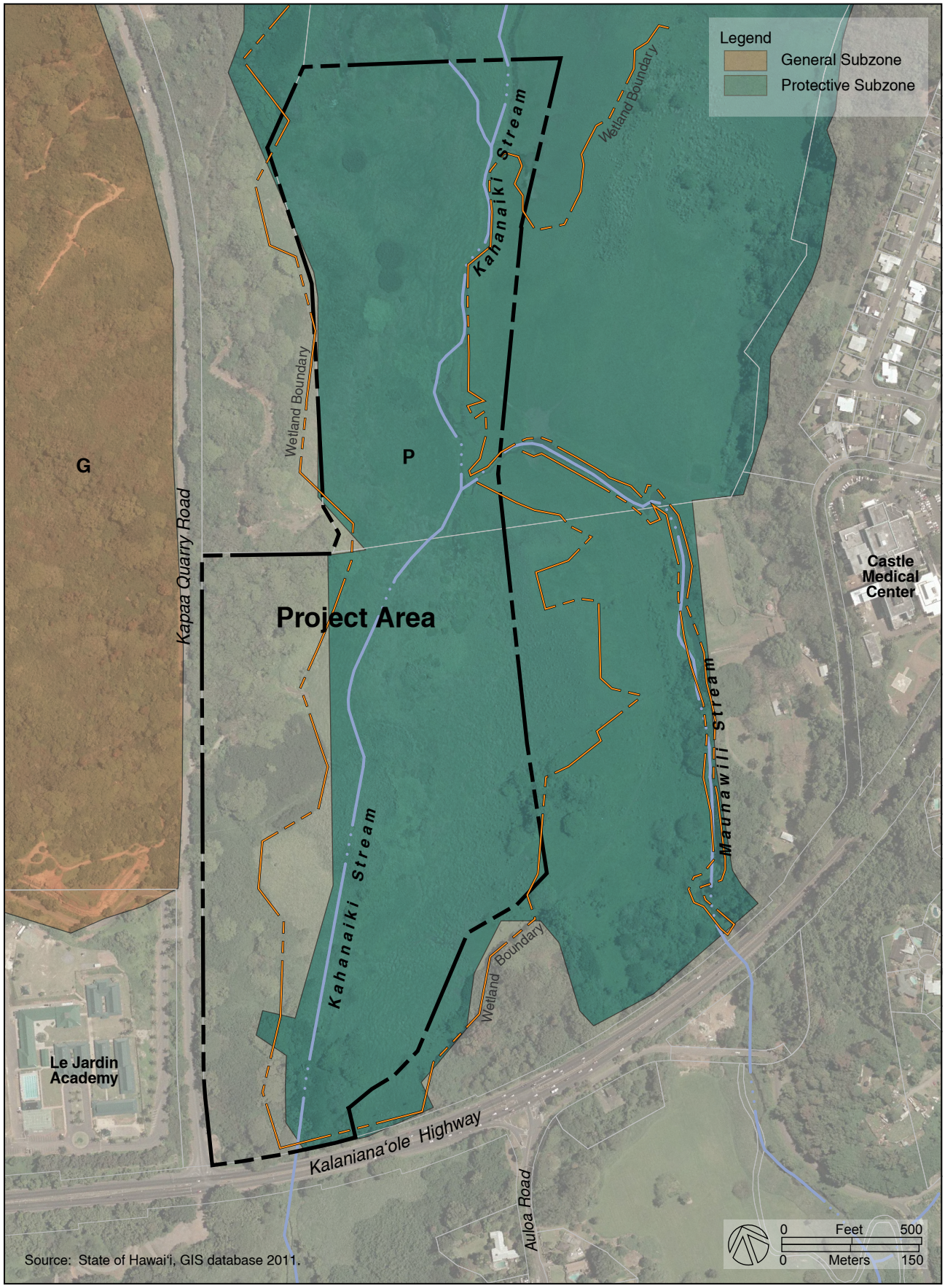


Figure 5.2
Conservation District Subzones Map

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

CDUP Applicability to Project

The proposed project would involve wetland restoration activities within the Conservation District boundary as described in Chapter 2. These activities involve mowing and removing existing invasive vegetation to create more open water, seasonal mud flats, and improved habitat for endangered waterbirds. Native vegetation would be used to replace non-native invasive plants within the wetland. These improvements would be consistent with the primary management objectives established under CDUP OA-3068 by protecting and enhancing wildlife species, their habitats, and related ecological systems. Restoration improvements would also enhance cultural, educational, and recreational values associated with this marsh.

Upland reforestation improvements planned would occur within the State's Urban District. This also includes outdoor recreational improvements planned such as parking, observation decks, and pathways. Therefore, these activities and improvements would not be subject to Conservation District regulations. Some portions of a future pedestrian path and boardwalk extending into the wetland planned may enter the Conservation District. However, these improvements would similarly support CDUP OA-3068 primary management objectives to enhance cultural, educational and recreational values associated with the marsh.

Therefore, the project should similarly meet the primary management objectives for Kawainui Marsh under CDUP OA-3068 and subsequently not need to submit a new CDUA. Consultation with staff of the Office of Conservation and Coastal Lands regarding this has been conducted, and a formal written request to this department would be submitted for confirmation.

5.2 CHAPTER 344, HRS, STATE ENVIRONMENTAL POLICY

This section discusses the project's conformance and consistency with the pertinent goals, policies, and guidelines described under Chapter 344, HRS, State Environmental Policy.

Section 344-3(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 resources, 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 Hawaii.

> **Discussion:** The project will be consistent with this policy as discussed throughout the various sections of this document. Proposed activities consist predominantly of wetland restoration and upland reforestation that would benefit natural resources by removing invasive plant species and replanting native plant species. These improvements would subsequently improve habitat for endangered waterbirds that will support their re-establishment. Therefore, project activities are not expected to have significant negative impacts on unique natural resources associated with Kawainui Marsh.

Restoration efforts and recreational improvements planned will be designed and constructed to minimize impacts, control pollutants during construction by implementing best management practices, and include review and approval of plans by pertinent regulatory agencies. Archaeological monitoring of certain restoration activities would mitigate potential impacts on subsurface sites that may be present, and such measures have been developed in consultation with several native Hawaiian organizations and the SHPD.

Section 344-3(2). Enhance the quality of life by:

A. Setting population limits so that the interaction between the natural and manmade environments and the population is mutually beneficial.

B. Creating opportunities for the residents of Hawaii 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.

D. Establishing a commitment on the part of each person to protect and enhance Hawaii's environment and reduce the drain on nonrenewable resources

Discussion: The proposed project would be consistent with these environmental policies regarding the quality of life. Project improvements would not affect the future resident population in the Kailua district, and restoration improvements should improve the interaction between natural and man-made environments by providing recreational, educational, and cultural opportunities for the public. The project would not generate noticeable long-term economic activities for residents, but construction activities would create short-term job opportunities to improve the quality of life for residents employed in the construction industry and would generate indirect benefits to other businesses. Improvements would be a wise use of land because it will help restore habitat and the function of Kawainui Marsh as a wildlife sanctuary and international wetland of importance (Ramsar). Replacing invasive vegetation with native plants would support a natural environment that is uniquely Hawaiian. Project improvements would support DOFAW's agency objectives and priorities for Kawainui Marsh and create opportunities for community organizations to participate in protecting and enhancing this marsh.

Section 344-4. Guidelines:

1. Population.

A. Recognize population impact as a major factor in environmental degradation and adopt guidelines to alleviate this impact and minimize future degradation;

B. Recognize optimum population levels for counties and districts within the State, keeping in mind that these will change with technology and circumstance, and adopt guidelines to limit population to the levels determined.

Discussion: The proposed project would not affect the existing or future resident population in the Kailua district or elsewhere in the State. Proposed improvements do not involve construction of any new homes or visitor units, and short-term construction jobs are expected to be filled by Hawai‘i residents. Therefore, resident population will not be affected by in-migration.

2. *Land, water, mineral, visual, air, and other natural resources*
   - A. *Encourage management practices which conserve and fully utilize all natural resources;*
   - B. *Promote irrigation and waste water management practices which conserve and fully utilize vital water resources;*
   - D. *Encourage management practices which conserve and protect watersheds and water sources, forest, and open space areas;*
   - E. *Establish and maintain natural area preserves, wildlife preserves, forest reserves, marine preserves, and unique ecological preserves;*
   - G. *Promote the optimal use of solid wastes through programs of waste prevention, energy resource recovery, and recycling so that all our wastes become utilized.*

Discussion: The project would be consistent with these guidelines because the restoration and other accessory improvements would not adversely impact natural resources. Restoration and management of the marsh by DOFAW supports conservation of this natural resource. Upland improvements will be designed to incorporate sustainability concepts to reduce the use of non-renewable resources, and best management practices will incorporate measures to protect the environment. Drainage improvements planned have been designed to retain surface runoff and increase infiltration before discharging into the wetland. Project improvements are intended to conserve, enhance, and support the flood protection functions of this marsh, protect upland and forest areas by removing invasive plant species, and retain open space areas. The project will help to restore, enhance, and maintain Kawainui Marsh as a wildlife preserve. Measures have been incorporated into the restoration plan to reduce green waste generated from invasive plants removed, utilize green waste into reforestation activities, and ultimately reduce solid waste that needs to be disposed.

3. *Flora and fauna*
   - A. *Protect endangered species of indigenous plants and animals and introduce new plants or animals only upon assurance of negligible ecological hazard.*
   - B. *Foster the planting of native as well as other trees, shrubs, and flowering plants compatible to the enhancement of our environment.*

Discussion: This project would support the protection of endangered waterbirds by restoring wetland habitat. Other measures incorporated into the management activities established for this marsh by DOFAW would further support these protection efforts.

Wetland restoration and upland reforestation includes the re-establishment of native plants in the area that would enhance the environment of this marsh.

4. *Parks, recreation, and open space*
   - *A Establish, preserve and maintain scenic, historic, cultural, park and recreation areas, including the shorelines, for public recreational, educational, and scientific uses.*
   - *C. Promote open space in view of its natural beauty not only as a natural resource but as an ennobling, living environment for its people.*

Discussion: The project will support establishing, preserving, and maintaining Kawainui Marsh as a scenic, historic, cultural, park and recreational area through restoration improvements and passive outdoor recreational amenities planned. Improvements would also create cultural and educational opportunities to learn more about Kawainui Marsh, its history, habitat, and cultural values. Historic or cultural resources should not be adversely impacted by restoration activities as mitigative measures will be implemented as prescribed under an archaeological monitoring plan. Project improvements will create and enhance open space areas within the marsh along with its beauty as a natural resource.

5. *Economic development.*
   - *C. Encourage federal activities in Hawaii to protect the environment;*

Discussion: The grant created for this project is largely funded by the U.S. Fish and Wildlife Service which supports this policy to encourage federal activities in Hawai‘i to protect the environment.

6. *Transportation.*
   - *C. Encourage public and private vehicles and transportation systems to conserve energy, reduce pollution emission, including noise, and provide safe and convenient accommodations for their users.*

Discussion: The project includes minor improvements to Kapa‘a Quarry Road to create a right-turn storage lane for vehicles turning into the parking lot established. This storage lane will improve access into the project site and provide increased safety for vehicles traveling along this road.

7. *Energy.*
   - *A. Encourage the efficient use of energy resources.*

Discussion: Outdoor recreational improvements (e.g. pathways, observation deck, etc.) will be designed to incorporate sustainability concepts to reduce the use of non-renewable resources and efficient use of energy resources. Other project improvements and

restoration activities will not generate new permanent demands for electrical service from HECO.

8. *Community life and housing.*
   E. *Recognize community appearances as major economic and aesthetic assets of the counties and the State; encourage green belts, plantings, and landscape plans and designs in urban areas; and preserve and promote mountain-to-ocean vistas.*

Discussion: The project will support Kawainui Marsh serving as wildlife sanctuary and wetland of international importance by removing invasive vegetation, restoring native vegetation, and improving the site as wildlife habitat. This marsh is important to the Kailua community and island of O‘ahu, and landscaping improvements of upland areas will contribute to its value as an important open space resource.

9. *Education and culture.*
   A. *Foster culture and the arts and promote their linkage to the enhancement of the environment.*

Discussion: Project improvements will increase public accessibility to the area and provide for educational, cultural, and recreational opportunities. DOFAW would continue working with educational institutions and community organizations to foster such opportunities to enhance the marsh environment and maintain it.

10. *Citizen participation*
   A. *Encourage all individuals in the State to adopt a moral ethic to respect the natural environment; to reduce waste and excessive consumption; and to fulfill the responsibility as trustees of the environment for the present and succeeding generations;*
   B. *Provide for expanding citizen participation in the decision making process so it continually embraces more citizens and more issues.*

Discussion: Educational and cultural opportunities created by this project would support DOFAW’s effort to improve the natural environment and wildlife habitat associated with Kawainui Marsh. Such opportunities would further the public’s understanding of this resource and its importance to the environment. The environmental review process undertaken for this project allows for public and government agency input during the review of the Draft EA. Public consultation efforts help provide decision-makers with a diverse array of information and comments to consider when evaluating this project.

5.3 KOʻOLAU POKO SUSTAINABLE COMMUNITIES PLAN

The City's Development/Sustainable Communities Plan (DP) program provides a framework for implementing the City's *General Plan* objectives and policies for the growth, development, and sustainability of Oʻahu at a regional level. The program established eight geographical areas one of which is the Koʻolaupoko district where the project site is located within. The *Koʻolau Poko Sustainable Communities Plan* (DPP, August 2000) seeks to preserve Koʻolaupoko's natural, scenic, cultural, historical and agricultural resources, and to protect the residential environment of its neighborhoods. The Koʻolaupoko district encompasses the windward coastal and valley areas generally extending from Makapuʻu Point to Kailua, Kāneʻohe, and northbound up to Kaʻōʻio Point in Kualoa. This community plan was adopted in August 2000 as Ordinance No. 00-47, ROH.

This section discusses the project's conformance and consistency with the pertinent policies and guidelines of the City's *Koʻolau Poko Sustainable Communities Plan*. The Land Use Map for this community plan designates the project site as Open Space/Preservation Areas. Figure 5.3 graphically shows this land use designation. The Open Space Map under this community plan similarly identifies the project site as Preservation Areas and Nature Parks. The project improvements would be consistent with this community plan's land use designation for the site.

Section 3.1 *Open Space Preservation*
Section 3.1.3.3 *Wetlands, Wildlife Preserves and Nature Parks/Preserves*

- *<u>Kawainui Marsh.</u> Kawainui Marsh serves multiple purposes as a flood storage basin, wetland filter, wildlife habitat and cultural and scenic resource pursuant to a master plan prepared in 1994. The master plan includes hiking trails through the Marsh. Also proposed are an environmental education center and a pedestrian path around the perimeter of the Marsh.*

Discussion: The project's restoration and reforestation improvements will support the multiple purposes served by Kawainui Marsh along with the wetland and wildlife preserve guidelines identified. The project will improve wildlife habitat and provide opportunities for the public to experience cultural and scenic resources associated with this marsh. Improvements have accommodated prior plans for pedestrian trails around the marsh perimeter.

Guidelines:

- *Prohibit encroachment or intensification of residential or other urban uses near wildlife sanctuaries and nature parks.*
- *Wildlife preserve management plans should emphasize conservation and restoration of native plants, birds, fish and invertebrates.*
- *Private landowners should be encouraged to investigate the various State and Federal programs that provide incentives for landowners to manage their lands for the benefit of wildlife.*

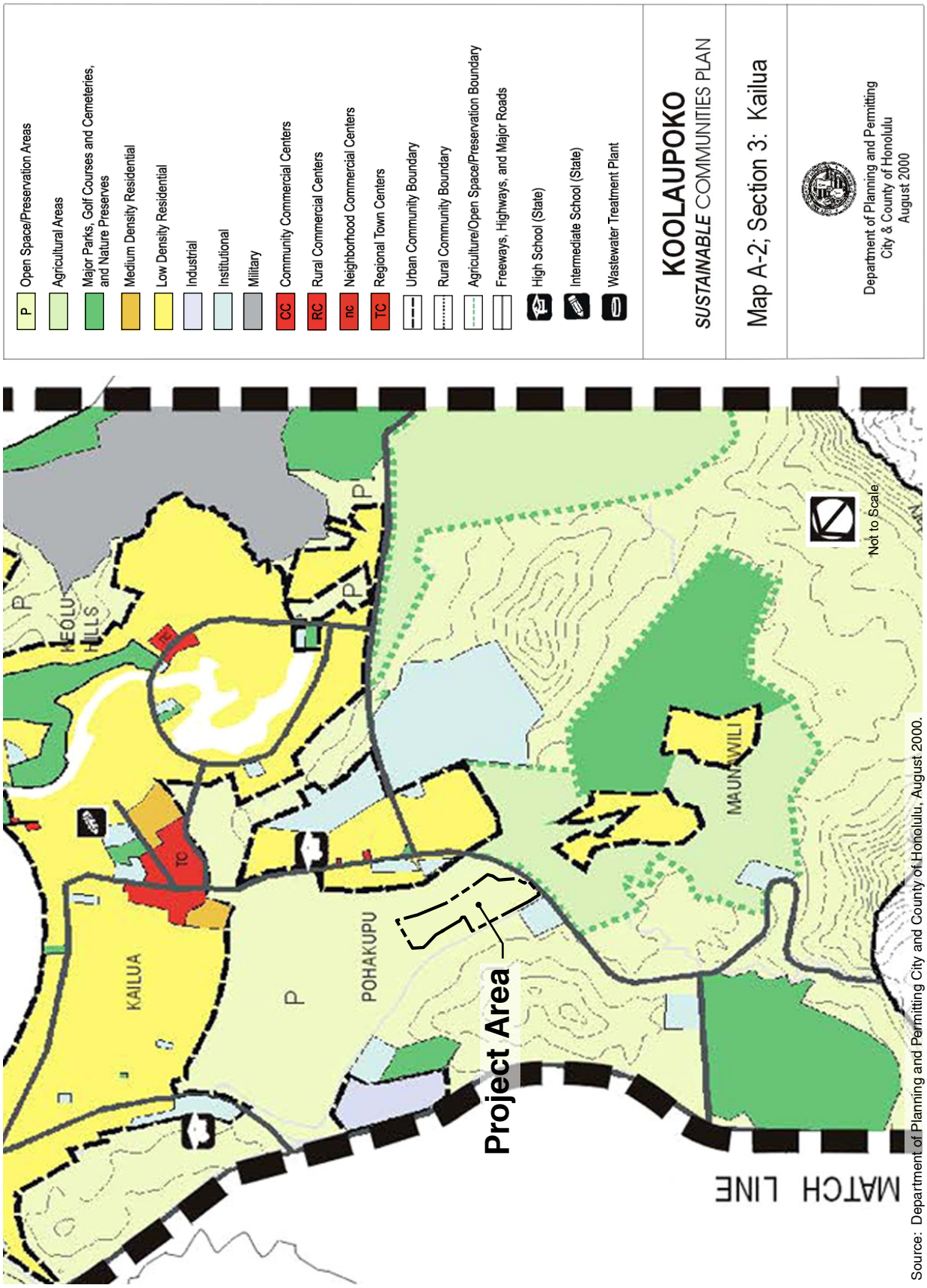


Figure 5.3
Ko'olau Poko Sustainable Communities Plan Land Use Map

Discussion: The project is consistent with and supports prohibiting encroachment of intensification of urban uses near Kawainui Marsh because improvements will restore the wetland and enhance this wildlife sanctuary's value as waterbird habitat. Invasive vegetation in wetland and upland areas will be removed and native plants used to revegetate this marsh. Restoration improvements would thus support conservation and enhancement of the area for endangered waterbirds along with invertebrates. Although DOFAW is not a private landowner, their efforts seeking assistance from Federal funding programs for the benefit of wildlife have allowed them to obtain the grant from the FWS for this project.

Section 3.1.3.4 Natural Gulches, Streams and Drainageways

Guidelines:

- *Preserve the natural aesthetic and biological values of gulches, streams and drainageways as part of the open space system.*
- *Incorporate erosion control measures and best management practices, as cited in the Hawai'i's Coastal Nonpoint Pollution Control Program Management Plan to prevent pollution of wetlands, streams, estuaries and nearshore waters.*
- *Enhance, restore and preserve streams while providing public access.*

Discussion: Wetland restoration efforts will remove invasive vegetation presently impacting Kahanaiki Stream and increase open water areas through this project area. Thus, the natural aesthetic and biological values of this stream will be improved along with its functional value associated with the wetland. These measures will enhance and restore Kahanaiki Stream. Project improvements also include passive outdoor recreational improvements that will increase safe public access to this marsh. Erosion control measures have been incorporated in the project plans to reduce erosion, slow storm water discharges, and increase infiltration before entering the wetland. Such measures include drainage culvert improvements along Kapa'a Quarry Road and creating causeways along DOFAW maintenance paths to detain storm water. Improvements constructed would include best management practices as part of design plans prepared for implementation by the contractor.

Section 3.4 Historic and Cultural Resources

Guidelines:

- *Determine the appropriate preservation methods on a site-by-site basis in consultation with the State Historic Preservation Officer.*
- *Determine appropriate delineation of site boundaries and setbacks and restrictions for adjacent uses on a site-by-site basis in consultation with the State Historic Preservation Officer.*
- *Determine the appropriateness of public access on a site-by-site basis in consultation with the State Historic Preservation Officer and the owner of the land on which the site is located.*

- *Promote the identification, survey and listing of sites that are eligible for the Hawaii or National Registers of Historic Places.*

Discussion: Project improvements have been developed in consultation with the SHPD to identify potential historic sites, assess project effects, and determine necessary mitigative measures. Consultations have also occurred with other agencies, community organizations, and the public as part of Section 106 consultation efforts. The result of these efforts has identified archaeological monitoring of selected areas and avoiding restoration work in certain areas as appropriate mitigation for this project as discussed in Chapter 4. Project improvements include outdoor recreational amenities that will increase public access to this area of Kawainui Marsh, and create educational and cultural opportunities. However, DOFAW will need to evaluate the results of their restoration efforts and management responsibilities for this wildlife sanctuary in increasing public access to this area. Kawainui Marsh has already been nominated for the National Register of Historic Places, and the results of archaeological work conducted for this project will provide additional information for this resource. Additional site features identified include some artifacts, coring results, and historic roadways.

5.4 CITY SPECIAL MANAGEMENT AREA

The Kawainui Marsh restoration project area is entirely located within the City's Special Management Area (SMA), therefore, the proposed project is subject to the requirements of Chapter 25, ROH. Figure 5.4 shows the SMA boundaries in relation to the project site which covers areas further inland and includes the entire Kawainui Marsh.

5.4.1 SMA Use Permit (Resolution No. 01-58, CD1)

A SMA Use Permit (File No. 2000/SMA-67) was approved by the Honolulu City Council in December 2001 under Resolution No. 01-58, CD1. This permit covered an area of Kawainui Marsh proposed for implementing wildlife habitat restoration improvements that were part of the State DLNR's Kawainui Marsh management plan. One of the improvements included in the approval was creating about 71-acres of shallow mudflat ponds with water control structures that were associated with the COE's ponds project.

This COE pond area included portions of TMK parcels 05 and 22 that are associated with the DOFAW restoration project. However, the pond area is located below (*makai*) of the wetland restoration project. A small portion of the SMA permit approved area does overlap the southern end of the restoration project area. Therefore, the DOFAW 80-acre restoration project will require a SMA Use Permit (Major), and an application will be submitted to the City for processing.

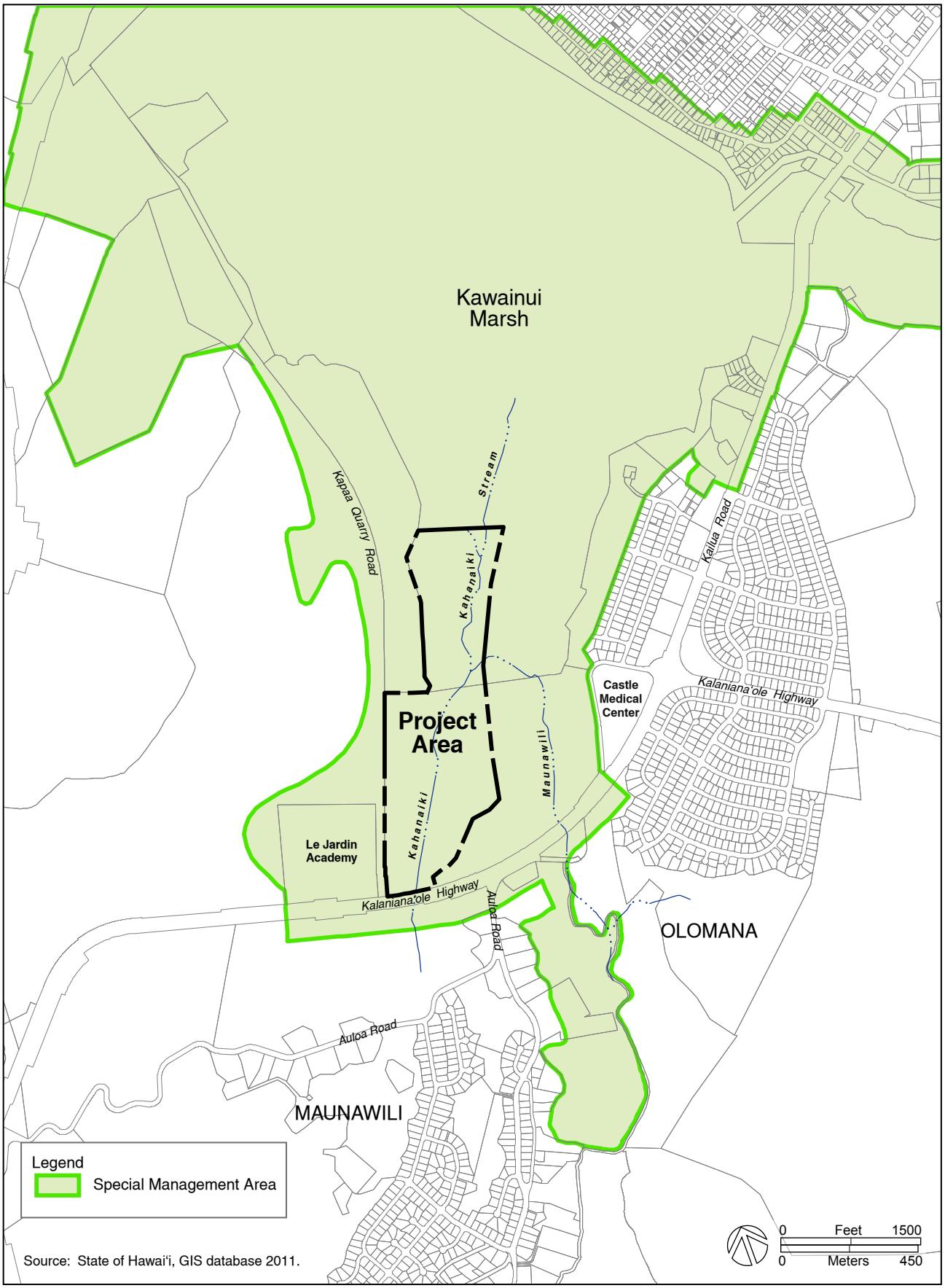


Figure 5.4
City Special Management Area Map

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

5.4.2 SMA Consistency with Objectives and Policies

The proposed project's consistency with applicable objectives and policies of the Special Management Area, as set forth in Chapter 205A-2, HRS are discussed below.

A. Objectives:

1. *Provide coastal recreational opportunities accessible to the public.*
2. *Protect, preserve, and where desirable, restore those natural and man-made historic and pre-historic resources in the coastal zone management area that are significant in Hawaiian and American history and culture.*
3. *Protect, preserve, and where desirable, restore or improve the quality of coastal scenic and open space resources.*
4. *Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.*
5. *Provide public or private facilities and improvements important to the State's economy in suitable locations.*
6. *Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.*

B. Policies:

1. *Recreational Resources:*
   - b. *Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by;*
     - iii. *Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
     - iv. *Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
     - v. *Ensuring public recreational use of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;*
     - vi. *Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;*
     - vii. *Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and*

Discussion: The project will not adversely affect coastal resources with significant recreational value because improvements predominantly involve wetland restoration and reforestation of upland areas with native vegetation. These efforts will improve Kawainui Marsh's function as a wildlife sanctuary.

Other accessory improvements planned include passive outdoor recreational amenities to support increased public access within this area of Kawainui Marsh. The project will thus support public recreational use of this marsh, improve public safety within this area due to increased accessibility, and conservation of biological resources within the wetland habitat. Drainage improvements will reduce discharges of storm water into the wetland and its associated non-point sources of pollutants (e.g. soils, debris, etc.).

2. *Historic Resources:*
   a. *Identify and analyze significant archaeological resources;*
   b. *Maximize information retention through preservation of remains and artifacts or salvage operations; and*
   c. *Support state goals for protection, restoration, interpretation, and display of historic resources.*

Discussion: As discussed in Chapters 3 and 4, archaeological surveys conducted for this project completed fieldwork and subsurface testing to identify significant historic resources present within the property. Artifacts and other features associated with Kawainui Marsh were identified and evaluated in consultation with the SHPD. Mitigative measures in accordance with an archaeological monitoring plan will be implemented to address other potential subsurface sites that may be present in the area. Such efforts support the State goals for protection of historic resources.

3. *Scenic and Open Space Resources:*
   a. *Identify valued scenic resources in the coastal zone management area;*
   b. *Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;*
   c. *Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources.*

Discussion: Valued scenic resources in the project area were identified and addressed in this document. Scenic views identified were of Kawainui Marsh from surrounding roadways, and the project will support such views by removing invasive plants and trees particularly along Kapa‘a Quarry Road and later along Kalaniana‘ole Highway. Native vegetation planted along with other reforestation activities used to landscape upland areas of the site will continue to retain some vegetation along these roadways to serve as visual buffers. However, this change will be an improvement over existing conditions overgrown with dense non-native invasive trees and vegetation. Project improvements would be compatible with the visual environment of Kawainui Marsh and will minimize significant

alteration of current natural landforms. These efforts will improve Kawainui Marsh as an open space and scenic resource.

4. *Coastal Ecosystems:*
   a. *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*
   c. *Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;*
   e. *Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.*

Discussion: The project will not adversely impact valuable coastal ecosystems, and restoration efforts planned reflect a practice of stewardship and protection of this wildlife sanctuary by DOFAW. Improvements will have a positive effect by helping restore the marsh ecosystem and enhance habitat for endangered waterbirds. Wetland restoration will improve Kahanaiki Stream by opening water flows through the marsh currently being impacted by growth of invasive vegetation and peat mat. Drainage improvements planned will also reduce discharges of storm water into the wetland and its associated non-point sources of pollutants (e.g. soils, debris, etc.).

5. *Economic uses;*
   a. *Concentrate coastal dependent development in appropriate areas;*
   b. *Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and*

Discussion: The project does not involve coastal dependent development as it consists predominantly of wetland restoration and reforestation of upland areas with native plants. As discussed in this document, improvements planned should not have an adverse effect on the social factors, visual resources, and other environmental resources.

6. *Coastal hazards:*
   b. *Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards.*

c. Ensure that developments comply with requirements of the Federal Flood Insurance Program;

d. Prevent coastal flooding from inland projects.

Discussion: Outdoor recreational amenities included with this project are not located within known floodways because they are located on the upland area of the project site. These improvements are also not located within the tsunami evacuation zone based upon the City Department of Emergency Management's updated map of the area. Project improvements should not significantly change Kawainui Marsh's function as a source of flood protection for Kailua.

7. Managing Development:

c. Communicate the potential short- and long-term impacts of proposed significant coastal developments early in their life-cycle and in terms understandable to the general public to facilitate public participation in the planning and review process.

Discussion: This document addresses the short and long-term impacts of project improvements, and its distribution during the public review process supports communication of information to the public. Other efforts have been implemented to facilitate public participation and input on this project. Efforts included consultations with various community organizations, presentations to the Kailua Neighborhood Board, and a public informational meeting.

8. Public participation;

a. Promote public involvement in coastal zone management processes;

b. Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and

Discussion: The publication and processing of this environmental document allows for information to be distributed to the public and for public participation to address comments and concerns associated with the project. The environmental assessment will also comply with this policy through its use in the submittal of a Special Management Area Use Permit for the proposed project. The processing of this application by the City DPP will involve consultation with the Kailua Neighborhood Board, a public hearing held by the City DPP, as well as the review and approval by the City Council to ensure the project's consistency with coastal management policies.

9. Beach protection;

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

Discussion: Outdoor recreational amenities constructed on upland areas of the project site will be located well inland from the shoreline and not interfere with the natural shoreline processes. These improvements will allow for increased public access to Kawainui Marsh and reforestation activities will enhance and improve open space areas.

C. Review Guidelines (Section 25-3.2, ROH)

a) All development in the special management area shall be subject to reasonable terms and conditions set by the council to ensure that:

1) Adequate access, by dedication or other means, to publicly owned or used beaches, recreation areas and natural reserves is provided to the extent consistent with sound conservation principles;

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

3) Provisions are made for solid and liquid waste treatment, disposition and management which will minimize adverse effects upon special management area resources; and

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

Discussion: The Applicant (DOFAW) is open to reasonable terms and conditions to allow the project to be consistent with applicable SMA policies. Based upon the assessment results, no unique terms or conditions should be required for this project. Restoration efforts will improve existing conditions within the project area and enhance waterbird habitat. Passive outdoor recreational amenities planned will provide improved public access to this area the presently don't exist, and DOFAW will evaluate management of this public access in relation to the wildlife sanctuary requirements and conservation principles. The project area is a wildlife preserve and DOFAW's management of this area and restoration improvements would be consistent with applicable State regulations governing these types of sanctuaries.

Solid waste would continue to be disposed of using a private contractor as needed as discussed in Chapter 4, and these restoration activities should not have a significant impact on the City's facilities. No wastewater facilities are planned under this project that would need to connect to the City's existing sewer system.

No major alterations to existing land forms would occur with this project as the improvements consist predominantly of wetland restoration and habitat enhancements. Project improvements would increase open space and landscaping over present conditions. Construction of other accessory project improvements (e.g. culvert improvements) is not expected to have an adverse effect on water resources along with scenic and recreational amenities as discussed in this document. Best management practices would be implemented by the contractor in compliance with permit conditions. Restoration improvements will not create a potential for increased flooding, landslides, erosion, siltation, or structural failure in the event of an earthquake. Various project improvements are designed to reduce erosion and such effects on Kawainui Marsh.

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

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

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

3) The development is consistent with the county general plan, development plans and zoning. Such a finding of consistency does not preclude concurrent processing where a development plan amendment or zone change may also be required.

Discussion: The project should not have any substantial adverse environmental or ecological impact based upon the assessment results addressed in this document. Necessary mitigative measures to minimize project related effects have been identified in various sections. This assessment also includes evaluating the potential cumulative impact from this project on the environment. The project would be consistent with the pertinent SMA objectives and policies as previously addressed. Proposed improvements would be consistent with the City's sustainable communities plan for the area as previously discussed. The majority of the project area is within the State's Conservation District. Proposed improvements within the area zoned P-2, General Preservation District would be consistent with the zoning established for this area and permitted uses and structures under this zoning district.

c) The council shall seek to minimize, where reasonable:

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

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

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

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

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

Discussion: The project would not significantly impact the various factors identified under this review guideline, and no unique measures or conditions should be required. Project improvements would have no effect on several of these factors which include: 1) the dredging, filling, or altering of any bay, estuary, salt marsh, river mouth, slough, or lagoon; 2) reducing the size of any beach or area used for public recreation; 3) reducing access or imposing restrictions on public access to tidal and submerged lands, beaches, rivers and streams; and 4) fisheries and fishing grounds, wildlife habitats, and existing agricultural uses of land. The project will improve wildlife habitats and the Kawainui Marsh through restoration efforts.

5.5 CITY ZONING REGULATIONS

Permitted land uses and activities under the City's jurisdiction are prescribed under Chapter 21, Land Use Ordinance (LUO) of the City's *Revised Ordinances of Honolulu, as amended* (City, 1990). Figure 5.5 shows the City's zoning districts established for this project area. As shown on Figure 5.5, portions of the project area are zoned both P-1, Restricted Preservation District, and P-2, General Preservation District. Only a portion of the project area associated with TMK 4-02-013: parcel 005 is zoned P-2 District. The rest of Parcel 5 along with the project area within TMK 4-02-013: parcel 022 is zoned P-1.

Restricted Preservation District (P-1) areas are governed by the appropriate State agency, and this includes the majority of the Kawainui Marsh restoration project area which is designated as State Conservation District. Conservation District designated lands fall under the jurisdiction of the State BLNR, and permitted uses are regulated under Section 13-5-23, HAR.

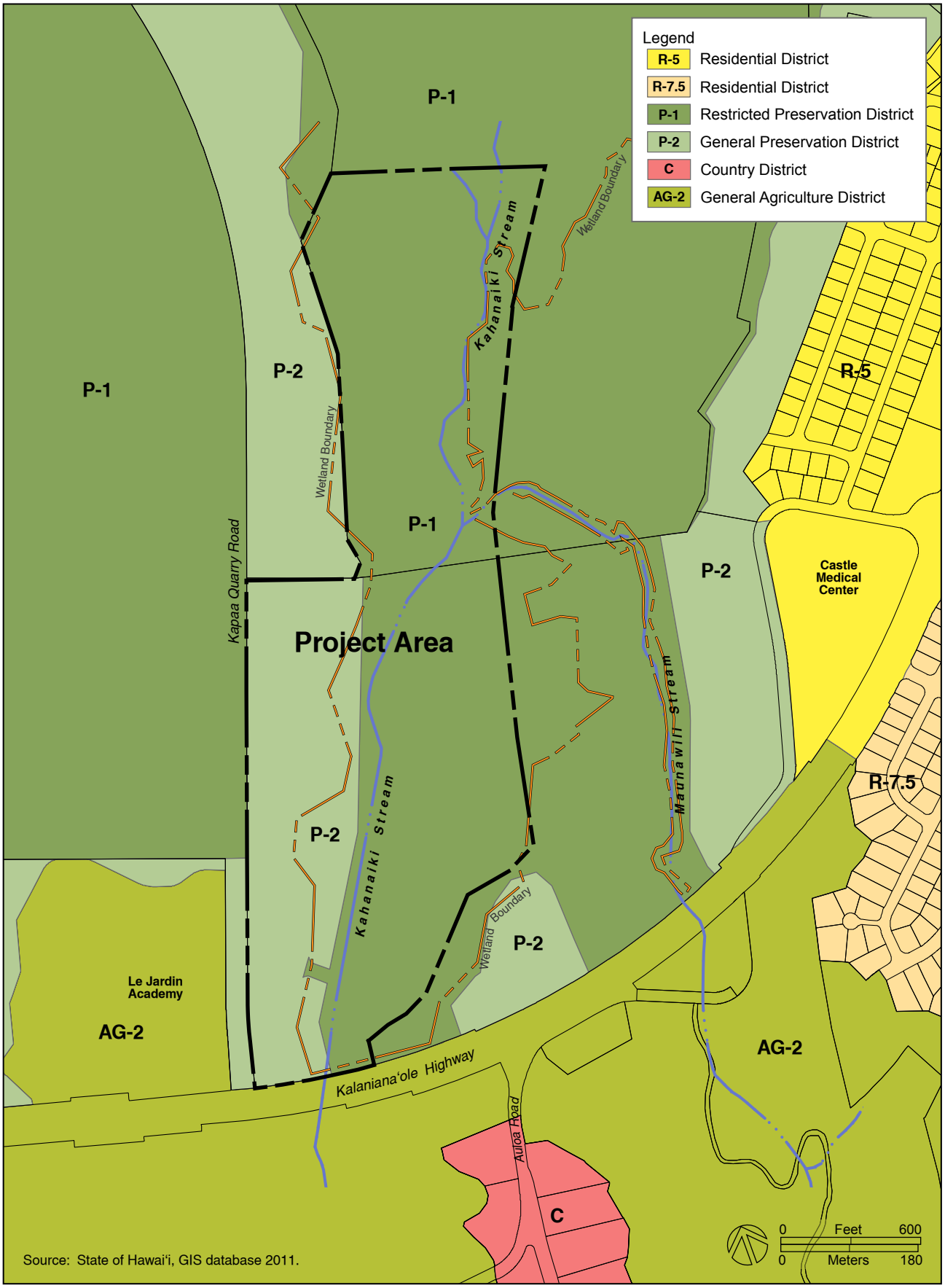


Figure 5.5
Existing City Zoning Map
Kawainui Marsh Wetland Restoration And Habitat Enhancement Project
Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

5.5.1 Consistency with Zoning District Permitted Uses

General Preservation District (P-2) areas are regulated under the City's LUO, and this zoning district covers most of the upland area in Parcel 5 associated with the project site. The purpose of Preservation Districts is to preserve and manage major open space and recreation lands, and lands of scenic and other natural resource value. Permitted uses and structures within this P-2 zoned district are identified under Table 21-3 of the LUO.

Under this table, the proposed wetland restoration and reforestation improvements along with outdoor recreational amenities (e.g. pathways, observation deck, signage, etc.) would be considered "public uses and structures" which are permitted within this zoning district. The Kawainui Marsh project area is an established wildlife sanctuary that is under the State DOFAW's jurisdiction, and recreational amenities would support increased public accessibility of this marsh.

Public uses and structures are defined in the LUO as uses conducted by or structures owned or managed by the federal government, the State of Hawaii or the City to fulfill a governmental function, activity or service for public benefit and in accordance with public policy. Typical public uses and structures include: libraries, base yards, satellite city halls, public schools, and post offices.

5.5.2 Consistency with Development Standards

General Preservation District development standards are specified under Table 21-3.1 of the LUO, and Table 5.1 summarizes the project's consistency with these standards. These development standards only apply to Parcel 005 that is zoned P-2 district.

Off-Street Parking Requirements

Under Table 21-6.1 of the LUO, off-street parking requirements are determined by the Director of the City DPP for public uses and structures. No buildings or major structures are planned under this project because it primarily involves wetland restoration and upland reforestation. However, a parking lot is proposed that will have a total of 25 parking stalls including 2 handicap stalls. These parking stalls should be sufficient to address necessary visitor parking for this area.

Table 5.1
Project Consistency with General Preservation District Development Standards

Development Standard		Discussion on Project Consistency
Minimum Lot Area.	5 acres	TMK parcel 005 has a lot area of about 97 acres which is greater than the 5 acre standard.
Minimum Lot Width And Depth	200 feet	Parcel 005 meets the minimum lot width and depth requirements as shown on Figure 1.5.
Yards - Front	30 feet	Parcel 005 has two roadways along the boundaries of this property which are Kapa‘a Quarry Road and Kalaniana‘ole Highway. Because DOFAW has two existing driveway accesses along Kapa‘a Quarry Road serving the upland area of the project, this parcel’s front yard is designated along this roadway. Project improvements would comply with this setback requirement.
Yards – Side / Rear	15 feet	The side yards of this Parcel 005 are along Kalaniana‘ole Highway and next to another parcel (Parcel 022). The project would be consistent with this setback requirement.
Maximum Density	5 percent	A total maximum density allowed for this parcel is about 211,745 square feet of floor area. No buildings are proposed under this project, and thus this project will be well within this maximum density requirement.
Maximum Height	15-25 feet	There are no existing buildings or structures present within Parcel 005, and no buildings or structures are planned under this project that would exceed this height requirement.
Height Setback	1 foot for each 2 feet in height above 15 feet	There are no existing buildings or structures present within Parcel 005, and no buildings or structures are planned under this project. Therefore, this project would be consistent with this height setback requirement.

CHAPTER 6
CONFORMANCE WITH FEDERAL PLANS AND POLICIES

This chapter discusses the project's conformance with Federal laws and consultations policies that are pertinent to implementing the Proposed Action.

6.1 NATIONAL ENVIRONMENTAL POLICY ACT

The Proposed Action is subject to compliance with the National Environmental Policy Act (NEPA) due to the use of Federal funds from the FWS under the grant issued to the State DOFAW to implement proposed improvements. A joint State and Federal environmental document has been prepared to satisfy NEPA requirements, and this document was prepared in compliance with these regulations and guidelines in coordination with the FWS.

Upon publication of this document, the FWS will review comments received and evaluate whether the Proposed Action would have a significant impact on the surrounding environment. A Final Environmental Assessment would be prepared, and a Finding of No Significant Impact issued if appropriate. A Decision Notice would then be prepared and published notifying the public of this decision.

6.2 NATIONAL HISTORIC PRESERVATION ACT

The National Historic Preservation Act (NHPA) of 1966, as amended (16 USC §470) recognizes the Nation's historic heritage and establishes a national policy for the preservation of historic properties as well as the National Register of Historic Places. Section 106 of the NHPA requires Federal agencies to take into account the effects of Federal undertakings on historic properties. The Section 106 process, as defined in 36 CFR §800, provides for the identification and evaluation of historic properties, for determining the effects of undertakings on such properties, and for developing ways to resolve adverse affects through the process of consultation.

This project is considered a Federal "undertaking" subject to Section 106 consultation under the NHPA. The FWS is the Federal Agency responsible for these requirements, and the State DLNR, DOFAW is serving as the Agency Official initiating this Section 106 consultation process. A preliminary "no adverse affect" determination is being proposed for the project at this time based upon the documentation provided and consultation with SHPD.

The environmental review process for this environmental assessment, and the information collected for it, was used to facilitate consultation efforts with parties to assess the project's effect. Comments received on the Draft EA document and Section 106 consultation efforts will be considered in evaluating the project's final effect determination on historic properties, and documented in the Final EA.

6.2.1 Description of Undertaking

The undertaking consists of wetland restoration and habitat enhancement improvements proposed for about 80 acres within Kawainui Marsh. Project background information, discussion of the purpose and need for improvements, and description of improvements were provided in Chapter 2 of this document.

Area of Potential Effect

The "area of potential effect" (APE) on historic sites was established based upon the improvements planned, and includes the area within which the project that may directly or indirectly cause alterations to the use of a historic property. Based on restoration improvements planned, the project will not have visual, auditory, or other environmental impacts to any known archaeological historic properties located outside the project area. Therefore, the area of potential effect, or APE, is the same as the project area of about 80 acres.

6.2.2 Identification of Historic Properties

An archaeological reconnaissance survey with limited subsurface testing of the project area was conducted by Cultural Surveys Hawai'i, Inc., and Appendix C includes a copy of this report. This study was designed to address archaeological site types and locations, and allow for future work recommendations. The results of this study were discussed in Chapter 3 and portions are summarized here.

The scope of the archaeological investigation included historical research of archival sources, historic maps, Land Commission Awards (LCA) and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near the project area. A reconnaissance survey of the project area was performed to identify any surface archaeological features and to investigate and assess the potential for impact to such sites. Limited subsurface testing consisting of 12 trenches and 2 sediment corings were conducted to identify any subsurface archaeological features and to assess the potential for impacts to such sites.

Historic properties identified within the project's area of potential effect consist of: 1) the Kawainui Marsh Archaeological-Cultural-Historical Complex; and 2) remnant of a historic road.

Kawainui Marsh Archaeological-Cultural-Historical Complex

State Inventory Historic Property (SIHP) 50-80-11-2029 is the Kawainui Marsh Archaeological-Cultural-Historical Complex, and was deemed eligible for listing on the National Register of Historic Places in 1979. The historic property complex has been identified and documented in several previous archaeological studies of this marsh.

Two archeological studies conducted by Cordy (1978) and Allen-Wheeler (1981), consisted of subsurface test excavations, and both investigations documented basalt-boulder alignments. The alignments ranged in depth from visible on the ground surface to 24 inches below ground surface. Cultural deposits consisting of basalt and volcanic glass flakes were also recovered at a depth of 22 to 50 inches below surface.

A Mann and Hammatt (2003) subsurface archaeological study, located just east of the restoration project area, also identified lithic debitage, volcanic glass flakes and a basalt adze at 28 to 38 inches below surface just above the water table. A mound of river cobbles may represent a local adaptation to water control utilizing immediately available resources (mounding river cobbles).

The information gathered from these three subsurface studies suggests that intact cultural deposits consistent with *lo'i* and rice agriculture still remain both on the surface, as well as buried beneath sediment deposits. The present study conducted by CSH for this restoration project identified additional components of the SIHP 50-80-11-2029 complex that include a grinding stone and remnant components associated with historic habitation.

Grinding Stone

The grinding stone is located approximately 260 feet to the southwest of the posited southeast corner of the former LCA 7588. The grinding stone is somewhat characteristic of a traditional Hawaiian artifact of the Kawainui slopes. This grinding stone lies at the base of a break in slope under a particularly large *noni* (*Morinda citrifolia*) tree which is a type of tree mentioned in supporting documents for LCAs in the area but was an uncommon tree in the general vicinity today.

Historic Habitation

The remnant components associated with historic habitation on the margins of Kawainui Marsh include a large rectangular stand of non-native bamboo, several pieces of lumber, and a post and barbed-wire fence line. Subsurface excavation of trenches within this area yielded sparse traditional Hawaiian artifacts that included one basalt flake, one volcanic glass flake, as well as several non-diagnostic historic artifacts. Additionally, a basalt boulder, along with several other basalt boulders that were observed on the present ground surface near Trench 11, may represent the remnants of a stone construction or possible house foundation although no stacking or alignments were discernable.

A review of historic maps indicates that the surface habitation remnants and subsurface findings are located within or adjacent to a building or house that was depicted on an 1899 map by W. E. Wall. The presence of subsurface traditional Hawaiian and historic artifacts, a stand of non-native bamboo, several pieces of lumber, and a post and barbed-wire fence line at the location of the possible 1899 house lot provided evidence for early historic habitation and the inclusion of the footprint as a component of SIHP 50-80-11-2029.

Historic Road Remnant

SIHP# 50-80-11-7199 consists of a presently in-use section of roadway that extends roughly parallel to the western edge of Kawainui Marsh along the western boundary of the project area. The extant portion of this roadway remnant measures approximately 1,310 feet within the current project area. Present vehicular access to this road is provided from a connecting modern entry road that extends from the southwestern end of this site west to connect with Kapa‘a Quarry Road. SIHP# 50-80-11-7199 is comprised of an unpaved and unimproved worn road surface with no associated construction or infrastructure.

While SIHP# 50-80-11-7199 appears to be related to a modern access point to Kawainui Marsh, a review of historic maps indicates that this site closely aligns with a section of roadway depicted on the 1928 U. S. Geological Survey map and the 1943 War Department Map. The historic unpaved road extends from the present alignment of Auloa Road (former access corridor to the Pali Road) north along the base of the slope within the western portion of the project area. SIHP# 50-80-11-7199 is likely a segment of a roadway that was constructed prior to 1928, and is therefore considered an historic property.

6.2.2 Preliminary Proposed Project Effect

The criteria of adverse effect were applied in the evaluation of this proposed wetland restoration project. An adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion in the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Consideration was given to all qualifying characteristics of a historic property, including those that may have been identified subsequent to the original evaluation of the property's eligibility for the National Register.

Project Affect on Historic Properties

Wetland restoration improvements along with other accessory improvements planned within the project area should not result in an adverse effect on historic sites. The reconnaissance survey completed within the project area identified two historic properties including components of SIHP# 50-80-11-2029, the previously identified Kawainui Marsh archaeological-cultural-historical complex, and SIHP# 50-80-11-7199, an in-use, early 20th century road remnant.

Limited subsurface testing within the project area identified a sparse amount of historic and traditional Hawaiian artifacts, some of which appear to be linked with habitation within the possible footprint of a house lot that appears on an 1899 map, and considered to be components of SIHP# 50-80-11-2029. Limited subsurface testing did not expose subsurface cultural deposits or modification within the project area. The documentation of backhoe test trenches that were excavated along LCA boundaries and within possible 20th century house lots failed to identify any associated rock or sediment walls (*lo‘i* walls), foundations, or associated features.

Sediment coring at two locations within Kawainui Marsh has provided additional palynological and radiocarbon data. Pollen analysis has indicated that Kawainui sediments still hold pollen data that can refine and expand our knowledge of Polynesian settlement and pre-Contact change. Some earlier conclusions have been supported and others have been called into question based upon the pollen analysis.

Radiocarbon analysis suggested that the uppermost stratum within the project area consists of deposits of decomposed plant matter overlying relatively modern alluvium. Radiocarbon analysis of Core Sample 1 indicated that, minimally, the upper 27 inches of the 32-inch core sample (upper 85%) was composed of modern-aged sediment. Radiocarbon analysis of Core Sample 2 indicated that, minimally, 14 inches of the 40-inch core sample (upper 35%) was composed of modern-aged sediment. The relative vertical thickness of modern-aged deposition within Kawainui Marsh indicates that the proposed project's subsurface impact, which includes restoring certain areas of shallow (6 to 12 inches deep) open water on the west side of the south end of Kawainui Marsh, will pose little or no impact on subsurface historic properties within the project area.

Preliminary Proposed Project Effect

A preliminary proposed project effect is being made that the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project should have "no adverse effect" on historic properties subject to various mitigative measures being implemented.

This preliminary determination is based upon the results of this archaeological study, consultation with the State SHPD, and consultation with other consulted parties under the Section 106 process. Comments received as part of these consultations have been considered in evaluating and developing the preliminary "no adverse effect" determination being proposed for this project. Further comments will be obtained under both the environmental assessment review process and Section 106 process from consulted parties, agencies, and the public on this preliminary proposed effect determination.

No further archaeological work is recommended for SIHP# 50-80-11-7199 (road remnant). Based on the results of the archaeological reconnaissance survey with limited subsurface testing report, the following mitigative measures are proposed:

1. An archaeological monitoring program would be developed to address the impact of subsurface disturbance within the project area.
    - The monitoring plan would include provisions for the post-review of historic properties if any are encountered during construction activities. As an example, data recovery work would be conducted if historic walls were found, and this would be documented in a data recovery report prepared and submitted to

SHPD. A synthesis evaluating historic properties encountered in relation to this Kawainui Marsh historic site should be included in the data recovery report.

2. Preservation, in the form of avoidance and protection, be considered for the two components of SIHP# 50-80-11-2029 (grinding stone and habitation area) that were identified during the current project.
   - A strand of bamboo about 12 feet wide present at the habitation site would be avoided if possible from restoration activities. The habitation site with bamboo area was about 0.25 acres in size.

6.3 COASTAL ZONE MANAGEMENT ACT

The State's Coastal Zone Management (CZM) policies and regulations prescribed under Chapter 205A, HRS implements the Federal Coastal Zone Management Act (CZMA) of 1972. The coastal zone management area is defined to include all lands of the State and the area extending seaward from the shoreline to the limit of the State's management authority. As a result, the project is within this area and subject to being consistent with the CZM program objectives and policies.

The Proposed Action would be consistent with these CZM objectives and policies as discussed in Chapter 5 of this document covering the project's consistency with plans and policies.

6.4 ENDANGERED SPECIES ACT

Under Section 7 of the Endangered Species Act (ESA) (16 USC §1531 *et seq*.), consultation with the FWS is required to address project effects on federally listed endangered and threatened plants and animals. The FWS is also a project funding participant and the Federal Agency responsible for this document's compliance with NEPA. A Biological Opinion is being prepared by the FWS for this project under Section 7 of the ESA.

This Biological Opinion is expected to determine that this restoration project is not likely to result in jeopardy of the Hawaiian waterbirds, and no critical habitat has been designated for these species so no adverse modification of critical habitat is possible. Reasonable and prudent measures would be implemented to minimize the impacts of incidental take that might otherwise result from the proposed activities. Necessary measures would be included in the Biological Opinion being prepared, and is expected to include those previously discussed in Chapter 4. The Kawainui Marsh Restoration Area Management Plan being developed for the COE's pond project would be modified to include management activities for this restoration project area identifying how threats will be controlled and managed.

6.5 CLEAN WATER ACT

6.5.1 Section 401

Section 401 of the Clean Water Act (CWA) of 1972 requires a Water Quality Certification (WQC) be obtained from an applicant for actions that require a Federal permit to conduct an activity, construction or operation that may result in a discharge into waters of the United States. The State DOH, Clean Water Branch (CWB) implements this program issuing WQC permits for activities affecting jurisdictional waters.

A WQC would not be required for the Proposed Action because restoration activities will not require a Federal permit from the COE.

6.5.2 Section 402

Section 402 of the CWA established the NPDES general permit process for point and non-point source discharges such as storm water discharges associated with construction activities. The DOH-CWB implements this NPDES for the State.

The Proposed Action will involve construction activities disturbing a land area of one acre or more, and may involve non-point discharges of storm water from the construction site into the Kawainui Marsh that is considered waters of the U.S. Because Kawainui Marsh is a wildlife sanctuary, an Individual NPDES permit for construction activities will be required from the State DOH-CWB.

6.5.3 Section 404

Section 404 of the CWA requires a permit from the COE for the discharge of dredged or fill material into a wetland, navigable water, or jurisdictional waters of the United States. The delineated wetland area of Kawainui Marsh (June 2008 delineation study), which includes portions of Maunawili and Kahanaiki Streams, falls under the jurisdiction of the COE under Section 404. Project improvements proposed within this delineated wetland consist of wetland restoration activities. Reforestation and upland outdoor recreational accessories are not located within this jurisdictional wetland.

Based upon consultation with the COE, a Department of Army permit (NWP or Standard Permit) would not be required for planned wetland restoration activities because this activity is not regulated under the CWA. Restoration activities planned are considered a form of maintenance activities to manage wildlife habitat by keeping invasive vegetation out.

Mowing of invasive vegetation and tilling of soils would be conducted using equipment such as an excavator or backhoe equipped with a cutting blade. This equipment is not intended to clear or grade the area because the objective is to keep current grade conditions and allow Kahanaiki Stream and Maunawili Stream to flow and meander through the area naturally following present

topographic conditions. Vegetation removal would occur within less than a foot deep of the surface. This activity consists of a form of moist soil management not triggering a permit from the COE.

Wetland restoration activities would also not change the output or manipulate stream flows to impound the flow of water from Kahanaiki and Maunawili Streams that may trigger a Department of Army permit. Restoration activities will also stay outside of any visually identified open water stream flow having defined bed and banks. The objective is to let the flow of these streams to meander through the wetland area following its natural path after removing invasive vegetation. These activities would not cause a significant loss of the stream's character, degradation of water quality, increased turbidity, or change the "output" of stream flow from this project area. The project should improve water quality, turbidity, and improve the stream's character that is presently being impacted by invasive vegetation.

Project information in the form of a Pre-Construction Notification would be submitted to the COE Regulatory Branch for review and a Jurisdictional Determination (JD) to confirm that the project does trigger regulation and a permit under the CWA.

6.6 EXECUTIVE ORDER 11988 FLOODPLAIN MANAGEMENT

Executive Order 11988 requires the FWS to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of flood plains associated with Kawainui Marsh. The project needs to avoid construction or management practices that would adversely affect floodplains unless the FWS finds that: 1) there is no practical alternative, and 2) the proposed action has been designed or modified to minimize harm to or within the floodplain.

Floodplains associated with the project area consist of the Kawainui Marsh wetland area and associated Maunawili and Kahanaiki Streams. The northern portion of the wetland area is designated as Zone A which is a special flood hazard area subject to the 100-year flood (no base flood elevations determined). The southern portion of the wetland area is designated as Zone D representing unstudied areas where flood hazards are undetermined, but flooding is possible. Because Kahanaiki Stream flows through this southern portion of the wetland area, most of this lower lying area would likely be similarly subject to the 100-year flood.

Project improvements within this floodplain would only consist of wetland restoration activities. These activities would be consistent with Executive Order 11988 by avoiding long and short-term adverse impacts associated with the occupancy and modification of floodplains. Under the FWS's procedural guidance (613 FW 1, Floodplain Management) for compliance with Executive Order 11988, wetland restoration activities would not be considered "construction" activity (FWS 1994a). Construction under this guidance is defined as "draining, dredging, channelizing, filling, diking, impounding, and related activities and any structures or facilities." Wetland restoration would not involve these activities or involve constructing any structures or facilities in this floodplain.

The FWS guidance includes criteria for evaluating potential effects of actions in the floodplain, and proposed wetland restoration will be consistent with these criteria as discussed below.

A. *Avoid the long and short-term adverse effects caused by the human occupancy and modification of floodplains.*

   Wetland restoration activities will not involve human occupancy within the floodplain or modification of floodplains as defined under "construction" of this guidance. Restoration work would remove invasive vegetation to open up Kahanaiki Stream and allow flows to meander through the marsh following the natural topographic conditions.

B. *Avoid the direct or indirect support of floodplain development whenever there is a practicable alternative.*

   Wetland restoration activities will not involve development within this floodplain.

C. *Reduce the risk of flood loss and minimize the impacts of floods on human health, safety and welfare.*

   Wetland restoration activities will not increase the risk of flood loss because it will improve the wetland and associated floodplain by opening up the natural flow of streams, and will support the marsh's function as flood protection for Kailua town.

D. *Restore, preserve, and enhance the natural and beneficial values served by floodplains.*

   The project would restore and enhance the natural and beneficial values of Kawainui Marsh as a floodplain and wetland. Restoration activities would enhance the wetland's value as habitat for endangered waterbirds.

E. *Inform the public of flood hazards on Service property; and include any appropriate floodplain references or restrictions in conveyances of property proposed for lease, easement, right-of-way, or disposal to non-Federal public or private parties.*

   The project site is not owned by the FWS, and FWS is not involved in the lease or use of this property which is under the jurisdiction of the State DOFAW. However, this environmental document will inform the public of the flood hazards associated with the project site as part of environmental review process.

F. *Incorporate the concepts, strategies, and management tools of the Unified National Program for Floodplains Management into the Service's programs and actions.*

   Wetland restoration activities will be consistent with the goals established under this national program as addressed under these various guidance criteria. The four goals involve: 1) formalizing a national goal-setting and monitoring system; 2) reducing the risks to life, property, and natural resources; 3) developing and implementing a process to encourage positive attitudes toward floodplain management; and 4) establish in-house floodplain management capability.

G. *Use an integrated process to involve the public in the planning of all actions and decisions.*

The environmental document prepared incorporated an integrated process to involve the public in the planning of this project. Publication of this document provides another opportunity for review and comments by the public and government agencies that will be used decision-making.

H. *Monitor Federal actions undertaken, funded, or permitted to ensure that they are carried out in accordance with the Executive Order.*

The State DOFAW has been coordinating with the FWS on the development of project plans and preparation of this environmental document, and will continue coordinating with FWS throughout the project's implementation. Such coordination will support FWS's ability to monitor the actions taken and compliance with the Executive Order.

I. *Ensure all Service personnel, when working with other agencies and the public, advocate compliance with the spirit and intent of the Executive Order.*

The State DOFAW has been and will continue coordinating with the FWS to ensure compliance with the spirit and intent of the Executive Order.

6.7 EXECUTIVE ORDER 11990 PROTECTION OF WETLANDS

Executive Order 11990 requires the FWS to minimize the destruction, loss or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands such as Kawainui Marsh. The project needs to avoid construction or management practices that would adversely affect wetlands unless the FWS finds that: 1) there is no practical alternative, and 2) the proposed action has been designed or modified to minimize harm to the wetlands.

Project improvements within wetlands would only consist of restoration activities removing invasive vegetation and re-establishing growth native vegetation in this area. These activities would be consistent with Executive Order 11990 because it would not result in the destruction, loss, or degradation of wetlands. Restoration plans would improve this wetland that is presently being impacted by growth of invasive vegetation, and enhance this wetland's value and function as habitat for endangered waterbirds. These improvements would be consistent with this Executive Order by enhancing the natural beneficial values of wetlands.

Under the FWS's procedural guidance (613 FW 2, Wetland Protection) for compliance with Executive Order 11990, wetland restoration plans would not be considered "construction" activity (FWS 1994). Construction under this guidance is defined as "draining, dredging, channelizing, filling, diking, impounding, and related activities and any structures or facilities." Wetland restoration would not involve these activities or constructing structures or facilities in the wetland. Therefore, the project would not adversely affect wetlands, and does not require

evaluation of other practical alternatives or modifying restoration plans to minimize harm to the wetlands of Kawainui Marsh.

The FWS guidance includes criteria for evaluating potential effects of actions in wetlands, and proposed wetland restoration plans will be consistent with these criteria as discussed below.

A. *Avoid adverse effects caused by the human modification or occupancy of wetlands.*

   Project improvements will not involve occupancy within wetlands or modification of wetlands as defined under the term "construction" of this guidance. Restoration work would remove invasive vegetation to open up Kahanaiki Stream and allow flows to meander through the marsh following the natural topographic conditions.

B. *Avoid support of wetland development whenever there is a practicable alternative.*

   Project improvements will not involve development within this wetland.

C. *Restore, preserve, and enhance the natural and beneficial values served by wetlands.*

   The project would restore and enhance the natural and beneficial values of Kawainui Marsh as a wetland. Restoration activities would enhance the wetland's value as habitat for endangered waterbirds.

D. *Include any appropriate wetlands references or restrictions in conveyances of property proposed for lease, easement, right-of-way, or disposal to non-Federal public or private parties.*

   The project site is not owned by the FWS, and FWS is not involved in a lease, easement, etc. of this property which is under the jurisdiction of the State DOFAW.

E. *Use an integrated process to involve the public in the planning of all actions.*

   The environmental document prepared incorporated an integrated process to involve the public in the planning of this project. Publication of this document provides another opportunity for review and comments by the public and government agencies that will be used decision-making.

F. *Monitor Federal actions undertaken, funded, or permitted to ensure that they are carried out in accordance with the Executive Order.*

   The State DOFAW has been coordinating with the FWS on the development of project plans and preparation of this environmental document, and will continue coordinating with FWS throughout the project's implementation. Such coordination will support FWS's ability to monitor the actions taken and compliance with the Executive Order.

G. *Ensure all Service personnel, when working with other agencies and the public, advocate compliance with the spirit and intent of the EO 11990.*

   The State DOFAW has been and will continue coordinating with the FWS to ensure compliance with the spirit and intent of the Executive Order.

6.8 EXECUTIVE ORDER 12898 ENVIRONMENTAL JUSTICE

Executive Order 12898 (Environmental Justice) requires the FWS to identify and address disproportionately high and adverse environmental effects from the proposed action on minority and low-income populations. As discussed in Chapter 4, the project should not have disproportionately high and adverse environmental effects on environmental justice target populations identified. No target population of concern based upon income was identified in the Kailua or Maunawili CDPs as households in these areas had significantly higher incomes and lower percentages of families below the poverty level as compared to the island of O‘ahu.

A study prepared by OMPO (OMPO 1994) identified one census block area in Kailua (Ulupaina Street) as an environmental justice target population based upon race. This area is located well north of the project site. Construction related nuisance effects from restoration improvements would not cause any disproportionately adverse human health or environmental impacts on this population that is different from that which may be experienced by other surrounding residential areas or land uses. Necessary mitigative measures would also be implemented by the contractor and monitored by DOFAW to minimize such effects.

Project improvements consisting predominantly of wetland restoration and upland reforestation activities would also be consistent with the environmental justice definition created for the State. No one segment of the population or geographic area would be disproportionately burdened by environmental impacts caused by restoration improvements, construction of accessory improvements, or DOFAW’s operational management of this important resource. Enhancement of this wildlife sanctuary would allow for increased public access at this site along with educational, cultural, and recreational opportunities that could be experienced by all persons of various race or income status. The public involvement process implemented along with this environmental review process provides opportunities for all persons to have meaningful involvement and input into the development of plans and decisions. Such efforts have included consultations with native Hawaiian organizations.

6.9 FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act is administered by the FWS for this restoration project, and is intended to protect fish and wildlife when Federal actions result in the control or modification of a natural stream or body of water. The FWS takes into consideration the effect that water-related projects would have on fish and wildlife resources, take action to prevent loss or damage to these resources, and provide for the development and improvement of these resources. The FWS is also the Federal agency responsible for implementing this project.

Wetland restoration improvements would not involve impounding, diverting, or controlling waters from Maunawili Stream, Kahanaiki Stream, and associated wetlands. Activities would primarily involve mowing and tilling to remove invasive vegetation and allow waters from the streams to flow naturally following existing topographic conditions as it meanders through the

marsh. In addition, the FWS is preparing a Biological Opinion that is evaluating the effects of this project and identifying mitigate and management measures that would be implemented. Therefore, DOFAW has been and will continue to consult with the FWS on this project as required under this coordination act.

6.10 LAND AND WATER CONSERVATION FUND, SECTION 6(F)

Section 6(f) of the Land and Water Conservation Fund (LWCF) ensures that Federal investments made under this assistance are being maintained in public outdoor recreational use. The State Parks Division of the State DLNR administers this regulation in the State of Hawai‘i in coordination with the National Park Service. Tax Map Key 4-02-013: parcel 05 was purchased by the State using federal assistance from the LWCF. As a result, the project area associated with this property needs to accommodate public recreational use.

The project is consistent with the Section 6(f) requirement in that passive outdoor recreational amenities have been incorporated into plans for the upland area of the project site. Wetland areas would be subject to restoration efforts, and no recreational activities are planned within this portion of the wildlife sanctuary. The objective of the project is to enhance this wetland habitat for endangered waterbirds. However, upland areas are planned to support passive recreational use and allow for increased public access in this area under the management of DOFAW.

6.11 AMERICAN DISABILITY ACT

The Americans with Disabilities Act (ADA), amended with changes in 2009, is intended to make society more accessible to people with disabilities, and prohibits discrimination based on disability under certain circumstances. Of the five titles that this law covers, project improvements would be most applicable to the areas of public services (Title II) and public accommodations (Title III). Public services cannot deny services to people with disabilities participation in programs or activities that are available to people without disabilities. Public accommodations require all new construction and modifications must be accessible to individuals with disabilities.

The State DOFAW would comply with these regulations by having new project improvements, such as vehicle parking and pedestrian pathways designed to meet the 2010 ADA standards for accessible design. Handicap parking stalls have been incorporated into the preliminary conceptual plan for the project, and pathways would be designed with appropriate grades and materials to support access for all. Wetland restoration and upland reforestation improvements would be consistent with the public services provision by making public access to the project area more accommodating for all. Therefore, the project would be consistent with this ADA law.

CHAPTER 7
CONSULTED AGENCIES AND ORGANIZATIONS

7.1 PRE-ASSESSMENT CONSULTATION

Consultation with various government agencies and community organization was undertaken to obtain information on agency requirements and potential issues so that they could be addressed in this Draft EA. Consultation involved distributing a pre-assessment consultation letter with supporting documentation to various parties requesting written comments. A listing of those parties consulted is below and those providing written responses have been identified with a "»" symbol. Copies of written comments received and responses to these comments are included in Appendix A.

Federal Agencies

U.S. Department of Army, Honolulu District, Corps of Engineers
» Regulatory Branch
Project Management Branch
U.S. Department of Interior, Fish and Wildlife Services
U.S. Department of Agriculture, Natural Resources Conservation Service
U.S. National Oceanic Atmospheric Administration, National Marine Fisheries Service
U.S. Environmental Protection Agency, Region 9

State of Hawai‘i

» Department of Accounting and General Services
Department of Business, Economic Development and Tourism (DBEDT)
DBEDT, Director
DBEDT, Land Use Commission
»[1] DBEDT, Office of Planning
Department of Defense
» Department of Education
Department of Health (DOH)
DOH, Director
DOH, Clean Air Branch
» DOH, Clean Water Branch
DOH, Environmental Planning Office
Department of Land and Natural Resources (DLNR)
DLNR, Chairperson
» DLNR, Commission on Water Resource Management
DLNR, Division of Aquatic Resources

[1] Email received January 10, 2011 just requesting a copy of the Draft EA in pdf file format. No response letter included.

State of Hawai‘i (continued)

- DLNR, Division of State Parks
- DLNR, Engineering Division
- DLNR, Land Division
  DLNR, O‘ahu Island Burial Council
- DLNR, Office of Conservation and Coastal Lands
  DLNR, State Historic Preservation Division
- Department of Transportation
- Office of Hawaiian Affairs

City and County of Honolulu

- Board of Water Supply
- Department of Community Services
- Department of Design and Construction
- Department of Emergency Management
  Department of Enterprise Services
  Department of Environmental Services
- Department of Facility Maintenance
- Department of Parks and Recreation
- Department of Planning & Permitting
- Department of Transportation Services
- Honolulu Fire Department
- Honolulu Police Department

Utilities, Elected Officials, and Organizations

- Hawaiian Telcom
  Hawaiian Electric Company, Inc.
  Time Warner Oceanic Cable

  Senator Jill Tokuda, 24th Senate District
  Representative Pono Chong, 49th Representative District
  Councilmember Ikaika Anderson

  ‘Ahahui Mālama I Ka Lokahi
  Castle Medical Center
  Harold K. L. Castle Foundation
  Hawai‘i’s Thousand Friends
  Historic Hawai‘i Foundation
  Hui o Ko‘olau Poko

Utilities, Elected Officials, and Organizations (continued)

Kailua Chamber of Commerce
Kailua Hawaiian Civic Club
Kailua Historical Society
Kailua Neighborhood Board No. 31
Kāneʻohe Ranch
Kapaʻa II, LLC
Lani Kailua Outdoor Circle
LeJardin Windward Oʻahu Academy
Maunawili Community Association
Pacific American Foundation
Sierra Club, Hawaiʻi Chapter
The Nature Conservancy of Hawaiʻi
Windward Ahupuaa Alliance
YMCA of Honolulu – Windward Branch

7.2 PRESENTATIONS TO COMMUNITY ORGANIZATIONS

Consultation efforts also included presentations to various community organizations, and a description of those presentations is provided.

7.2.1 Hoʻolaulima iā Kawainui

Hoʻolaulima iā Kawainui is a network of concerned community organizations, government agencies, and individuals cooperating to foster public awareness and understanding of the natural, cultural, and scenic resources of the Kawainui/Hamakua Marsh complex to ensure the long-term protection, restoration, and stewardship of this complex and the surrounding area. This network includes representatives from the State DLNR, Division of State Parks and DOFAW, and several community organizations such as ʻAhahui Mālama i ka Lōkahi, Hawaiʻi Audubon Society, Hawaiʻi's Thousand Friends, Kailua Hawaiian Civic Club, Kailua Historical Society, Kawainui Heritage Foundation, Lani-Kailua Outdoor Circle, Pacific American Foundation, and Windward Ahupuaʻa Alliance.

Three presentations were given to this organization to inform them of this project, respond to questions members had, and to solicit their comments on proposed plans. Presentations were conducted on July 22, 2010, February 10, 2011, and July 12, 2011, and a summary of comments received is discussed.

July 22, 2010 Presentation

A presentation was given to: 1) introduce the project to members; and 2) solicit input on improvements and issues that should be considered in developing project plans.

1. *Parcel 05 was purchased by the State using Federal funds from the Land and Water Conservation Fund. As a result, project plans need to include a recreational component under the Federal funding requirements.*

   Discussion: Passive outdoor recreational amenities that are common within wildlife sanctuaries have been incorporated into the project plans for the upland areas of the site. These consist of pedestrian paths, observation decks, parking, and signage kiosks.

2. *The southern corner of the project area was comprised of much fill material from the construction of the former Kailua Drive Inn across Kapa'a Quarry Road where Le Jardin Academy is presently.*

   Discussion: Reforestation plans for this southern corner along with outdoor recreational improvements proposed were developed using this information.

3. *Former taro loi were present in the project area and could be impacted by restoration activities. Need to address how the project may affect those historic sites (walls). It was mentioned there is a map showing field systems in the area.*

   Discussion: Archaeological subsurface testing for the COE's pond project and as part of this project has determined that much of the wetland area is covered with more contemporary soils up to two feet deep from years of storm water runoff discharging into this marsh. Wetland restoration activities is planned to occur within about 6-inches from the surface, and should therefore not affect subsurface sites. Archaeological test trenches conducted at several locations within this project area did not encounter any historic walls. This testing methodology was developed in consultation with the SHPD, and included review of a map SHPD had which showed potential historic field systems in the area. To minimize impacts on subsurface sites, archaeological monitoring at selected areas will be implemented as mitigative measures.

4. *The Harold K. L. Castle Foundation and 'Ahahui Mālama I Ka Lōkahi were mentioned as organizations that should be consulted in developing project plans.*

   Discussion: Consultation with both the Harold K. L. Castle Foundation and 'Ahahui Mālama I Ka Lōkahi was conducted during the preparation of project plans and as part of this environmental process.

5. *Suggested having areas made available for use by cultural practitioners, and re-establishing taro loi was suggested as a use that should be accommodated in plans developed.*

Discussion: Establishing areas within the project site for use by cultural practitioners would be part of educational and cultural opportunities created by restoration improvements and outdoor recreational amenities supporting increased public access. Such activities would need to be established after initial wetland restoration and reforestation activities are conducted, and DOFAW has been able to monitor and evaluate the results. DOFAW plans to continue working with cultural practitioners and community organizations in establishing management plans for increased access of this area.

Re-establishing agricultural production, such as taro, within a portion of the project area was considered. However, this activity was not included in this restoration project at this time because the focus of the funding grant is on wetland restoration to enhance waterbird habitat. This agricultural use is also not permitted within the State's Conservation District (Protective Subzone) which encompasses most of the project's wetland area. A Conservation District Use Permit would be required to permit such agricultural use in the project area. The State DLNR's Final EA for the marsh's management plan did identify allowing a one-acre experimental plot within one of the COE's ponds planned. However, this use would only occur after construction of that pond project, and would need to be evaluated for its wildlife habitat contribution. The pond area referenced is situated outside of this DOFAW restoration project site.

6. *Should determine whether upland areas would be restored to a native forest or Polynesian forest.*

Discussion: Reforestation plans for the upland area would allow for a mixture of both Polynesian plants, referred to as cultural plantings on project plans, and native indigenous plants. As an example, reforestation of the southern corner of the project area is intended to consist of endemic indigenous plants. However, a gully located further north would be improved with terraces for drainage mitigation purposes that would include a cultural planting theme using various types of Polynesian introduced plants. Project plans have designated certain areas that are intended for either reforestation with native indigenous plants or Polynesian introduced plants, but actual implementation of such plantings would be the discretion of DOFAW as they monitor and evaluate the progress of reforestation efforts.

7. *Plans should address runoff and sediment being discharged into the marsh from Le Jardin Academy and surrounding areas.*

Discussion: Project plans include improvements to existing drainage culverts along Kapa‘a Quarry Road along with on-site improvements to mitigate storm water runoff. This includes creating terraces with cultural plantings at a gully and creating causeways along access paths to detain storm water.

8. *Hāmākua Marsh has a problem due to people feeding endangered waterbirds at that site and this should be avoided at Kawainui Marsh.*

   Discussion: DOFAW will monitor and evaluate the progress and success of restoration activities along with working with community organizations and the public to manage access in this area. Appropriate signage would be provided at areas to inform the public of necessary restrictions, and DOFAW staff present on the property would assist in enforcement.

February 10, 2011 Presentation

A presentation was given to: 1) present the project's conceptual restoration plans developed; and 2) solicit input from the members.

1. *Why does the project area boundary stop by the State Parks area for the upland portion.*

   Discussion: It was explained that the project area was based upon those lands that are under the jurisdiction of the Department of Forestry and Wildlife. The area in question was under the jurisdiction of State Parks.

2. *Inquired whether the parking lot would be closed at night.*

   Discussion: The parking area is planned to be closed after hours, and a gate would be provided to secure it.

3. *Questioned how this restoration project was related to the future master plan update for Kawainui Marsh.*

   Discussion: Plans and information from this restoration project would be incorporated into the master plan update when that project is initiated.

4. *State Parks would like to submit the restoration plan to the National Parks Service for their review since it involves Section 6(f) lands. Land and Water Conservation Fund grant money could also be sought to construct the recreational improvements proposed which includes the parking area.*

   Discussion: This restoration plan has been provided to the Division of State Parks for their review and information, and they will also receive a copy of the Draft EA as part of the environmental process. DOFAW will coordinate with the Division of State Parks at the appropriate time in pursuing additional funds for implementing recreational improvements.

July 12, 2011 Presentation

A presentation was given to: 1) update members on the project's status; and 2) brief them on the results of archaeological testing, and discuss a proposed "no adverse effect" determination under Section 106 consultation efforts.

1. *What was the thickness of the peat mat, why no walls were found during testing, and where the locations of the corings were.*

   Discussion: The thickness of the peat mat varied, but was about one to two feet thick. An aerial location map was used to show members where the two corings taken were located. It was discussed that there was no known reason explaining why no walls were found, and there could be walls present in the area. However, the testing locations were determined based upon land commission awards (LCA) and historic house locations where such walls would likely occur. Archaeological monitoring will be included as a mitigative measure based upon the archaeological test results and consultation with SHPD.

2. *Where was a historic house site and bamboo strand located.*

   Discussion: A map was used to show the location which is in the southeastern end of the project area. This area of about 0.25 acres will be avoided based upon consultation with SHPD.

3. *Questioned whether two historic roads running through the upland area of the project were lined with tree because they may be of importance and could be removed as part of reforestation efforts.*

   Discussion: A row of trees does not line these former roads, but DOFAW will consider preserving pertinent trees present along the roads if they are important when implementing reforestation improvements.

4. *Were other archaeological studies reviewed to assist with the fieldwork and testing. Did these testing efforts try to find the other historic sites.*

   Discussion: Several archaeological studies completed for this project area were reviewed, and two historic sites consisting of terraces were identified in those other studies. The purpose for testing was not to try to find those terraces, however, fieldwork conducted generally located them and are addressed in the archaeological report in Appendix C.

5. *Commented that their organization wanted to plant kalo in this project area, but this has not been included in the restoration plan.*

   Discussion: This request was already received via prior consultation efforts conducted, and their organization's desire to establish agricultural activities using *kalo* was considered. However, that land use was not included in this restoration plan and can be incorporated as part of the upcoming update of the master plan for Kawainui Marsh. Further information addressing this is provided under similar comments received at the July 22, 2010 presentation.

6. *Where was the wetland boundary located, and would that change by planting kalo in an area if that is the community's desire.*

Discussion: The jurisdictional wetland boundary was determined based upon three factors which are: hydric soils, vegetation, and hydrology. The COE established a wetland boundary that includes this project area a few years ago which is good for five years. Therefore, it was clarified that planting *kalo* now will not "establish" a new wetland boundary because that boundary would have already been set by existing conditions. The planting of *kalo* would be an agricultural activity that needs to be permitted within a wetland.

7. *Would the public be allowed to assist in the restoration work.*

   Discussion: DOFAW would consider allowing the public to assist in restoration work if it is safe, and they would evaluate potential opportunities.

7.2.2 Kailua Neighborhood Board No. 31

The project site is located within the jurisdiction of the City's Kailua Neighborhood Board No. 31. Two presentations were given to this Board and one presentation to their Planning, Zoning & Environment Committee to inform them of this project, respond to questions members had, and to solicit their comments on proposed plans. Presentations were conducted on August 5, 2010 and July 7, 2011 to the Board and on April 19, 2011 to one of their Committees. A summary of pertinent comments received is discussed.

August 5, 2010 Presentation to Board

A presentation was given to: 1) introduce the project to the Board; and 2) solicit input on improvements and issues that should be considered in developing project plans. A copy of pertinent project related sections of the Board's meeting minutes are included in Appendix A. Comments received from Board members and responses are included in the meeting minutes. One correction should be that the timeline given was for an Environmental Assessment and not an Environmental Impact Statement.

April 19, 2011 Presentation to Committee

A presentation was given to the Planning, Zoning and Environment Committee of the Kailua Neighborhood Board to: 1) present the project's conceptual restoration plans developed; and 2) solicit input from the members.

1. *Would restoration plans conflict with other prior plans for the Kawainui Marsh area such as a visitor center.*

   Discussion: Restoration plans would not conflict with other plans, and information from those plans were used in developing the restoration plan improvements.

2. *Inquired where the cattle ranching activities occurred in relation to the project area.*

   Discussion: The former cattle ranching activities was located where the COE's ponds are planned which is below (makai) the project area. The other ranching activities occur along Kapa'a Quarry Road north of and outside the restoration project area.

3. *Suggested that concrete not be used for boardwalk path planned in southern area by parking.*

   Discussion: The path was designed to be compliant with ADA standards. However, the availability and feasibility of other types of material for the path will be considered by DOFAW when this improvement is implemented.

4. *Commented that the upland area may have historic sites such as terraces or walls, and questioned if the cultural landscape will be impacted.*

   Discussion: Archaeological survey work was conducted for this project area as discussed in other chapters of this document, and consultation was conducted with SHPD in determining the scope of surveying, evaluating impacts, and determining mitigative measures. No terraces or walls are anticipated to be impacted based upon the field work conducted. However, archaeological monitoring will be implemented and DOFAW can work with an archaeologist during restoration improvements in upland areas. DOFAW staff are also knowledgeable of archaeological resources further helping minimize impacts. The restoration improvements are not expected to negatively impact the cultural landscape which is already altered and dominated by non-native invasive plant species. Thus, the project will help restore the cultural landscape by replacing invasive species with native plants and vegetation.

July 7, 2011 Presentation to Board

A presentation was given to: 1) present the project's conceptual restoration plans developed; and 2) solicit input from Board members. A copy of pertinent project related sections of the Board's meeting minutes are included in Appendix A. Comments received included the following.

1. *Questioned potential water quality effects from pollutants in sediment transported downstream to other areas of the marsh, and pollutants in runoff discharged into the marsh from Kapa'a Quarry Road.*

   Discussion: Wetland restoration activities involve cutting and removing invasive vegetation and should not cause transporting significant amounts of soils to downstream areas of the marsh. A prior study sampling soil sediments determined that it contained heavy metals that were not unusual due to heavy metals being naturally present in weathered basalt, and would thus be expected in sediments derived from erosion of this material carried into the marsh as part of

storm water runoff. Sediment samples found that heavy metal levels were lower than the maximum concentration of contaminants for characteristics of EP Toxicity. Studies have shown that the marsh slows down and absorbs storm runoff, then releases the stored water at a slower rate downstream. Suspended solids are allowed to settle, decompose, oxidize or made available for uptake by the roots of wetland plants. Changes in water quality measurements between upstream and downstream areas of the marsh were due to the addition of organic acids leached into the water from decomposing vegetation. Further information on water quality is addressed in Chapters 3 and 4.

2. *Questioned where the funding came from and whether work will be bid out to contractors.*

   Discussion: As discussed in Chapter 2, funding is from a grant sponsored by Federal, State, and private contributions. Additional funding would be sought for improvements not covered under this grant. DOFAW will solicit bids from licensed contractors under the State's procurement process for necessary activities.

3. *How long will it take to complete improvements and who is responsible for managing the marsh.*

   Discussion: Project improvements are planned to be completed by the end of 2019 subject to availability of additional funding. Work would be implemented in phases based upon the progress of restoration efforts. The State DOFAW is responsible for managing this project area along with other portions of Kawainui Marsh. The State DLNR, Division of State Parks has jurisdiction for some portions of the marsh that are outside this project area.

7.2.3 Lani Kailua Outdoor Circle

A presentation was given to the Lani Kailua Outdoor Circle at their meeting held on Friday, May 20, 2011. The purpose was to: 1) present the project's conceptual restoration plans developed; and 2) solicit input from association members. General comments and questions were received from members and answered at this presentation.

7.2.4 Other Community Organizations

Meetings were also held with other community organizations to present the project's conceptual restoration plans developed and solicit their input. A summary of these meetings is provided.

1. Kailua Cultural Descendants Group. A meeting was held on March 17, 2011 with a group comprised of members from various native Hawaiian organizations and individuals. Organizations represented included ʻAhahui Mālama I Ka Lōkahi, Pacific American Foundation, and Kekahua o Kūaliʻi. General comments and questions received

from members were addressed at this meeting, and input received was used developing restoration plans.

2. ‘Ahahui Mālama I Ka Lōkahi Board. A meeting was held with this association at one of their regularly scheduled meetings on March 20, 2011. General comments and questions received from members were addressed at this meeting, and input received was used developing restoration plans.

7.3 PUBLIC INFORMATIONAL MEETING

A public informational meeting was held by DOFAW to introduce the project to the public and solicit community input on improvements and issues that should be considered in developing project plans. The informational meeting was held on Thursday, July 29, 2010 at 6:30 p.m. at the Le Jardin Academy’s Wang Auditorium. Public notification of this meeting was published in the July 18th issue of *The Honolulu Star-Advertiser* newspaper. Notice of this meeting was also distributed to several community organizations, associations, and elected officials. A copy of the attendance sheets for this informational meeting is provided in Appendix A along with a summary of comments received at that meeting.

7.4 OTHER COMMUNITY PRESENTATIONS AND BRIEFINGS

Participation in other community sponsored and organized events was conducted as part of efforts to notify the public of this project, present conceptual restoration plans, and solicit public input and comments. A summary of these other community events is provided.

1. World Wetlands Day. The Ramsar World Wetland Day 2011 was held on Saturday, February 5, 2011 at the Faith Baptist Church in Kailua. This event consisted of tours of Kawainui Marsh, entertainment, games, and other activities. An informational brochure from this event is included in Appendix A. HHF participated in this event by establishing a display booth with materials showing the conceptual plans for the restoration project and responding to questions and comments from participants.

2. Envisioning Kawainui Community Meetings. Senator Jill Tokuda and the Harold K.L. Castle Foundation jointly held Envisioning Kawainui community meetings on Saturday, August 7, 2011 and Saturday, April 2, 2011. These meetings were held at the Le Jardin Academy’s multi-purpose room in Kailua, and were attended by approximately 50 to 70 persons. These meetings consisted of presentations by the sponsors, discussion of issues associated with Kawainui Marsh, brief presentations by agencies involved with Kawainui Marsh projects, and responding to questions and comments from the public. HHF and DOFAW participated in these meetings by providing a short presentation on the project plans, distributing a project summary handout, and responding to questions and comments.

3. Briefings of Elected Officials. Elected officials for the Kailua district were briefed on the project and proposed improvements. This included State Senators Tokuda and Ryan, State Representatives Chong and Thielen, and City Councilman Anderson.

CHAPTER 8
FINDINGS AND ANTICIPATED DETERMINATION

To determine whether a proposed action may have a significant effect on the environment, the State Approving Agency and Federal Lead Agency need to consider every phase of the action, the expected primary and secondary consequences, cumulative effect, and the short- and long-term effects. The agency's review and evaluation of the proposed action's effect on the environment would result in a determination of whether: 1) the action would have a significant effect on the environment, and an Environmental Impact Statement Preparation Notice should be issued, or 2) the action would not have a significant effect warranting a Finding of No Significant Impact (FONSI).

This chapter addresses the anticipated determination based upon the evaluation criteria prescribed for the State Approving Agency and Federal Lead Agency. A Finding of No Significant Impact determination is presently anticipated for this project.

8.1 FINDINGS UNDER STATE CHAPTER 343, HRS

8.1.1 Anticipated Determination

A FONSI determination should be warranted for the Kawainui Wetland Restoration and Habitat Enhancement Project based upon the assessments results and information provided in this document. The findings supporting this anticipated determination are based upon discussion of the project's effect on the environment in relation to the 13 Significance Criteria prescribed under the State Department of Health's Administrative Rules Title 11, Chapter 200.

8.1.2 Findings

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

The proposed restoration project and accessory improvements would not result in the irrevocable commitment to loss or destruction of any natural or cultural resource. Wetland restoration and reforestation plans would restore the natural environment by removing non-native invasive vegetation and re-establishing native vegetation. These improvements would naturalize Kahaniki Stream which is being impacted by the expansion of invasive vegetation and peat mat. These efforts would enhance this wetland habitat supporting the growth and repopulation of endangered waterbirds inhabiting this area. Project improvements should not have a significant negative impact on cultural resources and appropriate mitigative measures will be implemented during activities as discussed in this document. Restoration and accessory recreational improvements would increase opportunities for conducting educational and cultural activities within this project area.

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

The project would not curtail the range of beneficial uses associated with this property. Kawainui Marsh is a wildlife sanctuary under the jurisdiction of DOFAW, and beneficial uses within the project area is currently limited and restricted due to present conditions. The project will increase the range of beneficial uses of the environment by restoring the wetland and upland area, and provide passive outdoor recreational amenities for use by the public. These improvements would make this project area more easily accessible by the public, accommodate ADA standards for pedestrian pathways, and increase safety in the area.

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 should not conflict with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS. A discussion of the project's consistency with applicable guidelines was provided in Chapter 5 of this document.

4. Substantially affects the economic welfare, social welfare and cultural practices of the community or state;

The project will provide minor short-term economic benefits in the form of construction jobs, income, and additional tax revenue to the State. No additional City revenues would be generated because it is a State-owned property, therefore, this project should have minimal or no effect on the current or future levels of City tax revenues. The project will improve the landscape character of Kawainui Marsh's through removal of invasive vegetation, opening water flow of Kahanaiki Stream, and re-establishing native plants in both the wetland and upland areas. These changes would have a beneficial impact within the project area but will not change the overall character of the surrounding environment. Therefore, the character of these existing uses would not be changed or adversely impacted by the project. This project is not expected to significantly affect traditional native Hawaiian cultural practices or other traditional cultural practices occurring in the surrounding area. Mitigative measures implemented under an archaeological monitoring plan during construction will minimize any impacts on potential subsurface sites. Project improvements would increase opportunities for conducting educational and cultural activities within this project area.

5. Substantially affects public health;

The project would not substantially affect public health as discussed in various sections of this document. Minimal effects on public health from restoration, reforestation, and construction activities are anticipated relative to various health issues such as air quality and noise. Short-term construction-related effects would be mitigated by complying with pertinent State or City regulations and conditions of ministerial permits obtained. Best management practices will also be implemented as part of construction activities.

6. Involves substantial secondary impacts, such as population changes or effects on public facilities;

The project should not have any substantial secondary impacts on the social environment, infrastructure facilities, and public facilities. Improvements do not involve adding residential housing or visitor accommodation units that may generate population changes and increase demands on public facilities. The project would not contribute to in-migration of residents to the island.

7. Involves a substantial degradation of environmental quality;

The project would not contribute to a substantial degradation to the quality of the surrounding environment. Proposed activities would support restoring the wetland and upland areas by removing invasive vegetation and planting native plants all of which will enhance habitat for endangered waterbirds. These changes would result in a beneficial effect on the environmental quality of Kawainui Marsh. Appropriate mitigative measures will be implemented to address construction related impacts on the environment in coordination with appropriate government agencies. This includes implementing best management practices during construction to minimize erosion and other short-term impacts in compliance with ministerial permits and conditions.

8. Individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;

This project would not have significant cumulative effect on the environment as discussed in Chapter 4 nor does it commit to larger actions. Cumulative impacts from these restoration improvements were considered and addressed in relation to the ponds being developed by the COE. In evaluating environmental impacts, it was determined that the project should not contribute to a significant cumulative effect on the environment.

9. Substantially affect a rare, threatened, or endangered species, or its habitat;

The project would not have a substantial adverse effect on endangered, threatened, or rare species or resources present on the property. Restoration activities would improve wetland and upland areas and are intended to enhance this habitat to support endangered waterbirds.

10. Detrimentally affect air or water quality or ambient noise levels;

The project should not have detrimentally significant impacts on air, water quality, or ambient noise levels as discussed in this document. Impacts associated with these factors would be limited to short-term construction activities. However, such impacts are expected to be minor, will be monitored by DOFAW to minimize nuisance effects (e.g. odors), and include mitigative measures such as best management practices. Construction activities would also be subject to applicable State and City regulations and permit conditions.

11. Affect 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;

No structures associated with recreational amenities would be constructed within the flood plain. These amenities are not located within a tsunami evacuation zone, within the shoreline, or geologically hazardous area. Culvert improvements and other erosion control measures will be implemented to reduce erosion presently occurring within upland areas and to improve discharges of storm water runoff into the wetland. Wetland restoration activities do occur within a flood plain and will support the flood protection function of Kawainui Marsh.

12. Substantially affect scenic vistas and view planes identified in county or state plans or studies;

The project involves a type of landscaping activity that will improve the landscape character of Kawainui Marsh's through removal of invasive vegetation, opening water flow of Kahanaiki Stream, and re-establishing native plants in both the wetland and upland areas. These changes would have a beneficial impact on views of the wetland and upland areas. Recreational amenities proposed will increase public views of the marsh.

13. Require substantial energy consumption

The project will not require substantial energy consumption or place increased demands on the capacity of supporting electrical facilities because it primarily involves wetland restoration and reforestation activities.

8.2 FINDINGS UNDER FEDERAL NEPA

This section discusses the results of the assessment conducted for the proposed project to determine whether it would significantly affect the environment under the regulations prescribed under the Council on Environmental Quality NEPA Regulations (40 CFR, Part 1500 – 1508). The purpose of this assessment was to consider the "significantly" definition under these regulations that require considerations of both context and intensity. The resulting findings are discussed below for these criteria.

The results of the assessments conducted along with technical studies performed for various disciplines have determined that the Proposed Action should not have a significant impact on the surrounding environment. The findings supporting this anticipated determination are based upon the discussion of the project's affect on the environment in relation to the 10 intensity criteria (40 CFR 1508.27).

Context

Context means that the significance of an action must be analyzed in several contexts such as society as a whole, the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action, and both short- and long-term effects are relevant.

This document has addressed and evaluated the significance of the Kawainui Wetland Restoration and Habitat Enhancement Project under this context. The assessment included the environment associated with the affected 80-acre project site, immediate surrounding vicinity, and the neighboring Kailua district. Both short- and long-term effects were addressed under this document.

Intensity

Intensity refers to the severity of impact, and several criteria are identified which should be considered in evaluating impacts. A discussion of these intensity criteria is provided below.

1. Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

The project would not have significant negative impacts on the environment as discussed in this document. The project predominantly consists of wetland restoration and upland reforestation efforts to remove invasive vegetation and re-establish native vegetation in this area. These improvements would enhance habitat in this wildlife sanctuary for endangered waterbirds. Outdoor recreational amenities planned will support increased public accessibility within this project area and allow for educational and cultural opportunities which are beneficial effects from the project. There are also some minor short-term beneficial effects involving economic benefits in the form of construction jobs, income, and tax revenue. A significant effect would not occur with this project even if considering both these benefits with environmental effects separately or on balance together.

2. The degree to which the proposed action affects public health or safety.

As previously discussed under the State environmental review criteria (No. 5), the project would not adversely affect the public health or safety of the surrounding community and residents.

3. Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

Kawainui Marsh is a large 830-acre area that has historic or cultural resources based upon previous studies, and is eligible for listing on the National Register of Historic Places. Project improvements are not expected to have a significant impact historic or cultural resources based upon the archaeological study conducted, consultations with SHPD, and consultations with native Hawaiian organizations and the public. Mitigative measures implemented under an archaeological monitoring plan during construction will minimize any impacts on potential

subsurface sites. Project improvements would also increase opportunities for conducting educational and cultural activities within this project area which are beneficial effects. Restoration plans will improve the cultural value of Kawainui Marsh, and enhance this site's function as habitat for endangered waterbirds.

4. *The degree to which the effects on the quality of the human environment are likely to be highly controversial.*

The project is not expected to be highly controversial adversely effecting the surrounding community. Consultation efforts conducted with several government agencies, elected officials, community organizations, and the public have not raised issues of a highly controversial nature. Many comments received from these consultations have been supportive of the project, and certain organizations have expressed an interest in assisting DOFAW the actual implementation of some improvements.

5. *The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.*

The degree to which the probable effects on the human environment associated with the project is known and has been addressed and evaluated in this document. Restoration methods proposed are based upon DOFAW's experience with other wetland areas managed by this agency. Therefore, this project does not involve unique or unknown risks that cannot be addressed.

6. *The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.*

This project would not establish a precedent for future actions having significant effects on the environment. As discussed under the State's environmental review criteria (No. 8), this document addressed the impacts resulting from the implementation of this project.

7. *Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.*

As discussed under the State's environmental review criteria (No. 8), this document addressed the cumulative impacts resulting from the project. The COE's ponds planned adjacently *makai* of this project site was also included in assessing and evaluating cumulative environmental impacts. Therefore, the cumulative impacts associated with this project was considered and addressed which determined that the project would not have a significant impact on the environment.

8. *The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.*

This project would not adversely affect or cause loss or destruction to significant historic properties as discussed in Chapter 4 of this document. Consultation with the SHPD has been conducted to address such resources which determined the project would have no adverse effect. Consultation with native Hawaiian organizations and the public have also supported this

determination. Mitigative measures implemented under an archaeological monitoring plan during construction will minimize any impacts on potential subsurface sites. The project would also not adversely affect any cultural resources because it primarily involves wetland restoration and upland reforestation activities. These plans would improve the functional and cultural value of Kawainui Marsh.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

As discussed under the State environmental review criteria (No. 9), the project would not adversely affect known endangered, threatened, or rare species or critical habitat. Restoration activities would improve wetland and upland areas and are intended to enhance this habitat to support endangered waterbirds.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

The project would not threaten or violate Federal, State, or City laws or requirements imposed for the protection of the environment.

CHAPTER 9
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APPENDICES

APPENDIX A
Pre-Assessment Consultation

A-1 Pre-Assessment Consultation Comments and Responses

A-2 Kailua Neighborhood Board No. 31
Regular Meeting Minutes; Thursday, August 5, 2010
Regular Meeting Minutes; Thursday, July 7, 2011

A-3 Public Informational Meeting, Thursday, July 29, 2010

A-4 Other Community Events
Envisioning Kawainui; Saturday, August 7, 2010
Envisioning Kawainui; Saturday, April 2, 2011
Ramsar World Wetlands Day 2011; Saturday, February 5, 2011

APPENDIX A-1

Pre-Assessment Consultation Comments and Responses

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS, HONOLULU DISTRICT
FORT SHAFTER, HAWAII 96858-5440

REPLY TO
ATTENTION OF:

November 4, 2010

Regulatory Branch

File No. POH-2010-00289

RECEIVED
NOV - 8 2010
HELBER, HASTERT & FEE
PLANNERS

Ronald A. Sato
Senior Planner
Helber Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, HI 96813

Dear Mr. Sato:

This responds to your request for written comments for the preparation of a draft Environmental Assessment (dEA) which will address activities and impacts of the proposed Kawainui Marsh Wetland Restoration and Habitat Enhancement Project located at TMKs 142013005 AND 142013022, Kailua, Oahu Island. The proposed project area encompasses as much as 80 acres of state-owned land and includes wetlands, riparian and forested lands.

The proposed dEA will be reviewed pursuant to Section 10 of the Rivers and Harbors Act of 1899 (Section 10) and Section 404 of the Clean Water Act (Section 404). Section 10 requires that a Department of Army (DA) permit be obtained for certain structures or work in or affecting navigable waters of the United States (U.S.), prior to conducting the work (33 U.S.C. 403). Navigable waters of the U.S. are those waters subject to the ebb and flow of the tide shoreward to the mean high water mark, and/or other waters identified as navigable by the Honolulu District. In addition, a Section 10 permit is required for structures or work outside this limit if they affect the course, location, or condition of the waterbody as to its navigable capacity.

Section 404 requires that a DA permit be obtained for the placement or discharge of dredged and/or fill material into waters of the U.S., including wetlands, prior to conducting the work (33 U.S.C. 1344). For regulatory purposes, the U.S. Army Corps of Engineers (Corps) defines wetlands as those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. The area of Corps jurisdiction under Section 404 extends to the Ordinary High Water Mark (OHWM) for navigable waters other than the Pacific Ocean, and to the upland boundary of any adjacent wetlands.

The dEA should indicate where waters of the United States, as typically represented by navigable waters, perennial, intermittent, ephemeral streams and wetlands, are in, or adjacent to, or absent from, the proposed project areas. The dEA should state in appropriate sections whether there is the potential for waters of the U.S. to be impacted by construction of project structures and associated ground disturbing activities, such as temporary access and egress across or within the streams and wetlands to accomplish the proposed work. Information for delineations of wetlands and Kahanaiki Stream should be provided as technical appendices in the dEA. Finally, a proposed project of this magnitude should articulate a Best Management Practices Plan (BMPP) for the protection and

management of the aquatic environment and measures for the avoidance, minimization and mitigation of potential impacts.

This additional information would enable the Corps to determine the scope of this activity and determine whether a discharge of fill material may require DA permit authorization. You will need to apply for and receive authorization from the Corps prior to the installation of access/egress and bermed structures that could be construed as fill material into waters of the U.S..

A copy of the dEA is requested for review and comment by our program.

Thank you for giving us the opportunity to review this proposal and for your cooperation with our regulatory program. You are encouraged to provide comments on your experience with the Honolulu District Regulatory Branch by accessing our web-based customer survey form at http://per2.nwp.usace.army.mil/survey.html.

Should you have any questions, please contact Mr. Farley Watanabe of this office at the above address, by telephone 808-438-7701 (FAX: 808-438-4060), or by e-mail at Farley.K.Watanabe@usace.army.mil. Please refer to **File No. POH-2010-00289** in all future communications with this office regarding this or other projects at this location.

Sincerely,

George P. Young, P.E.
Chief, Regulatory Branch

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. George P. Young, P.E., Chief
Regulatory Branch
Corps of Engineers
U.S. Department of the Army, Honolulu District
Fort Shafter, Hawai‘i 96858-5440

Dear Mr. Young:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022
File No. POH-2010-00289

Thank you for your letter of November 4, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We have had two meetings with your regulatory branch staff to discuss the project, solicit comments, and better assess applicability of Department of Army (DA) permits. Based upon these meetings, the project should not require a Section 10 permit because waters within the project area are not subject to the ebb and flow of the tide shoreward of the mean high water mark. These waters within the project area consist of portions of Kahanaiki Stream, Maunawili Stream, and associated wetlands.

Wetland restoration efforts occurring within these waters predominantly involve removal of invasive vegetation and re-establishing growth of native wetland plants. No structures would be constructed or impounding of water, and increased open water areas should be created to allow the stream flow to continue meandering through this wetland area. These activities would not affect the course of the streams, their location, or condition of its navigable capacity.

Wetland restoration work would occur within the U.S. Army Corps of Engineers (COE) jurisdictional wetland based upon a 2008 wetland delineation map certified by the COE for this area. Reforestation and other passive outdoor recreational amenities planned will be located outside the delineated wetland boundary. Wetland restoration activities planned should not involve the placement or discharge of dredged or fill materials into jurisdictional waters. Discussions with COE regulatory staff have indicated that these activities should not require a DA permit under Section 404.

The Draft EA will include information on Kahanaiki and Maunawili Streams and wetland area within the project site. This document will include details of restoration activities and other improvements planned. No structures are planned within COE jurisdictional waters, and no vehicle access paths within or across this wetland is planned. Best management practices implemented for restoration activities and construction of recreational amenities will be addressed in the document. The State Department of Land and Natural Resources, Division of Forestry and Wildlife, will also be developing a Kawainui Marsh Restoration Area Management Plan for the COE's pond project, and this management plan would be modified to include best management practices and other management activities for this restoration project area.

A section of the Draft EA will address the applicability of DA permits with the project. We appreciate your comments, and a copy of the published Draft EA will be submitted to the COE for review and comments.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

LINDA LINGLE
GOVERNOR

RUSS K. SAITO
COMPTROLLER

STATE OF HAWAI'I
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)1268.0

NOV - 4 2010

RECEIVED
NOV - 5 2010
HELBER, HASTERT & FEE PLANNERS

Mr. Ronald A. Sato, AICP
Helber, Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawai'i 96813

Dear Mr. Sato:

Subject: Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Enivironmental Assessment Pre-Assessment Consultation
Kailua, Oahu, Hawai'i
TMK: (1) 4-2-013: portions of 005 and 022

Thank you for the opportunity to provide pre-assessment consultation comments on the Kawainui Marsh Wetland Restoration and Habitat Enhancement project. This 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. Clarence Kubo of the Public Works Division at 586-0488.

Sincerely,

RUSS K. SAITO
State Comptroller

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Ms. Jan S. Gouveia, Acting Comptroller
Department of Accounting and General Services
State of Hawai‘i
P.O. Box 119
Honolulu, Hawai‘i 96810-0119

Dear Ms. Gouveia:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your department’s letter dated November 4, 2010 as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note this project does not impact any of your department’s facilities or projects, and you have no comments at this time..

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

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HONOLULU, HAWAII 96809

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HELBER, HASTERT & FEE PLANNERS

November 8, 2010

Helber, Hastert & Fee Planners, Inc.
733 Bishop Street Suite 2590
Honolulu, Hawaii 96813

Attention: Mr. Ronald A. Sato, AICP

Ladies and Gentlemen:

Subject: Pre-Assessment Consultation for Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Engineering Division, Commission on Water Resource Management, Office of Conservation & Coastal Lands, Land Division – Oahu District, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Historic Preservation will be submitting comments through a separate letter. Should you have any questions, please feel free to call our office at 587-0414. Thank you.

Sincerely,

Russell Y. Tsuji
Administrator

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

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DEPT. OF LAND &
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STATE OF HAWAII

2010 OCT 21 AM 9:38
RECEIVED
COMMISSION ON WATER
RESOURCE MANAGEMENT

October 20, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District

FR:

TO:

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
LOCATION: Island of Oahu
APPLICANT: Helber Hastert & Fee on behalf of Division of Forestry & Wildlife

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by November 6, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

More information is required on scope of work in stream bed & bank.

Signed: RKChong
Date: 10/25/10

FILE ID:	RFD. 2755.3
DOC ID:	7035✓

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON

WILLIAM D. BALFOUR, JR.
SUMNER ERDMAN
NEAL S. FUJIWARA
CHIYOME L. FUKINO, M.D.
DONNA FAY K. KIYOSAKI, P.E.
LAWRENCE H. MIIKE, M.D., J.D.

LENORE N. OHYE
ACTING DEPUTY DIRECTOR

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

November 1, 2010

REF: RFD.2755.3

TO: Russell Y. Tsuji, Administrator
Land Division

FROM: Lenore N. Ohye, Acting Deputy Director Lenore N. Ohye
Commission on Water Resource Management

SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project

FILE NO.: n/a
TMK NO.: (1) 4-2-013:portion of 005 and 022

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://www.hawaii.gov/dlnr/cwrm.

Our comments related to water resources are checked off below.

☐ 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

☐ 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

☐ 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

☐ 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EPA as having high water efficiency can be found at http://www.epa.gov/watersense/pp/index.htm.

☐ 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://hawaii.gov/dbedt/czm/initiative/lid.php.

☐ 6. We recommend the use of alternative water sources, wherever practicable.

☐ 7. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:
Additional information and forms are available at http://hawaii.gov/dlnr/cwrm/resources_permits.htm.

☐ 8. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water.

☐ 9. A Well Construction Permit(s) is (are) required any well construction work begins.

☐ 10. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

☐ 11. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

☐ 12. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

☐ 13. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.

☐ 14. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.

☐ 15. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

☐ 16. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

☒ OTHER:
Additional information on proposed scope of work in stream bed and bank is needed to determine whether a stream channel alteration permit (SCAP) is required. If a SCAP may be needed, this should be discussed in the environmental assessment.

If there are any questions, please contact Robert Chong at 587-0266.

CIRR DX 11-91 MILLS

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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OFFICE OF CONSERVATION & COASTAL LANDS
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DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

October 20, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
LOCATION: Island of Oahu
APPLICANT: Helber Hastert & Fee on behalf of Division of Forestry & Wildlife

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by November 6, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(✓) Comments are attached.

Signed:
Date: November 1, 2010

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

PAUL J. CONRY
ACTING FIRST DEPUTY

LENORE N. OHYE
ACTING 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

REF:OCCL: TM

Correspondence: OA 11-91

NOV - 1 2010

MEMORANDUM

TO: Charlene Unoki, Assistant Administrator
Land Division

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands (OCCL)

SUBJECT: Pre-Assessment for the Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project Located at Kailua, Oahu

The OCCL has reviewed the subject document and note that the subject area lies within the Protective subzone of the Conservation District. The Board of Land and Natural Resources approved Conservation District Use Permit (CDUP) OA-3068 for the Kawai Nui Marsh Improvements on January 25, 2002. The primary objectives were 1) to provide a comprehensive and coordinated management plan for existing and future land and water uses; 2) to protect, maintain and enhance wildlife species, their habitats and related ecological systems; and 3) Protect, preserve and enhance cultural, educational and recreational values.

CDUP OA-3068 also allows for plans for the future of the marsh to be developed, changed and implemented pursuant to plan goals and objectives. In addition, the development, operation and maintenance of ranching, agricultural activities, wildlife habitat, vegetation buffers, flood control and fire control areas are on going and would continue.

We shall reserve further comments upon reviewing the draft environmental document. We look forward to the draft environmental document as a pdf. file on CD. Should you have any questions regarding this matter, contact Tiger Mills of our Office at 587-0382.

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

10 PM03:22 ENGINEERING

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

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October 20, 2010

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LAND DIVISION
2010 NOV -1 P 2:12
DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
LOCATION: Island of Oahu
APPLICANT: Helber Hastert & Fee on behalf of Division of Forestry & Wildlife

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by November 6, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed:
Date: 10/1/10

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/CharleneUnoki
Ref: PreAssessConsultDEAKawainuiMarshRestoration
Oahu.801

COMMENTS

(X) **We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zones D, X and A. The National Flood Insurance Program does not have any regulations for developments within Zones D and X, however, it does regulate developments within Zone A as indicated in bold letters below.**

( ) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

(X) **Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.**

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

(X) **Mr. Robert Sumitomo at (808) 768-8097 or Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.**

( ) Mr. Carter Romero at (808) 961-8943 of the County of Hawaii, Department of Public Works.

( ) Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.

( ) Ms. Wynne Ushigome at (808) 241-4980 of the County of Kauai, Department of Public Works.

( ) The applicant should include water demands and infrastructure required to meet project needs. Please note that projects within State lands requiring water service from the Honolulu Board of Water Supply system will be required to pay a resource development charge, in addition to Water Facilities Charges for transmission and daily storage.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments:_____

( ) Other: _____

Should you have any questions, please call Ms. Suzie Agraan of the Planning Branch at 587-0258.

Signed: _____
CARTY CHANG, CHIEF ENGINEER

Date: 12/1/10

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

October 20, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
LOCATION: Island of Oahu
APPLICANT: Helber Hastert & Fee on behalf of Division of Forestry & Wildlife

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by November 6, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
(✓) We have no comments.
( ) Comments are attached.

Signed: TCha
Date: 10/21/2010

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Russell Y. Tsuji, Administrator
Land Division
Department of Land and Natural Resources
State of Hawai‘i
P.O. Box 621
Honolulu, Hawai‘i 96809

Dear Mr. Tsuji:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 8, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project. Our responses address the comments from each division.

Commission on Water Resource Management

Information on any work proposed within the stream bed and bank will be included in the Draft EA so that your division can determine whether a stream channel alteration permit is required. At this time, no restoration work is planned to occur within the stream channels of Kahanaiki and Maunawili Streams that have definite bed and banks. Restoration work predominantly involving the removal of invasive vegetation will occur with wetland areas outside of these stream channels.

Office of Conservation and Coastal Lands

We confirm that the portion of the project area within the Conservation District is designated as Protective Subzone. A meeting was conducted with staff from this office to discuss the project, solicit comments, and better assess applicability of permit requirements. Based upon this meeting and review of Conservation District Use Permit (CDUP) OA-3068, we believe the proposed restoration project would be consistent with the primary objectives of that CDUP. Therefore, a new CDUP for this project should not be required. The Draft EA will include information for this office to better evaluate the project and permit requirements.

Engineering Division

We confirm that portions of the project area are located within Zones D and A of the Flood Insurance Rate Map for this area. However, the project area does not extend into Zone A, and a map showing the project area in relation to flood zones will be included in the Draft EA. The

project would comply with applicable rules and regulations of the National Flood Insurance Program, and we appreciate the contact information provided for the State coordinator and City coordinator. No structures are planned within this flood area because it consists of a wetland and is part of the State's wildlife sanctuary established for Kawainui Marsh. The only activities occurring will be wetland restoration efforts, and the Draft EA will provide further project information.

Land Division – O'ahu District

We note this division had no comments.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

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LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

November 16, 2010

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NOV 18 2010
HELBER, HASTERT & FEE PLANNERS

Helber, Hastert & Fee Planners, Inc.
733 Bishop Street Suite 2590
Honolulu, Hawaii 96813

Attention: Mr. Ronald A. Sato, AICP

Ladies and Gentlemen:

Subject: Pre-Assessment Consultation for Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to Division of State Parks for their review and comment.

The Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0414. Thank you.

Sincerely,

Charlene E. Unoki

Charlene Unoki
Assistant Administrator

5U.72

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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2010 OCT 21 A9:59
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NATURAL RESOURC

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

October 20, 2010

MEMORANDUM

TO: **DLNR Agencies:**
x Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
x Engineering Division
__Div. of Forestry & Wildlife
x Div. of State Parks
x Commission on Water Resource Management
x Office of Conservation & Coastal Lands
x Land Division –Oahu District

FROM: Charlene Unoki, Assistant Administrator
SUBJECT: Pre-Assessment Consultation for Draft Environmental Assessment for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
LOCATION: Island of Oahu
APPLICANT: Helber Hastert & Fee on behalf of Division of Forestry & Wildlife

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by November 6, 2010.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact my office at 587-0433. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed: Martha Yent
Date: 11/10/10

LINDA LINGLE
GOVERNOR OF HAWAII

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

PAUL J. CONRY
ACTING FIRST DEPUTY

LENORE N. OHYE
ACTING 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

DIVISION OF STATE PARKS
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HONOLULU, HAWAII 96809

RECEIVED
LAND DIVISION
2010 NOV 12 P 2:46
DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

November 9, 2010

Mr. Ronald Sato, Senior Planner
Helber Hastert and Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawai'i 96813

Dear Mr. Sato:

SUBJECT: Draft Environmental Assessment Pre-Assessment Consultation
Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
TMK: (1) 4-2-013: portions 005 and 022

Thank you for the opportunity to provide comments on this project proposed by the Division of Forestry and Wildlife for wetland restoration and habitat enhancement in the *mauka* portion of Kawainui Marsh. We support this project as an important step towards improving one of the most significant wetlands in Hawai'i for both the waterbirds and those who experience the wetland by visiting one of the park sites located around the perimeter of the marsh. We would like to point out several concerns and requirements to consider as you move forward with your planning and regulatory documents.

- The planning of projects at Kawainui appears to be piecemeal and there needs to be better coordination of projects so they support each other and the cumulative environmental effects are addressed. This includes current plans by the Army Corps of Engineers to construct a wetland in an area adjacent to this current project where a separate EA document was prepared. There is also a need to consider your project in conjunction with the interpretive planning being conducted by Ho'olaulima Iā Kawainui and the current funding appropriated by the State Legislature for updating the 1994 Master Plan for Kawainui.

- Much of your project occurs within a 6(f) area that was designated when DLNR used federal funds from the Land and Water Conservation Fund (LWCF) Program to purchase various parcels around the marsh. The requirements of the LWCF Act include making the area accessible to the public and providing opportunities for outdoor recreation such as trails and wildlife viewing platforms. Your plan should be reviewed by State Parks as the local administrator of the LWCF Program and approved by the National Park Service as another LWCF requirement.

If we can be of further assistance as you move forward with this project, please contact Martha Yent, State Parks Interpretive Program and LWCF Coordinator, at Martha.E.Yent@hawaii.gov or 587-0287.

Very truly yours,

DANIEL S. QUINN
State Parks Administrator

cc: Land Division

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Russell Y. Tsuji, Administrator
Land Division
Department of Land and Natural Resources
State of Hawai‘i
P.O. Box 621
Honolulu, Hawai‘i 96809

Dear Mr. Tsuji:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 16, 2010 providing additional comments from your Division of State Parks as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project. We appreciate your division's support of this project and have the following responses to their comments.

DOFAW has been and will continue to coordinate the refinement of project plans with the Division of State Parks, U.S. Corps of Engineers (COE), and Ho‘olaulima iā Kawainui so that these improvements within Kawainui Marsh may support each other. Meetings have been conducted with both the COE and Division of State Parks, and several presentations given to Ho‘olaulima iā Kawainui on this project.

The Draft EA will include a section addressing cumulative impacts from this and other probable projects occurring in the area which includes the COE ponds project. Interpretive planning efforts for Kawainui March being conducted by others is still in the initial planning stages. Some of the concepts being considered by that effort are outside of the scope and project area for this restoration project such as kiosks around the marsh and some type of visitor or nature center. Those land uses would be more appropriately addressed as part of a future update of the master plan for the entire Kawainui Marsh. It is anticipated that plans for this restoration project would be incorporated in the eventual update of the Kawainui Marsh master plan effort. However, DOFAW will continue to coordinate with the Division of State Parks regarding their progress on interpretive planning efforts.

It is our understanding that only parcel 05 of the project area was purchased by the State using Federal funds from the Land and Water Conservation Fund based upon our consultation with your division. In compliance with that program's requirements, project plans have included some passive outdoor recreational improvements in the upland area outside the wetland. This

includes pedestrian trails, parking, observation decks, and interpretive signage supporting increased public access within this area. A copy of the draft restoration plan has been provided to your division for review, and the Draft EA will also be provided for review when published during the public review period.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

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LINDA LINGLE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI'I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI'I 96804

OFFICE OF THE SUPERINTENDENT

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PLANNERS

November 1, 2010

Mr. Ronald A. Sato, AICP
Helber, Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Pre-Assessment Consultation for the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project Draft Environmental Assessment, TMK (1) 4-2-013:005 (por.) and 022 (por.), Kailua, O`ahu, Hawai`i

The Department of Education (DOE) has reviewed the pre-assessment consultation request for the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project.

The DOE has no comment to offer.

Thank you for the opportunity to comment. If you have any questions, please call Jeremy Kwock of the Facilities Development Branch at 377-8301.

Very truly yours,

Kathryn S. Matayoshi
Superintendent

KSM:jmb

c: Randolph Moore, Assistant Superintendent, OSFSS
Suzanne Mulcahy, CAS, Kailua/Kalaheo Complex Areas

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Ms. Kathryn S. Matayoshi, Superintendent
Office of the Superintendent
Department of Education
State of Hawai‘i
P.O. Box 2360
Honolulu, Hawai‘i 96804

Dear Ms. Matayoshi:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 1, 2010 as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note that your department has no comments at this time.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

LINDA LINGLE
GOVERNOR

MICHAEL D. FORMBY
INTERIM DIRECTOR

Deputy Directors
FRANCIS PAUL KEENO
JIRO A. SUMADA

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

IN REPLY REFER TO:

STP 8.0282

November 9, 2010

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HELBER, HASTERT & FEE
PLANNERS

Mr. Ronald A. Sato, AICP
Senior Planner
Helber, Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation

Thank you for requesting the State Department of Transportation's (DOT) review of the Department of Land and Natural Resource's (DLNR), Division of Forestry and Wildlife (DOFAW) project to implement wetland restoration and habitat enhancement improvements for a portion of Kawainui Marsh. The proposed improvements would include restoring and naturalizing Kahanaiki Stream and native wetland habitat, restoring and enhancing native bird habitat in this wetland, mitigating existing storm water runoff and reducing erosion problems, improving DOFAW maintenance operations of the area, and accommodating public access. Access to project will be off Kapaa Quarry Road.

Given the project location, the State's highway facilities, Mokapu Saddle Road and Kalanianaole Highway, may be impacted. The Draft Environmental Assessment (DEA) should address any traffic, access or construction equipment travel impacts that could occur and identify appropriate mitigation measures.

DOT appreciates the opportunity to provide comments and requests four copies of the DEA when it is available. If there are any questions, including the need to meet with DOT staff, please contact Mr. David Shimokawa of the DOT Statewide Transportation Planning Office at telephone number (808) 831-7976.

Very truly yours,

Francis Paul Keeno

for MICHAEL D. FORMBY
Interim Director of Transportation

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Glenn Okimoto, P.E., Director
Department of Transportation
State of Hawai‘i
869 Punchbowl Street
Honolulu, Hawai‘i 96813-5097

Dear Mr. Okimoto:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your department’s letter dated November 9, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

The project should not have a significant impact on State highway facilities particularly related to Kalaniana‘ole Highway. The Draft EA will address traffic access and short-term constructed related impacts on State highway facilities.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

LINDA LINGLE
GOVERNOR OF HAWAII

CHIYOME L. FUKINO, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
DOH/CWB

11030CEC.10

November 9, 2010

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HELBER, HASTERT & FEE
PLANNERS

Mr. Ronald A. Sato, AICP
Helber Hastert & Fee Planners, Inc.
Pacific Guardian Center, Makai Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

SUBJECT: Request for Pre-Assessment Consultation for Draft Environmental Assessment
Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Kailua, O'ahu, Hawai'i
TMKs: (1) 4-2-013: portions of 005 and 022
Army File No. POH-2010-00289

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of two (2) copies of your letter, dated October 18, 2010, requesting pre-assessment consultation comments for the preparation of a joint Federal and State Draft Environmental Assessment (DEA) as required under the National Environmental Policy Act (NEPA) and Chapter 343 of the Hawai'i Revised Statutes (HRS), respectively, for the subject project. The CWB has reviewed limited information submitted with your letter and offers these comments on your project. Please note that our review is based solely on the information provided in the "Project Information" document and its compliance with Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. Your client 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://www.hawaii.gov/health/environmental/env-planning/landuse/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. A Section 401 Water Quality Certification (WQC) authorized under Section 401 of the Clean Water Act (CWA) and HRS, Section 342D-53 is required for the proposed project.

   Honolulu Engineer District (HED) staff informed the CWB staff through a cc copy of an email to you dated October 19, 2010 that [O]ur Admin File No. for this proposed project is POH-2010-00289. Applicable federal statute is Sec. 404, CWA. Pls *(SIC)* refer to this file No. in your discussions w/CWB, DOH..." As such, a CWA, Section 401 WQC is required. Your client, State of Hawai'i, Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) shall contact the DOH-CWB for detailed requirements.

3. The DEA should discuss the potential National Pollutant Discharge Elimination System (NPDES) permitting requirements authorized under CWA, Section 402 and managed by the DOH-CWB.

   Your client may be required to obtain an NPDES permit for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55):

   a. Storm water associated with construction activities, including excavation, grading, clearing, demolition, uprooting of vegetation, equipment staging, and storage areas that result in the disturbance of equal to or greater than one (1) acre of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. An NPDES permit is required before the start of the construction activities.

   b. Discharges of construction dewatering effluent.

   c. Herbicide application.

      Localized herbicide application in combination with mechanical methods is proposed to remove the existing vegetation.

      A Notice of Draft Pesticide General Permit (PGP) for Point Source Discharges From the Application of Pesticides and notice of public meetings was published in the June 4, 2010 Federal Register (75 FR 31775). In the summary, EPA stated that:

      > All ten EPA Regions today are proposing a draft NPDES general permit for point source discharges from the application of certain pesticides to waters of the United States. Once finalized, this permit will be available to operators in those areas where EPA is the NPDES permitting authority. This action is in response to the Sixth Circuit Court's ruling that vacated an EPA regulation that excluded discharges from the application of pesticides to or over, including near waters of the United States from the need to obtain an NPDES permit if the application was done in accordance with other laws. EPA requested and was granted a two year stay of the Court's mandate to provide time to draft and implement the

> permit noticed today. The stay of the mandate expires on **April 9, 2011**; where after, NPDES permits will be required for all point source discharges to waters of the United States of biological pesticides, and chemical pesticides that leave a residue. (Emphasis added)

The background information regarding the NPDES permit requirements for point source discharges from the application of pesticides is prescribed in the fact sheet for the EPA draft PGP and is available on the Internet at *http://www.epa.gov/npdes/pesticides*.

The DOH is delegated by EPA Region 9 in managing the NPDES permitting program in the State of Hawaii. An NPDES permit will be required for point source discharges from the application of certain pesticides to State waters on/after **April 9, 2011**.

4. The DEA shall evaluate the potential cumulative adverse impacts resulting from the construction, operation and maintenance of the proposed "**Kawainui Marsh Wetland Restoration and Habitat Enhancement Project.**"

   The restoration improvements are planned to start in the Fall of 2011 and be completed by the end of 2012. This construction schedule overlaps with the adjacent "***Kawainui Marsh Environmental Restoration Project***" located at TMKs: (1) 4-2-013:005 and (1) 4-2-013:022 and proposed by the U.S. Army Corps of Engineers (COE), Honolulu Engineer District (HED), and DLNR-DOFAW under HED's Civil Works (CW, P2#103776) program which is scheduled to begin in May 2011 during the dry months of the year and anticipated to take 3-4 months. In addition, the construction of a maintenance access way will encroach into HED's CW project boundary.

5. The DEA shall discuss the "Applicable Monitoring and Assessment Plan (AMAP)" in detail. The AMAP shall include the Data Quality Objective (DQO) planning process, which serves to to demonstrate that the construction, operation and maintenance of the proposed "**Kawainui Marsh Wetland Restoration and Habitat Enhancement Project**" will comply with HAR, §11-54-3(b) requirements.

   The affected receiving State waters, Kawainui Marsh and Kahanaiki Stream, at the project site are classified by the DOH as "Class 1, Inland Waters."

   HAR, §11-54-3(b) states, in part, that:

   "(b) Inland waters.

   (1) Class 1.

   It is the objective of class 1 waters that these waters remain in their natural state as nearly as possible with an absolute minimum of pollution from any human-caused

source. To the extent possible, the wilderness character of these areas shall be protected. Waste discharge into these waters is prohibited. Any conduct which results in a demonstrable increase in levels of point or nonpoint source contamination in class 1 waters is prohibited."

(A) Class **1.** a.

The uses to be protected in class **1.a** waters are scientific and educational purposes, protection of native breeding stock, baseline references from which human-caused changes can be measured, compatible recreation, aesthetic enjoyment, and other nondegrading uses which are compatible with the protection of the ecosystems associated with waters of this class;

(B) Class **1.b.**

The uses to be protected in class **1.b** waters are domestic water supplies, food processing, protection of native breeding stock, the support and propagation of aquatic life, baseline references from which human-caused changes can be measured, scientific and educational purposes, compatible recreation, and esthetic enjoyment. Public access to these waters may be restricted to protect drinking water supplies;"

a. By Executive Order No. 4258, dated January 6, 2009, the Governor of the State of Hawaii has set aside land at TMKs: **(1) 4-2-013:022**; 4-2-016:Por. 001, 005 and Por. 006 FOR HABITAT RESTORATION AND MARSH WILDLIFE SANCTUARY PURPOSES, to be under the control and management of the State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife, being that parcel of land situated at Kailua, Koolaupoko, Oahu, Hawaii, and identified as "Addition to Kawainui Wildlife Sanctuary," containing an area of 693.155 acres ..."

   Exhibit 2 of the HAR, Chapter 13-126 (titled RULES REGULATING WILDLIFE SANCTUARIES) (Eff. January 22, 2010) designated "Kawainui Marsh **wetlands**" (TMK Nos. **(1) 4-2-013:005**, and (1) 4-2-013:043) as "RESTRICTED wildlife sanctuaries."

   As such and pursuant to HAR, §11-54-5.1(b)(1)(A), Kawainui Marsh Wetlands shall be classified as "Wetlands," "Class 1.a, Inland Waters."

b. Pursuant to HAR, Chapter 13-5 (titled "Conservation District"), Kawainui Marsh wetlands at the project site is listed as "protective subzone," therefore, pursuant to HAR, §11-54-5.1(b)(2), Kawainui Marsh wetland at the project site can also be classified as "wetlands," "Class 1.b, Inland Waters."

6. The DEA shall discuss in detail and shall also demonstrate that the construction, operation and maintenance of the proposed **"Kawainui Marsh Wetland Restoration and Habitat Enhancement Project"** will meet CWA, Subsections 303(d) requirements.

As reported in DOH's "**2006 STATE OF HAWAII WATER QUALITY MONITORING AND ASSESSMENT REPORT,**" dated January 11, 2008, "Kawainui Marsh (Oahu) - Major wetland component of stream network separated as a Tier II decision unit from downstream receiving segment (Kawainui Stream) and upstream tributary segment (Kapaa Stream)." The entire Kawainui Marsh wetlands (EW) is listed as a Water Quality-Limited Segment (WQLS) under the authorization of CWA, Section 303(d) and subject to comply with Total Maximum Daily Loads (TMDL) to be established by the DOH and approved by the Environmental Protection Agency (EPA). Prior to the establishment of TMDL implementation plan, net increases of pollutants of concerns (POC) in Kawainui Marsh shall be avoided.

7. The DEA should discuss types and functions of the selected native plants to be planted to replace the existing vegetation within the wetlands and the upland slope along Kapa'a Quarry Road. The discussion should include why and how the selected native plants are capable of providing equal or better functions, such as nutrient uptake and solids filtration, etc., than the existing vegetation.

   One of the goals identified in the DEA is to restore native wetland habitat and naturalize Kahanaiki Stream. After gradual removal of invasive vegetation, various types of native plants would be used to revegetate the wetland area and the upland slope along Kapa'a Quarry Road. A wetlands delineation map should be provided in the DEA to distinguish the wetlands and upland boundaries. Calculations used to determine the amount of wetlands to be enhanced and filled should also be provided. Please clarify what "naturalize Kahanaiki Stream" means. Isn't the stream is at its natural state? Are there any manmade structures within the section of the Kahanaiki Stream?

8. The DEA should include a copy of the DLNR-DOFAW proposed "Operation and Maintenance Manual" or similar document that will "[e]nsure efficient DOFAW maintenance operations and improve their maintenance capabilities to sustain a remediated native ecosystem."

9. DLNR-DOFAW shall ensure that the construction and operation of the proposed **"Kawainui Marsh Wetland Restoration and Habitat Enhancement Project"** will not result in receiving State water quality degradation downstream from the project site. It is recommended that a long term AMAP be established and implemented for this purpose.

10. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 Water Quality Certification are required, must comply with the 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://www.hawaii.gov/health/environmental/water/cleanwater/index.html, or contact the Engineering Section, CWB, at 586-4309.

Sincerely,

ALEC WONG, P.E., CHIEF
Clean Water Branch

EC:ml

c: DOH-EPO #I-3389

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Alec Wong, P.E., Chief
Clean Water Branch
Department of Health
State of Hawai‘i
P.O. Box 3378
Honolulu, Hawai‘i 96801-3378

Dear Mr. Wong:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 9, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project. Our responses are numbered to correspond to your comments.

1. The project should be consistent with the antidegradation policy because the existing Kawainui Marsh wetland and level of water quality would be maintained with the project. Improvements within this wetland consist of restoration efforts to remove invasive vegetation and re-establish native vegetation. These efforts are intended to support wildlife by enhancing habitat for endangered waterbirds. The Draft EA will address the State’s water classification designation for the site and water quality criteria under Chapter 11-54, HAR.
2. A Section 401 Water Quality Certification would not be applicable to this restoration project based upon further consultation with the U.S. Corps of Engineers (COE). Based upon more detailed project information developed, a Department of Army permit would not be required now. This will be further addressed in the Draft EA.
3. National Pollutant Discharge Elimination System (NPDES) individual permit coverage for construction activities will be obtained for this project because activities occur within a State wildlife refuge. A NPDES permit for point source discharges from the application of certain herbicides will be obtained as applicable.
4. The Draft EA will address the cumulative adverse impacts associated with the project and COE’s environmental restoration project located nearby. A maintenance access across the wetland initially being considered under the project has been eliminated.
5. If required, an applicable monitoring and assessment plan (AMAP) that includes the data quality objective planning process will be prepared for this restoration project. This monitoring and assessment plan may incorporate similar plans and monitoring efforts as that developed for the COE’s ponds project. However, at this time a Section 401 Water

Quality Certification would not be applicable for this project. The information on inland waters classification for this project area is noted and will be incorporated into the Draft EA.

6. The Draft EA will address the Kawainui Marsh wetland's listing as a water quality limited segment.
7. The Draft EA will identify the types of native plants that DOFAW can use in replacing existing non-native and invasive plants. Native and cultural plantings are proposed to replace existing non-native vegetation because they would not be invasive to the environment and support the cultural values associated with Kawainui Marsh. Such plantings would be similar to other cultural landscaping efforts being conducted at other areas of the marsh by others. A wetlands delineation map approved by the COE in 2008 will be included in the Draft EA. Filling activities will not be conducted within the wetlands. Wetland restoration activities are intended to increase open water areas of Kahanaiki Stream that are being reduced and eliminated over time by the encroachment of invasive plant species. There are no known manmade structures within Kahanaiki Stream, however, historical use of this marsh was for taro *lo'i* and rice fields.
8. The statement in the summary provided to your branch to ensure efficient DOFAW maintenance operations was in reference to vehicle access so that DOFAW staff can efficiently transport staff and equipment as part of maintenance activities (e.g. cutting tree branches).
9. The restoration project is not expected to cause a degradation of water quality for downstream areas of the marsh, and the Draft EA will discuss project effects. If required, an AMAP would be established for this project.
10. The information of non-compliance with water quality and permitting requirements is noted and appreciated.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

PHONE (808) 594-1888

FAX (808) 594-1865

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
711 KAPI'OLANI BOULEVARD, SUITE 500
HONOLULU, HAWAI'I 96813

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HRD10/0021G

October 28, 2010

Ronald A. Sato, Senior Planner
Helber Hastert & Fee
Pacific Guardian Center, Makai Tower
733 Bishop Street, Suite 2590
Honolulu, Hawai'i 96813

RE: Pre-draft environmental assessment consultation
Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Kailua, Island of O'ahu

Aloha e Ronald A. Sato,

The Office of Hawaiian Affairs (OHA) is in receipt of your October 18, 2010 letter initiating consultation ahead of a draft environmental assessment (DEA) for a proposed wetland restoration and habitat enhancement project (project) in portions Kawainui Marsh (Kawainui). The project area includes 60 acres of wetlands and 20 acres of riparian lands or dry land forest. Grant funding from the U.S. Fish and Wildlife Service, Harold K.L. Castle Foundation and the State of Hawai'i will support the project.

Kawainui provides critical flood control for the urban areas of Kailua. National recognition to the area was provided in 1979 when Kawainui was determined eligible for listing on the National Register of Historic Places. International recognition was provided in 2005 when the Kawainui and Hamakua Marsh Complex was designated a Wetland of International Importance at the Ramsar Convention.

Overall, we support the intent of the project as the efforts to protect, restore and enhance the numerous resources in Kawainui will certainly benefit current and future generations of our community. The project description recognizes many fundamental traditional land management concepts which have been practiced by Native Hawaiians for generations and we are pleased to see acknowledgment of the interconnectivity between all living things from the uplands to the sea. Completion of this project certainly has the potential to contribute to the well being of a larger traditional cultural landscape and ecosystem which includes the adjacent lands of Hamakua, Kapa'a, Ka'elepulu and the near shore waters of Kailua Bay.

Certain historical accounts detail that in 1795, the last major successful military campaign of Kamehameha ended on O'ahu with what is commonly known as the "Battle of Nu'unanu", overlooking Ko'olaupoko. As skirmishes and hostilities were concluded and the victory of Kamehameha was confirmed, defeated chiefs were offered as sacrifices to ancestral gods as traditional protocol demanded. One can only imagine this horrific scene as warriors who had endured years of conflict turned to their leader for guidance. Perhaps it would be a time to avenge the countless families, friends and loved ones who had perished during this tumultuous period in Hawaiian history. The opportunity to ravage the lush lands of Kailua and its inhabitants would have only been the beginning of more bloodshed.

Instead, the order was given to begin what would be defined today as civil works projects and the repair of fishponds and lo'i began. It is highly likely the lands and people of Kawainui and Ka'elepulu would have benefitted from these efforts as a new period of healing and peace began.

The DEA will be the primary support document for multiple approvals which the project requires from the City and County of Honolulu and State of Hawai'i. Because federal funds will be used, compliance with the National Environmental Policy Act is also required. We hope that a broad consultation effort with individuals and organizations with an interest in Kawainui will be reflected in the DEA. Appropriate consideration should be afforded to public scoping meetings, if they are not occurring already.

The project summary included with your letter does not indicate the provisions of Section 106 of the National Historic Preservation Act apply. We seek clarification on this matter. Thank you for initiating consultation and we look forward to reviewing the DEA. Should you have any questions, please contact Keola Lindsey at 594-0244 or keolal@oha.org.

'O wau iho nō me ka 'oia'i'o,

Clyde W. Nāmu'o
Chief Executive Officer

C: Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawai'i 96813

Department of Interior
U.S. Fish and Wildlife Service
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96813

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Clyde W. Nāmuʻo, Chief Executive Officer
Office of Hawaiian Affairs
State of Hawaiʻi
711 Kapiʻolani Boulevard, Suite 500
Honolulu, Hawaiʻi 96813

Dear Mr. Nāmuʻo:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, Oʻahu, Hawaiʻi
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated October 28, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project. We appreciate your department's support of this project and have the following responses to their comments.

We concur that completion of this restoration project will contribute to the well being of the cultural landscape and ecosystem of Kawainui Marsh, and appreciate your background information provided.

The Draft EA document prepared will be a joint Federal and State environmental document to meet both Federal and State requirements. A broad consultation effort with organizations and the community has been and will continue to be conducted throughout this environmental process, and these efforts will be discussed in the document. Section 106 consultation is applicable and is being conducted of which the Office of Hawaiian Affairs will be a consulted party.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

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BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

PETER B. CARLISLE, MAYOR

RANDALL Y. S. CHUNG, Chairman
ANTHONY R. GUERRERO, JR.
WILLIAM K. MAHOE
THERESIA C. McMURDO
ADAM C. WONG

GEORGE "KEOKI" MIYAMOTO, Ex-Officio
MICHAEL D. FORMBY, Ex-Officio

WAYNE M. HASHIRO, P.E.
Manager and Chief Engineer

DEAN A. NAKANO
Deputy Manager

November 5, 2010

RECEIVED
NOV 12 2010
HELBER, HASTERT & FEE PLANNERS

Mr. Ronald A. Sato, AICP
Senior Planner
Helber, Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Your Letter Dated October 18, 2010 Requesting Comments on the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project Draft Environmental Assessment, TMK: 4-2-13:5 & 22

Thank you for the opportunity to comment on the proposed Kawainui Marsh Wetland Restoration Project.

The Board of Water Supply has no objections to the proposed habitat enhancement and restoration project at this time.

If you have any questions, please contact Robert Chun at 748-5443.

Very truly yours,

PAUL S. KIKUCHI
Chief Financial Officer
Customer Care Division

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Paul S. Kikuchi, Chief Financial Officer
Customer Care Division
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawai‘i 96813

Dear Mr. Kikuchi:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for letter dated November 5, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note that your department had no comments, and no water connections were planned at that time based upon discussions with your staff.

However, some water is now desired to support upland reforestation efforts to establish native Hawaiian plants used to replace existing non-native invasive vegetation. Water for this effort will be used on a temporary basis in establishing reforested areas and may involve some type of drip irrigation system that is turned on during certain timeframes on various days. A temporary construction water meter would be applied for from the City BWS. The Draft EA will include more information addressing this.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

DEPARTMENT OF COMMUNITY SERVICES
CITY AND COUNTY OF HONOLULU
715 SOUTH KING STREET, SUITE 311 • HONOLULU, HAWAII 96813 • AREA CODE 808 • PHONE: 768-7762 • FAX: 768-7792

PETER B. CARLISLE
MAYOR

ERNEST Y. MARTIN
ACTING DIRECTOR

November 3, 2010

RECEIVED
NOV - 8 2010
HELBER, HASTERT & FEE
PLANNERS

Mr. Ronald A. Sato, AICP
Senior Planner
Helbert, Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Kawainui Marsh Wetland Restoration
and Habitat Enhancement Project
Draft Environmental Assessment (DEA) Pre-assessment Consultation
Kailua, Hawaii
Submittal of Comments

In response to your request of October 18, 2010, the Department of Community Services (DCS) supports the subject project because it protects our physical environment in regards to restoring and improving the marsh. DCS administers job training and placement programs, and notes that the project would generate the related increase in employment for planners, engineers, and field workers.

Please remove DCS from the list of reviewing agencies. If we have any concerns, we will review the DEA on the OEQC web-based on-line database. In closing, if you need additional information, please call Mr. Charles McClure at 768-7755.

Sincerely,

Ernest Y. Martin
Acting Director

EYM:cm

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Samuel E.H. Moku, Director
Department of Community Services
City and County of Honolulu
715 South King Street, Suite 311
Honolulu, Hawai‘i 96813

Dear Mr. Moku:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for department’s letter dated November 3, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We appreciate your department’s support of the project. We will also remove your department from the list of reviewing agencies as requested.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

DEPARTMENT OF DESIGN AND CONSTRUCTION
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 11TH FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8480 • Fax: (808) 768-4567
Web site: www.honolulu.gov

PETER B. CARLISLE
MAYOR

COLLINS D. LAM, P.E.
ACTING DIRECTOR

DEPUTY DIRECTOR

November 9, 2010

RECEIVED
NOV 10 2010
HELBER, HASTERT & FEE
PLANNERS

Mr. Ronald A. Sato
Helber Hastert & Fee
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Kawainui Marsh Wetland Restoration and Habitat Enhancement Project Draft Environmental Assessment Pre-Assessment Consultation Kailua, O'ahu, Hawai'i

Thank you for inviting us to review the above Draft Environmental Assessment Pre- Assessment Consultation. The Department of Design and Construction does not have any comments to offer at this time.

Should you have any questions, please contact me at 768-8480.

Very truly yours,

Collins D. Lam, P.E.
Acting Director

CL:pg(388643)

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Collins Lam, P.E., Director
Department of Design and Construction
City and County of Honolulu
650 South Beretania Street, 11th Floor
Honolulu, Hawai‘i 96813

Dear Mr. Lam:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 10, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note your department does not have any comments to offer at this time.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

DEPARTMENT OF EMERGENCY MANAGEMENT
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET HONOLULU, HAWAII 96813
PHONE: (808)723-8960 FAX: (808)524-3439 WORLDWIDE WEB: www.oahudem.org

PETER B. CARLISLE
MAYOR

MELVIN N. KAKU
DIRECTOR

RECEIVED
NOV - 8 2010
HELBER, HASTERT & FEE
PLANNERS

November 4, 2010

Mr. Ronald A. Sato, AICP
Senior Planner
HELBER, HASTERT & FEE, Planners
Pacific Guardian Center, Makai Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

SUBJECT: Kawainui Marsh Wetland Restoration and Habitat Enchancement Project, Draft Environmental Assessment Pre-Assessment Consultation, Kailua, Oahu, Hawaii, TMK (1) 4-2-013:portions of 005 and 022

Thank you for the opportunity to review and comment on the above subject matter. The Department of Emergency Management does not have any comments at this time.

Sincerely,

Melvin N. Kaku
Director

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Melvin N. Kaku, Director
Department of Emergency Management
City and County of Honolulu
650 South Beretania Street, Basement
Honolulu, Hawai‘i 96813

Dear Mr. Kaku:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 4, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note your department does not have any comments to offer at this time.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 768-3343 • Fax: (808) 768-3381
Website: www.honolulu.gov

PETER B. CARLISLE
MAYOR

GEORGE "KEOKI" MIYAMOTO
ACTING DIRECTOR

IN REPLY REFER TO:
DRM 10-877

November 16, 2010

RECEIVED
NOV 17 2010
HELBER, HASTERT & FEE
PLANNERS

Helber, Hastert & Fee, Planners
Ronald A. Sato, AICP
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96743

Dear Mr. Sato:

Subject: Kawainui Marsh Wetland Restoration and Habitat Enhancement Project Draft Environmental Assessment Pre-Assessment Consultation, Kailua
TMK: 4-2-013: portions of 005 and 022

Thank you for informing us about the upcoming draft environmental assessment for the subject project. We do not have any comments at this time.

Should you have any questions, please contact Thomas Takeuchi of the Division of Road Maintenance, at 768-3608.

Sincerely,

George "Keoki" Miyamoto
Acting Director

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Westley K.C. Chun, Ph.D., P.E., Director
Department of Facility Maintenance
City and County of Honolulu
1000 Uluohia Street, Suite 215
Kapolei, Hawai‘i 96707

Dear Dr. Chun:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your department’s letter dated November 16, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note your department does not have any comments to offer at this time.

As requested, the Draft EA will be distributed to your agency as a pdf file on a CD. Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

DEPARTMENT OF PLANNING AND PERMITTING
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 7TH FLOOR • HONOLULU, HAWAII 96813
PHONE: (808) 768-8000 • FAX: (808) 768-6041
DEPT. WEB SITE: www.honoluludpp.org • CITY WEB SITE: www.honolulu.gov

PETER B. CARLISLE
MAYOR

DAVID K. TANOUE
DIRECTOR

JIRO A. SUMADA
DEPUTY DIRECTOR

2011/ELOG-414(ST)
2010/ELOG-2293

March 1, 2011

RECEIVED
MAR - 2 2011
HELBER, HASTERT & FEE
PLANNERS

Mr. Ronald A. Sato, AICP
Helber Hastert & Fee, Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Pre-assessment Consultation
Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Department of Land and Natural Resources (DLNR)
Kawai Nui Marsh - Kailua
Tax Map Key 4-2-13: portions of 5 and 22

This is in response to your letter initially received on October 19, 2010, and your follow-up letter dated February 17, 2011. We apologize for the very late response.

The proposed project involves much of the remaining area of Kawai Nui Marsh that is mauka of the Kawai Nui Marsh Management Plan Improvements which were the subject of a previous Special Management Area (SMA) Use Permit (File No. 2000/SMA-67) granted by the City Council on December 12, 2001 (Resolution No. 01-58, CD1). That SMA Permit covered a 70.7-acre area of the Marsh, which was part of the DLNR 2000 Kawainui Marsh Management Plan. We note that those previously approved improvements have not been initiated and, based on the U.S. Army Corps of Engineers Supplemental Environmental Assessment (2008), that the southern improvement area has been reduced in area to about 40 acres.

Given the length of time that has elapsed since the SMA Permit No. 2000/SMA-67 was granted, we believe that the pending draft environmental assessment should thoroughly discuss how the current proposal relates to and is dependant on improvements which were previously authorized. Please contact Steve Tagawa of our staff at 768-8024 if you have any questions.

Very truly yours,

Elizabeth Ch

for David K. Tanoue, Director
Department of Planning and Permitting

DKT:cs
cc: U.S. COE (Nani Shimabuku)
G:/SMAs/2009/KawainuiHelber.doc

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. David K. Tanoue, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, Hawai‘i 96813

Dear Mr. Tanoue:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated March 1, 2011 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We confirm your department’s information on a previous Special Management Area (SMA) Use Permit (Resolution No. 01-58, CD1) issued for a 70.7-acre portion of Kawainui Marsh. The area covered under that permit was predominantly associated with the U.S. Corps of Engineers ponds project which is located adjacently *makai* (east) of our project area. The area covered under that permit did include a portion of this project’s area. However, a new Special Management Area Use Permit would be required for this project. The Draft EA will address this project’s relation to the existing permit and its consistency with SMA policies.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

DEPARTMENT OF PARKS AND RECREATION

CITY AND COUNTY OF HONOLULU

KAPOLEI HALE, 1000 ULUOHIA STREET, STE. 309 • KAPOLEI, HAWAII 96707
Phone: (808) 768-3003 • FAX: (808) 768-3053 • Internet: www.honolulu.gov

PETER B. CARLISLE
MAYOR

LESTER K. C. CHANG
ACTING DIRECTOR

RICHARD HARU
DEPUTY DIRECTOR

RECEIVED
DEC - 1 2010
HELBER, HASTERT & FEE
PLANNERS

November 30, 2010

Mr. Ronald A. Sato, AICP
Helber Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, Oahu, Hawaii
TMK (1) 4-2-013: portions of 005 and 022

Thank you for the opportunity to review and comment at the pre-consultation stage of the Draft Environmental Assessment for the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project.

The Department of Parks and Recreation has no comment, as the proposed project will not impact any program or facility of the department. You may remove us as a consulted party to the balance of the EIS process.

Should you have any questions, please contact Mr. John Reid, Planner, at 768-3017.

Sincerely,

LESTER K. C. CHANG
Acting Director

LKCC:jr
(388734)

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Gary B. Cabato, Director
Department of Parks and Recreation
City and County of Honolulu
1000 Uluohia Street, Suite 309
Kapolei, Hawai‘i 96707

Dear Mr. Cabato:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 30, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note your department has no comment on the project as it will not impact any program or facility of your department. We will also remove your department as a consulting party on this environmental review process as requested.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 768-4730 • Internet: www.honolulu.gov

PETER B. CARLISLE
MAYOR

WAYNE Y. YOSHIOKA
ACTING DIRECTOR

SHARON ANN THOM
DEPUTY DIRECTOR

KENNETH TORU HAMAYASU, P.E.
SECOND DEPUTY DIRECTOR

TP10/10-388638R

November 10, 2010

Mr. Ronald A. Sato, AICP
Senior Planner
Helber, Hastert & Fee Planners, Inc.
Pacific Guardian Center
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

RECEIVED
NOV 16 2010
HELBER, HASTERT & FEE
PLANNERS

Dear Mr. Sato:

Subject: Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment (DEA) Pre-Consultation

This responds to your letter of October 18, 2010, requesting our comments concerning this proposed project.

Our Traffic Engineering Division (TED) recommends that the DEA discuss any traffic impacts and proposed mitigative measures which the project may have on the surrounding street system.

Thank you for the opportunity to review this matter. Should you have any further questions, please contact Michael Murphy of my staff at 768-8359.

Very truly yours,

WAYNE Y. YOSHIOKA
Acting Director

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Wayne Y. Yoshioka, Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawai‘i 96813

Dear Mr. Yoshioka:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 10, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

The Draft EA will address the traffic impact likely resulting from the project, and will identify mitigative measures if appropriate.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

HONOLULU FIRE DEPARTMENT

CITY AND COUNTY OF HONOLULU

636 South Street
Honolulu, Hawaii 96813-5007
Phone: 808-723-7139 Fax: 808-723-7111 Internet: www.honolulu.gov/hfd

PETER B. CARLISLE
MAYOR

KENNETH G. SILVA
FIRE CHIEF

ROLLAND J. HARVEST
DEPUTY FIRE CHIEF

November 3, 2010

RECEIVED
NOV - 5 2010
HELBER, HASTERT & FEE
PLANNERS

Mr. Ronald Sato, AICP
Senior Planner
Helber Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Draft Environmental Assessment Preassessment Consultation
Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Kailua, Oahu, Hawaii
Tax Map Key: 4-2-013: Portions of 005 and 022

In response to your letter of October 18, 2010, regarding the above-mentioned subject, the Honolulu Fire Department reviewed the material provided and determined there will be no significant impact to its services.

Should you have any questions, please call Battalion Chief Socrates Bratakos of our Fire Prevention Bureau at 723-7151.

Sincerely,

KENNETH G. SILVA
Fire Chief

KGS/SY:bh

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Kenneth G. Silva, Chief
Honolulu Fire Department
City and County of Honolulu
636 South Street
Honolulu, Hawai‘i 96813-5007

Dear Mr. Silva:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated November 3, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note your department believes the project will have no significant impact on your department’s protective services.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

PETER B. CARLISLE
MAYOR

LOUIS M. KEALOHA
CHIEF

DELBERT T. TATSUYAMA
RANDAL K. MACADANGDANG
DEPUTY CHIEFS

OUR REFERENCE DMK-DK

October 27, 2010

RECEIVED
NOV - 1 2010
HELBER, HASTERT & FEE
PLANNERS

Mr. Ronald A. Sato, AICP, Senior Planner
Helber Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

This is in response to your letter of October 18, 2010, requesting comments on a Pre-Consultation, Draft Environmental Assessment, for the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project.

This project should have no unanticipated impact on the facilities or operations of the Honolulu Police Department.

If there are any questions, Major Susan Ballard of District 4 (Kaneohe/Kailua/Kahuku) may be contacted at 247-2166.

Sincerely,

LOUIS M. KEALOHA
Chief of Police

Dave Kajihiro

By
DAVE M. KAJIHIRO
Assistant Chief of Police
Support Services Bureau

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Mr. Louis M. Kealoha, Chief
Honolulu Police Department
City and County of Honolulu
801 South Beretania Street
Honolulu, Hawai‘i 96813

Dear Mr. Kealoha:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your letter dated October 27, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note your department believes the project will have no unanticipated impact on your department’s facilities or operations.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

Hawaiian Telcom

RECEIVED
OCT 28 2010
HELBER, HASTERT & FEE
PLANNERS

October 26, 2010

Helber Hastert & Fee, Planners
Pacific Guardian Center, Makai Tower
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Attention: Mr. Ronald A. Sato, ACIP

Dear Mr. Sato:

Subject: **Kawainui Marsh Wetland Restoration and Habitat Enhancement Project - Draft Environmental Assessment Pre-Assessment Consultation**

Thank you for the opportunity to review and comment on the Draft Environmental Assessment Pre-Assessment Consultation for the subject project.

Hawaiian Telcom does not have any comments to offer at this time. Please continue to include us during the design stages of the project.

If you have any questions or require assistance in the future on this project, please call Les Loo at 546-7761.

Sincerely,

Lynette Yoshida
Senior Manager – OSP Engineering
Network Engineering & Planning

cc: File [Kailua]

Helber Hastert & Fee
Planners, Inc.

December 20, 2011

Ms. Lynette Yoshida, Senior Manager
Network Engineering and Planning
Hawaiian Telcom
P.O. Box 2200
Honolulu, Hawai‘i 96841

Dear Ms. Yoshida:

Kawainui Marsh Wetland Restoration and Habitat Enhancement Project
Draft Environmental Assessment Pre-Assessment Consultation
Kailua, O‘ahu, Hawai‘i
TMK (1) 4-2-013: portions of 005 and 022

Thank you for your company’s letter dated October 26, 2010 providing comments as part of pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note your department has no comments to the project at this time. As requested, Hawaiian Telcom will be coordinated with as appropriate during the project’s design phase.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 545-2055, or by email at rsato@hhf.com.

Sincerely,

HELBER HASTERT & FEE, Planners

Ronald A. Sato, AICP
Senior Planner

APPENDIX A-2

Kailua Neighborhood Board No. 31
Regular Meeting Minutes; Thursday, August 5, 2010
Regular Meeting Minutes; Thursday, July 7, 2011

KAILUA NEIGHBORHOOD BOARD NO. 31

P.O. BOX 487 • KAILUA, HAWAII 96734
PHONE (808) 768-3710 • FAX (808) 768-3711 • INTERNET: http://www.honolulu.gov

DRAFT REGULAR MEETING MINUTES
THURSDAY, AUGUST 5, 2010
KAILUA RECREATION CENTER

Call to Order: Chair Chuck Prentiss called the meeting to order at 7:10 p.m., **with a quorum of 17 members present**. Note – This 19-member Board needs 10 members for quorum and to take official Board action.

Members Present – Larry Bartley, Jon Chinen, Jim Corcoran, Virginia Enos, Derrick Fenske, Debbi Glanstein, Michael Hirao, Richard Hill, Knud Lindgard, Charles Prentiss, Ursula Retherford, Claudine Tomasa, Linda Ure, Norma Bustos, Catie Fernandez, Michael Hawes, Donna Wong, and Ronald Weinberg.

Members Absent – Knud Lindgard.

Guests – Councilmember Ikaika Anderson, Representatives Chris Lee and Cynthia Thielen, Captain Damien Kahaulelio (Honolulu Fire Department), Officer James Causey (Honolulu Police Department), Linda Read (Marine Corps Base Hawaii-Public Affairs Office), Mark Scalzone (Mayor's Office), Dennis Cheng, Rudy Ahlo, Natalie Oda, Ed Enos, Kevin Juan, Doug Brown, Angela & Frances Britten, David Kim, Paul Haring, Stephen Smith, Ken Unten, Jim Mitten, Miles Shiratori, Marrie Morgan, Nancy Cartwright, Joe Gilman, Rosie Goo, Joanne Flannery, Cierra Cedar, Madeline Bulacan, Clinton Abe, Stann Reiziss, Wirshi Huddengioidy, Chris Delannay, Franc & Diane Kam, Manny Sardinha Jr., Glenn Uyeshiro, John Reyes, Maria Goaok, Bob Bonte, David Curry, Joseph Dillinger, Sharon Nichols, Jim & Sharron Wask, Rose Miltier, and Mary Chanel-Benjamin (Neighborhood Commission Office staff).

FILLING VACANT SEAT: No candidate stepped forward to fill the seat

ANNOUNCEMENTS:
A candidate forum was slated for October 19, 2010.

AGENCY REPORTS:

Honolulu Police Department (HPD) – Officer James Causey circulated a report with the following information:

- July 2010 Statistics – There were 7 simple assaults, 5 aggravated assaults, 16 burglaries, 6 narcotics, 51 firework violation, 32 hazardous driver, 12 car thefts, 78 motor vehicle collisions, 3 robberies, 18 suspicious person, 16 suspicious vehicles, 53 thefts, and 35 unauthorized vehicle entry.
- Neighborhood Security Watch Program (NSWP) – A suspicious motorcycle driver was reported; however, reporting license plates could help with identifying the problem. For more information and participation in NSWP, call Officer Duane Samson at 262-6555.

Questions, comments, and concerns followed:

Ulupaina Street – Speeding reported and possible HPD could set up a speed trap there. A manhole cover was loose and causing noise when vehicles speed over the cover. 78 MVC was a high number statistic for Kailua.

Honolulu Fire Department (HFD) – Captain Damien Kahaulelio circulated a report with the following information:

- July 2010 Statistics – There were 17 fires: 5 rubbish, 3 vehicles, 7 wildland and 2 structures; 104 medical emergencies, 15 search and rescues, and 28 miscellaneous calls for service.
- Safety Tip – A home fire escape plan is an integral part of our family's safety. Advanced smoke and fire warning increases ability to exit safely and quickly. A well prepared escape plan and practice may save your family's lives.

Questions, comments, and concerns followed:

Mokulua Drive – No information was available regarding an incident involving a segway on July 19, 2010.

- Reach the Mayor's office at 768-4141.

Questions, comments, and concerns followed:

1. Board Budget – The recent 50 percent cut to the system will not be adequate to operate the current board system. Can the commission provide reasoning for the budget cut? The Board moved to request for R. Gee, executive secretary to the Neighborhood Commissioners to make a personal visit during the Board meeting to provide further budget information.
2. Landfill – What was Acting Mayor Kirk Caldwell's stance on the landfill issue?

Senator Jill Tokuda – Senator Tokuda was not present but can be reached at 587-7215 or by email at sentokuda@capitol.hawaii.gov.

BOARD PRESENTATIONS:

Wetland Restoration Plan of Kawai Nui Marsh – Helber, Hastert and Fee circulated a report:

1. Background – The marsh restoration and habitat enhancement project aims to restore habitat for native Hawaiian waterbirds, migratory shorebirds and waterfowl, and native fish species. The planning process involves community organization, agencies, and the pubic to integrate this wildlife sanctuary ownership and encourage further restoration.
2. Location & Objectives – The marsh encompasses about 830 acres of land and the largest remaining wetland in the State. The restoration involves a total of 80 acres east of Kapaa Quarry (KQ) Road: Tax map Key No. (1) 4-02-013: portions of 005, 022 and 043. 60 acres of wetland and 20 of adjacent riparian and forested slopes; all owned by the State. The marsh provides flood control and sediment filtration that protect urbanized areas of Kailua and the bay ecosystem and also an important habitat for endangered birds and species. Challenges with management and maintenance have resulted in an invasion of alien species and overgrowth.
3. Planning Issues – Some issues to tackle are: what native plants to re-vegetate, how to control predation of native birds, storm water runoff from KQ, maintenance capabilities to sustain a re-mediated native ecosystem, and how to accommodate public access. There will be an EIS period for input.

Questions, comments, and concerns followed:

1. EIS Timeline – The draft should be done by the year 2011.
2. Area Management – Area being considered only has been donated by the State. No plan was available covering the entire area. The roadway is private.
3. Funding – The $800,000 for the project is not from the State.
4. Plan Meeting – Saturday, August 7, 2010 at Le Jardin School beginning at 1:00 p.m.

BOARD MOTIONS: Chair Prentiss relinquished the gavel to Vice Chair Bartley.

Motion 1 from The Public Health, Safety, and Civil Defense Committee – **Prentiss moved seconded by Hawes that the Kailua Neighborhood Board supports Bill 34 CD1 Regulating the Use of Fireworks.**

Questions, comments, and concerns followed:

1. Some major countries and cities in China, Hong Kong and Taiwan have banned fireworks.
2. Motion 1 – **The motion was adopted; 13-3-1.** (Ayes: Chinen, Corcoran, Enos, Fenske, Fernandez, Glanstein, Hawes, Hill, Prentiss, Retherford, Tomasa, Weinberg, and Ure. No: Bustos, Wong and Hirao. Abstain: Bartley)

NA, M. Chanel-Benjamin left the meeting at 10:00 p.m.

All remaining business of the Board Agenda was deferred to the next meeting.

ADJOURNMENT: The meeting was adjourned shortly after 10:00 p.m.

Submitted by M. Chanel-Benjamin Reviewed by Chair Prentiss

KAILUA NEIGHBORHOOD BOARD NO. 31

c/o NEIGHBORHOOD COMMISSION OFFICE • 530 SOUTH KING STREET, ROOM 406 • HONOLULU, HAWAII 96813
TEL: (808) 768-3710 • FAX: (808) 768-3711 • INTERNET: http://www1.honolulu.gov

DRAFT REGULAR MEETING MINUTES
THURSDAY, JULY 7, 2011
KAILUA RECREATION CENTER

CALL TO ORDER: Chair Chuck Prentiss called the Kailua Neighborhood Board (NB) meeting to order at 7:18 p.m., **with a quorum of 16 members present**. Note – This 19-member Board requires 10 members to establish quorum and to take official Board action.

Members Present – Joseph Aiona, Larry Bartley, Jon Chinen, Douglas Dudevoir, Derrick Fenske, Debbi Glanstein, Michael Hawes, William Hicks, Michael Hirao, Knud Lindgard, Chuck Prentiss, Ursula Retherford, Randy Rodriguez, Kelly Tomioka (arrived at 7:30 p.m.), Claudine Tomasa, Ronald Weinberg (departed at 9:04 p.m.), and Donna Wong.

Members Absent – Pamela DaGrossa and Virginia Enos.

Guests – Acting Captain David Taratko (Honolulu Fire Department); Lieutenant John Vines (Honolulu Police Department); Representative Chris Lee; Senator Pohai Ryan; Alenka Remec (Mayor Peter Carlisle's Representative); Councilmember Ikaika Anderson and Jo Aweau (Councilmember Anderson's Office); Major Alan Crouch, Sergeant Whittington, and Tiffany Patrick (Marine Corps Base Hawaii); Tom Heinrich (Executive Secretary – Neighborhood Commission Office); Bob Finley (Neighborhood Commissioner); Rowell Crivello (Bob's Kailua); Clarlene MacPherson (Windward Neighborhood Security Watch); Leigh Prentiss (Outdoor Circle); Joe Gilman; Laurel Leslie; Mary Pulle; Marria Gorak; John Hung; Helen Walker; Noah Downes; Sara Thomas; Todd Hendricks; Theona Kapoi (Neighborhood Commission Office).

VACANCIES: The Kailua NB does not have any vacant seats at this time.

PUBLIC SAFETY AGENCY REPORTS:

Honolulu Police Department (HPD) – Lieutenant John Vines circulated a report and highlighted the following:

- May 2011 Statistics: There were 4 auto thefts, 13 assaults, 14 burglaries, 7 drug/narcotic offenses, 4 graffiti offenses, 3 robberies, 47 thefts, and 48 unauthorized entry into motor vehicles (UEMV). Further statistics can be found on the HPD website at www.honolulupd.org.
- Parade: It was noted that the July 4th Parade was good, except for intoxicated people in the park causing some trouble. The traffic was heavy and HPD expressed their appreciation to residents for being patient. It was also noted that the fireworks statistics were down and there were no major problems.

Questions, comments, and concerns followed:

Statistics Comment – Board Member Retherford made the following statement:
"Property Crimes in November 2010 were 127, February 2011 were 132, March 2011 were 109, April 2011 were 161 and May 2011 were 185. I [Retherford] do not have the statistics for December and January. Looking at the statistics for the above months, except for a decrease in March, there has been a steady increase in property crimes in Kailua. April and May show a steep increase from 127 in November to 161 in April, and 185 in May. That translates into a percentage increase of 46% for May compare to November. Comparing November to May [the] following are the increase for the different categories:

	November 2010	May 2011	% increase
BURGLARY	29	33	14%
THEFT	47	61	30%
UEMV	25	50	100%

The statistics presented each month by HPD show the crimes and in which neighborhoods they occur, but they no longer present the month to month, year to year, comparisons, neither in actual figures nor percentages. Not

- Town Hall Meeting – There will be a meeting at the Windward Community College on July 28, 2011 at 7:00 p.m. that he hosts twice a year and all are welcome to attend.
- House Bill (HB) 1524 – This Bill is related to the theft of agriculture and is still alive and sits in the Senate.
- Kayaks – There is not much going on with the kayak situation in Kailua, however, one way to ensure a business is running legally is through taxes. If businesses fail to file their taxes, they may receive a maximum fine of $2,000.
- Landfill – All site selections will be looked at with due diligence. The City will have to do what needs to be done.

Questions, comments, and concerns followed:

1. Community Projects – It was commented that there are community painting projects that need to be scheduled. Representative Lee will keep residents informed with those dates and projects.
2. HB 1555 – This Bill is relating to the States ability to sell or lease public lands. This bill may go in the direction of not necessarily selling the land, but collecting the funds necessary. This bill is related to Senate Bill 2 which calls for an inventory of all clean title lands before sales or transfers are made.

Chair Prentiss noted that there is no Governor's Representative assigned to the Kailua NB. A letter will be sent to the Governor requesting a representative to be present at the Kailua NB meetings.

PRESENTATION:

Kawainui Marsh Wetland Restoration Plan – Ron Sato, representative of the State Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), distributed a handout to the Kailua NB and highlighted the following:

- Background – The Kawainui Marsh Wetland Restoration and Habitat Enhancement Project aims to restore habitat for native Hawaiian waterbirds, migratory shorebirds and waterfowl, and native fish species within 80 acres of the Kawainui Marsh located in Kailua, Ko`olaupoko, O`ahu.
- Conceptual Restoration Plan – The Conceptual Restoration Plan for the project area consists of: 1. wetland restoration and erosion control for a portion of Kawainui Marsh; 2. habitat restoration for native Hawaiian waterbirds, migratory shorebirds and waterfowl, and native fish species; 3. improvements to support DOFAW's maintenance operations; and 4. provide public access to a portion of the marsh.
- Wetland Restoration Program – The program would consist of several steps occurring in phases over time due to seasonal conditions, and allow Kahanaiki Stream and associate wetland to naturally reestablish itself. Restoration efforts will incorporate an adaptive management process to provide DOFAW with the ability to adapt and modify activities depending upon the progress of restoration efforts along with possible resource issues.
- How it will be Completed –
    - Invasive vegetation will be removed along with dead vegetation that has formed a thatch layer. A contemporary soil layer about 20 inches thick below this vegetation due to sediment settling from storm water runoff into this marsh over the years.
    - A tractor, mower, or floating excavator would be used to cut or grub the vegetation and thatch layer up to a few inches below the soil level.
    - A tiller would be used to break up the soil to about four inches in depth to expose the invasive vegetation seed bank being eliminated and to aerate the soil. This process minimizes potential effects on subsurface archaeological resources.
    - Areas would be cleared in phases of about three or four acres in size.
    - Native plants would be reestablished in the wetland along with transitional sections to upland areas.
    - Vegetation mowed or grubbed would either be left on the site to decompose or temporarily stored in established staging areas within upland areas. Amount of biomass removed would be reduced.
- Upland Reforestation Program – Restoration efforts for the upland area are intended to reestablish it as a native upland forest area using a "hybrid ecosystem" restoration concept. This concept allows native and existing non-native species to mix in a transitional period that benefits native biodiversity. It allows for a more practical and cost effective process of reestablishing a complete native forest.
    - Some non-native plants will remain to serve as over story canopies. Other aggressive invasive species to be contained while understory native plantings grow and mature. Once an appropriate

density of native vegetation has been restored, remaining non-native trees and other species would be removed and additional native shrubs and ground covers planted.
    - Various types of native vegetation would be used for the area similar to that being implemented at Na Pohaku o Hauwahine.
    - Transitional plantings using cultural plants along with theme plantings would be incorporated between the wetland and low mesic forest areas.
- Other Improvements – Other improvements would be implemented to support DOFAW maintenance operations, mitigate stormwater runoff, and increase public access to the area.
    - Continue existing predator control program, and install a protective fence around the wetland.
    - Provide a maintenance pathway for vehicles and equipment transport within the project area.
    - Repair existing drainage culverts along Kapa`a Quarry Road, and implement site improvements to detain runoff discharging into marsh.
    - Provide accessory improvements increasing public access of the area.
- More Information – The presentation can be found online a http://hawaii.gov/dlnr/dofaw/hkmc. For further information regarding the project contact Ron Sato at 545-2055 or via email at rsato@hhf.com.

Questions, comments, and concerns followed:

1. Cost – It was clarified that it will cost about $900,000 to complete the first phase that was presented tonight. Some of the funding will come from the State.
2. Completion Date – It was clarified that the completion date will be several years out but within four years, a good portion of the project should be done.
3. Soil Testing – It was questioned if the soil that is being move has been tested for anything harmful to residents. Sato noted that the soil is being mowed and not moving locations, the only thing moving is the vegetation. Some metals were found in the sediment however, they were consistent with eroding bedrock as well.
4. Environmental Assessment – The Kailua NB will be notified of the Environmental Assessment when it is ready.

APPROVAL OF MINUTES:

June 2, 2011 Meeting Minutes – **The June 2, 2011 Regular Meeting Minutes of the Kailua NB were approved by UNANIMOUS CONSENT, 16-0-0** (**AYE**: Aiona, Bartley, Chinen, Dudevoir, Fenske, Glanstein, Hawes, Hicks, Hirao, Lindgard, Prentiss, Retherford, Rodriguez, Tomioka, Tomasa, and Wong).

BOARD MOTIONS & RESOLUTIONS:

Motion 1 – **The Kailua Neighborhood Board approves the Olelo videotaping of its regular Board meetings by Tinkle Malama for Fiscal Year 2012. The Kailua NB ADPOTED the MOTION by UNANIMOUS CONSENT, 16-0-0** (**AYE**: Aiona, Bartley, Chinen, Dudevoir, Fenske, Glanstein, Hawes, Hicks, Hirao, Lindgard, Prentiss, Retherford, Rodriguez, Tomioka, Tomasa, and Wong).

Motion 2 – **The regular monthly meetings of the Kailua Neighborhood Board shall be held on the first Thursday of the month at the Kailua Recreation Center, 21 N. Kainalu Drive, at 7:00 p.m. The Kailua NB ADPOTED the MOTION by UNANIMOUS CONSENT, 16-0-0** (**AYE**: Aiona, Bartley, Chinen, Dudevoir, Fenske, Glanstein, Hawes, Hicks, Hirao, Lindgard, Prentiss, Retherford, Rodriguez, Tomioka, Tomasa, and Wong).

Motion 3 – Motion made by the Public Health, Public Safety, and Civil Defense Committee: It was clarified that the Big Island has hazard zones signs and directions to evacuation sites. **In an effort to become a Tsunami Ready Community and to raise public awareness, the Kailua Neighborhood Board requests that the City and County of Honolulu post Tsunami signage -similar to what is already posted on the Big Island of Hawaii - as soon as such signage is provided by the Hawaii State Civil Defense and the National Weather Service. The Kailua NB ADPOTED the MOTION by UNANIMOUS CONSENT, 16-0-0** (**AYE**: Aiona, Bartley, Chinen, Dudevoir, Fenske, Glanstein, Hawes, Hicks, Hirao, Lindgard, Prentiss, Retherford, Rodriguez, Tomioka, Tomasa, and Wong).

Resolution – Resolution made by the Planning, Zoning and Environment Committee: **The Kailua Neighborhood approves the resolution titled: Opposing direct or indirect public financing of the proposed undersea cable**

from Lana`i and Moloka`i to O`ahu, and opposing direct or indirect public financing of the construction and maintenance of industrial wind power plants providing energy for O`ahu. Discussion followed:

- Committee Chair Wong noted that this will use public financing and it will increase everyone's bills. A picture of wind turbines was circulated amongst the Board members showing its abandonment at South Point on the Big Island. Wind turbines are only good for 20 years. There was also a correction to the 8th WHEREAS, which should read "…Moloka`i for O`ahu that would; and…"
- A question was raised about the 10th WHEREAS, which an answer could not be provided.
- A question was raised about the 4th and 5th WHEREAS, and if the undersea cables would have and adverse effect to the marine life. Committee Chair Wong stated that she was not sure of the effect because there is no Environmental Impact Statement to determine that yet.
- Board Member Bartley stated that he was in favor of the motion and would have like to have a representative from the State or the Hawaiian Electric Company to better inform the Kailua NB of this project.
- It was suggested to defer this matter until more information could be found out about the project.
- Board Member Retherford made the following statement:

  "I support this resolution not simply because of the unfair expectation that Oahu electric rate payers absorb most of the cost of this proposed wind turbine venture while the energy companies and investors will pocket the profits. But my support is also based on deeper moral grounds.

  Some point out that mainland states help each other out by supplying energy to each other, therefore our islands should do the same. This ignores the differential of impacts. The impacts of a large number of 400 foot high turbines with wing spans the size of a Boeing 747 on two small land masses are quite different from the impacts of similar turbines on the vast lands of California and other large states.

  Molokai and Lanai are two small islands inhabited mostly by local people, many of whom are of Hawaiian descent, wanting to preserve and perpetuate their values and culture. Their lifestyles in general are mindful of the finite resources of their island and the need to minimize their footprint so as to pass on a wholesome environment to those who come after. There culture is tightly interwoven with the spirit of the land. The blight of these big wind turbines on the landscape of these tow small islands represents a virtual rape of their land, a rape of the aina into which so much of their Hawaiian culture is webbed. What is being proposed here is not unlike the behavior of a colonizing power that is insensitive to indigenous habitats, values and cultures.

  Some argue that since Oahu helps support their schools, and other things, the people of Molokai and Lanai should be willing to do something in return, such as help with our energy needs. I am opposed to such a demand for pack-back that entails the sacrifice of the soul of Molokai and Lanai in order to feed the insatiable appetite for energy on Oahu. I find this morally wrong.

  I agree with all the WHEREAS and the BE IT RESOLVED of this resolution."

The Kailua NB ADPOTED the MOTION, 10-4-2 (**AYE**: Bartley, Chinen, Hicks, Lindgard, Prentiss, Retherford, Rodriguez, Tomioka, Tomasa, and Wong; **NO**: Dudevoir, Glanstein, Hawes, and Hirao; **ABSTAIN**: Aiona and Fenske).

COMMITTEE REPORTS: These items were deferred.

ADJOURNMENT: The meeting adjourned at 10:33 p.m.

Submitted by: Theona Kapoi, Neighborhood Commission Office

Reviewed by: Chuck Prentiss, Kailua Neighborhood Board Chair

APPENDIX A-3

Public Informational Meeting, Thursday, July 29, 2010

Helber Hastert & Fee
Planners, Inc.

SIGN-IN SHEET
Kawainui Wetland Restoration Plan Public Information Meeting
Thursday July 29, 2010, 6:30 p.m.
Le Jardin Academy

Name	Affiliation	Email	Phone
Rick Quinn	HHF	rquinn@hhf.com	545-2055
POOLA VILLARIMO	resident	—	(808) 389-9716
Chuck Burrows	Ahahui Malama	chuckb@hawaii.rr.com	263-8008
Terry George	Harold K.L. Castle Fdtn.	tgeorge@castlefoundation.org	263-7071

SIGN-IN SHEET

Kawainui Wetland Restoration Plan Public Information Meeting

Thursday July 29, 2010, 6:30 p.m.

Le Jardin Academy

Helber Hastert & Fee
Planners, Inc.

Name	Affiliation	Email	Phone
NORMAN (PUNA) NAM	KAILUA CHAMBER OF COM.		391-5895
Julie Zimmerman	AECOM	julie.zimmerman@aecom.com	356-5382
Michelle Mason	AECOM	michelle.mason@aecom.com	356-5323
Meredith Speicher	NPS-RTCA	meredith_speicher@nps.gov	541-2693 x 725
Shannon Wood	Windward Ahupuaa Alliance	info@waa-hawaii.org	224-4496 247-6366
Andrea Malahoff	Council member Ikuko Anderson	amalahoff@honolulu.gov	768-5003
ROB GERWIG	Pacific Dynamics	RGERWIG@GMAIL.com	386-7146

Helber Hastert & Fee
Planners, Inc.

SIGN-IN SHEET

Kawainui Wetland Restoration Plan Public Information Meeting

Thursday July 29, 2010, 6:30 p.m.

Le Jardin Academy

Name	Affiliation	Email	Phone
Sherry Campagna	AECOM	sherry.campagna@aecom.com	343-9785
Derrick W. Fenske	Resident	~~derri~~ surfdfense@msn.com	953-5604
Paul Brennan	KHS - resident	drpbrennan@yahoo.com	262-6828
Francine Hagstrom	LKOC Pub Affair Comm	Francine33333@aol.com	

Helber Hastert & Fee
Planners, Inc.

Project Name:	Kawainui Marsh Wetland Restoration and Habitat Enhancement Project	Project #	2009132
Subject:	Public Information Meeting #1		
Date:	Thursday, July 29, 2010	Time:	6:30-8:00 pm
Location:	Le Jardin Academy, Wang Auditorium	Recorded by:	Aki Marceau
Presenters:	Ati Jeffers-Fabro – State Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) David Curry- Helber Hastert & Fee (HHF) Richard Quinn - HHF Ronald Sato - HHF Aki Marceau – HHF		
Attendees:	See Sign-In Sheet		

The purpose of this Public Information Meeting (PIM) was to: 1) notify the public of the project; 2) provide background information; 3) discuss planning issues and preliminary concepts; and 4) solicit input from the community. The PIM opened with an introduction of participants and general overview of the meeting. This was followed by an approximately 20-minute PowerPoint presentation by HHF, and closed with a question and answer session.

The following is a list of questions, responses, and comments received from the community.

Question: After completing wetland restoration and bird habitat mitigation, what will the water quality be (fresh/brackish)? There is a concern with salvinia molesta present in other areas of the marsh, and fresh water supports this invasive species.

Response: *The Environmental Assessment will address water quality effects from restoration improvements, and will coordinate with the Department of Health to determine water quality and public health risks.*

Question: Have you met with the Kailua Neighborhood Board?

Response: *A presentation with that neighborhood board is scheduled for August 5, 2010.*

Question: How was the acreage of the project determined?

Response: *The acreage was determined by the area under DOFAW's jurisdiction and the scope of the grant funded.*

Question: Does public access mean a parking lot?

Response: *DOFAW and HHF hope to receive input from the public regarding their vision for public access. The actual construction of amenities such as this may need other funding sources if not allowed under the grant.*

Question: Who will be doing the construction work?

Response: *DOFAW staff will conduct some of the restoration work and but will likely have to hire a contractor for some of the work.*

Question: What type of heavy equipment would need to be brought in?

Response: *An excavator will likely be necessary, but the specific equipment requirements have not been assessed as yet.*

Question: Has Cultural Surveys Hawai‘i, Inc (CSH) prepared a cultural impact document?

Response: *They are working on a plan to address field work and mitigation measures that will be included in the Draft Environmental Assessment.*

Question: When will the Draft EA be available?

Response: *The Draft EA is planned to be available the later part of this year.*

Question: Has Cultural Surveys Hawai‘i, Inc. utilized archives from the Kaneohe Ranch for their work?

Response: *CSH will be coordinating with the Kaneohe Ranch to obtain pertinent information from their archives.*

Question: Providing a legitimate public use for this site will prevent destructive use of the area. Do you plan to include public access into the plan, and control access due to the history of dumping problems along the road?

Response: *The existing grant may not allow its use for certain types of public access improvements. However, public access will be incorporated into the plans so that improvements constructed under this project does not preclude future developments for public access especially those uses recognized under other published documents.*

Question: What are the restrictions on commercial use of the marsh, and cultural versus commercial use should be addressed?

Response: *The DLNR Administrative Rules indicate that the marsh is restricted and would require a permit for public access. However, for commercial activities, the recently updated 2009 Administrative Rules allow for 100 visitors per day within the full 830 acre wetland. Cultural and commercial uses will be addressed in the environmental document.*

Question: Will Kapa‘a Quarry Road be widened due to the increased traffic from the site as well as new developments, such as Target?

Response: *Road widening improvements are outside the scope of this project which concerns wetland restoration. Project effects on the roadway will be addressed in the environmental document.*

Question: Why are the Army Corps of Engineers (COE) building ponds and what water source will feed those ponds?

Response: *The COE is implementing their project as part of mitigation for the habitat they removed from construction of the levee project. The COE agreed to restore an area of the Kawainui Marsh and provide bird habitat. The ponds will utilize solar powered water pumps that pull stream or groundwater to create ponds for bird habitat. DOFAW will maintain the pumps after they are constructed.*

General Comments:

- The Kawainui Marsh needs public access because it is important and organizations conduct monthly educational tours there taking people down from the Knott's Ranch area to the center of the marsh. Other amenities like signage and kiosks are also important for the public.
- Historically, the Kahanaiki Stream offered an environment for taro farming. With public access plans, some want taro grown in the project area and community organizations can work with DOFAW to manage these *loi*
- An integrated public access plan with educational component is important and should help deter some of the illegal activities presently occurring in the area.
- In pre-contact history, the project area was utilized for recreational use as there used to be a slide used by *ali'i* long ago in the area of Pali Highway. Land and Water Conservation Funds were used for purchasing property in the project area from the City. Therefore, a recreational component needs to be incorporated into plans for the marsh.
- A lot of biomass will be removed from the marsh and storing and transporting it will require a tremendous amount of effort. Information on these activities and its disposal should be addressed.
- This project only utilizes 10 percent of the marsh, however, the birds will utilize the entire 830 acres. It is necessary to recognize that all restoration improvements, even in disparate parts of the marsh will affect the birds and environment.
- To provide public access, DOFAW may want to look towards other wetlands in the U.S. which escort visitors in using a shuttle system.
- At Hāmākua Marsh, there are problems with visitors feeding the native birds and as a result these birds walk onto parking lots and get run over.

APPENDIX A-4

Other Community Events
Envisioning Kawainui; Saturday, August 7, 2010
Envisioning Kawainui; Saturday, April 2, 2011
Ramsar World Wetlands Day 2011; Saturday, February 5, 2011

Envisioning
KAWAINUI

Saturday, August 7, 2010

1p.m. to 4p.m.

Wang Auditorium

Le Jardin Academy

Please join us for a community discussion to talk about Windward O'ahu's most valued natural and cultural resource and updates on ongoing and future restoration projects.

For more information, please contact Senator Jill N. Tokuda's office at 587-7215 or by email at sentokuda@capitol.hawaii.gov

This event is co-sponsored by the Office of senator Jill N. Tokuda and Harold K. L. Castle Foundation

Envisioning

KAWAI NUI

Saturday, April 2, 2011

1p.m. to 4p.m.

Le Jardin Academy

Lower School Multi-Purpose Room

Please join us for a community discussion to talk about Windward O'ahu's most valued natural and cultural resource and updates on ongoing and future restoration projects.

For more information, please contact Senator Jill N. Tokuda's office at 587-7215 or by email at sentokuda@capitol.hawaii.gov

This event is co-sponsored by the Office of Senator Jill N. Tokuda and Harold K. L. Castle Foundation

RAMSAR WORLD WETLANDS DAY 2011

Saturday, February 5
9:00am - 1:30pm
Faith Baptist Church
Kailua

FORESTS FOR WATER AND WETLANDS

The health of our wetlands is linked to the health of our forests and watersheds. Forested wetlands are home to a diversity of plants and wildlife. Learn more by joining the celebration of Ramsar World Wetlands Day in Hawai'i. There will be tours of the Kawainui and Hāmākua Marsh Complex, talks, exhibits, Hawaiian plant and food sales, entertainment, and learning activities for the whole family.

INTERNATIONAL YEAR OF FORESTS · 2011

World Wetlands Day 2011 is being celebrated in association with the International Year of Forests.

2011 marks 40 years of caring for the world's wetlands of international importance by the Ramsar Convention.

40 Ramsar 1971-2011

Native lowland forest and wetland restoration project at Nā Pōhaku O Hauwahine, Kawainui.

TENTATIVE PROGRAM

9:00am	Opening ceremonies with Oli and Blessing
9:15	• Bus tours of Kawainui* • Walking tour of Ulupō Heiau & Wetland Restoration Site*
9:15 - 9:45	Live Hawaiian Entertainment
9:45 - 10:45	Hawaiian/Western Games and Demonstrations
10:45 - 11:00	Tree Planting Ceremony at Ulupō Heiau
11:00 - 12:00	• Talk story with kūpuna & long-time families of Kailua • Live Hawaiian Entertainment
11:30 - 12:30	Hawaiian/Western Games and Demonstrations
12:00pm	• Bus tours of Kawainui* • Walking tour of Ulupō Heiau & Wetland Restoration Site*
12:30 - 1:00	Live Hawaiian Entertainment
1:15	Closing Ceremony - Mahalo and Aloha

* Bus tours will last about 1.5 hours. Advance reservations can be made through Thursday, Feb. 3 at email@ahahui.net. Sign-up for other available spaces on a first come, first served basis on the day of the event at Faith Baptist Church.
* Walking tours of Ulupō Heiau & wetland restoration site will last about an hour.
* For tours, wear good walking shoes or boots, and bring water, hat & sunscreen.

UPDATES & INFORMATION

www.waa-hawaii.org
www.hawaii.gov/dlnr/dofaw or www.heea.org
www.ahahui.wordpress.com
Shannon Wood - 224-4496

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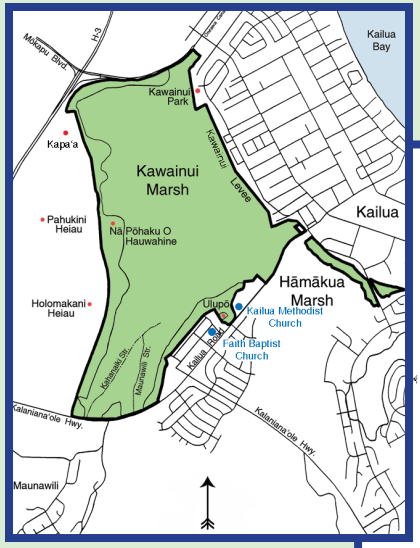
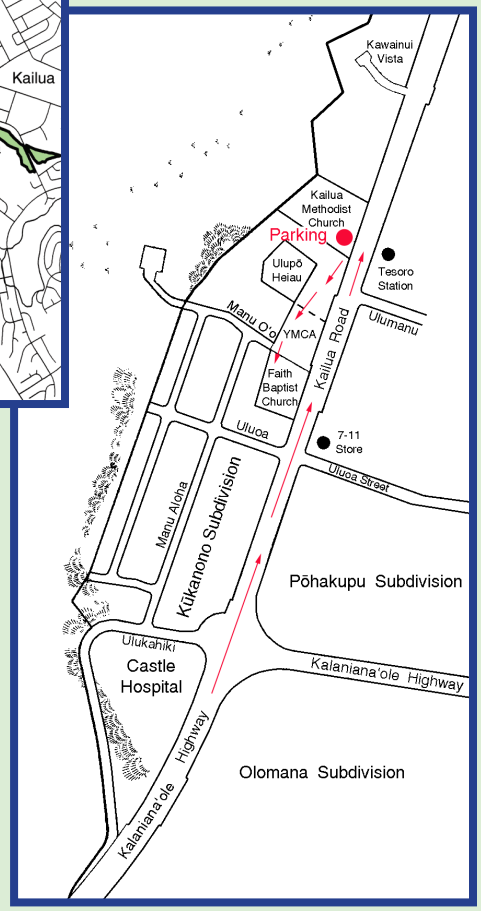


This event and all activities are free and open to the public.



EVENT LOCATIONS

PARKING:
Kailua Methodist Church

EXHIBITS & TALKS:
Faith Baptist Church

WALKING TOURS:
Ulupō Heiau

BUS TOURS:
Kapa'a
Nā Pōhaku O Hauwahine
Hāmākua Marsh

DIRECTIONS

From Pali Highway, take Kalaniana'ole Highway toward Kailua Town. Go past Ulumanu Street and the Tesoro Gas Station on your right. Make a left turn into the parking lot of the Kailua Methodist Church. Park your car and signs will direct you to Ulupō Heiau and Faith Baptist Church.

Exhibitors and vendors can drop-off at Faith Baptist Church. Turn left from Kalaniana'ole Highway onto Ulukahiki Street at Castle Hospital and then right onto Manu Aloha. Go to the end of the road, turn right onto Manu O'o that leads into the Windward YMCA and the Faith Baptist Church parking lot. After unloading, please park at the Methodist Church.

APPENDIX B

Photos of Existing Project Site

Photo 1: Panoramic East View of Kawainui Marsh Restoration Project Area.

Photo 2: Panoramic Southeast View of Kawainui Marsh Restoration Project Area.

Photos of Existing Site Conditions

Kawainui Marsh Wetland Restoration And Habitat Enhancement
Project Draft Environmental Assessment
Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Photo 1: Northeast view of southern corner of project site at Kalanianaole Highway with Kapaa Quarry Road intersection.

Photo 2: Southwest view of Kalanianaole Highway with Kapaa Quarry Road intersection.

Photo 3: Southwest view along Kapaa Quarry Road toward intersection.

Photo 4: Northeast view along Kapaa Quarry Road toward Le Jardin Academy entrance.

Photo 5: Southwest view along Kapaa Quarry Road toward Le Jardin Academy entrance.

Photos of Existing Site Conditions

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Photo 4: East view of Kahanaiki Stream Bridge along Kalanianaole Highway.

Photo 5: East view along Kalanianaole Highway of southern boundary of project area near bridge.

Photo 6: East view along Kalanianaole Highway of southern boundary terminus of project area.

Photos of Existing Site Conditions

Kawainui Marsh Wetland Restoration And Habitat Enhancement Project Draft Environmental Assessment

Kailua, O'ahu

Prepared for:
State of Hawai'i
Department of Land and Natural Resources
Division on Forestry and Wildlife

U.S. Department of Interior
Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office

Photo 1: South view of Kahanaiki Stream under highway bridge.

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Photos of Existing Site Conditions

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Photos of Existing Site Conditions

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Photo 6: Southwest view of Area B (taken in January 2011 after clearing of invasive vegetation).

Photos of Existing Site Conditions

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Photos of Existing Site Conditions

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Photos of Existing Site Conditions

APPENDIX C
Archaeological Reports

Archaeological Reconnaissance Survey with Limited Subsurface Testing in Support of the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project (December 2011)

Prepared by: Cultural Surveys Hawai'i, Inc.

Draft
Archaeological Reconnaissance Survey With Limited Subsurface Testing in Support of the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project, Kailua Ahupuaʻa, Koʻolaupoko District, Oʻahu TMK: [1] 4-2-013: 005 por., 022 por. and 043 por.

Prepared for

Helber Hastert and Fee, Planners, Inc.

Prepared by

Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawaiʻi, Inc.

Kailua, Hawaiʻi

(Job Code: KAILUA 32)

December 2011

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Management Summary

Reference	Archaeological Reconnaissance Survey with Limited Subsurface Testing in Support of the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project, Kailua Ahupuaʻa, Koʻolaupoko District, Oʻahu TMK: [1] 4-2-013: 005 por., 022 por. and 043 por. (Hammatt 2011)
Date	December 2011
Project Number (s)	Cultural Surveys Hawaiʻi (CSH) job code: KAILUA 32
Investigation Permit Number	CSH completed the fieldwork component of the archaeological reconnaissance survey with limited subsurface testing under Hawaiʻi State Historic Preservation Division/Department of Land and Natural Resources (SHPD/DLNR) permit No. 11-17, issued per Hawaiʻi Administrative Rules (HAR) Chapter 13-13-282.
Project Location	The project area is located at the south end of Kawainui Marsh at central Kailua Ahupuaʻa, Oʻahu and is bounded on the south side by Kalanianaʻole Highway and on the west side by Kapaʻa Quarry Road (for the southern portion) and the west edge of Kawainui Marsh (for the northern portion).
Land Jurisdiction	The land is understood to be owned by the State of Hawaiʻi
Agencies	This study was prepared for the review and approval of the State Historic Preservation Division, Department of Land and Natural Resources (SHPD/DLNR)
Project Description	The State of Hawaiʻi Department of Land and Natural Resources proposes certain wetland restoration and habitat creation including re-creating certain areas of shallow (approximately 3-inches to 12-inches deep) open water on the west side of the south end of Kawainui Marsh.
Project Acreage	Approximately 79.5 acres
Document Purpose	At the request of SHPD/DLNR and Helber Hastert and Fee Planners, CSH has prepared this archaeological reconnaissance with limited subsurface testing report in order to identify and document historic properties within the project area. Mitigation recommendations are presented that, through consultation with SHPD/DLNR, may be used to reduce or eliminate the proposed project's effect on historic properties located within the project area.
Fieldwork Effort	The fieldwork component was accomplished between June 2010 and June 2011 by a crew of CSH archaeologists including David W. Shideler, M.A., Matt McDermott, M.A., and Trevor Yucha, B.S. This effort required approximately 21 person-days to complete. All fieldwork was carried out under the overall supervision of Hallett H. Hammatt, Ph.D. (principal investigator).
Number of Historic Properties Identified	Two (2)

Historic Properties Recommended Eligible to the Hawai‘i Register of Historic Places (Hawai‘i Register)	SIHP 50-80-11-2029, Kawainui Marsh archaeological cultural-historical complex SIHP# 50-80-11-7199 (road remnant)
Recommendations	Based on the results of this archaeological reconnaissance survey with limited subsurface testing report, it is recommended that an archaeological monitoring program be developed to address the impact of subsurface disturbance within the project area, and that preservation, in the form of protection through avoidance, be considered for the two components of SIHP# 50-80-11-2029 (grinding stone and habitation area) that were identified during the current project. No further archaeological work is recommended for SIHP# 50-80-11-7199 (road remnant).

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Section 1 Introduction

1.1 Project Background

Cultural Surveys Hawai‘i, Inc. was contracted by Helber Hastert and Fee, Planners, Inc. to provide an archaeological reconnaissance survey with limited subsurface testing for an approximately 79.5-acre portion of Kawainui Marsh and adjacent western slope, Kailua Ahupua‘a, Ko‘olaupoko District, Island of O‘ahu (TMK: [1] 4-2-013: 005 por., 022 por. and 043 por.). The project area is located at the south end of Kawainui Marsh bounded on the south side by Kalaniana‘ole Highway and on the west side by Kapa‘a Quarry Road (for the southern portion) and the west edge of Kawainui Marsh (for the northern portion) (Figure 1 to Figure 3).

The project area is understood to be owned by the State of Hawai‘i. The project area comprises approximately 79.5 acres. The proposed project consists of wetland restoration and habitat creation proposed by the State of Hawai‘i Department of Land and Natural Resources, including re-creating certain areas of shallow (approximately 3-inches to 12-inches deep) open water on the west side of the south end of Kawainui Marsh. The area of potential effect (APE) for the current project area is defined as the entire 79.5-acre project area.

1.2 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. Historical research including study of archival sources, historic maps, Land Commission Awards and previous archaeological reports to construct a history of land use and to determine if archaeological sites have been recorded on or near the project area.
2. Reconnaissance survey of the project area to identify any surface archaeological features and to investigate and assess the potential for impacts to such sites. This assessment identifies sensitive areas that may require further investigation or mitigation before the project proceeds.
3. Limited subsurface testing within the project area to identify and subsurface archaeological features and to investigate and assess the potential for impacts to such sites.
4. Preparation of a report, including the results of the historical research and the field inspection, with an assessment of archaeological potential based on that research and recommendations for future archaeological work. The report also provides mitigation recommendations for archaeologically sensitive areas, which should be taken into consideration.

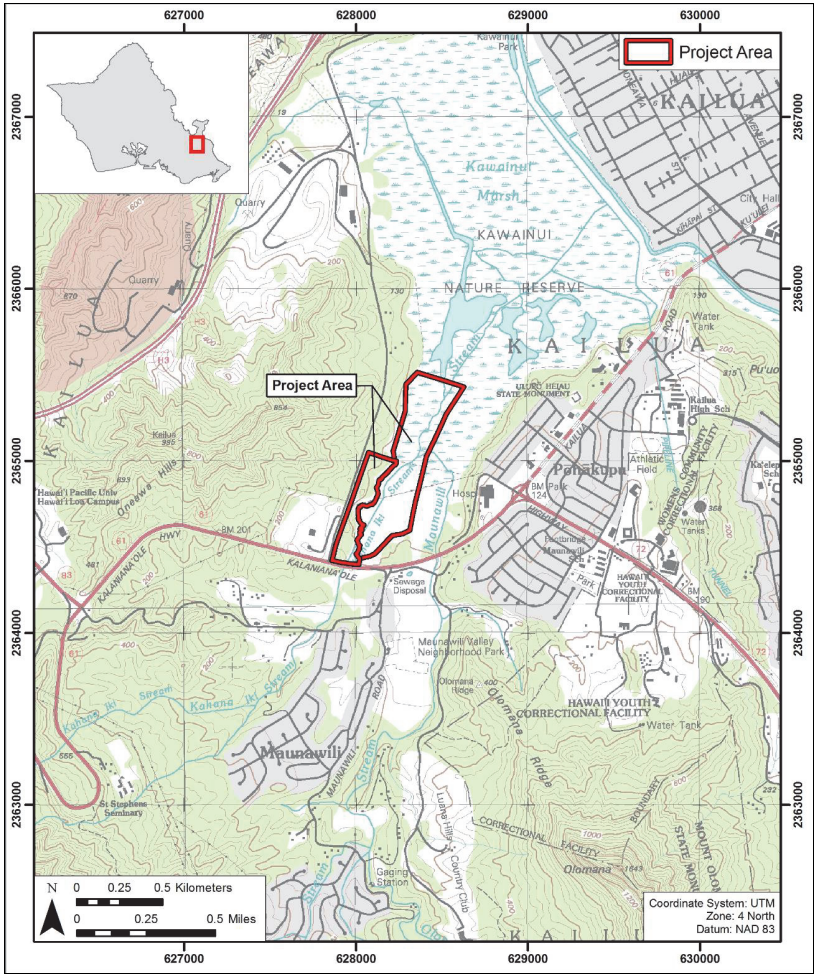

Figure 1. 1998 U.S. Geological Survey 7.5-Minute Series Topographic Map, Mokapu Point Quadrangle, showing the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area

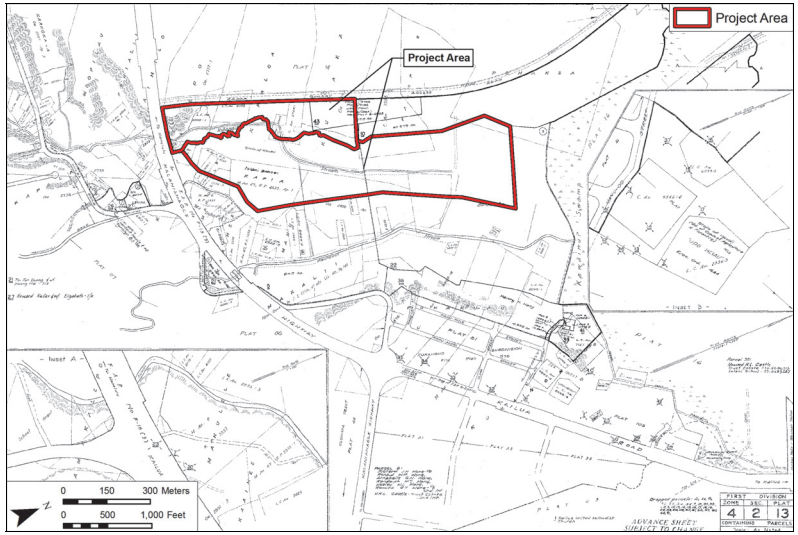

Figure 2. Tax Map Key 4-2-13, showing the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area

Figure 3. 2005 U.S. Geological Survey aerial photograph showing the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area (source USGS Orthoimagery 2005)

1.3 Environmental Setting

1.3.1 Natural Environment

The project area is located within Kawainui Marsh, which is approximately 1.5 m above sea level. According to Foote et al. (1972), the project area includes three soil types: Pearl Harbor Clay, Hanalei Silty Clay, Lolekaa Silty Clay, and Alaeloa Silty Clay (Figure 4).

The northern portion of the project area overlies Pearl Harbor Clay (Ph). The Pearl Harbor soil series “consists of very poorly drained soils on nearly level coastal plains… developed in alluvium overlying organic material” (Foote et al. 1972:112). The southern portion of the project area overlies Hanalei Silty Clay, 0 to 2 percent slopes (HnA). The Hanalei series “consists of somewhat poorly drained to poorly drained soils on bottom lands…developed in alluvium derived from basic igneous rocks” (Foote et al. 1972:38). Portions of the project area along the western boundary overly Lolekaa Silty Clay, 8 to 15 percent slopes (LoC) and Alaeloa Silty Clay, 15 to 35 percent slopes (AeE). The Lolekaa soil series “consists of well-drained soils on fans and terraces…developed in old, gravelly colluviums and alluvium” (Foote et al. 1972:83). The Alaeloa soil series “consists of well-drained soils on the uplands…developed in material weathered from basic igneous rock” (Foote et al. 1972:26).

Kahanaiki Stream, the western of the two major streams feeding Kawainui Marsh, (Maunawili Stream runs roughly parallel just 250 m to the east) basically bisects the project area. The present effects of siltation and eutrophication obscure to what extent these two streams actually channel water flow.

Marsh vegetation within the project area is dominated by California grass (*Brachiaria mutica*), which occurs on alluvial clays that are continuously damp and flooded periodically. On the western slopes are large monkey pod trees, extensive expanses of *hau* (*Hibiscus tiliaceous*), and a variety of other exotic shrubs.

1.3.2 Built Environment

The built environment surrounding the current project area includes Kalaniana‘ole Highway and associated improvements to the south and Kapa‘a Quarry Road and associated improvements to the west. The current project area remains undeveloped. Two gated, unimproved access roads provide entry to the project area from Kalaniana‘ole Highway and Kapa‘a Quarry Road.

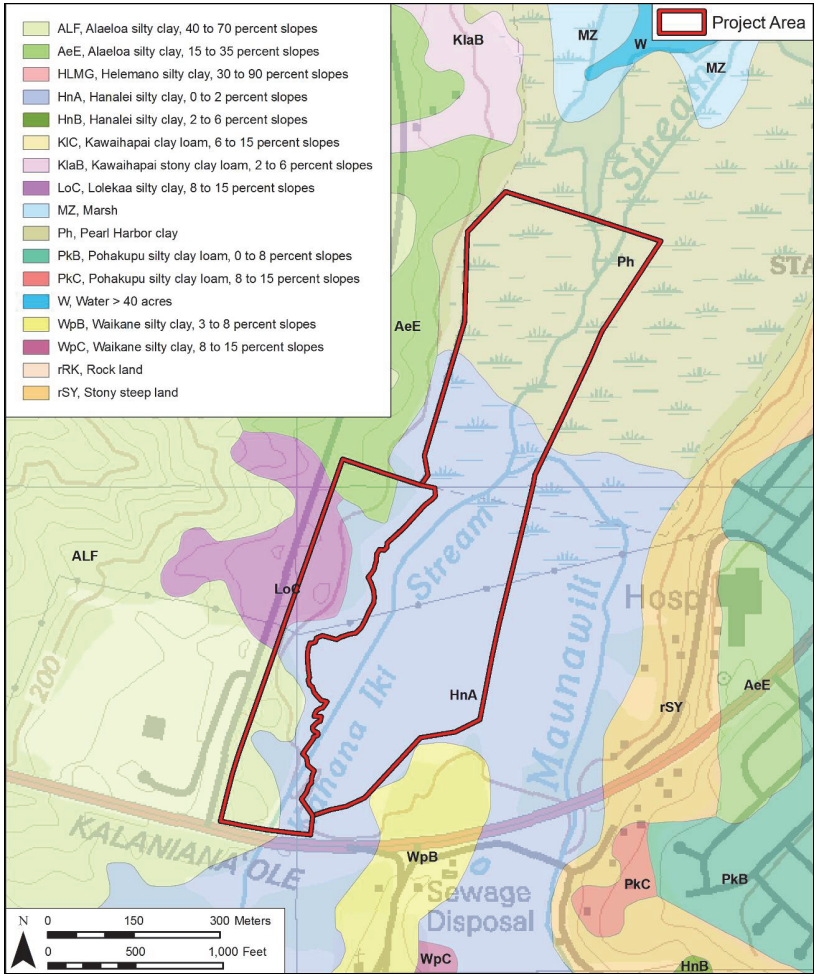

Figure 4. Overlay of the Soil Survey of the State of Hawai‘i (Foote et al. 1972), indicating sediment types within and surrounding the current project area (source: Soils Survey Geographic Database [SSUGRO] 2001, U.S. Department of Agriculture)

Section 2 Methods

2.1 Field Methods

2.1.1 Reconnaissance Survey

A reconnaissance-level pedestrian survey of the 79.5-acre project area was conducted by CSH archaeologists, David W. Shideler, M.A. and Matt McDermott, M.A., under the overall supervision of Hallett H. Hammatt Ph.D. Fieldwork was accomplished over the course of 3 days in June 2010. In general, surface visibility was poor due to dense vegetation growth dominated by California grass (*Brachiaria mutica*) and *hau* (*Hibiscus tiliaceous*).

All surface historic properties were documented with a detailed written description including an evaluation of function, interrelationships, and significance, photographs, and scale drawings when appropriate.

2.1.2 Limited Subsurface Testing

Limited subsurface testing within the project area consisted of the excavation of twelve test trenches (Trench 1-12) between May 23, 2011 and May 25, 2011. An excavator with a standard-size bucket (approximately 75 cm wide) was used to excavate each test trench. CSH archaeologists monitored all excavations conducted within the project area.

2.1.3 Sediment Coring

Sediment coring methodology generally followed the methods previously used by Hammatt et al. (1990) in Kawainui Marsh and Kikuchi (1992) in Kamo‘o maika‘i Fishpond. Sediment coring within the project area consisted of the manual extraction of 2 core samples (Core Sample 1 and 2) on June 6, 2011 from two pre-selected areas within the project area (Core Location 1 and 2). Using a heavy-duty fence post pounder, a crew of three CSH archaeologists pounded prepared sections of open-ended PVC pipe (2 in. diameter) into selected locations within the project area. When significant resistance was encountered, each PVC coring pipe was cut and capped above the ground surface. The depth of each PVC pipe from ground surface was then documented. Capping the above-ground portion of the PVC pipe created a vacuum within the below-ground portion of the pipe, which assured that the sediment core, contained within, remained intact. The CSH field crew then attached large pipe wrenches to the capped end of the PVC pipes and manually removed each pipe section from the marsh. Upon extraction, the opposite or coring end of the PVC pipe was also capped, which sealed in each sediment core sample from external contamination. Each sediment core pipe was labeled with provenience information and core direction and returned to the CSH laboratory for processing.

2.1.4 Documentation of Stratigraphy

The stratigraphic profile of each backhoe test trench and each sediment core sample was drawn and photographed. The observed sediments were described using standard USDA soil description observations/terminology. Sediment descriptions included: Munsell color; texture; consistency; structure; plasticity; cementation; origin of sediments; descriptions of any

inclusions, such as cultural material and/or roots and rootlets; lower boundary distinctiveness and topography; and other general observations.

2.2 Laboratory Methods

2.2.1 Artifact Analysis

Following the completion of fieldwork, all collected material was analyzed using standard laboratory techniques. Historic and traditional Hawaiian artifacts that were collected in the field were returned to the CSH laboratory to be sorted, identified, and analyzed. In general, artifact analysis focused on establishing, to the greatest extent possible, material type, formal/functional type, cultural affiliation, and age of manufacture. Upon completion of the project, all material collected during fieldwork will remain at the CSH Waimānalo Office until a permanent facility is determined through consultation with the landowner and SHPD/DLNR.

2.2.2 Sediment Core Analysis

2.2.2.1 Core Extraction

Sediment core extraction and preparation generally followed the methods used by Hammatt et al. (1990) for core samples collected from within Kawainui Marsh. First a makeshift stand was prepared from two saw horses and a cut sheet of plywood to support the PVC pipe core during the cutting process. The PVC pipe was then rested on the surface of the stand and clamped in place using C-clamps and two 2 x 4 boards, which also acted as guides for the router. After the PVC pipe core was secured, a router with a V-shaped bit was used to created a wide groove along the length of the pipe. The router was adjusted in order to cut through the bulk of the PVC pipe exterior, only leaving a thin membrane of PVC plastic between the actual sediment core and the outside environment. Upon completion of one linear router cut, the PVC pipe core was slightly rotated within the makeshift stand and a second linear router cut was performed. Following use of the router, a final cut through the thin PVC membrane of each router cut was performed using a rug knife with a clean blade. The final cut allowed for the removal of a linear section of PVC pipe, equal to approximately 1/4 of the PVC pipe’s circumference, which exposed the length of the sediment core for documentation and sampling.

2.2.2.2 Radiocarbon Analysis

A total of six sediment sub-samples (three each from Core Sample 1 and 2) were sent to Beta Analytic, Inc. of Miami, Florida for radiocarbon dating analysis using the Accelerator Mass Spectrometer (AMS) method. The conventional radiocarbon age determined by Beta Analytic, Inc. was calibrated to calendar ages using the OxCal calibration program, Version 4.1, developed by the University of Oxford Radiocarbon Accelerator Unit (ORAU).

2.2.2.3 Pollen Analysis

A total of six sediment sub-samples (three each from Core Sample 1 and 2) were sent to PaleoResearch Institute of Golden, Colorado for pollen analysis. A chemical extraction technique based on flotation was used to remove pollen from the sediment matrix. After additional treatments, a light microscope was used to count and identify pollen grains within the

sample. A report detailing the methodology and findings of pollen analysis is included in the present Appendix B (Cummings October 2011).

2.3 Document Review

Background research included: a review of previous archaeological studies on file at the SHPD/DLNR library; review of historical documents at Hamilton Library of the University of Hawai‘i at Mānoa, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Archives of the Bishop Museum; study of historic photographs at the Hawai‘i State Archives and the Archives of the Bishop Museum; study of historic maps at the Hawai‘i State Land Survey Division; and study of historic maps and photographs at the CSH library. This research provided the environmental, cultural, historic, and archaeological background for the project area. The sources consulted were used to formulate a predictive model regarding the expected types and locations of historic properties that may be located in the project area.

Section 3 Background Research

3.1 Traditional and Historical Background

The history of Kailua region of O‘ahu has been documented in a number of studies including, but not limited to, Hall’s (1997) “*The History of Kailua*”, Creed and Chiogioji’s (1991) “*Facets of Maunawili Valley and Kailua Ahupua‘a History*”, Kelly and Nakamura’s (1981) “*Historical Study of Kawai Nui Marsh Area, Island of O‘ahu*” and the Kailua Historical Society’s (2009) “*Kailua in the Wisps of the Malanai Breeze*”. All of these studies detail the legendary history and oral traditions, the legendary rulers and personalities, the early historic accounts, land ownership and utilization changes during and following the *Māhele*, and the changes in land use from traditional to modern times. Included in this section, under the discussion of the *Māhele* land divisions of the mid 19th century, is a detailed discussion of the Land Commission Awards claimed and awarded within the current Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area.

Kailua Ahupua‘a is the largest valley on the windward side of O‘ahu, and the largest *ahupua‘a* of the Ko‘olaupoko District (approximately 15 km by 11 km). Flanked by the *ahupua‘a* of Waimānalo on the southeast, Kāne‘ohe on the northwest and Honolulu to the south, the *ahupua‘a* of Kailua is shaped like a rectangle. From the Ko‘olau ridge line it extends down two descending ridge lines which provide the natural boundaries for the sides of the *ahupua‘a*. The fourth side of the rectangle is the reef line of Kailua Bay.

The natural environment includes the sand accretion barrier upon which Kailua Town stands, the mountainous upland terrain and alluvial valley of Maunawili, the largest fresh water marsh in Hawai‘i (Kawainui Marsh), another inland pond (Ka‘elepulu), approximately 18 permanent and intermittent streams, a freestanding mountain halfway between the shore and the Ko‘olau (Olomana–1,643 ft.), several low ridge lines, and off-shore the Mokulua Islands, Mokole‘a Rock, and Popoia Island. It comprises 11,885 acres of land according to the Boundary Commission Review of the mid-19th century, but in fact extends beyond the shore approximately a mile out to sea, to the reef.

During the estimated 1000 to 1500 years since initial Polynesian settlement, the sand barrier that forms the shore at Kailua Bay has provided a desirable location for residences with a sunny, dry beach area. The well-watered interior lands, including the two marsh/pond areas of Ka‘elepulu and Kawainui and the many springs and streams of Maunawili, provided bountiful agricultural and resource gathering areas. During the 15th and 16th centuries, Kailua, O‘ahu was the center of a large royal complex with sample playgrounds for sports and physical training, and recreation (Sterling and Summers 1978:231-232). Supporting this large complex was a most bountiful garden hinterland where fish, fowl, and vegetables were plentiful (Sterling and Summers 1978:227-228).

3.1.1 Mythological and Traditional Accounts

Kailua is said to have been one of the places where, following their arrival on O‘ahu from Kahiki, the *menehune* were assigned to live. These legendary workers are credited with the construction of numerous fishponds and religious structures. Fornander (1917-1918:23) points

out that the term *menehune* in Tahitian had become the name for the lowest laboring class of people, suggesting a Tahitian origin for the term for the legendary workers.

Traditional history describes Kailua as the residence of many prominent O‘ahu ruling chiefs. There is ‘Olopana, “who with his brother Kahiki‘ula came to O‘ahu from Kahiki . . . He is said to have established several *heiau* in Kāne‘ohe and Kailua, including Pahukini and Holomakani in the Kawainui area” (Kelly and Nakamura 1981:3). One of the earliest great chiefs to reside in Kailua was the 16th-century ruler Kakuhihewa, who built himself a great house at ‘Ālele in Kailua (Kelly and Nakamura 1981:5). At approximately the same time, another prominent chief, Kuali‘i, born at Kalapawai, Kailua, and raised in Kualoa and Kailua, had his navel-cutting ceremony at the *heiau* of Alāla (present-day Lanikai Point); and, after heroically succeeding in many battles, became the high chief of all O‘ahu (Kelly and Nakamura 1981:6). In early historic times, the conquering chief Kahekili, followed by Kamehameha I, resided in Kailua for a time (Kelly and Nakamura 1981:6-7).

There are legendary accounts of the prominent Mount Olomana, which is named after a great mythological giant and/or chief (Kelly and Nakamura 1981:1). Tradition also says Kawainui was inhabited by a *mo‘o* called Hauwahine, whose name literally means “female ruler.” Her residency at Kawainui follows Haumea’s, the earth-mother goddess whose name literally means “red ruler.” She ensured that all the people of the *ahupua‘a* shared in the pond’s wealth but punished those who were greedy (Beckwith 1970:126).

Oral history notes that the stones overlooking Kawainui on Pu‘u o ‘Ehu are sacred to Hauwahine and her companion (Paki 1976). This interpretation is connected to the ancient Hawaiian notion that the channel/canal beneath Pu‘u o ‘Ehu (which is adjacent to the southern portion of the study area) connects Kawainui and Ka‘elepulu and was considered to be the coital connection between the two fishponds, giving the area great *mana* (spiritual or divine power). Kawainui Marsh was considered male, and Ka‘elepulu Pond, female. They mated at Kawailoa, according to a Hawaiian tradition (Paki 1976).

Mele, or chants, about Kailua frequently mention the two fishponds, which were famous for their *‘ama‘ama* (mullet, *Mugil cephalus*) and *awa* (milkfish, *Chanos chanos*). They also praise the taro gardens of the area (see Beckwith 1970 and Drigot 1982). A few of these chants and legends are those of Hi‘iaka, Kahinihini‘ula, the Mākālei Tree, and Ka‘ulu.

Situated between the sunny beach area and uplands watered by frequent showers, other resources were readily available in Kailua. As the center of the caldera of the ancient Ko‘olau Volcano, a basalt quarry (the present Ameron Quarry is built upon the site of the pre-Contact quarry) provided raw material for lithic tools (MacDonald and Abbott 1974:363). Kailua was a residential district surrounded by *ahupua‘a* that were also highly cultivated and capable of providing ample resources for a large resident and visiting population. Kailua apparently also was a *pu‘uhonua* (place of refuge) before Kamehameha I conquered the island of O‘ahu. After this time, the ancient *pu‘uhonua* were abolished.

3.1.1.1 Mount Olomana

“Olo,” meaning “hill,” and “mana,” meaning “forked divided, or branched,” is a peak that rises 1,643 feet from the valley floor (Creed and Chiogioji 1991:33). The remains of a long-extinct volcano, Olomana has two neighboring peaks, Pāku‘i and Ahiki. Many legends are

associated with Olomana, which is named after a great mythological giant and is also the name of a renowned O‘ahu chief (Kelly and Nakamura 1981:1). One legend relates that Haumea installed Olomana as the chief of the district. But Olomana’s pride and arrogance cause Palila, a “warrior of the gods” from Kaua‘i (Creed and Chiogioji 1991:6), to punish Olomana. Palila breaks Olomana in two and throws one portion to the sea and the other becomes the Mount Olomana we know today (Kelly and Nakamura 1981:1). Another legend describes the giant Olomana jumping from Kaua‘i to the O‘ahu peak that bears his name. Traditions related to early creation stories also mention Olomana (Creed and Chiogioji 1991:33).

The middle of the three peaks of Mount Olomana, Pāku‘i (literally, “attached”), is named after the legendary keeper of the Kawainui and Ka‘elepulu fishponds who was a fast runner (Pukui et al. 1974:176). Ahiki is the closest peak to Waimānalo, and is named after the *konohiki* of Ka‘elepulu and Kawainui ponds (Pukui et al. 1974:5).

3.1.1.2 Kawainui Marsh

Kawainui Marsh was traditionally known as Kawai Nui Loko, or the big freshwater pond. The locale’s name has two spellings in the literature: Kawai Nui, and as one word, Kawainui. Currently, Kawainui appears to be the more common spelling and will be used in this document unless it appears in a citation or title.

The marsh is a “*wahi pana*,” a celebrated, noted, and legendary place in Hawaiian traditions. The legends of Kawelo, Kahalaopuna, Keaomelemele, the *menehune* (mythical ‘little people’ who built major structures in old times) all refer to Kawainui, as does the history of the ruling chiefs Kūali‘i and Olopana. The marsh was the home of the *mo‘o* (supernatural water spirit) Hauwahine and of the wish-fulfilling tree, Mākālei. The demi-goddess Hi‘iaka and her companion Wahine-‘ōma‘o visited, and Kawainui’s fame is related in numerous chants (Drigot 1982:84-96 presents a good summary). Historically, a portion of Kawainui Marsh was a 450-acre fishpond that was cleared of encroaching vegetation by the communal efforts of the *ahupua‘a* residents. Kawainui was recognized for the abundance of resources that the area supplied to the Hawaiian people, including avian, earth, fish, and plant resources.

3.1.1.2.1 The Mākālei

The Mākālei, or Fish-Attracting Tree, was a mythological tree or stick that could summon fish from Kawainui. Reportedly located near the present day Hāmākua Bridge, it was described as a never-failing source of a plentiful supply of food (Beckwith 1970:279-280, Pukui and Elbert 1981:382) and it speaks of the ample productivity of the Kailua region. Haumea, the earth mother goddess of fertility and childbirth, is depicted in Hawaiian folklore as the one who brings the Mākālei tree to Kawainui, thereby establishing the fertile waters of the marsh (Kelly and Nakamura 1981:4-5, Creed and Chiogioji 1991:6). The removal of the tree by Haumea to punish the *ali‘i* who forgot to distribute Kawainui’s fish to a small, red-headed boy named Kahinihiniula and his grandmother Neula is a strong reminder of the chiefs’ “responsibility of stewardship to the planters on whom they depended on for food and power” (Creed and Chiogioji 1991:6). Once the *ali‘i* realized their shortcoming, Haumea returned the Mākālei tree to a hidden place and the fish returned to Kawainui.

3.1.1.2.2 Hauwahine, the Mo‘o of Kawainui

Tradition also says Kawainui was inhabited by a guardian spirit, or *mo‘o*, called Hauwahine, whose name literally means “female ruler.” Her residency at Kawainui follows Haumea’s, the earth-mother goddess whose name literally means “red ruler.” As previously mentioned, she ensured that all the people of the *ahupua‘a* shared in the pond’s wealth and punished those who were greedy (Beckwith 1970:126). According to legend, Hauwahine had a companion, a second *mo‘o*, who reportedly lived at the *hala* grove near the Ka‘elepulu stream. If one sees yellow grass and yellow rush in the stream, it is a sign of the presence of the two *mo‘o* women (Kelly and Nakamura 1981:3, citing an anonymous source).

3.1.1.2.3 Avian Resources

One folk saying paints a picture of the large number of birds living in the marsh:

Wawā ka menehune i	The shouts of the menehune on
Pu‘ukapele ma Kaua‘i, puoho	Pu‘ukapele on Kaua‘i startled
ka manu o ka loko o Kawainui	the birds of Kawai Nui Pond
ma O‘ahu.	on O‘ahu. (Pukui 1983:320)

Visitors to the area also wrote about the bountiful resources in the marsh area. In 1880, George Bowser noted the following:

> Wild duck and the famous Hawaiian goose are also to be found here in abundance. During the day I have fallen in with any quantity of plover. A good shot might have bagged his fifty brace in a very short time. These birds are very plentiful all over this part of the country... (Kelly and Nakamura 1981:60)

An article in a Hawaiian language newspaper in 1911 stated that “The necks of the birds appeared on the pond of Kawainui among the rushes...” (Ke Au Hou 1911). Birds documented living at Kawai Nui include various geese and ducks, or *koloa*, such as Northern Pintail (*Anas acuta*), Northern Shoveler (*Anas clypeata*), Mallard (*Anas platyrhynchos*), Canada Goose (*Branta canadensis*), Emperor goose (*Chen canagica*), Ring-necked Duck (*Aythya collaris*), Lesser Scaup (*Aythya affinis*), Green-winged Teal (*Anas crecca*), American Widgeon (*Anas americana*), and Redhead (*Aythya americana*) (Shallengerger 1977; Conant 1981; Drigot 1982; Engilis 1988; U.S. Fish and Wildlife Service 1991).

Migratory shorebirds that flock to Kawai Nui Marsh include the Lesser Golden Plover (*Pluvialia dominica*), Ruddy Turnstone or *‘Akekeke* (*Arenaria interpres*), Sanderling or *Hunakai* (*Calidris alba*), and Wandering Tattler (*Heteroscelus incanus*) (Shallengerger 1977; Conant 1981; Drigot 1982; Engilis 1988; U.S. Fish and Wildlife Service 1991). Other species include the indigenous Black-crowned Night Heron, or *‘Auku‘u* (*Nycticorax nycticorax hoactli*), and four endemic, federally-listed endangered waterbird species: the Hawaiian Coot, or *‘Alae Ke‘oke‘o* (*Fulica americana alai*), Hawai‘i Gallinule (a.k.a. the Hawaiian Common Moorhen), or *‘Alae ‘ula* (*Gallinula chloropus sandvicensis*), Hawaiian Duck, or *Koloa maoli* (*Anas wyvilliana*), and Hawaiian Stilt, or *Ae‘o* (*Kukulu ae‘o*) (*Himantopus mexicanus knudseni*) (Shallengerger 1977; Conant 1981; Drigot 1982; Engilis 1988; U.S. Fish and Wildlife Service 1991; Bruner 2000).

David Malo discussed the role of birds in Hawaiian culture, especially regarding the *‘Alae* (*Fulica americana alai* and *Galinula chloropus sandvicensis*):

> *…ua mana‘o ia keia manu, he akua, ua nui ka po‘e ho‘omana i keia manu, ua like kona nui me kekahi moa wahine, he manu ‘ono no ke ‘ai ia i ke alualu a me ka pehi ka mea e loaa [a]i.* (Malo 2006)
>
> This bird is thought to be a god and there are many people who worship this bird. Its size is like a hen. It is delicious to eat and it is chased after using stones (*pehi*) to catch it. (Malo 2006)

Malo also names the *Koloa* (*Anas wyvilliana* and other ducks) and the Lesser Golden Plover (*Pluvialia dominica*) as “*he manu ono*,” delicious birds. The *Kukulu ae‘o* (*Himantopus mexicanus knudseni*) is reported as a kind of edible bird (*he manu ano ke ‘ai ia*) as is the *‘Auku‘u* (*Nycticorax nycticorax hoactli*) (Chun 1987:22, 164). These water birds were taken by pelting them with stones.

Several waterfowl species are understood to have been widely hunted for food from traditional Hawaiian times into the mid-twentieth century. The Hawaiian Coot and Hawaiian Duck were legal game birds until 1939 (a bag limit of twenty-five birds a day was set), and the Hawaiian Gallinule and Hawaiian Stilt were legally hunted until 1941 (Drigot 1982:142-148). Many of these waterfowl species are listed as endangered species and protected by federal and state laws that are generally acknowledged as overriding native customary practices (for example, as in the case of sea turtles).

The only other bird species present that are known to have been worshiped other than the *‘Alae* was the *Kōlea* (Valeri 1985:27), although it is highly possible that certain *‘Auku‘u* would have been an *‘aumakua* (guardian ancestral spirit) species. Several of the bird species in Kawainui, including the *‘Akekeke, ‘Alae Ke‘oke‘o, ‘Alae ‘Ula, ‘Auku‘u, Kolea,* and the transiting Great Frigate bird or *‘Iwa* (*Fregata minor palmerstoni*), have various mythological associations (see Drigot 1982: 141 ff.).

3.1.1.2.4 Earth Resources

Sterling and Summers (1978:229) described the traditional Hawaiian adze quarry “on the [Kapa‘a] slopes below (north) of Pahukini heiau” that was “investigated by Dr. Emory and his class in 1951.” The quarry is relatively close to Kawainui and the *heiau* appears to be associated with the marsh. Sterling and Summers (1978:229) note that in 1953, the H.C. & D. quarry encroached on the quarry site, and by 1975, it was destroyed.

One of the more famous traditional Hawaiian associations with Kawainui is the “edible earth” (*Lepo ‘ai ia*). Pukui (1983:83) provides the following poetical saying:

He lepo ka ‘ai a O‘ahu, a	Earth is the food of O‘ahu, and
mā‘ona no i ka lepo	it is satisfied with the earth

Pukui explains the proverb, stating:

> Said in derision of O‘ahu, which was said to be an earth-eating land. In olden times, an edible mud like gelatine was said to fill Kawai Nui Pond. The mud which was brought hither from Kahiki in ancient days, was once served to the warriors and servants of Kamehameha as a replacement for poi. (Pukui 1983:83-84)

In addition to Mary Pukui's account, Sterling and Summers (1978:231-232) provide the following accounts of the edible mud:

> When there was a shortage of taro in Kailua, during Kamehameha's stay there with his men, the men of Kailua went to the pond of Kawainui to get the edible mud of Kawainui. It was a mud brought from Kahiki by Kaulu-a-kalana and put in the pond of Kawainui. The warriors and servants of Kamehameha ate the mud which had been put in the calabashes. (History of Kamehameha, *Ka Na‘i Aupuni* Sept. 4, 1906 in Sterling and Summers 1978:231-232)

The additional information is provided:

> The "Lepo ‘ai ia," or edible mud, was found only in Kawainui Pond at Kailua, O‘ahu. It was thick and jelly-like, like haupia pudding. A strict kapu was imposed when one dived to get it. No one was allowed to utter a word while the diver was in the pond getting it. If a word was spoken, ordinary mud rose up around the diver and covered him so that he died. There was no escape. ("Note from Lahilahi Webb" in Sterling and Summers 1978:232)

There is a tradition among archaeologists that a certain archaeologist from the mainland consumed a good serving of the famous "*Lepo ‘ai ia*." He soon fell quite sick. Given the presence of potentially lethal leptospirosis in the Kawainui drainage, mud consumption cannot be recommended and is not believed to be ongoing.

3.1.1.2.5 Fish Resources

A portion of Kawainui was historically a 450-acre fish pond known as Kawainui Loko, a partially brackish inland pond (*loko wai*) famous for harboring fat fish (Kamakau 1875). It had "the finest fat mullet on this side of the island...The *Awa* fish were so tame that they were easily caught" (Alona 1939:1314-1315). While it is believed that the pond was the property of the *ali‘i* (McAllister 1933:186), Keko‘owai gives an account of communal cleaning of the pond in which the people harvested some fish for their own use.

> This being communal work, the *konohiki* (land agent) commanded the men, women and children of Maunawili, Kailua and Waimānalo to come to Kawai Nui. The people went into the pond, and with their hands broke the *limu* (algae) loose, piling it up, twisting it under as it was gathered. After a quantity of *limu* had been piled and twisted under, the workers formed it into a ring. "Then the *limu* that was broken off was pressed (*pili*) down like a dish and all the fish that were caught in this *limu* dish were for the *limu* breakers." The workers put these fish into lauhala bags which were tied behind them, for the fish in the "limu dish" were no longer the property of the *konohiki*. Breaking of the *limu* was continued until the pond was clean and "the food of the fish clean," which for Kawai Nui, required three days. (*Ka Nupepa Kuokoa*, January 6, 1922, quoted in Summers 1964:22)

While the majority of fish species reported from Kawainui are exotic, native species of the Kawainui drainage include the endemic goby or *O‘opu nākea* (*Awaous stamineus*), the indigenous goby *‘O‘opu naniha* (*Stenogobius genivittatus*), the endemic eleotrid with various Hawaiian names: *‘O‘opu ‘akupa, ‘Okuhe, ‘Apoha, Kuhe, ‘Oau* (*Eleotris sandwicensis*), the endemic flagtail (*Kuhlia sandvicensis*), the indigenous mullet or ‘*Ama‘ama* (*Mughil cephalis*),

Milkfish or *Awa* (*Chanos chanos*), and occasionally a variety of other common inshore species including jacks, barracuda and lizard fish (Drigot 1982:177; U.S. Fish and Wildlife Service 1991). Mullet, *Awa* and the *‘O‘opu* were the most famous fish of the pond (Alona 1939; *Saturday Press* 1883). The *‘O‘opu* were proverbial as in the saying:

He ‘o‘opu ku‘ia, ka i‘a hila o Kawai Nui	A bashful *‘o‘opu*, the shy fish of Kawai Nui

Pukui (1983:94) explains that this folk saying was applied to describe a bashful person. Another traditional account of the *‘O‘opu* catching at Kawainui was published in 1883:

> The ‘*O‘opu kuia* was a large fat mud fish, caught by many people joining hands and dancing in its [Kawainui's] waters to stir up mud, when the fish would run their heads up against the people, and so were caught. The fishes would cluster very thickly against particular individuals while leaving many others untouched, when, of course, he or she, would make a good haul and fill up his calabashes rapidly. This gave rise to the common saying of olden times, "*he ‘ili ona ia*" - "attractive skin." (*Saturday Press* 1883)

In a somewhat similar vein, Alona (1939) relates that the *Awa* fish of Kawainui "did not like persons with strong smelling skins (‘*ili awa*) and kept away from them."

3.1.1.2.6 Plant Resources

Vegetation composition within Kawainui Marsh has been significantly impacted by human activities with the result that the overwhelming majority of the vegetation is exotic. Some vegetation studies report no native plants or Polynesian introductions at all (M&E Pacific, Inc. 1990:3-21). Dominant plants include exotic species such as California bulrush (*Schoenoplectus californicus*), saw-grass (*Thelypteris interrupta*), common cat-tail (*Typha latifolia*), California grass (*Brachiaria mutica*), arrowhead (*Sagittaria latifolia*), Wandering Jew, or Honohono grass (*Commelina diffusa*), water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*) (Drigot 1982; U.S. Fish and Wildlife Service 1991). The upper slopes are wooded with *haole koa* (*Leucaena leucocephala*), guava (*Psidium guajava*), Chinese banyan (*Ficus microcarpa*), Christmas berry (*Schinus terebinthifolius*), Java plum (*Syzygium cumini*), octopus tree (*Schefflera actinophylla*), African tulip tree (*Spathodea campanulata*), albizia (*Falcataria moluccana*) and monkey pod (*Samanea saman*) (M&E Pacific, Inc. 1990:3-21).

However, as Beatrice Krauss pointed out in 1980, the ethnobotany of the marsh is not well-documented as the common approach "to the study of the flora surrounding Kawainui Marsh has been one which appears almost totally taxonomic and ecological" (Drigot 1982:99). The only plants that are indigenous include *Hau* (*Hibiscus tiliaceus*), *‘Anapanapa* (*Colubrina asiatica*) and *Kāmole* (primrose willow, *Ludwigia octivalvis*). *Hau* was used for quite a variety of traditional purposes such as fiber, fish net floats, fire making, tool handles, outriggers, fireworks and religious ceremonies. *Hau* is rather ubiquitous in Ko‘olau, O‘ahu. No specific cultural uses of *‘Anapanapa* or *Kāmole* are known. Such Polynesian introductions as *Noni* (*Morinda citrifolia*), *‘Ulu* (*Artocarpus communis*), *Mai‘a* (*Musa paradisiaca*) and *Kalo* (*Colocasia esculenta*) are known on the perimeter of the marsh. Some plants that have been associated with many Kailua and Kawainui Marsh legends are still likely to be present, including *‘awa*, *‘ōhi‘a*, *pūhala*, *‘uki*, *‘aka‘akai*, *‘ilima*, *loulu*, *popolo*, *kukui* and various *limu* (seaweeds) (Drigot

1982:104). Any ongoing Hawaiian gathering practices are likely to be focused on these Polynesian cultigens and later introductions such as mango (*Mangifera indica*).

3.1.1.2.7 Heiau

Three *heiau*: Ulupō, Holomakani and Pahukini, are within close proximity of Kawainui Marsh. Four other *heiau*, Halaualolo, Kawailoa, Kukapoki and Pu‘uwaniania, are associated with streams and springs that feed the marsh. The location of seven *heiau* within the vicinity of the marsh indicates its traditional significance (Brennan 2007a).

Ulupō Heiau measures 140 by 180 feet and its walls are up to 30 feet in height. Its original construction is attributed to the *menehune*, which indicates its antiquity. According to legend, some of the stones were transported from Kualoa. It is likely that the terraced platform was originally a *mapele*, or agricultural *heiau*, based on its location adjacent to the marsh. Over time, however, the *heiau* is believed to have been converted into a *luakini* or a large *heiau* used for human sacrifice and associated with war. The size of the structure indicates that an *ali‘i* had the power to order enough people to construct the *heiau* (State of Hawai‘i 1997).

Handy and Handy (1972:457) add:

> Kailua must formerly have been very rich agriculturally, having one of the most extensive continuous terrace areas on Oahu, extending inland one and a half miles from the margin of Kawainui Swamp. Terraces extended up into the various valleys that run back into the Ko‘olau range. There were some terraces watered by springs and a small stream from Olomana mountain along the western slope of the ridge that lies southeast of Kawainui Swamp, and another system of terraces was east of the seaward end of the ridge, watered by the stream which joins Kawainui and Ka‘elepulu Ponds. There were also terraces north of the Kawainui Pond, and several terrace areas flanked Ka‘elepulu Pond at the base of the ridge to the eastward. Much former taro land reverted to swamp when abandoned; this has since been drained.

3.1.2 Early Historic Period

Historic accounts of Kailua before 1850s are rare. One of the only accounts that could be located is that of Levi Chamberlain, a missionary who made a circuit around O‘ahu to inspect the mission schools in 1828. This account is particularly important because Chamberlain travels through and describes the landscape in the immediate vicinity of the current Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area. Chamberlain describes his progress from the settlement at Kailua through the low hills, today called the Kalaheo hills and the location of Kalāheo High School, that separate Kailua from Kāne‘ohe.

> Directing our course towards Kāne‘ohe, the next district, we were obliged to pass over a tract of low land mostly overflowed with water by the late rains. Here I was obliged to wade, as the distance was too great to admit of my being carried on the shoulders of my attendants, as was generally the case in passing a small stream of water. After emerging from the flat, our path was not improved, for we had now to walk through mud instead of water–we walked some distance along the steep hill, and at length by a winding path ascended to the top of it. We sat

> down to rest for a few minutes, and I found myself upon the summit of a ridge extending from the mountains in a right line to the sea and dividing the low lands of Kailua from those of Kaneohe (Chamberlain Ms.:664 in Kelly and Nakamura 1981:7).

It is clear from this account that this west-northwest portion of Kailua, in the vicinity of the project area, was low lying and prone to flooding. As we shall see in later discussions, this does not appear to change with the passage of time.

The drastic depopulation of the Hawaiian Islands following the introduction of Western disease has been documented in a number of sources (Bingham 1847; Stannard 1989;Bushnell 1993). According to one estimate the population of Hawaiians and part-Hawaiians fell from approximately 300,000 in 1778 to 82,593 by 1850 (Schmitt 1968:43; 74 cited in Kelly and Nakamura 1981:10). Population counts from the 1830s place the population of Kailua at approximately 760 individuals (Schmitt 1973:19 cited in Kelly and Nakamura 1981:10). This low population figure is incongruous with the productivity of the region, but well in keeping with population decline estimates due to western disease. Westerners passing through Ko‘olaupoko in the mid 1840s made note of the cold and flu symptoms among the native Hawaiians and that much formerly productive land appeared abandoned (Wyllie 1848:20 cited in Kelly and Nakamura 1981:10).

3.1.3 Mid- to late-1800s

3.1.3.1 *Māhele* Records

Māhele records are an important resource for determining land-use during the first half of the 19th century. In the division of lands among Kamehameha III and his people between 1848 and 1853, approximately 250 Land Commission Awards (LCAs) were claimed before the Board of Commissioners to Quiet Land Titles (Land Commission) in Kailua.

Many Kailua claimants list kings, queens, *kuhina nui* or governors to provide a time frame for when they received their land. The earliest such reference appears to be Kaloli, the wife of Kalani‘ōpu‘u who lived from 1752 to 1782 (Kuykendall 1980, Vol I:30-32), followed by Kamehameha I, *Mō‘ī* or king and conqueror of O‘ahu in 1795 (p.87), Liholiho, King Kamehameha II in the 1820s, Kaomi, the Tahitian companion of Kamehameha III who died in 1833 (p. 135), Boki, governor in the 1820s and his wife Liliha, *kuhina nui* - after 1829 and during the 1830s, Kīna‘u, Queen from 1832-1839, Ka‘ahumanu, Queen and *kuhina nui* in the 1820s and Kekū‘anao‘a, the governor of O‘ahu in the 1830s and 40s (p. 286), Pākī, a high chief during the same period (p. 285), and Kamehameha III during the early 1840s. Some claimants give specific dates and these range from 1828-1848. Thus, the people established in Kailua by 1848-1853 only ascribe their roots to the land from the period of the 60-70 years before the Land Commission Awards. While some claimant’s lands may have been in their family for longer periods, it would not have been politically correct in the land commission claims for land offered to them by Kamehameha III to refer to rulers prior to the Kamehameha dynasty.

It appears that Kailua, Kāne‘ohe, and Waimānalo were considered choice locations at the time of the *Māhele* as these *ahupua‘a* were awarded to the Crown, the royal family, and then to important *ali‘i* (particularly warrior chiefs for Kamehameha I). The entire *ahupua‘a* of Kailua was awarded to Queen Hakaleleponi Kapakuhaili Kalama (ca 1820-1870), wife of Kamehameha

III. An 1881 Hawaiian government survey map underscores the primary political fact of ownership of most of the marsh by Queen Kalama under LCA 4452 (Figure 5). The lands of Kūkanono are indicated to extend far out into the marsh, perhaps as far west as Maunawili Stream.

The Land Commission Award (LCA) records for Kailua document a thriving cultural landscape of garden areas clustered along its approximately 18 permanent and intermittent streams. The Maunawili/Kahana‘iki Stream delta is a large, marshy low-lying area with no more than a 6% slope, with fertile soils along stream beds with many taro *lo‘i*. Kapa‘a Valley is narrow but also had many gardens along its stream. Other fertile areas were cultivated on the *mauka* side of Ka‘elepulu Pond (modern fill now surrounds most of the former pond) going toward Waimānalo. Several fertile areas were cultivated within the present-day MidPac Country Club. The two great lagoonal fish ponds joined below the lookout point of Pu‘u o ‘Ehu and agricultural lands were maintained nearby drawing upon the wealth of these pond resources. A very narrow fertile area sits on the Pōhākupu upland about the location of Kailua High School. Most of the LCAs documented in the *Native Register*, *Foreign Testimony* and *Native Testimony* were in these areas close to ample surface water.

As reflected by Land Commission documentation, the settlement pattern within the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area during the mid 1800s was dominated by irrigated agriculture. Agricultural lands included numerous spring and stream watered pond fields (*lo‘i*). Dryland agriculture would have dotted the hill slopes above the marsh. Crops included traditional Hawaiian economic plants as well as Western introduced economic plants, such as fruit trees. House lots would have been dispersed on the higher grounds surrounding the marsh. *Māhele* records indicate differing periods of occupation of the land claimants. Some appear to be long time local residents. Others evidently received their land from the Kamehameha dynasty shortly before the time of the claim.

Table 1 lists the LCAs for the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area. The table was compiled using LCA information available through the Waihona ‘Aina online database (waihona.com) and from the Hawai‘i State Archives. For complete LCA and Royal Patent information, see Appendix A. These data provide insight into the specific land-use that was under way within the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area during the mid-19th century.

An 1899 Wall map shows more accurately the true complexity of ownership with the large land divisions of Kupaka, Kapalo, and Makalepo extending down from the summit of the Oneawa Hills to the west edge of the marsh and a large number of Land Commission Awards and later grants within the project area (Figure 6). A somewhat braided network of water flow between Kahanaiki Stream (on the west) and Maunawili Stream (on the east) is indicated. A small structure appears to be shown near the southeast side of the project area on the east side of Royal Patent 4533.1 to Kalawaiaku and just west of LCA 2544 to Lalapa.

3.1.4 1900s

In the early 1900s Kāneohe Ranch came to dominate land holdings in the Kailua and Kāne‘ohe area. Included within this acreage is much ranch land which has been bought, sold, let

Figure 5. 1881 Oahu Island Hawaiian Government survey map showing the location of the current project area

Table 1. Land Commission Awards located within the current project area

Land Claim #	Claimant	*‘Ili* (Land Division)	Land Use for Project Area Lands	Acreage Awarded	Royal Patent
2544	Lalapa	Ukikolo, Manu	4 *lo‘i* and a house site, claims for a small orange and lime grove appear to be elsewhere	2 *‘āp.*; 6.46 acres & 1.38 acres	R.P.2291
2575	Hekona	Manulele	5 *lo‘i* in each of 2 parcels	2 *‘āp.*; 2.29 Acs	R.P.2318
6153	Nanawahine	Manulele	2 *lo‘i*	1 *‘āp.*; 0.22 Ac.	No R.P.
6162	Punipeki	Olohana	2 (possibly 12) *lo‘i*	1 *‘āp.*; .47 Ac. Not awarded	R.P.2135
6807	K. Kapano	Kamakalepo & Kaaimoku	Claims 4 parcels incl. three of *lo‘i* (4,8 & 4 patches) and a house lot	Kamakalepo 2 *‘āp.*; 11.59 Acs; Pehialii; 1 *‘āp.*; 1.76 Acs	R.P. 2141;
6808	Poniuohua	Kamakalepo	15 *lo‘i*	2 *‘āp.*;5.254 acres	R.P. 3761
6813	Keli‘i-kanaka‘ole	Kamakalepo	12 (15?) *lo‘i*	3 *‘āp.*; 7.126 Acs.	R.P. 2139
7113:1 & 2	Keaka	½ Manu *‘ Ili*	taro lands	1 *‘āp.*; 1.52 Acs 1 *‘āp.*; 1.52 Acs	R.P.1652
7588 O	Kamo‘o-nohu	Palahele	?	1 *‘āp.*; 7.88 Acs	R.P. 7285
8797	Kao‘o	Kapalaoa	One *kula*, one house lot one *hala* tree	2 *‘āp.*; 2.61 Acs	R.P. 2142
8799	Kekaua-kamali‘i	Kapalaoa	9 *lo‘i* and a *kula* parcel	1 *‘āp.*; 2.66 Acs	R. P. 2528

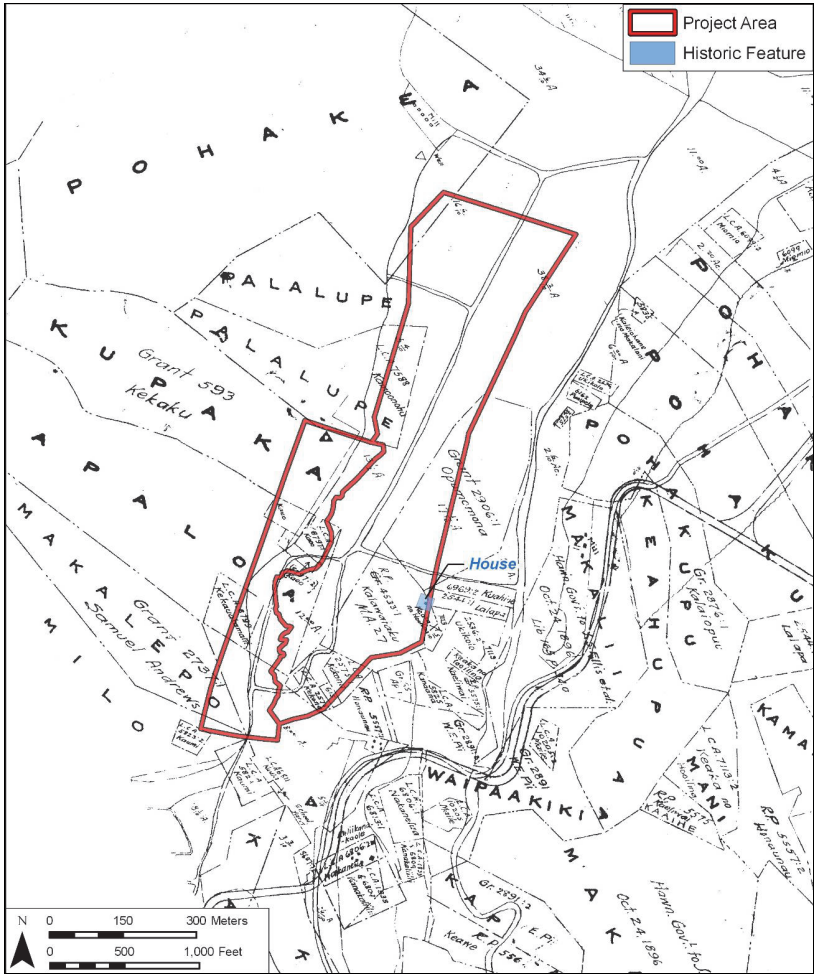

Figure 6. 1899 W.E. Wall map showing the location of the current project area

and used as ranch land by numerous parties since the mid-1850s. Kelly and Nakamura’s (1981:34-35) history mentions that Government land sales amounting to 3,000 acres were sold to 21 buyers in Kailua between the years 1849 and 1863. The largest parcel went to William Jarrett of the *‘ili* of Maunawili in 1849. The second largest was 399.5 acres to T. Cummins in Mokulua. Both parcels were used for ranching. Other land holdings which were turned into ranch land in the mid-1850s included the *‘ili* of Puanea and ‘Ohua‘uli (by the son of Paula Marin, Paul F. Manini). These large land holdings were used for years as ranch lands before becoming part of the Castle’s Kāneohe Ranch. Cattle, sheep, and horses, were thus allowed to roam at will through many parts of Kailua, and would have destroyed many gardens and abandoned habitation areas. Kelly and Nakamura point out that although specific records are not available, based on tax information, it is not unreasonable to estimate that several thousand head of cattle were grazing in Kailua by 1875 (Kelly and Nakamura 1981:69).

Kāneohe Ranch (Castle Trust) eventually acquired much of the land in Kailua (Hall 1997:84). Kāneohe Ranch, in addition to ranching, grew pineapple and sugarcane. With the decline of rice farming around the margins of Kawainui, cattle stock move onto the abandoned agricultural lands. Ranching in Kailua continues to this day, albeit on a drastically reduced scale.

For the nearly 100 years following the *Māhele*, Kailua grew into an important area of commercial agriculture. Kailua’s numerous abandoned taro *lo‘i* in the former taro lands of Maunawili and Kawainui provided perfect areas for the expansion of rice farms. By the early 1900s, the majority of the taro *lo‘i* in Kawainui marsh were converted to rice paddies, leaving little to no physical evidence of previous *lo‘i* cultivation. At one time, there were multiple rice mills functioning in Kailua Ahupua‘a, one of which was located in the vicinity of the present day Castle Medical Center. “The principle landowners at this time were N.R. Rice, Wong Leong, and W.G. Irwin, the Crown and heirs of J.S. Ellis” (Ewart and Tuggle 1977:8). By 1913, Wong Leong had sold his various parcels, land, leaseholds and rice mill to N.R. Rice and by this time, only five LCAs remained with their original claimant or heirs (Ewart and Tuggle 1977:9). A 1902 Wall Territory Survey map is of interest in that it appears to show a road making a southerly arc heading west from a rice mill and crossing the central portion of the project area (Figure 7). Any such road would have needed to cross the channels of Kahanaiki Stream (on the west) and Maunawili Stream and some very marshy ground.

By the first part of the 20th century, rice growing in California was using more modern production methods to reduce their costs. This led to the rapid decline in rice farming in Hawai‘i (Kelly and Nakamura 1981:51-63). Coulter and Chun (1937:53) also mention the prohibition of Chinese immigrants to Hawai‘i beginning in 1876 as another reason for the decline in rice cultivation. A 1919 Fire Control map shows no human activity within the project area. It is believed that rice cultivation had collapsed by this time (Figure 8).

Sugar never became an important crop in Kailua itself, but the need for water for the adjacent sugar lands of Waimānalo was an important factor in the transformation of the Kailua water shed. As early as the late 1870s a system of flumes, ditches, and tunnels were built in the *mauka* portion of adjacent Maunawili to collect water from the abundant springs and streams. By 1881 close to 1,000 acres of sugar had been planted, and milling operations were underway in Waimānalo (Kelly and Nakamura 1981:76). Expansion in acreage continued, increasing the need

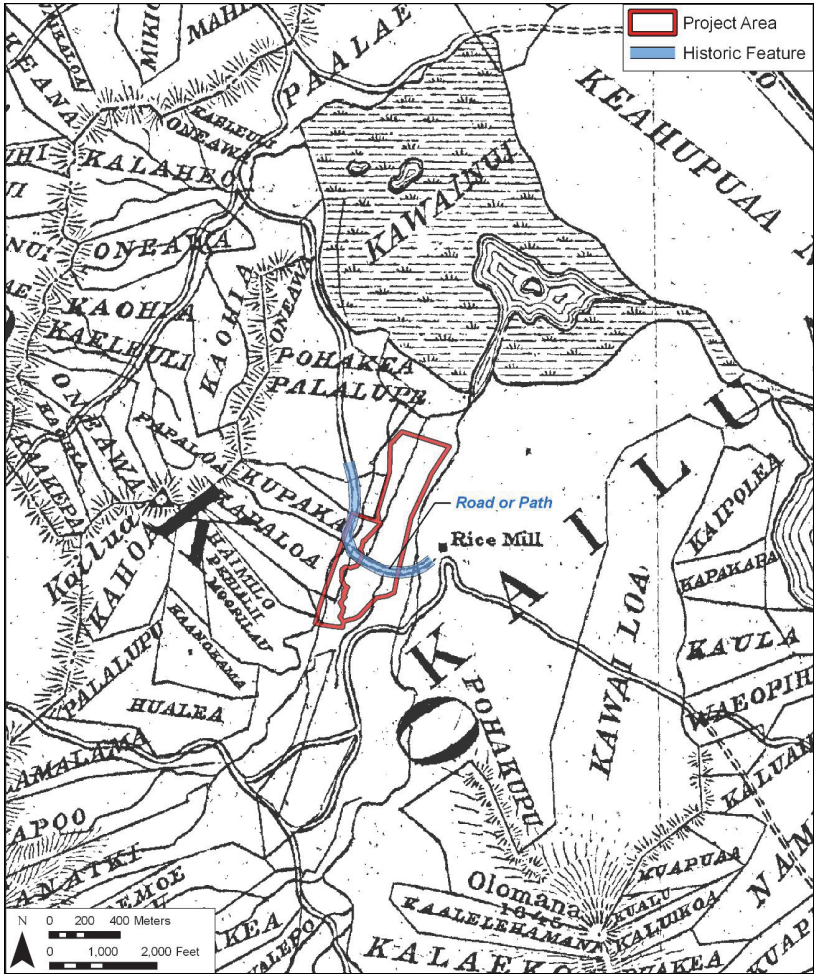

Figure 7. 1902 Hawai‘i Territory survey map by W.E. Wall (RM# 2374) showing the location of the current project area

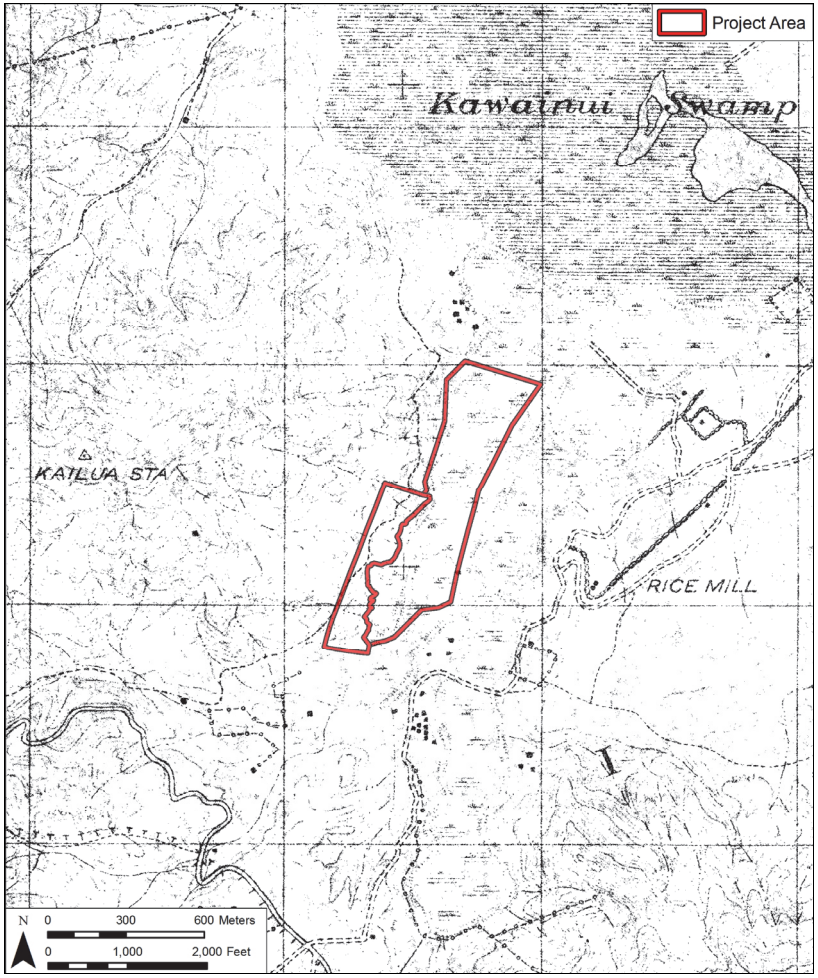

Figure 8. 1919 Fire Control map, Waimanalo Quadrangle showing the location of the current project area

for water. By the 1920s, improvements to the Waimānalo Irrigation System included catchment tunnels that were excavated into the base of the Ko‘olau in Maunawili to increase flow.

Also completed in 1923 was a system of pumps, pipelines, tunnels, and ditches, which conducted water from Kawainui Marsh into the Kailua ditch, a portion of the Waimānalo Irrigation System. This system continued to supply Kawainui water to Waimānalo until the early 1950s (Harland, Bartholomew, and Associates 1959:53-54; Hall 1997:94; Kelly and Nakamura 1981:778-79). According to Wilcox (1996:111) two pumps lifted water from Kawainui and took it to the head of a 10,000-foot system of small tunnels, most through stone or hard earth, into a reservoir in Waimānalo.

A 1928 U.S. Geological Survey map shows an unimproved road (approximating Kapa‘a Quarry Road but further east) snaking through the west side of the southern portion of the project area (Figure 9). A portion of this road may follow a portion of the route shown on the 1902 map where the route heading west from the Rice Mill ascends the lands of Kupaka (see Figure 7). This road appears to end near the northwest corner of the project area. It appears that two houses are faintly shown on the downslope side of this road in the south central portion of the project area. A 1943 War Department map shows the same unimproved road seemingly still ending near the northwest corner of the project area (Figure 10). Much of this road and two houses on the downslope side of the road lie within the central west portion of the project area. A dashed line trail appears to follow the approximate alignment of the road outlined on the 1902 map traversing NE/SW across the central portion of the project area.

By the 1950s, the truck farms that had flourished since the turn of the century within the bounds of present day Kailua Town, were slowly replaced by housing, municipal, and retail developments. A 1954 Army Service map of the project area shows none of the earlier mentioned infrastructure, but does show Kapa‘a Quarry Road along its present alignment (Figure 11).

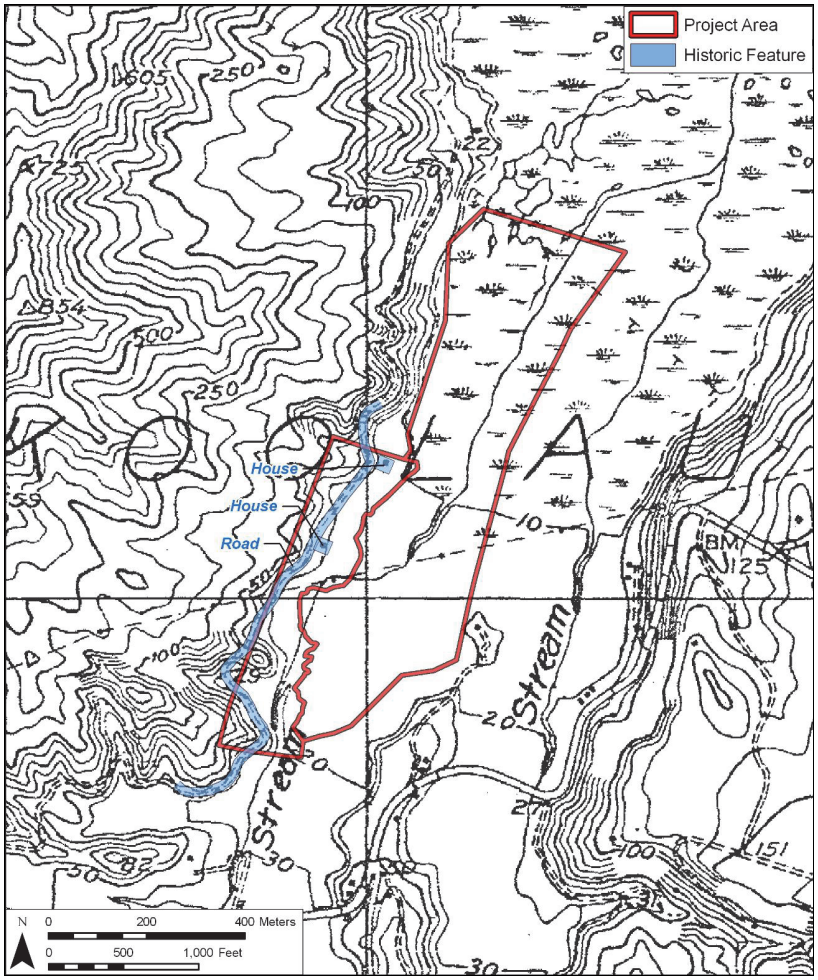

Figure 9. 1928 U.S. Geological Survey map, Mokapu Quadrangle showing the location of the current project area

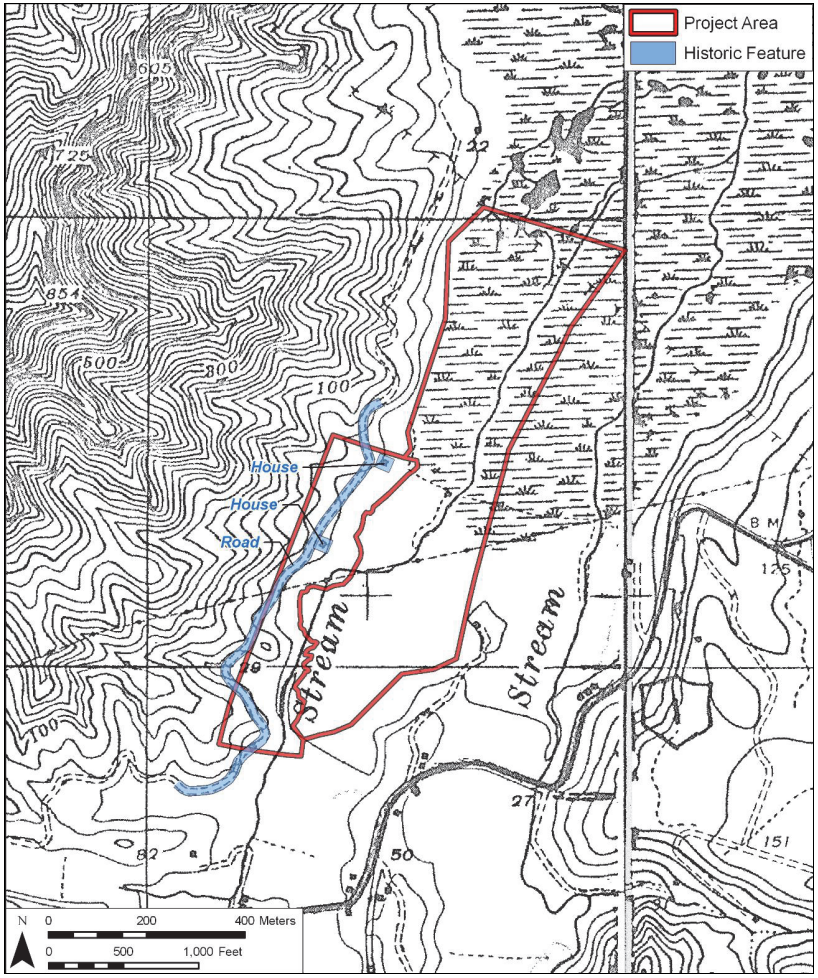

Figure 10. 1943 War Department map, Kaneohe Quadrangle showing the location of the current project area

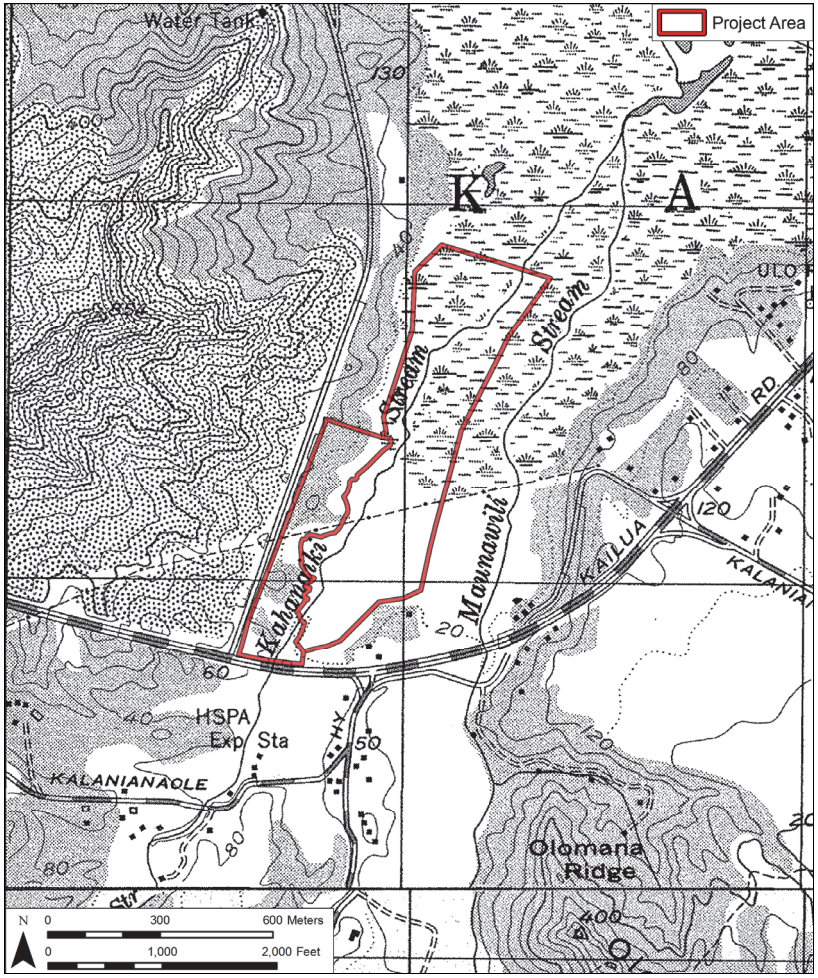

Figure 11. 1952 Army Map Service map, Mokapu Quadrangle showing the location of the current project area

3.2 Previous Archaeological Research in Kailua Ahupua‘a

Twentieth century archaeological findings from inventory surveys, data recovery projects, and inadvertent finds during development are the main source of our knowledge about the archeological record in Kailua. Archaeological work in the last 25 years in Kailua has been fairly extensive. This work has been concentrated along the margins of Kawainui Marsh and within Maunawili Valley for the most part. This is largely due to the fact that most of the *makai* portions of the Ahupua‘a had been developed prior to the implementation of State and Federal Historic Preservation Rules (Dye 1992). The many archaeological reports dealing with Kailua are listed and briefly summarized in Table 2 with the location of select archaeological projects in Figure 12.

Remains of upland terraces show that taro has been grown extensively and intensively in Kailua since the 13th or 14th century, and possibly earlier (Allen 1981, Williams, Mills and Allen 1995). The work of Cordy (1977, 1978), Allen (1981, 1986-87), and Athens (1983a) all document the mix of irrigated and dryland agriculture that was carried out in Kailua during prehistory and continuing into the historic period. Dryland agriculture, including yams, gourds, and sweet potato, would have been carried out on slopes and on drier flat-lands. Modification to the landscape would have been variable, ranging from none at all to the construction of terraces and mounds for planting. According to Handy (1940:155) the beach barrier at Kailua (current day Coconut Grove) was famous for its production of sweet potatoes, grown in small mounds. Irrigated agriculture would have been carried out along streams and below springs. Associated landscape modifications would have included construction of terraces and/or pondfields, ‘auwai, and earthen and stacked-stone berms. These types of dryland and irrigated agricultural features have been found in Maunawili and along the margins of Kawainui Marsh.

Previous archaeological investigations in Kailua have located dispersed prehistoric habitation remnants. This is in keeping with the observations of early Westerners in Hawai‘i that the settlement pattern for the most part was dispersed habitations scattered across the landscape amid agricultural fields. It should be remembered that settlement data is conspicuously absent from the lowland, beach berm areas of Kailua, due to early development of these areas.

McAllister (1933) reported eight *heiau* within the *ahupua‘a* of Kailua, and it is not unreasonable to conclude there were several more of which McAllister’s informants had no knowledge. This is well in keeping with Kailua’s status as a productive *ahupua‘a,* the residence of *Ali‘i*. The three known *heiau* closest to the current project area are McAllister’s sites 359 Pahukini Heiau, 360 Holomakani Heiau, and 371 Ulupō Heiau.

Table 2. Archaeological Studies at Kailua Ahupu‘a, O‘ahu (Kawainui studies are in bold)

Reference	Location	Description and Results
Thrum 1907, 1909 1916	Kailua Ahupua‘a	In his articles for the *Hawaiian Almanac and Annual* (1907-1916), Thrum is the first to document many of the *heiau* in the *ahupua‘a* of Kailua.
McAllister 1933	**Kailua Ahupua‘a**	**McAllister describes 16 sites within Kailua Ahupua‘a, including Kawainui pond (# 370), Ka‘elepulu fishpond (# 377), Ulupō Heiau (# 371), and Pahukini Heiau (# 359). In all, eight *heiau* are reported for Kailua.**
Handy 1940	Kailua Ahupua‘a	Kailua Ahupua‘a is described as a rich, productive, well-terraced taro growing area (p. 99). The “sandy plains” of Kailua were planted in sweet potato, using a planting system of small soil mounds (p. 155, plate 8).
Emory (Diary) 1952	Makawao Street	Early work by the Bishop Museum. A number of excavations took place, including some burials but recordation was sparse.
Johnson and Kikuchi 1963	Kailua	Report of area survey. Early report of sites in Kailua on file at Bishop Museum.
Watanabe 1976	Maunawili	Fieldtrip report – notes terraces and a house platform.
Bordner 1977	Proposed Kapa‘a Landfill Site	Archaeological reconnaissance with no significant findings.
Clark 1977	H~m~kua Drive Between Hahani Street and Akoakoa	Site survey of a proposed road corridor briefly describes stone alignments, a large earth mound and wall alignments, a house site (site -4699), and a possible *heiau* (site -4700).
Clark and Connolly 1977	H~m~kua Drive along Ka‘elepulu Stream	This survey identified five stacked-stone alignments, a possible wall alignment, a potential habitation site, two agricultural sites, the remains of an irrigation ditch, and surface midden. A possible *heiau* was also recorded.
Cordy 1977a, b	**S and SE margin of Kawainui Marsh**	**These reports, archaeological surveys, historic document research, and aerial photograph analysis, for the alignment of a proposed City and County sewer-line, document historic house sites and dry land and wetland agricultural features.**
Ewart and Tuggle 1977	**Kawainui Marsh**	**Archaeological investigation reports no significant findings.**
Cordy 1978a	**(Site 7) at Kawainui Marsh**	**Test excavations involving four test trenches in a large walled agricultural complex.**
Cordy 1978b	Kailua Beach Park Boat Ramp Area	Archaeological inventory survey. Reports no significant finds.
Morgenstein 1978	Kawainui Marsh	Geoarchaeological analysis of field remnants dating to the late pre-Contact early post-Contact period.
Dye 1979a, b	Kapa‘a Quarry, Ulumawao Ridge	Reports the discovery, mapping, and excavation of Bishop Museum site # 50-Oa-G6-31, a combination of terrace remnants and cobble paving, thought to be prehistoric agricultural remnants.

Reference	Location	Description and Results
Clark 1980a	**“Site F” (just west of Ulupō Heiau on Kawainui’s SE margin)**	**Inventory survey documented over 178 predominantly agricultural features, many of which were previously located by Cordy (1977); reports a 350-650 A. D. radiocarbon date from a context that is not clearly associated with human activity.**
Clark 1980b	Paul Property 1-4-2-018:016	Analysis of skeletal remains. No documented recommendations.
Clark and Kelly 1980	**Kawainui Marsh**	**Historical and archaeological study. Includes a summary of work at six sites.**
Kraft 1980a, b, c	**Kawainui Marsh**	**Geoarchaeological study. Coring results suggested a shallow marine embayment similar to present day Kāne‘ohe Bay c. 6000 and 2800 years B. P. Kraft suggested formation of the sand berm could be related to human factors.**
Allen-Wheeler 1981	**Kawainui Marsh**	**Archaeological excavations of agricultural features in marsh - presents a model for agricultural developments in the area.**
Kelly and Nakamura 1981	**Kawainui Marsh Area**	**Detailed historical study of the marsh area. Findings included a fishpond and agricultural features within marsh.**
Neller 1981	Waimānalo Ditch System	Photo survey of the ditch system. Report records features without recommendations.
Bordner 1982	Proposed Kalāheo Sanitary Landfill Site	Archaeological reconnaissance reports no significant finds.
Morgenstein 1982; Hommon 1982	H~m~kua Drive adjacent to Ka‘ele-pulu Stream	Archaeological investigation documented historic fill in the upper layers and the presence of one potential agricultural “bund” (embankment used to control the flood of water), thought to be associated with rice farming, below.
Neller 1982a	Maunawili Valley	Reconnaissance of abandoned *lo‘i* & terraces up ‘∅ma‘o Stream and near Api Spring. Recommends state purchase of areas for preservation and public use.
Neller 1982b	**Kawainui, K©kanono area TMK 4-2-13:38**	**These limited subsurface investigations were carried out in the same area reported by Clark (1980) and Athens (1983a). Neller dismisses the early date reported by Clark (1980).**
Neller 1982c	Kīhāpai Street	Archaeological reconnaissance with one test unit produced inconclusive results.
Athens 1983a	P◠h~kupu K©kanono slope SIHP #50-80-11-2022	Archaeological investigation concluded that the numerous surface features (primarily agricultural mounds and terraces) were mostly built after 1900 A. D.; calls into question the early dates (4th to 7th century A. D.) obtained by Clark on the same slope.
Athens 1983b	H.A.R.C. Site 50-OA-G6-40	Archaeological excavations at a beach midden deposit reports marine midden, hearths and pit features.

Reference	Location	Description and Results
Barrera 1983	Ko‘olau Vista	Archaeological reconnaissance and testing noted surface coral and marine shells; test borings produced no significant finds.
Barrera 1984a	Maunawili at Proposed Well Locations	Archaeological survey notes terrace retaining walls for agriculture (likely prehistoric).
Barrera 1984b	Kailua Mall	Archaeological reconnaissance reports no significant finds.
Barrera 1984c	**Kailua Road Maunawili and Kūkanono**	**Archaeological survey for Interceptor Sewer, Wastewater Pumping Station and Force Main, reports general observations on archaeology in vicinity.**
Barrera 1985	Maunawili at Proposed Golf Course Location	Archaeological reconnaissance notes potential for subsurface archaeological remains.
Toenjes and Donham 1985	Maunawili Stream	This reconnaissance focuses on a ditch that once carried water from Maunawili Stream to a rice mill; previously unreported archaeological features are discussed.
Allen 1986, 1988a, b	Maunawili Valley	These mitigation and data recovery plans and preliminary reports detail the results of archaeological investigations at the site of the Royal Hawaiian Country Club, Inc. Golf Course.
Brennan 1986	Maunawili Valley	Archaeological survey in which 42 sites located and described, some of which had been previously identified, including historic features, a *heiau* (possibly McAllister's site 374) prehistoric irrigated taro fields, habitations, walls, and burials.
Bath & Pietrusewsky 1988	59 Kailuana Place	Data recovery. Single burial recovered, osteological analysis completed.
Bath and Smith 1988	Lanikai 8-inch water main project	Data recovery. Single burial recovered, osteological analysis completed.
Kawachi 1988	Kapa‘a Ridge	Field check of Ulumawao Area. This report is a field check with no recommendations.
Pietrusewsky 1988	Kailua Beach Park	Data recovery. Single burial removed, osteological analysis completed.
Sinoto 1988	Maunawili	A pre-field literature search presents a chronological history and bibliography.
Smith and Kawachi 1988	1063 Ko‘oho‘ō Place	Data recovery. Single burial recovered, osteological analysis completed.
Watanabe 1988	**Kawainui Marsh Levee**	**Archaeological monitoring of dredging and vegetation removal in marsh operations notes modest features.**
Williams 1988	Maunawili	Survey report in which 13 sites were recorded in this *mauka* portion of Maunawili (540'-920' elevation), including probable historic charcoal kilns and agricultural complexes.
Allen 1989	‘Ainoni Spring Ditch, Maunawili	Letter report regarding modern ditch notes terraces and planting areas in the vicinity.

Reference	Location	Description and Results
Pantaleo and Cleghorn 1989	Proposed Windward Park	Reconnaissance survey. Five archaeological sites recorded prompting a recommendation of further work.
Szabian, 1989	Olomana, Maunawili	Archaeological reconnaissance survey of the Women's Community Correctional Complex reports no significant finds other than historic buildings.
Athens 1990	**Kawainui Marsh**	**Field summary report: archaeological subsurface excavations for flood control project.**
Hammatt and Shideler 1990	Castle Junction	Archaeological reconnaissance for the interchange project. Survey revealed no archaeological resources within the project area. Previously recorded ranch office and war memorial noted.
Hammatt et al. 1990	**Kawainui Marsh**	**Geoarchaeological study; sediment cores from 10 locations in the Marsh were analyzed. At approximately 1400 A. D. there are dramatic changes in the pollen record. These changes may well be the result of increases in Hawaiian subsistence activities.**
Kawachi and Smith 1990	Kawailoa Road	A burial was removed at Ka‘ili‘ili. Reported by SHPD archaeologist.
Kennedy 1990	P∩h~kupu	Archaeological reconnaissance survey for a proposed subdivision emphasizes substantial land alteration.
Athens and Ward 1991	**Kawainui Marsh**	**Paleo-environmental and archaeological investigations, flood control project. Survey reveals no cultural resources within marsh, but suggests archaeological monitoring in future.**
Dye 1991	1414 ‘A‘alapapa Drive, Lanikai	Burial recovered.
Hammatt et al. 1991	N~ Ala Hele Trail Corridor at Maunawili	Archaeological inventory survey of a trail corridor identifies seven sites, including old Pali Road, two charcoal kilns, and an agricultural complex.
Medical Examiner 1991	Ku‘uhoa Place Shed	Includes police report which documents the inadvertent discovery of a human burial.
Orndoff and Clark 1991	Lanikai	A historic literature and documents search that presents finds of monitoring.
Quebral et al. 1991	**Kailua Gateway Development**	**Archaeological inventory survey. Four new sites are located including two lithic scatters, one previously recorded site relocated. Further investigations, are recommended.**
Creed 1992	Waim~nalo Irrigation System	National Register nomination form. Includes areas in Kailua, Maunawili and Waimanalo.
Hammatt 1992	Kailua Elderly Housing	Archaeological testing and burials reported.
Hammatt, and Shideler 1992	Site 50-80-11-3738 Ka‘ōhao ("Lanikai")	Archaeological disinterment of inadvertent burial finds.

Reference	Location	Description and Results
Hammatt et al. 1992	Pu‘u o ‘Ehu Ridge	Inventory survey for the proposed location of the Kailua 272 Reservoir found no historic properties. Oral history research did reveal the traditional Hawaiian significance of Pu‘u o ‘Ehu peak.
Allen and Somer 1993	H-3 Highway Archaeological Projects	Inventory Survey. Human burials and isolated remains documented, Interstate H-3 Highway Archaeological Projects.
Athens and Ward 1993	Hāmākua Marsh	Paleo-environmental investigations.
Erkelens 1993	**Kūkanono Slope, Kawainui Marsh**	**Archaeological investigation M.A. thesis documents surface survey and the excavation of 29 test pits. Results give clearer picture of activity in area.**
Stride et al. 1993	Olomana Golf Course Expansion Area	Archaeological reconnaissance survey of a 56-acre proposed Olomana Golf Course expansion area documents ditches and reservoirs (SIHP # 50-80-11-4524) of Waimānalo Sugar Company - a geographic extension of SIHP # 50-80-11-4042.
Brennan 1994	Maunawili	Monitoring results, site documentation, and significance assessment for 8 sites.
Dagher 1994	Mauliola Family Cemetery	Complete recordation of cemetery.
Jourdane 1994	Ulupa Street	Report on inadvertent discovery of human remains at SIHP # 50-80-11-4864.
Kawachi 1994	Maunawili Valley	An archaeological review presenting an overview of land use and results of archaeological studies.
Williams et al. 1995	Upper Maunawili Valley	Data recovery. Excavations at six predominantly prehistoric agricultural sites within upper Maunawili Valley (the location of the Luluku Banana Farmers Relocation) are reported with radiocarbon results between 1260 and 1650 A. D.
Putzi 1996	North Kainalu Drive	Data recovery. Report on the recovery of human remains (2 burials) from State Site # 50-80-11-5377.
Allen et al. 1997	Middle Maunawili Valley	Geoarchaeological and historical investigations presents results of inventory survey, data recovery, and interpretive excavations (3 volumes).
Cleghorn 1997	Ku‘u Kama Street	Data recovery. Reports recovery of human skeletal material.
Hammatt and Chiogioji 1997	Auloa Road	This reconnaissance assessment of a 0.8-mile section of Auloa Road, reports no significant finds other than the previously recorded Kaneohe Ranch office building and the adjacent war memorial (SIHP # 50-80-10-1360).
Riford et al. 1997	Maunawili	Archaeological monitoring report documents 8 new sites and 131 new features.
Cleghorn 1999a&b	Pūniu & Ho‘olai Streets	Monitoring report. Three separate human burials were encountered and recorded during property development. Two features were noted; one pit feature and a post-hole.
Collins 1999	66 Kaiholu Place	Monitoring report. Human skeletal remains of an adult female individual were disturbed during excavations.

Reference	Location	Description and Results
Dagher 1999	Old Orson’s Chowder House	Monitoring report. Reports inadvertent discovery of human skeletal remains.
Hammatt and Medeiros 1999	119-A Mo‘okua Street	Monitoring report. A single human burial was encountered during excavation of a swimming pool.
Hammatt et al. 1999	Kailua 272 Reservoir	Archaeological Inventory Survey. No archeological sites were recorded. One historic feature, a water tunnel constructed in 1923 was present.
Jourdane 1999	Kaiholu Place	Police report. Details recovery of human remains.
Kikiloi et al. 2000	**Kawainui Marsh**	**Archaeological inventory survey for the Kawainui Marsh Park Improvements area.**
McDermott et al. 2000	**Kawainui Marsh**	**Archaeological assessment and background literature search for the proposed circle Kawainui Trail Project. Highlights possibilities for interpretive trail through marsh area.**
Medeiros et al. 2000	Andy’s Drive-Inn	Archaeological monitoring report for the former Andy’s Drive-Inn. Fragmented human remains encountered.
Hammatt & Shideler 2001a	**Kawainui Marsh**	**Cultural impact evaluation in support of the Kawainui Marsh Pathway Plan.**
Hammatt & Shideler 2001b	St. Anthony’s School, 145 Makawao Street	Report documenting the disinterment of inadvertently discovered human burials (SIHP # 50-80-11-5771).
Mann, McDermott, and Hammatt 2001	**Kawainui Gateway Park**	**Archaeological assessment of area finds no above-surface resources. Possibility of encountering burial thought likely.**
Mann, Shideler, and Hammatt 2002	Kalama Beach Park	Monitoring report: no cultural features, cultural deposits, or burials were found.
Jones & Hammatt 2004	Kailua Road	Monitoring report. Discontinuous and disturbed subsurface pre-Contact cultural layer (SIHP No. 50-80-11-6657) containing charcoal concentrations observed.
Borthwick et al. 2006	Kal~heo Avenue	Monitoring report. Two separate sets of human remains encountered during the course of excavations for new sewer line.
Garrett and McDermott 2006	Uluniu Street	One Burial recovered
Stein and Hammatt 2006	Kailua Beach Berm, Kīh~pai Street	Archaeological monitoring of building demolition revealed no cultural deposits.
Tulchin & McDermott 2007	408 A Uluniu Street	Burial site component of an archaeological data recovery report. Remains of one individual (SIHP # 50-80-11-6859) inadvertently discovered.

Reference	Location	Description and Results
Tulchin & Hammatt 2007	Hekili Street	Archaeological inventory survey. Pre-Contact subsurface cultural layer (SIHP No. 50-80-11-6916) consisting of a buried A horizon (former land surface) containing marine shell midden, stone tools (hammer stones), lithic debitage (flakes & cores), numerous pit features, and two human burials.
Tulchin, J and Hammatt 2008	For a New Kailua First Hawaiian Bank Project, TMK: [1] 4-2-038: por. 022 & 062	Identified SIHP No. 50-80-11-6960), a pre-Contact subsurface cultural layer containing 3 human burials (Features A-C), an *imu* (Feature D), midden (marine shell and mammal bone), fire-cracked rock, charcoal deposits, lithic debitage (basalt flakes), and numerous pit features.
Pammer, and Hammatt 2008	For Kailua Road Sewers Improvement District No. 276, TMK: [1] 4-2-001, 4-3-056 & 4-3-071	No significant finds
Whitman and Hammatt 2008	Kailuana Place and Kailuana Loop	Identified SIHP # 50-80-11-6925, a previously disturbed burial
Cultural Surveys Hawai‘i 2010	For the Pali 12kV/Maunawili Tree Wire Project, [TMK: (1) 4-2-014: 001,002, 006 por.]	Letter Report for an Archaeological Field Inspection identified no new historic properties

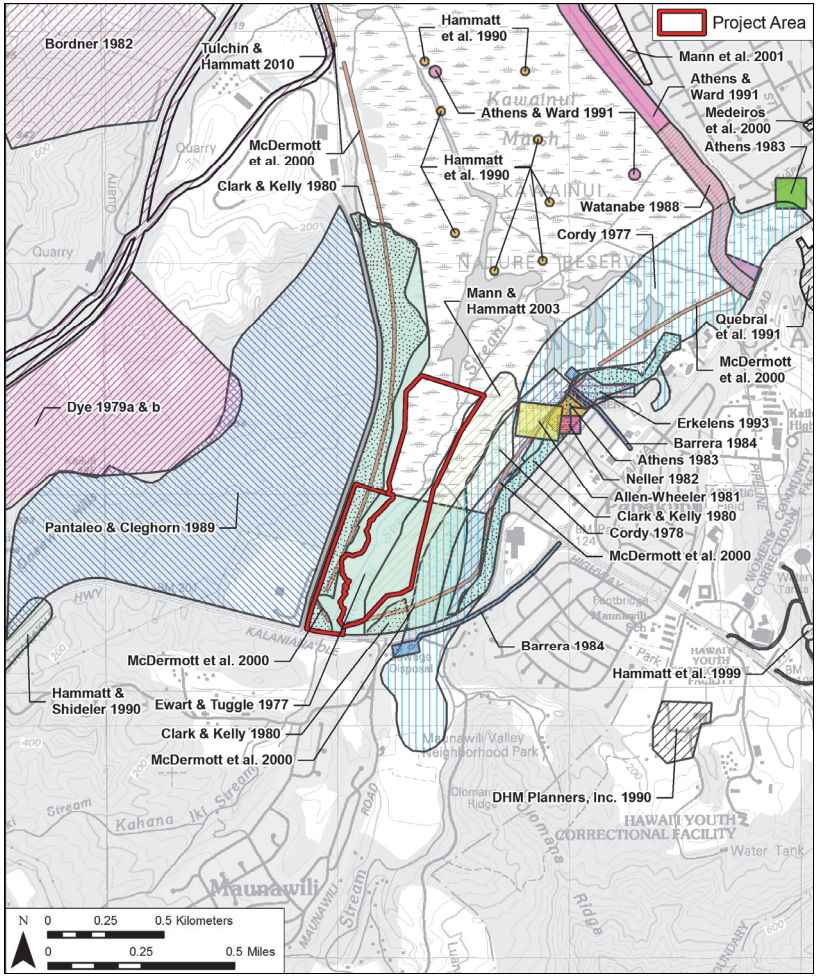

Figure 12. 1998 U.S. Geological Survey 7.5-minute topographic map, Mokapu Point Quandrangle showing the location of previous archaeological studies in the vicinity of the current project area

In the last eleven years over 15 reports of inadvertent finds of human skeletal remains have been made in Kailua, on the sandy beach berm of Coconut Grove and Lanikai. As with other near shore sandy areas in Hawai‘i, clearly Kailua was used for burial of the dead. These burial remains are not nearly as extensive, however, as the hundreds of human burials discovered from nearby Mōkapu peninsula (Snow 1974).

3.3 Most Relevant Archaeological Reports Conducted in Kawainui Marsh

Most relevant to the current project area are a dozen archaeological investigations by Ewart and Tuggle (1977), Cordy (1977), Cordy (1978), Clark (1980), Allen-Wheeler (1981), Athens (1983a), Athens (1983b), Hammatt et al. (1990), Athens and Ward (1991), Neller (1982), Erkelens (1993), and Mann and Hammatt (2003).

3.3.1 Ewart and Tuggle (1977).

An archaeological reconnaissance survey and historic literature review of Kawainui Marsh was undertaken in 1977 by Ewart and Tuggle (1977). Their somewhat U-shaped study area (Figure 13) consisted of an area of higher ground between Maunawili and Kahana Iki Stream at the south end of the marsh, and the slopes between the marsh and Quarry Road as far north as the Kapa‘a Quarry on the west and the southeastern slopes between the marsh and modern developments as far north as St. Johns Lutheran Church on the east. As a result of the reconnaissance survey, six archaeological features (Site 1 through Site 6) were identified on the Kūkanono-Pōhakupu slope (summarized in Table 3). With the exception of a single terrace on the west side of the marsh and two abandoned modern house sites near the H-3, no cultural remains were noted in the remainder of the project area. The authors note however, that cultural deposits may exist in the area between Maunawili and Kahana Iki Stream and along the marsh periphery, but due to historic surface alterations and vegetation coverings, these areas were not visible to ground surveyors. Subsequently, the authors recommended archaeological monitoring in the area between Maunawili and Kahana Iki Stream.

Only one of the nine sites identified by Ewart and Tuggle (1977) lies near, but outside (just northwest of the northwest corner of) the present project area – their site 7 consisting of a terrace and stone wall (Figure 13). No map is provided for this site and the description is brief (summarized in full in the table below). Their evaluation of Site 7 is lumped with an evaluation of several other sites that “offer very poor research prospects. They are all isolated, badly disturbed, and for the most part, historic sites. Their status is recommended to be considered as MARGINAL” (Ewart and Tuggle 1977:24).

Table 3. Brief Summary of Nine Sites Reported by Ewart and Tuggle (1977:18-25)

Site #	General Location	Description
1	SE marsh, just north of Ulupō Heiau by a spring	Group of terraces with a long retaining wall upslope & ruins of a post-Contact house
2	SE marsh, just NW of Ulupō Heiau	Poorly defined terraces and numerous stone mounds& 2 post-Contact house ruins
3	SE marsh, just NW of NW end of Uluoa Street	Terraces & mounds (one associated with a pipe hence post-Contact)
4	S marsh just west of Ulukahiki Street	2 mounds and some small wall fragments also a fragment of a wall located on top of the bluff
5	S marsh just west of Ulukahiki Street	Remains of at least 3 post-Contact buildings
6	S marsh just west of Ulukahiki Street	Unusual earthen mounds in a *hau* grove
7	W side of marsh, just east of Quarry Road (in present study area)	“a low stone alignment forming a terrace approximately 5 m (16.40 ft.) in length with a stone wall approximately 1 m. (3.28 ft.) high x 3 m (9.84 ft.) long running at right angles to it. The wall and terrace abut at their southeast corners.”
8	NW corner of marsh near H-3	Recently abandoned house site
9	NW corner of marsh near H-3	Recently abandoned house site

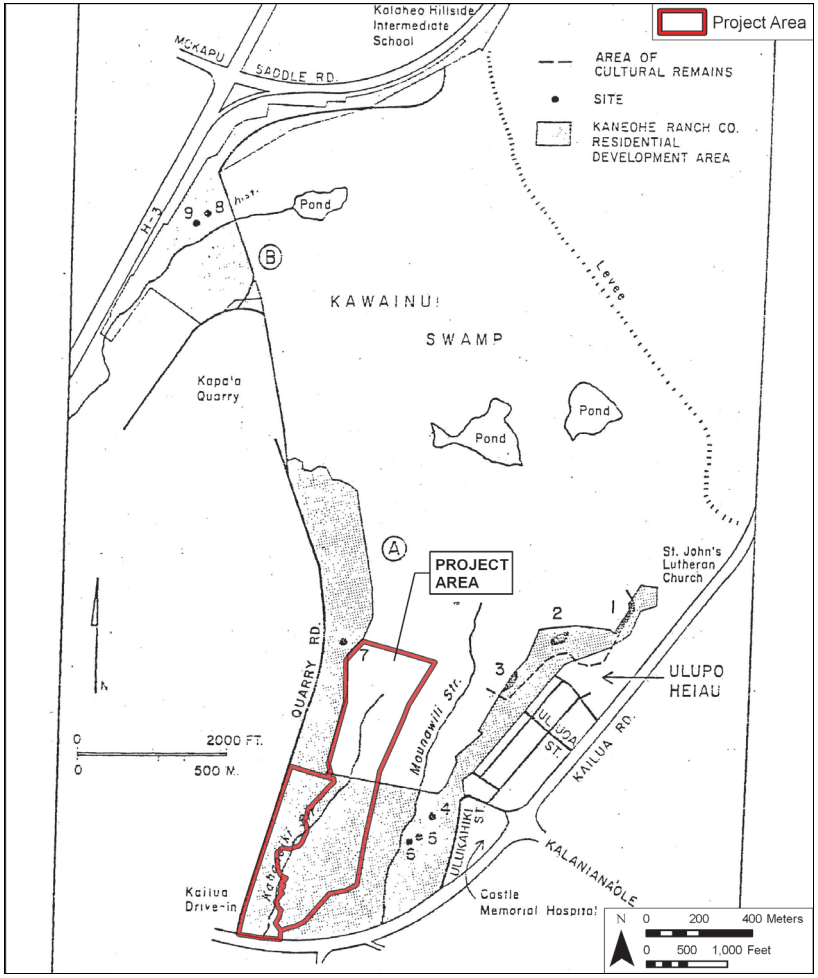

Figure 13. Ewart and Tuggle (1977 study area map showing the location of the nine archaeological sites located with reference to the present study area (outlined in red; only their “Site 7” is near the present study area)

3.3.2 Cordy (1977)

Cordy (1977) completed a cultural resource study involving historic background research and a reconnaissance survey for the proposed City and County sewerline in Kawainui Marsh. The Cordy (1977) archaeological study area extended along virtually the entire southeast side of the marsh but did not overlap with the present study area. Study results indicated that the only archaeological remains found during the reconnaissance survey existed on the Kūkanono-Pōhākupu slope. Seven archeological sites were identified in the project area, consisting of clusters of terraces, walls, mounds, and historic houses. Cordy’s (1977) designated sites 1 through 6 (summarized in Table 4) are relatively discrete and small and are all located on the Kūkanono/Pōhākupu slope (Figure 14). The author concluded that the sewerline alignment would not affect most of the sites identified, and recommended no further archaeological work. However, the author did indicate the Kūkanono and Pōhākupu sites to be of significant value and further recommended that any future work in the vicinity should be preceded by additional archaeological work.

Cordy’s (1977) work (including a “Supplement 1 of the same August 1977 date) included analyses of historic aerial photographs in which he noted faint rectangular markings in the marsh off the Pōhākupu area that appeared to be evidence of former agricultural fields in the marsh. It appears that no formal designation for this patchwork of former fields was made in the Cordy (1977) work (or in the accompanying “Supplement 1). The following year, Cordy (1978), addresses this agricultural complex as “Site 7” (building sequentially on the designations of Site 1 through Site 6 in the Cordy 1977 studies). Cordy’s (1978) discussion of “Site 7” encompasses a large area east of Maunawili Stream along the slopes of Pōhākupu from Kalaniana‘ole Highway to the southern most extreme of Kūkanono slope.

Table 4. Brief Summary of Sites Reported by Cordy (1977:34-42)

Site #	General Location	Description
1	N Kūkanono slope between Kailua Road and marsh	Cluster of terraces and a U-shaped enclosure, and wall by a spring
2	W Kūkanono slope between Kailua Road and marsh	Cluster of 9 or 10 terraces, mounds (2 with post-Contact artifacts), rectangular enclosure, a walled depression and a historic house
3	Central Kūkanono slope between Kailua Road and marsh	2 walls: (6 m long, 1 m wide, 1.0-1.5 m high) (5 m long, 0.5 m wide and 0.5 m high)
4	Pōhākupu slope between the west end of Uluoa Street and marsh	Cluster of 10 mounds, 9 terraces, 1 wall and a cement foundation (“Historic House # 4)
5	Pōhākupu slope between Manu Mele Street and marsh	Walls and mounds. Main wall 10 m long, 0.5 m wide and 0.4 m high; mounds are 2 x 2 m.
6	W Kūkanono slope between W end Manu ‘Ō‘ō Street and marsh	Terrace (7 m long, 0.6 m high) & canal (12 m long, 1 m wide, 0.6 m deep)
7*	Off the marsh in the Pōhākupu area	Faint rectangular markings on aerial photographs suggestive of former agricultural fields in the marsh

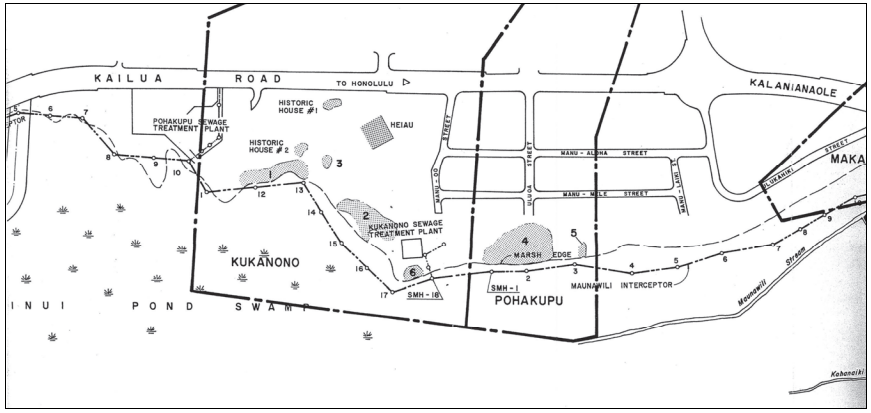

Figure 14. Map showing location of Cordy (1977:35) sites 1 through 6 on the Kūkanono-Pōhākupu slope

3.3.3 Cordy (1978)

A second phase of archaeological investigation in relation to the proposed City and County sewer line was undertaken less than a year later by Cordy (1978). The second phase was initiated after the first study concluded that an intensive cultural survey should be conducted to characterize and describe the sites, and to make an accurate determination of probable significance. In the initial 1977 study, many aerial photographs were reviewed. Several of the aerial photographs showed faint parallel lines extending into the marsh. Review of a series of aerial photographs (circa 1940) suggested that Kawainui marsh from the mouth of Maunawili Valley to Kūkanono included a number of faint, rectangular areas that could be abandoned agricultural fields (Cordy 1977:33). As a result of the preliminary aerial photograph review, Cordy excavated three test units within his designated Site 7 and one test unit within his designated Site 5. All four test trenches were located east of Maunawili Stream and in the immediate vicinity of Pōhākupu slope. Test Trench 1 and 2 were excavated across two stone walls that were 45 and 25 cm below surface. Cordy concluded that the stones walls were associated with taro cultivation. A basaltic glass fragment was also recovered in-situ and dated. Test Trench 4, was excavated across a visible stone wall. Cordy (1978:5) concluded that associated stratigraphic layers suggest that the stone wall may have been used for crops other than taro. Test Trench 3 was located upon the Pōhākupu slope. No stone walls were identified, although the presence of charcoal suggested agricultural use. This study was significant in demonstrating that buried cultural deposits are still present and intact below the existing ground surface of the marsh.

Cordy (1978:5) defined "Site 7" as "part of a large walled agricultural complex in the marsh at the mouth of Maunawili Valley" and provided a map (present Figure 15) showing his understanding at the time of the extent of "Site 7". In casual discourse amongst those concerned with the cultural resources of Kawainui "Site 7" came to refer to much larger ill-defined areas of the marsh in which agricultural field walls and agricultural or cultural deposits were thought to possibly be present.

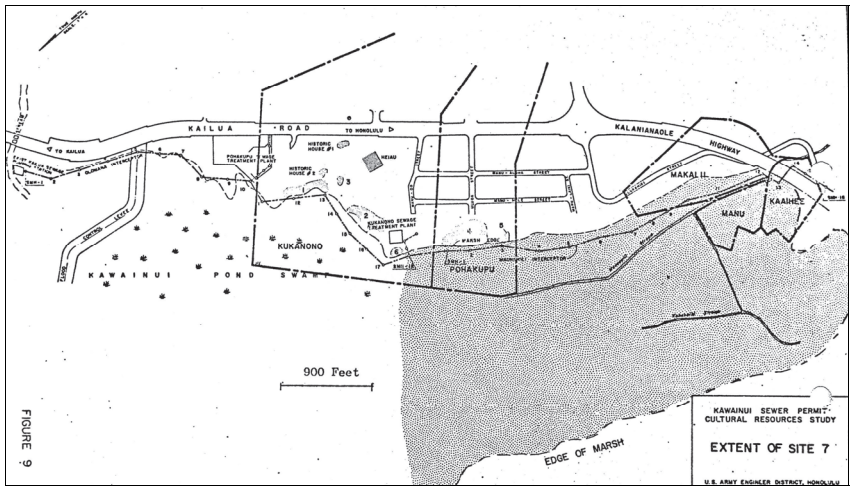

Figure 15. Cordy (1978: Figure 9) map of extent of Site 7

3.3.4 Clark (1980)

Jeffrey T. Clark working with the Bishop Museum for the Trustees of Castle Estate prepared a Phase I Archaeological Inventory Survey of Castle Estate Lands around the Kawainui Marsh. His work presents a general historical background, a summary of previous research, and then the results of archaeological survey which was focused on the south portion of the marsh.

He reports his survey results in terms of four geographic segments (I through IV). The present study area includes much of his Segment II and most of his Segment III study areas (Figure 16).

Clark presents his findings both by “archaeological loci” or “cluster” and by B. P. Bishop Museum site number which he correlates with the finds reported in prior studies in the following table (Table 5).

Table 5. Comparative Listing of “Archaeological Loci” reported in Clark (1980:24) (note: Site 50-Oa-G6-36 and Ewart & Tuggle Site 7 are correlated as the same).

Segment Location	Clark (1980)	Cordy (1977)	Ewart & Tuggle (1977)	Site
I	Cluster 1	Site 1	Site 1	50-Oa-G6-32
I	" 2	" 2	" 2	"
I	" 3	" 3	--	"
I	" 4	" 4	Site 3	"
I	" 5	" 5	--	"
I	" 6	" 6	--	"
I	" 7	--	Site 4	50-Oa-G6-34
IV	" 8	--	" 5	--
IV	" 9	--	" 6	--
II	" 10	--	--	50-Oa-G6-33
II	" 11	--	--	"
II	" 12	--	Site 7	50-Oa-G6-36
IV	" 13	Site 7	--	50-Oa-G6-39
I	" 14	--	--	50-Oa-G6-38
I	" 15	--	--	50-Oa-G6-37

It may be readily noted that of his 15 archaeological loci 9 (60%) are in his Segment I (the Kūkanono Slope), 3 (20%) are along his Segment II (the Kapa‘a Quarry Road slope), and 3 (20%) are in the south central portion of the marsh.

Of Clark’s three Archaeological Loci on the Kapa‘a Quarry Road slope (Clusters 10, 11 and 12) only his Cluster 12 (B. P. Bishop Museum site 50-Oa-G6-36) lies within the present project area (see Figure 17; his clusters 10 & 11 conforming to B. P. Bishop Museum site 50-Oa-G6-33 lie far to the north, east of the junction of Quarry Road and the Kapa‘a Dump Road, or outside the present study area).

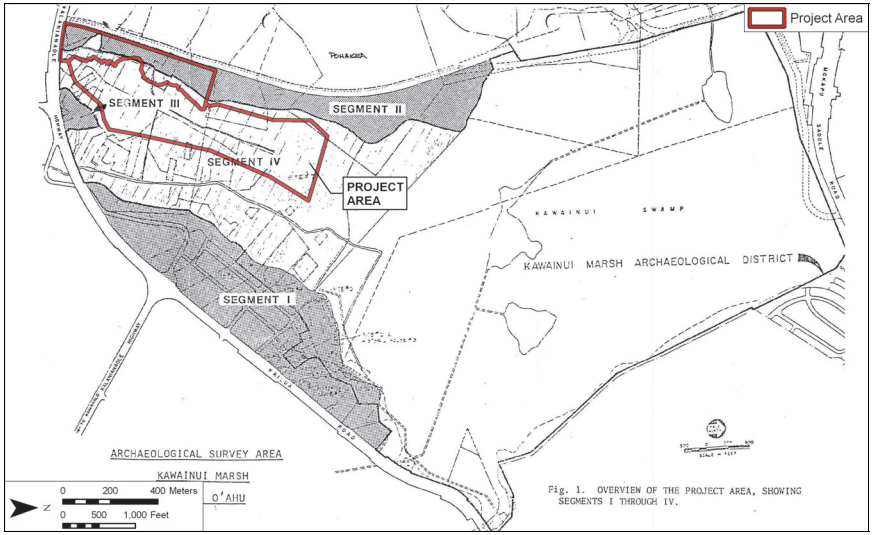

Figure 16. Clark (1980) Project Area Map showing project segments I through IV (present project area outlined in red)

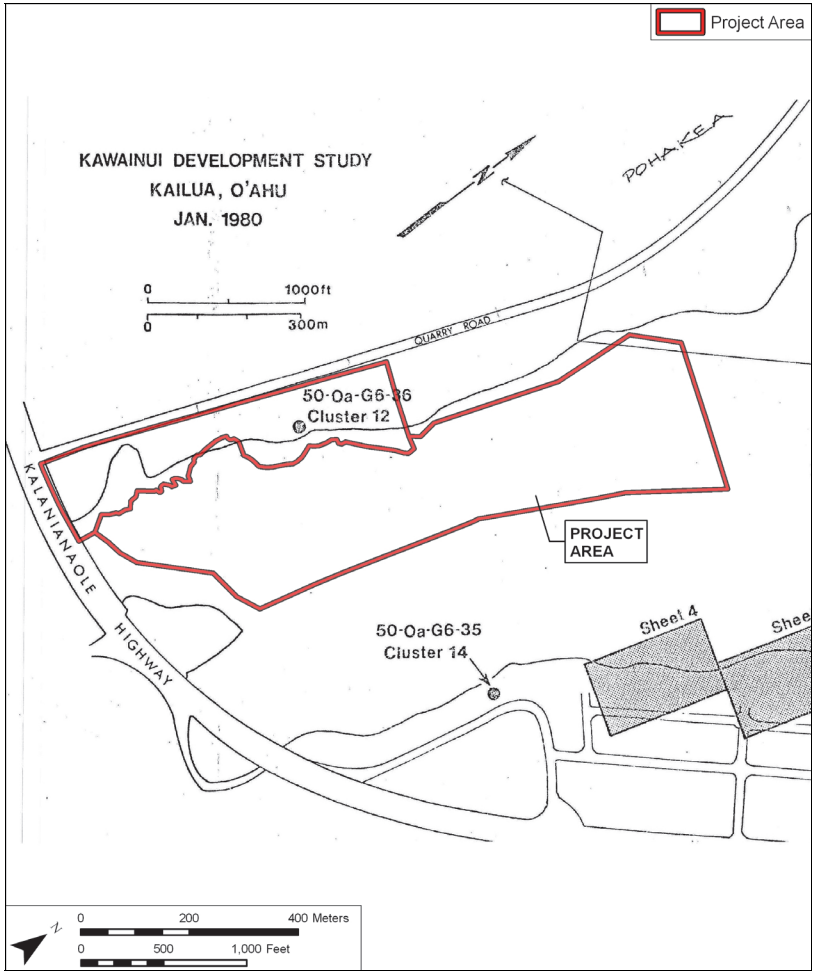

Figure 17. Location map for Clark's Cluster 12 that Clark identified with B. P. Bishop Museum site 50-Oa-G6-36 (from Clark 1989:25) (present project area outlined in red)

Clark’s description of B. P. Bishop Museum site 50-Oa-G6-36 also known to him as Cluster 12 follows:

> Site 50-Oa-G6-36
>
> This site is located in Segment II along the marsh edge at a point some 500 meters north of the intersection of Kalanianaole Highway and Quarry Road. It consists of a single cluster, [Clark Cluster designation #] 12, which has a single feature, a large terrace. The terrace walls extend for 65 meters along the marsh edge in a northeast-southwest direction and for 14 meters southeast-northwest. The walls appear to be a single course high and are marked by a somewhat sporadic occurrence of rocks. The terrace itself constitutes a relatively flat region ranging from .5 to 1.5 meters above the surrounding marsh. An old, rusting, dilapidated crane, some 80 m north of the southerly wall, is the most prominent feature of the area. [Clark includes a photo of the vicinity; see present Figure 18].
>
> No test excavation was conducted at this site and the only artifact recovered from the surface was the base from a ceramic bowl [Clark includes a photo of the artifact, see present Figure 19]. The site appears to be an agricultural terrace.

Clark’s designation of B. P. Bishop Museum site 50-Oa-G6-36 also known to him as Cluster 12 is particularly germane as it lies within the present study area (see Figure 17). The present study notes the presence in the early twentieth century of a number of roads and houses in this immediate area. It may be that Bishop Museum site 50-Oa-G6-36 relates largely, or entirely, to these early twentieth century constructions.

Clark’s three site identifications out in the south central marsh include designated clusters 8 & 9 (no B. P. Bishop Museum site # given) and Cluster 13 (identified with B. P. Bishop Museum site # 50-Oa-G6-39. Clark (1980:27) asserts that: “Clusters 8, 9, and 13 are located in Segment IV and are therefore outside the specific project area” and presents no data at all for these sites. Clark equates his clusters 8 & 9 with Ewart and Tuggle’s Sites 5 and 6 – see Table 5 above (from Clark 1980:24).

Clark (1980:72) presented three ^{14}C dates from his work: A.D. 529-965 & A.D. 353-655 from his B. P. Bishop Museum site 50-Oa-G6-32 (on the southeast side of Kawainui near the sewage treatment plant, outside of the present study area) and A.D. 706-898 from his B. P. Bishop Museum site 50-Oa-G6-33 (on the NW margin of Kawainui, north of the present study area). These were perceived as very early dates for Polynesian settlement and were viewed skeptically by some (Neller 1982:30-33, Athens 1983:70) but found support from others (Erkelens 1993:56).

Figure 18. B. P. Bishop Museum site 50-Oa-G6-36 (aka Cluster 12) southeast corner of Feature 1, marsh in foreground and to the left (from Clark 1980:50)

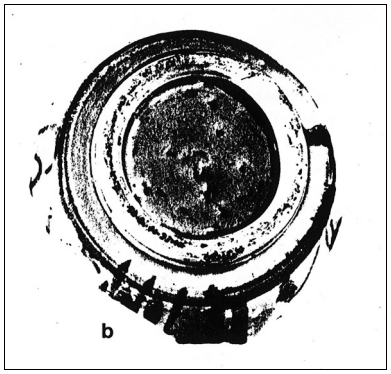

Figure 19. Ceramic bowl fragment recovered from surface of B. P. Bishop Museum site 50-Oa-G6-36 (aka Cluster 12) (from Clark 1980:70)

3.3.5 Allen-Wheeler (1981)

Allen-Wheeler (1981) carried out four archaeological test trenches in the southeast side of Kawainui Marsh, in areas where both taro and rice were believed to have grown. This research “fit within the broad area designated as Site 7 by Cordy and re-designated 50-Oa-G6-39 by Clark.” Allen-Wheeler (1981:30). The most significant finding was a boulder alignment buried 60 cm below soil, which appeared to correspond to one of the linear alignments observed on an aerial photograph. The alignment was constructed of small to medium basalt angular to sub-angular basalt boulders and large basalt cobbles. Also recovered in the same trench were seven indigenous basalt flakes 55-126 cm below surface. The other three test trenches revealed no additional boulder alignments consistent with taro or rice cultivation; however several *kukui* nuts and indigenous basalt flakes were recovered. This study demonstrates that buried cultural deposits and remnants of cultivation exist below the current ground surface of the marsh.

Allen-Wheeler’s (1981:77) work also underscored the unique preservation conditions of Kawainui Marsh for vegetal materials. Sugar cane (*Saccharum* sp.; *kō*) was identified along with two fragments that were interpreted as from the neck of a *Lagenaria* gourd.

Allen-Wheeler (1981) presents a site location map (present Figure 20) for Kawainui Marsh and a site designation correlation table (present Table 6). Allen-Wheeler’s correlation table (present Table 6) shows that B. P. Bishop Museum Site # 50-Oa-G6-36, and Clark’s Cluster 12 and Ewart & Tuggle’s Site 7 are all one and the same (which is also what Clark’s site correlation table – present Table 5 indicates).

3.3.6 Are Ewart & Tuggle’s (1977) Site 7 and Clark’s (1980) B. P. Bishop Museum Site 50-Oa-G6-36/Cluster 12 One and the Same?

It may be noted, however, that Allen-Wheeler’s site map (present Figure 20) shows two site designations on the southwestern edge of Kawainui: “Ewart & Tuggle Site 7” and “36” [clearly an abbreviation for B. P. Bishop Museum Site # 50-Oa-G6-36] which she has located approximately 550 m apart. Our examination suggests that she is at least approximately correct in showing the Ewart & Tuggle mapped location for their Site 7 (see present Figure 13) and Clark’s mapped location for Site 10 (see present Figure 17) correctly and that they are approximately 550 m apart.

So both the Clark (1980:24) study and the Allen-Wheeler study (1981:20 see following Table 6) assert that Ewart & Tuggle’s (1977) “Site 7” and Clark’s “Cluster 12” are one and the same – but they are depicted 550 m apart. We also note that the reported maximum length for Ewart & Tuggle’s “Site 7” is 5 m and Clark’s “Cluster 12” has a reported length of 65 m. It is unclear to us whether these sites are one and the same or not and whether either Ewart & Tuggle (1977) or Clark (1980) have located their sites remotely correctly. It seems probable that these two terrace sites both relate to road and house construction in this immediate area in the early twentieth century.

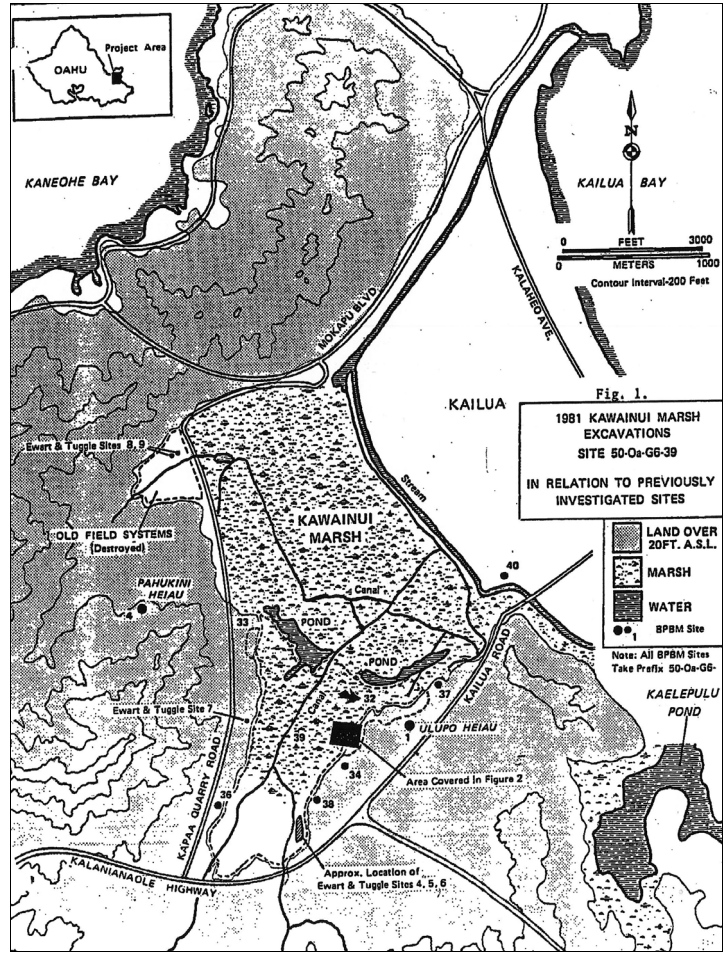

Figure 20. Kawainui site location map from Allen-Wheeler (1981:19), her work was within the black rectangle on the southeast side of the marsh (note: distance between site “36” and Ewart & Tuggle Site 7)

Table 6. Kawainui site nomenclature correlation table from Allen-Wheeler (1981:20) (note: B. P. Bishop Museum Site # 50-Oa-G6-36 and Ewart & Tuggle Site 7 are correlated as the same)

CORRELATION TABLE: SITE DESIGNATIONS IN KAWAINUI MARSH (after Clark 1980b & c: Table 1).

Bishop Museum Site No.	Clark (1980b & c)	Cordy (1977 & 1978)	Ewart & Tuggle (1977)	McAllister (1933)
50-Oa-G6-1 (Ulupo Heiau)	--	--	--	371
50-Oa-G6-2 (Kawainui pond)	--	--	--	370
50-Oa-G6-3 (adze quarry)	--	--	--	--
50-Oa-G6-4 (Pahukini Heiau)	--	--	--	359
50-Oa-G6-5 (Holomakani Heiau)	--	--	--	360
50-Oa-G6-13 (Kaelepulu pond)	--	--	--	377
50-Oa-G6-16 (Halaualolo Heiau, Maunawili)	--	--	--	373
50-Oa-G6-17 (heiau, Maunawili)	--	--	--	374
50-Oa-G6-18 (Maunawili, housesites)	--	--	--	375
50-Oa-G6-30 (hōlua slide?)	--	--	--	--
50-Oa-G6-32	Cluster 1	Site 1	Site 1	
"	" 2	" 2	" 2	
"	" 3	" 3	--	
"	" 4	" 4	Site 3	
"	" 5	" 5	--	
"	" 6	" 6	--	
50-Oa-G6-34	" 7	--	Site 4	
--	" 8	--	" 5	
--	" 9	--	" 6	
50-Oa-G6-33	" 10	--	--	
"	" 11	--	--	
50-Oa-G6-36	" 12	--	Site 7	
--	--	--	" 8	
--	--	--	" 9	
50-Oa-G6-37	" 15	--	--	
50-Oa-G6-38	" 14	--	--	
50-Oa-G6-39	" 13	Site 7	--	
50-Oa-G6-40	--	--	--	

3.3.7 Neller (1982)

Earl ("Buddy") Neller (1982) conducted archaeological investigations on the Kūkanono Slope (outside the present project area) recovering an abundance of traditional Hawaiian stone artifacts (mostly basalt waste flakes but including adze fragments, abraders, scrappers, and hammerstones) and post-Contact artifacts associated with Japanese activities. These excavations and finds were not associated with any specified site per se. Neller notes the presence of a grinding stone (seemingly the same grinding stone shown on Athens 1983a map shown in present Figure 22) – which would become a distinctive artifact type to be associated with the margins of Kawainui.

Neller (1982:30-33) takes issue with early dates reported for Kawainui.

3.3.8 Athens (1983a)

J. Stephen Athens (1983a) documented archaeological excavations on the Pōhākupu-Kūkunono Slope of Kawainui Marsh (Figure 21 and Figure 22) within B. P. Bishop Museum Site # 50-Oa-G6-32 and 50-Oa-G6-41. Features including dryland terraces, stone mounds, and flat-topped stone mounds were investigated. "Excavation revealed that all the surface features were built in the most recent soil layers after A.D. 1900; some features may be quite recent." (Athens 1983a:1). Athens concluded the surface structures had been built in the early twentieth century by Chinese during the course of intensive gardening after the decline of rice farming in the marsh – with many features posited to post-date A.D. 1930 (Athens 1983a:69)

One small area of undisturbed pre-Contact deposits (an earth oven) was identified and dated to between the 13th and 15th centuries A.D.

Athens (1983a:70-71) discusses the evidence of early occupation given by Clark noting that samples that were not from in-situ features were somewhat suspect.

Athens includes certain pollen studies in his Appendix A of pollen analysis of samples from B. P. Bishop Museum Site # 50-Oa-G6-32, Feature 116 and Appendix D Palynological Study of Some Angiosperms of Ethnobotanical Interest - the later was really more in the nature of an effort to build up literature as a reference collection. The pollen results for Kawainui were not very hopeful – "Because of oxidation, coupled with disturbance and erosion at this site, the pollen and spore flora is poorly preserved." (Athens 1983a:76).

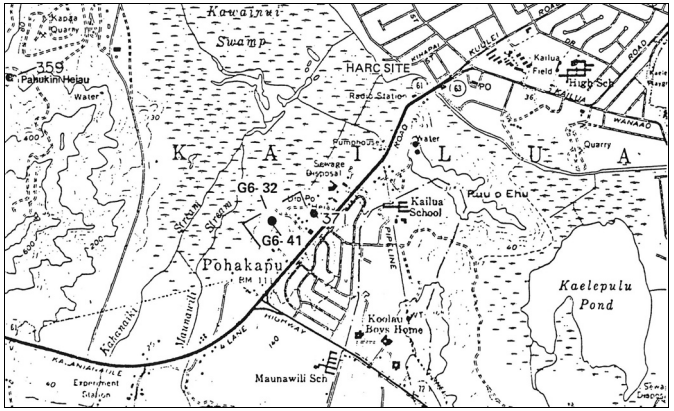

Figure 21. Portion of U.S. Geological Survey quad map showing Athens (1983a) project area of B. P. Bishop Museum Site # 50-Oa-G6-32 and 50-Oa-G6-41

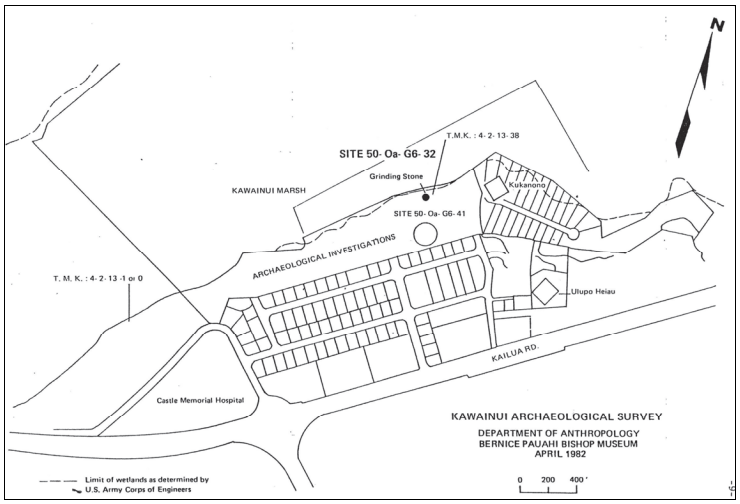

Figure 22. Map showing Athens (1983a) project area of B. P. Bishop Museum Site # 50-Oa-G6-32 and 50-Oa-G6-41

3.3.9 Athens (1983b)

J. Stephen Athens (1983b) documented 11 excavation units in site 50-Oa-G6-40, the H.A.R.C. site, located at the northeast end of Kawainui Marsh (see Figure 21 for location) in 1983. The site consisted of marine midden, artifacts, and subsurface features including hearths and pits. Radiocarbon dates indicated occupation of the site sometime in the mid- 13th to early 15th century. Midden remains were analyzed and conclusions suggest a change through time in the exploitation pattern. Athens suggested the use of the Kailua accretion barrier for habitation may have started about the same time as the occupation of the site. This site was originally located and excavated by Wheeler (1981). This study demonstrated the potential for significant archaeological deposits within the sandy deposits of the previously disturbed residential neighborhoods along the seaward margin of Kawainui Marsh.

3.3.10 Hammatt Shideler, Chiogioji, and Scoville (1990),

Hammatt et al. (1990), like Athens and Ward (1991), conducted sediment coring in Kawainui Marsh with the goal of palaeoenvironmental reconstruction. This Hammatt et al. (1990) sediment coring was conducted over a wide area at the north end of the marsh (outside of the present study area) and was not associated with any particular site nomenclature. The U.S. Army Corps of Engineers proposed construction of open water channels in the marsh for flood control. There was concern for impacts to archaeological resources within/surrounding the marsh. The objective of the study was to (1) characterize depth, age and nature of sediments to be impacted in relation to present marsh sediments and (2) reconstruct environmental history of marsh to determine nature and location of native Hawaiian use including shoreline habitation, fishponds, and agricultural sites. Ten sediment cores were taken from Kawainui Marsh and analyzed for pollen, organic clay mineralogy, stratigraphy and heavy metals.

The pollen results from this study were particularly notable particularly the finding that *Loulu* (*Pritchardia* sp.) palm pollen was by far the most abundant pollen until circa A.D. 1410-1650 when the Pritchardia presence collapses and the abundance of grasses (Poaceae) and sedges (Cyperaceae) explodes. The implications for our understanding of Polynesian settlement and the mechanisms of environmental change are explored (Hammatt et al. 1990:54-56).

A preliminary identification of certain macro- botanical finds as possibly *Lagenaria* sp. gourd (as was reported by Allen-Wheeler 1981:77) lead to a recommendation to further consideration of fruits from marsh muck (Hammatt et al. 1990:56-57).

3.3.11 Athens and Ward (1991)

In 1991, Athens and Ward (1991) carried out an archaeological investigation for a flood control project at the north end of Kawainui Marsh. Thirty-seven core/auger units were excavated along the eastern margin of marsh, in the vicinity of the drainage control levee. The purpose of the investigation was to evaluate the presence or absence of significant archaeological remains in the vicinity. The investigation revealed no archaeological deposits or architectural features. Some possible archaeological sites proved to consist only of levee fill and previously dredged sediment. The palaeoenvironmental investigations of Athens and Ward (1991) were highly successful. These results, coupled with those of Hammatt et al. (1990), did much to

broaden our understanding of prehistoric human induced environmental change in the Hawaiian lowlands.

3.3.12 Erkelens 1993

Conrad Erkelens completed a Master’s Thesis in Anthropology at the University of Hawai‘i Mānoa on archaeological investigations of the Kūkanono slope (Figure 23 and Figure 24) building on the work of a University of Hawai‘i 1991 archaeology field school. Erkelens reports on the results from 29 test pits which included the recovery of midden remains, charcoal from intact hearths, and lithic artifacts from the lower slope areas (Erkelens 1993:78) A main focus on this research was on carbon dating and seven ^{14}C dates are newly reported which are compared with previously reported dates (see Table 7). Erkelens (1993:79) concludes that settlement at Kawainui “occurred by at least 1000 BP”

Table 7. Radiocarbon Dates from the Slopes around Kawainui (Erkelens 1993:54)

Beta #	*'Ili* / date recovered	Invest-igator	C-14 Years B.P.	Calibrated Years**	Calibrated Age**
1138	Kukanono (1980b)	Clark	1500 ± 145	1720-1103 B.P.	A.D. 230-847
1139	Palalupe (1980b)	Clark	1220 ± 90	1296-968 B.P.	A.D. 654-982
1137	Kukanono (1980b)	Clark	1210 ± 215	1540-690 B.P.	A.D. 410-1260
47768	Kukanono (1991)	U of H	1000 ± 110	1171-694 B.P.	A.D. 779-1256
51809	Kukanono (1991)	U of H	1000 ± 130	1180-680 B.P.	A.D. 770-1270
46684	Kukanono (1991)	U of H	810 ± 80	926-654 B.P.	A.D. 1024-1296
4412	Pohakupu (1983)	Athens	680 ± 50	720-548 B.P.	A.D. 1230-1402
51808	Kukanono (1991)	U of H	600 ± 80	687-512 B.P.	A.D. 1263-1438
47767	Kukanono (1991)	U of H	370 ± 70	528-298 B.P.	A.D. 1422-1652
47769	Kukanono (1991)	U of H	350 ± 50	506-310 B.P.	A.D. 1444-1640
3645	Pohakupu (1983)	Athens	340 ± 70	523-284 B.P.	A.D. 1427-1666
3298	Pohakupu (1983)	Athens	<160		
47766	Kukanono (1991)	U of H	110 ± 80	284-0 B.P.	A.D. 1666-1955

* Allen-Wheeler’s dates from within the marsh wetlands are not considered here since they are not artifactual.

** Calibration from Stuiver and Reimer (1986) using the 10 year atmospheric record data set provided by Stuver and Becker (1986). The time period cited reflects a statistical range having a 95.4% confidence interval at two sigma (2Ù).

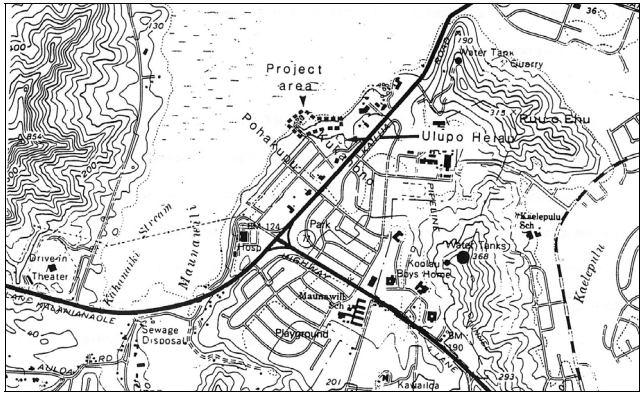

Figure 23. Location of Erkelens (1993) project area on the Kūkanono slope

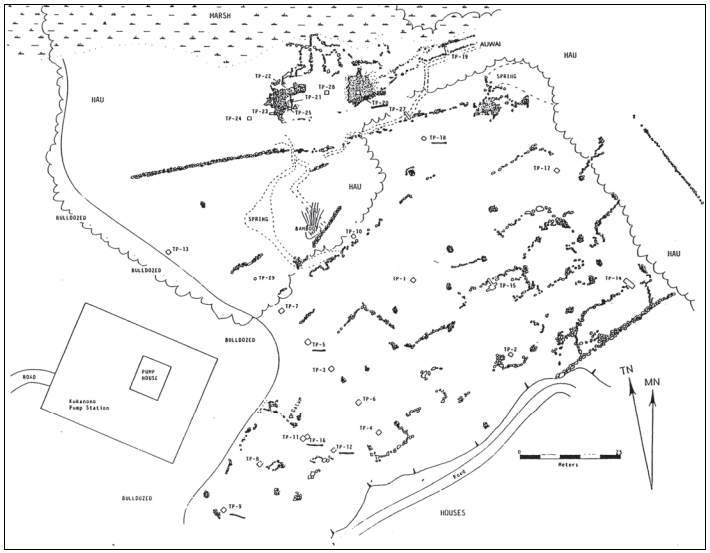

Figure 24. Detail of Erkelens (1993) project area on the Kūkanono slope

3.3.13 Mann and Hammatt (2003)

Cultural Surveys Hawai‘i, Inc. was contracted to provide a mitigation plan and field verification and flagging for an approximately 60-acre portion of Kawainui Marsh, adjacent to the east of the present study area The project was very similar to the present project and because the archaeological approach proved relatively successful it seems appropriate to discuss this project at some length.

The project was to create a series of pond systems to encourage the habitat of endangered bird species for the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area. A 1977 archaeological reconnaissance study of Kawainui Marsh conducted by the Army Corps of Engineers' archaeologist, Dr. Ross Cordy, had indicated a conceptual layout of *lo‘i* walls observed on a series of historic aerial photographs within Cordy's "Site 7", and in the immediate vicinity of the Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area. The primary goal of the Mann and Hammatt (2003) archaeological investigation was to confirm the presence or absence of *lo‘i* walls within the 60-acre Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area and twofold, to provide appropriate mitigation measures to insure the integrity of any surface or subsurface cultural deposits. That project area was understood to lie within SIHP 50-80-11-2029, the Kawainui Marsh archaeological cultural-historical complex, deemed eligible for listing on the National Register of Historic Places in 1979.

A walk-through survey was completed by two Cultural Surveys Hawai‘i, Inc. archaeologists. Historic maps and aerial photographs compiled during the historic overview were consulted throughout the walk-through survey. No boulder-alignments consistent with *lo‘i* walls or rice paddies were observed on the surface and there was no surface indication of any remaining archaeology. However, two linear vegetation alignments running east to west in the central aspect of the project area were observed. These linear vegetation alignments appeared, at the time, to correspond to two LCA boundaries (LCA 2544:1 and 6969:2).

To better support this theory, additional research on the meets and bounds of the two LCAs were carried out. The Māhele award descriptions and Royal Patents provided the necessary information to locate the two LCAs. Using the descriptions derived from the Māhele award descriptions and the Royal Patents, calculations were made, and finally compared to LCA boundaries depicted on a current Tax Map Key. The information provided on the Māhele descriptions and Royal Patents were very consistent with the lengths and angles calculated on the current Tax Map Keys.

With the lengths and angles calculated, a second field inspection was undertaken. Using tape and compass, two Cultural Survey's Hawai‘i, Inc. archeologists attempted to confirm if the two linear vegetation alignments observed during the initial walk-through was consistent with the lengths and angles depicted in the Māhele award descriptions and Royal Patents for LCAs 2544:1 and 6969:2. At the end of the second walk-through it was concluded that based on the information provided through the Māhele descriptions and the Royal Patents, that indeed the linear vegetation alignments are consistent with the boundaries for LCA 2544:1 and 6969:2. However, it should be noted that there was no indication of any surface archeological findings other than the alignment of vegetation at this stage of the investigation.

Cultural Survey's Hawai‘i, felt that ground truthing was necessary as a means of verifying what was found during the initial project area walk through.

Backhoe test excavations were carried out to investigate subsurface deposits in the vicinity of the two linear vegetation alignments (Figure 25). Two units were selected for backhoe testing: one unit in the vicinity of LCA 2544:1 and a second unit in the vicinity of LCA 6969:2. Both test units were positioned perpendicular to the two linear vegetation alignments in anticipation of transecting a segment of a *lo‘i* wall associated with LCA 2544:1 and 6969:2. The locations of trenches 1 and 2 are shown on present Figure 25.

The stratigraphy was consistent in both test units. Stratum I and II were associated with the present grass mat and consisted of a dark grayish brown to dark brown sandy loam to loam. Stratum III consisted of a very dark brown clay loam, oxidized with a reddish brown staining observed throughout the stratum. This staining is consistent with cultivation and may correspond to the Old A-Horizon. Cultural deposits collected in situ included a basalt adz recovered 97 cm below surface in trench 1 and two volcanic glass flakes recovered 70 cm below surface in trench 2. Abundant basalt water-worn river cobbles was observed throughout the trenches. In both trench 1 and trench 2, a mound of river cobbles was observed in an isolated area of the trench profile. It is not clear what purpose or function this may have played in either *lo‘i* or rice cultivation. Charcoal flecking was diffused throughout Stratum III. Stratum III is considered the cultural layer. Stratum IV consists of a very dark gray water logged sticky clay. This stratum may correspond to the natural river bed. The water table was observed approximately 115 cm below surface. Stratum V consists of a dark gray sandy clay loam with a layer of basalt river cobbles aligned 2 meters below surface.

One basalt adz was recovered in situ 97 cm below ground surface within Trench 1. Additionally several basalt flakes were collected from the dirt pile during excavations; there in situ origins are unknown. Within Trench 2, two volcanic glass flakes were recovered in situ 70 cm below ground surface.

Unfortunately, no basalt boulder alignments were observed within the test units. In both trenches, however, a distinct mass of basalt water worn cobbles was observed. Its function in correlation to *lo‘i* or rice cultivation is unknown, although the mass appeared to have been pushed up into a mound-like feature.

The test units yielded no archaeological reality in terms of discrete *lo‘i* walls or berms. It was evident however, that there was a buried cultural layer 50 cm below ground surface that contains buried cultural material and charcoal. This cultural layer was approximately 50 cm thick and is composed of organic material and oxidized sediments.

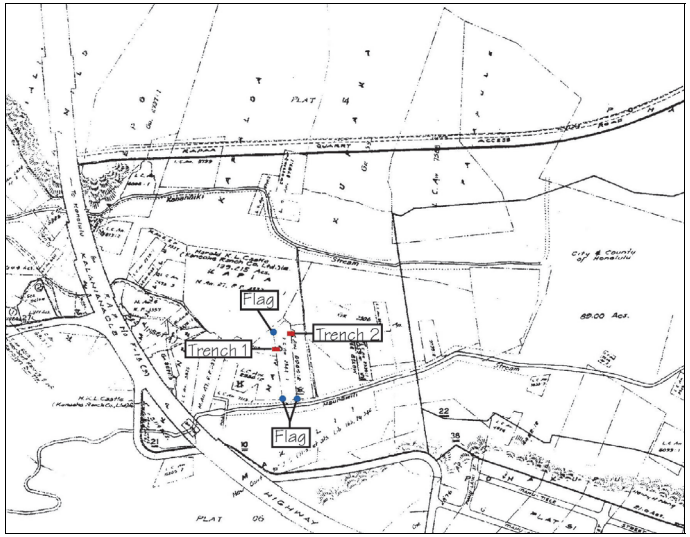

Figure 25. Tax Map Key 4-2-13 Showing Location of Mann and Hammatt (2003) Test Trench 1 and 2

Section 4 Results of Fieldwork

4.1 Results of Reconnaissance Survey

The following narrative of the field inspection is generally given in a counter-clockwise manner keyed into the number locations of Figure 27. This narrative is actually a conflation of observations from four different site visits.

An attempt was made to access the vicinity of the northeast corner of the former LCA 7588 (see Figure 26 and “Point 1” on Figure 27). Access was attempted by following the base of a steep soil slope at the edge of the marsh to the southwest. While a trail of sorts does follow the base of the soil slope at the edge of the marsh within the former location of LCA 7588 this was perceived to fade out moving towards the north edge of the former location of LCA 7588. The access route chosen became quite steep, entered an area of very dense *hau*, and entered an area of standing water (see Figure 28). No evidence of an archaeological site was observed despite a significant traverse of the east/central portion of the former LCA 7588. As far as could be determined access for mechanical excavation assistance to the northeast corner of the former LCA 7588, and excavation there once accessed, would be exceedingly problematic in the foreseeable future owing to the steepness of the slope to the east, the density of the *hau* and the fact that the vicinity appeared to be standing water. Under existing conditions archaeological testing in this posited location was thought to be exceedingly problematic.

In contrast the southeast corner of the former LCA 7588 (see Figure 26 and “Point 2” on Figure 27) was perceived as relatively easy of access via a (chained off) access corridor connecting to Kapa‘a Quarry Road to the southwest. It appears that the Department of Forestry and Wildlife (DOFAW) has conducted considerable clearing of the upslope margin of the marsh to the southwest of the southeast corner of the former LCA 7588 which greatly facilitates access. The immediate posited vicinity of the southeast corner of the former LCA 7588 transitions from an area of recent clearing to 3 m high exotic grasses at very close to the water table (see Figure 29). No trace of an archaeological site was observed. It was nevertheless concluded that this is an area that would be appropriate for a trial of archaeological testing although the high water table was noted as a constraint.

Just 80 m or so to the southwest of the posited southeast corner of the former LCA 7588 a grinding stone artifact had been pointed out by DOFAW staff (for location see annotation “GStone” on Figure 27 and see Figure 30 and Figure 31 photos). These grinding stones are somewhat characteristic traditional Hawaiian artifacts of the Kawainui slopes (documented by Neller 1982, Athens 1983, and others). This grinding stone lies at the base of a break in slope under a particularly large *noni* (*Morinda citrifolia*) tree (a tree mentioned in supporting documents for LCAs in the area but an uncommon tree in the general vicinity today).

The break in slope extending northeast from the grinding stone (Figure 31) appeared to have a concentration of subangular cobbles and small boulders (suggestive of an archaeological feature) and we believe this to be a remnant terrace. The break in slope extending southwest from the grinding stone (Figure 32) appeared to have a concentration of large and small subangular boulders also suggestive of a human constructed terrace face in poor condition. While this pronounced break in the soil slope extending northeast and southwest from the grinding stone

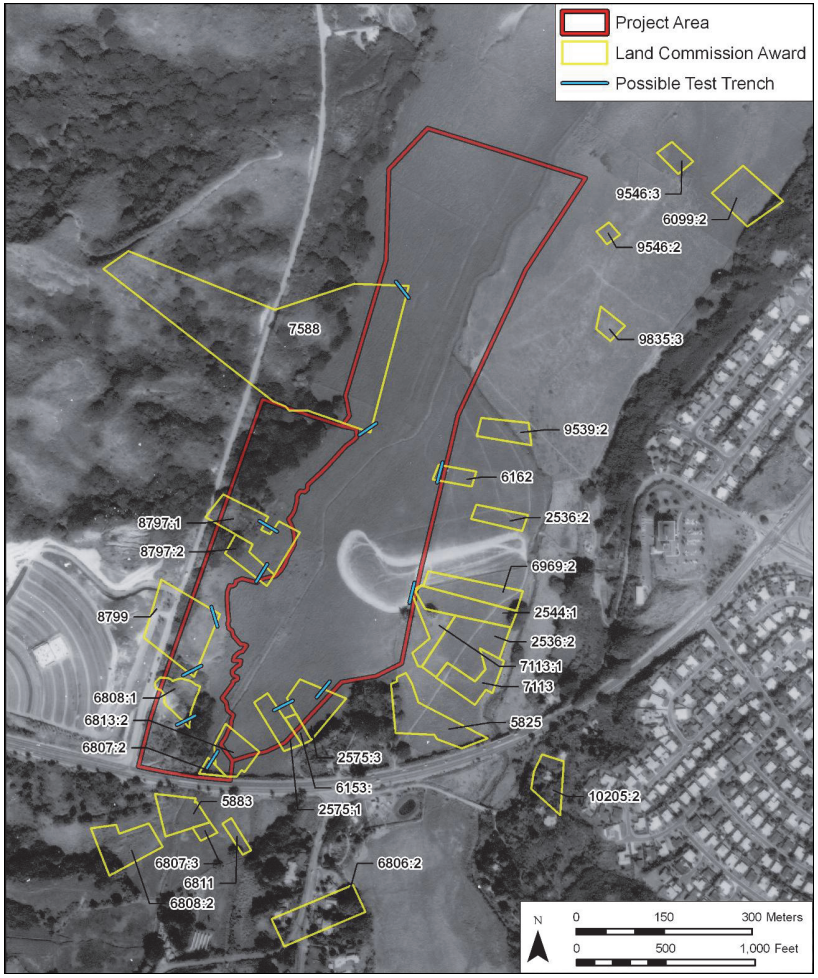

Figure 26. Schematic sketch of initially proposed areas for possible archaeological test trenches within the project area (generally targeting corners of LCAs where it was thought that walls or other finds might be more likely) on a 1969 aerial photograph

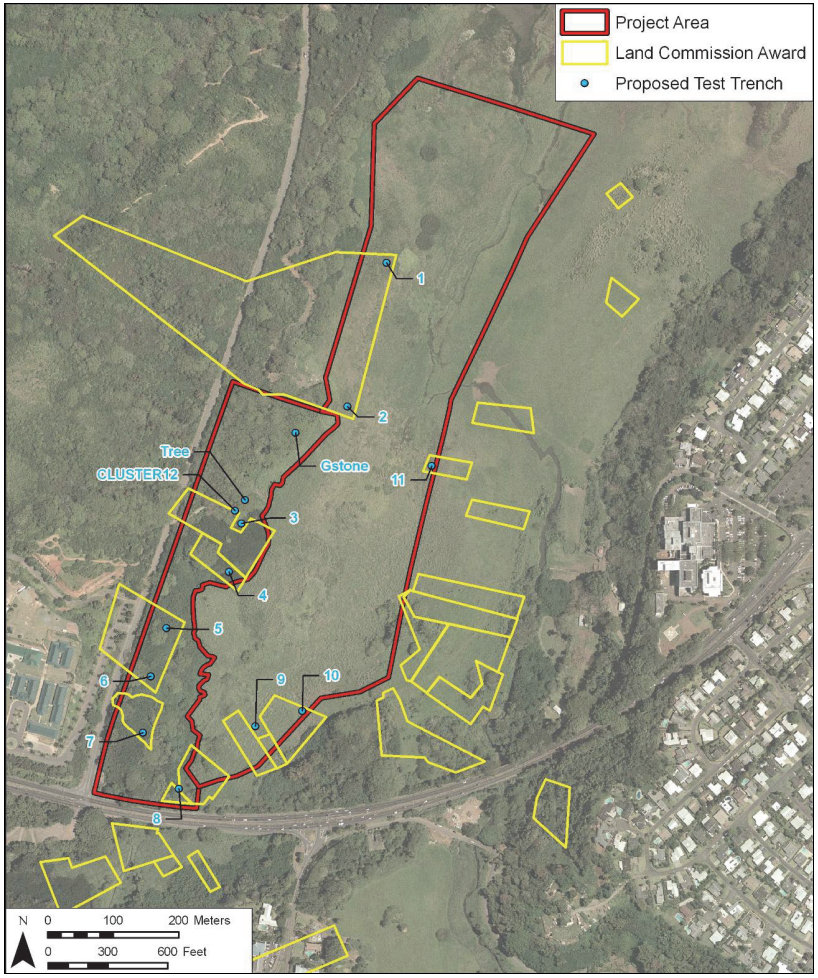

Figure 27. Approximation of what was entered (outlines of LCAs and midpoints of initially proposed test trenches) in handheld GPS unit for preliminary fieldwork

Figure 28. General view of dense *hau* and water at base of significant slope approaching northeast corner of LCA 7588 (Point 1 on Figure 27), showing problematic access, view to northeast

Figure 29. View of southeast corner of LCA 7588 (Point 2 on Figure 27), posited for archaeological testing, view to northeast

Figure 30. View of grinding stone artifact just south of LCA 7588 near edge of marsh, view to northwest

Figure 31. View of possible terrace extending northeast from grinding stone (at center left), view to northwest

Figure 32. General view of break in slope extending southwest from the grinding stone (extending from lower right corner to center of photo) understood to be largely geological in origin but most likely subject to at least minimal piling to create a terrace

Figure 33. Approach to general vicinity indicated on B. P. Bishop Museum maps for Clark’s “Cluster 12”/ B. P. Bishop Museum Site # 50-Oa-G6-36, view to southwest

may be largely geological in origin it was almost certainly subject to the piling of boulders and cobbles to create a terrace in the early twentieth century. Our overlays of historic maps indicate a road alignment in this immediate area as well as two 1928/1943 houses on the downslope side of the road and two 1949 houses on the upslope side of the road and also an extensive area of cultivation.

In the course of this period of fieldwork on the southwest margin of Kawainui Marsh Cultural Surveys Hawai‘i was contacted by the State Historic Preservation Division (in a matter understood to originate from a citizen’s complaint regarding recent clearing work in the vicinity). Cultural Surveys Hawai‘i was asked to supply clarification regarding our understanding of previously identified archaeological sites in the vicinity.

To our knowledge only two archaeological sites (both described as terraces) have been reported in the vicinity near the margin of Kawainui Marsh: Ewart & Tuggle’s (1977) “Site 7” and Clark’s (1980) “Cluster 12”. Two Bishop Museum studies concluded that Ewart & Tuggle’s (1977) “Site 7” and Clark’s “Cluster 12” were one and the same and designated this site as B. P. Bishop Museum Site # 50-Oa-G6-36 - despite the fact that a Bishop Museum study more-or-less accurately portrayed the indicated position of these two sites (Ewart & Tuggle’s Site 7 and “36” as more than 500 m apart.

An attempt was made to locate Clark’s (1980) “Cluster 12” in the field. A good faith effort was made to enter the indicated location of “Cluster 12” in a GPS unit (see “Cluster 12” on Figure 27) and walk to the point. The location is in fairly dense brush north of the DOFAR clearing area (see Figure 33). Some time was spent in an almost comical attempt to compare Clark’s photo of the site (and in particular a large monkeypod tree at the site with the shape of myriad monkeypod trees in the indicated vicinity (30 years later) (Figure 34). Several areas of densities of scatter boulders and cobbles were observed (Figure 35) but no clear archaeological feature was discerned. The upshot is that the indicated location of the B. P. Bishop Museum Site # 50-Oa-G6-36 terrace is south of the presently posited terrace feature bracketing the grinding stone however if Clark’s location point for his 65 m long terrace was taken at the southeast corner (as his site photo was) then the two appear to overlap and may be one and the same. Overlays of structures documented on historic maps and aerial photographs indicate roads and a circa 1928-1943 house in this immediate area.

It was concluded that it is highly probable that both Ewart & Tuggle’s (1977) “Site 7” and Clark’s (1980) “Cluster 12” relate to extensive early twentieth century activity including grading for a road, agricultural field preparation and seemingly four houses in this immediate area (shown on 1928 & 1943 maps and a 1949 aerial photograph).

It was concluded that excavation anywhere in the vicinity of all of these posited terraces would be relatively straightforward and was recommended (particularly at the indicated locations of the early/mid twentieth century house sites) if ground disturbance appeared to be likely in this vicinity. Avoidance would be the preferred option.

Figure 34. One of several monkeypod trees considered (in 2010) to possibly be that depicted as adjacent to the “Cluster 12” terrace in Clark’s 1980 photo

Figure 35. Density of subangular basalt boulders and cobbles near the indicated location of Clark’s (1980) “Cluster 12” – no clear archaeological feature was discerned

Moving on to the south an effort was made to assess the potential for archaeological testing at former LCA 8797. The vicinity of the northeast corner of LCA 8797 (“Point 3” on Figure 27) was observed to drop away steeply to the northeast from an access road into a tangle of *hau* (Figure 40). The steepness of the slope, the density of the *hau* and the seeming height of the water table indicated that access and archaeological testing in this posited location under existing conditions would be exceedingly problematic. It was noted that an access road crossing east/central portion of LCA 8797 appeared to be raised on 3 m+ of modern fill (recent piles of earth and broken asphalt were notable in this area; Figure 37). Although multiple roads and at least one (circa 1949) house are believed to have been present in this LCA it is believed that most of this fill is quite recent. The southeast corner of LCA 8797 (“Point 4” on Figure 27), however, was observed to be relatively accessible (Figure 38). In the immediate vicinity of the southeast corner of LCA 8797 a high water table area of relatively low, exotic, marsh grasses transitions abruptly to *hau* 10 m tall on the west or upslope side. This appeared to be a viable area for a trial of archaeological testing although the high water table was noted as a constraint.

Moving on to the south, the former location of LCA 8799 (“Point 5 & Point 6” on Figure 27) was initially a bit of a surprise. This area is covered with what appears to be a mowed short ground cover on a steep slope dropping 10+ m in elevation from the downslope side of Kapa‘a Quarry Road (on the center of the south side of the former LCA) towards the northeast corner (Figure 39). It was concluded that the fill on the center of the south side of LCA 8799 is more than 10 m thick. This prompted a closer examination of a 1969 aerial photograph (see present Figure 26) which suggests that (amongst many other possible sources of the fill) that grading activities at the time of the construction of the Kailua Drive-In Theater in 1969 may have involved significant push of earth east across Kapa‘a Quarry Road. The fill in the south corner of the former location of LCA 8799 (“Point 6” on Figure 27) is regarded as too thick 3m+ for archaeological testing. Initially the northeast corner of the former location of LCA 8799 (“Point 5” on Figure 27) was regarded as covered by too thick a deposit of fill (2m+) and too likely to be disturbed by fill activities as to recommend it but the constraints at other possible test locations are so great as to suggest this northeast corner as indeed worth consideration for a testing effort.

It is understood that the general area of the former LCA 8799 (see Figure 39; a mowed short groundcover slope) has been proposed as a possible location for a possible Kawainui interpretive infrastructure. Given the massive fill present this might well be a good choice (as would be the area immediately northeast of the intersection of Kalaniana‘ole Highway and Kapa‘a Quarry Road) as the fill deposits appear to be quite thick safeguarding any cultural resources as may have survived the filling actions.

Moving on to the south it was noted that the former location of LCA 6808 descends rather precipitously on the east side of Kapa‘a Quarry Road into a dense tangle of *hau* (). It appears that significant run-off may have been channeled into the former location of LCA 6808. This area was regarded as highly problematic for access and archaeological testing.

Moving on to the south to the general area northeast of the intersection of Kalaniana‘ole Highway and Kapa‘a Quarry Road (Figure 41) it was noted that a great deal of fill, (perhaps more than 6 m high) has been deposited in this area. We understand the area immediately northeast of the intersection of Kalaniana‘ole Highway and Kapa‘a Quarry Road has been

Figure 36. General view of portion of LCA 8797 (Point 3 on Figure 27), view to southeast showing problematic access due to steep drop and thick *hau* growth

Figure 37. General view showing access road that appears to be built over modern fill 3 m + thick in southwest portion of LCA 8797, view to northwest

Figure 38. General view of southeast corner of LCA 8797 (Point 4 on Figure 27) on marsh edge posited for archaeological testing, view to southwest

Figure 39. General view of LCA 8799 from west corner, view across LCA to southwest showing extensive modern fill perhaps 10 m thick on southwest side (far end of slope)

Figure 40. General view of west edge of LCA 6808 (from Kapa‘a Quarry Road) showing problematic access due to steep descent and thick *hau*, view to southeast

Figure 41. General view of area adjacent to the northeast of the intersection of Kapa‘a Quarry Road and Kalaniana‘ole Highway showing area of major modern fill, view to northeast

suggested for any possible Kawainui interpretive infrastructure and this would also appear (like the vicinity of former LCA 8799) to be a good choice given the prior land disturbance and the thickness of the fill.

Turning to the east from the intersection with Kapa‘a Quarry Road onto the north side of Kalaniana‘ole the vicinity of LCAs 6807 and 6813 (see Figure 26 and “Point 8” on Figure 27) was inspected. This LCA 6807/6813 area is separated from Kalaniana‘ole Highway by a guard rail and a steep (4 m) drop. This area (Figure 42) appears to have 3 m high exotic grasses, a tangle of other vegetation and a high water table. Under existing conditions access for mechanical assistance and archaeological testing in this posited location was thought to be exceedingly problematic. Continuing on to the northeast along the southeast edge of the marsh the next area examined was the vicinity of LCAs 2575 and 6153 (see Figure 26 and “Point 9” and “Point 10” on Figure 27). A relatively good vehicular track (blocked by a cable) extends north from Kalaniana‘ole Highway but was not observed to extend as far as the edge of the marsh. The final approach to the LCA 2575/6153 area from the south involved a traverse of a densely wooded stretch and down a steep slope and then wading into a sea of 1.5 to 2 m high exotic grass with a high water table (see Figure 43). Under existing conditions access and archaeological testing in this posited location was thought to be exceedingly problematic.

Pedestrian inspection then continued to the northeast to the vicinity of LCA 6162 (see Figure 26 and “Point 11” on Figure 27). This LCA is understood to straddle the east side of the present project area and is somewhat unusual among the LCA locations examined in being so far into the central portion of Kawainui Marsh. The majority of the pedestrian access from the southeast was relatively easy and we have reason to believe a mechanical excavator could access the general vicinity. In the immediate vicinity of LCA 6162, however, the traverse became decidedly soggier (Figure 44). It is uncertain whether a mechanical excavator could reach the west end of LCA 6162 (the portion within the project area) and if excavations were carried out there it is uncertain whether sediments more than 10 cm above the water table would be encountered.

At this point the prospects for archaeological testing of the perimeters of former Land Commission Awards within the present project area were few. An additional area was examined at the west end of LCAs 2544, 6969 and 7113 (see Figure 26) located 170 m south of “Point 11” on Figure 27). Our GPS reading in the field indicated that the extreme west end of these LCAs does indeed extend into the east side of the project area. These LCAs had been the focus of a somewhat similar study (Mann and Hammatt 2003). This area (Figure 45) was observed to be somewhat drier and less problematic of access and for potential archaeological testing. On the one hand the general success of the Mann and Hammatt (2003) archaeological testing just to the east recommends this area but on the other hand we already have data from quite close by.

Closer scrutiny of historic maps and aerial photographs indicated two pair of structures (understood as permanent residences) on 1928 maps and two pair of structures (understood as permanent residences) on a 1949 aerial photograph. The project area was revisited to identify and evaluate the indicated locations of these early to mid twentieth century houses. Figure 46 shows the immediate area indicated for the northernmost of the structures indicated on the 1928 and 1943 maps. The indicated location is in a relatively clear area on the terrace suggested as modified by human activity and is only 15 m or so northeast of the grinding stone. This is

Figure 42. View from north side of Kalaniana‘ole of LCA 6807 and LCA 6813 area showing difficult access due to 6 m steep drop and thick vegetation, view to NNE

Figure 43. General view of LCA 2575 and LCA 6153 area showing difficulty of access owing to tall grass (and high water table), view to northeast

Figure 44. View of LCA 6162 area approaching west edge (in project area) showing problematic high water table, view to northwest

Figure 45. General view of west edge of LCA 2544 and 7113 posited for archaeological testing, view to southwest

Figure 46. General view of vicinity of northernmost of two house locations as shown on 1928 and 1943 maps on earthen terrace (note: noni tree by grinding stone in background left), view to south

Figure 47. General view of vicinity of southernmost of two house locations as shown on 1928 and 1943 maps in dense *hau* (note: large oblong stones in lower left and center right edge), view to southeast

understood as the general vicinity of Ewart and Tuggle’s “Site 7”. Figure 47 (above) shows the immediate area indicated for the southernmost of the structures indicated on the 1928 and 1943 maps. The indicated location is near the north edge of an area of dense *hau* and was noted to be quite close to the indicated location for Clark’s “Cluster 12”/ B. P. Bishop Museum Site # 50-Oa-G6-36. Two decidedly oblong large boulders were observed in this immediate area. Figure 48 shows a general view of the vicinity of the southernmost of two house locations as shown on a 1949 aerial on the north edge of a drainage extending southwest from a cement culvert. Figure 49 shows a general view of the vicinity of the northernmost of the two house locations as shown on a 1949 aerial. The indicated house site is just north of the large cleared terrace area. No clear physical indication of these houses was observed.

Figure 48. General view of vicinity of southernmost of two house locations as shown on a 1949 aerial on north edge of drainage, view to west

Figure 49. General view of vicinity of northernmost of two house locations as shown on a 1949 aerial (large cleared terrace area immediately to north), view to south

4.2 Results of Limited Subsurface Testing

Limited subsurface testing within the project area consisted of the backhoe-assisted excavation of 12 test trenches (Trench 1-12) that were positioned at or near the location of post-Contact features as indicated by historic background research (Figure 50 and Figure 51). Trench 11 and Trench 12 were positioned within the possible footprint of the house lot that is depicted on an 1899 map by W. E. Wall (see Figure 6 and Figure 51). Trenches 1-3 and Trench 8 were positioned within the possible footprint of house lots that are depicted on a 1928 U.S. Geological Survey topographic map (see Figure 9 and Figure 51). Trench 6 and Trench 7 were positioned within the possible footprint of house lots that are depicted on a 1949 aerial photograph (see Figure 51). The remainder of the backhoe test trenches (Trench 4, 5, 9, and 10) were placed at or near the boundaries of Land Commission Awards (LCAs) that are also depicted on the 1899 map by W. E. Wall (see Figure 6 and Figure 51).

Subsurface testing within the project area failed to identify any formal habitation-related subsurface structures, however, the presence of stratigraphic anomalies within Trench 2 and Trench 11, and sparse historic and traditional Hawaiian artifacts within several trenches provide some evidence for pre-Contact or early post-Contact and historic land-use within the project area.

One small area of loose basalt cobbles was identified within the southwestern end of Trench 2 near the present ground surface (approximately 0.2 m to 0.7 m below surface). The loose cobble concentration is likely the remnant of a historic or modern fill event, but does not appear to be related to a house foundation or infrastructure. Additional testing in the immediate vicinity (Trench 3) indicated that the cobble concentration is an isolated anomaly and not part of a linear or expansive structure. The loose cobble concentration that was identified within Trench 2 was not considered to be the remnant of a historic structure and therefore was not designated as a historic property.

One basalt boulder was indentified within the northern end of Trench 11, near the base of excavation (approximately 0.6 m below surface). The basalt boulder, along with several other basalt boulders that were observed on the present ground surface near Trench 11, may represent the remnants of a stone construction or possible house foundation although no stacking or alignments were discernable. A roughly rectangular stand of non-native bamboo at the location of the possible 1899 house lot also seems indicative of landscaping associated with a house, yard, or garden. This evidence provided the basis for inclusion of the possible 1899 house lot area as a componenet of the Kawainui Marsh archaeological-cultural-historical complex (SIHP 50-80-11-2029).

Additional evidence for historic habitation within the project area included sparse diagnostic and non-diagnostic historic artifacts that were identified within several test trenches at or near the present land surface (A-Horizon). Diagnostic historic artifacts included glass jug and jar fragments collected from Trench 6 with a range of manufacture dating from 1947 to 1963 (Accession #4-7).

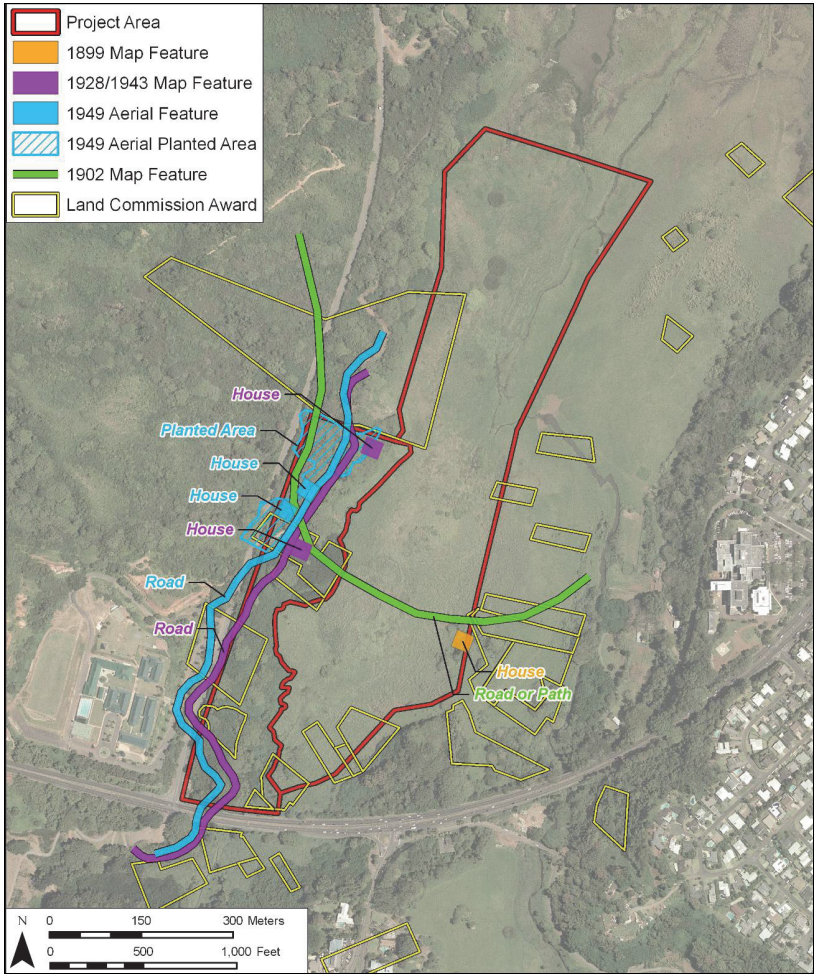

Figure 50. Aerial photograph showing the locations of post-Contact features identified during historic background research (World Imagery 2006)

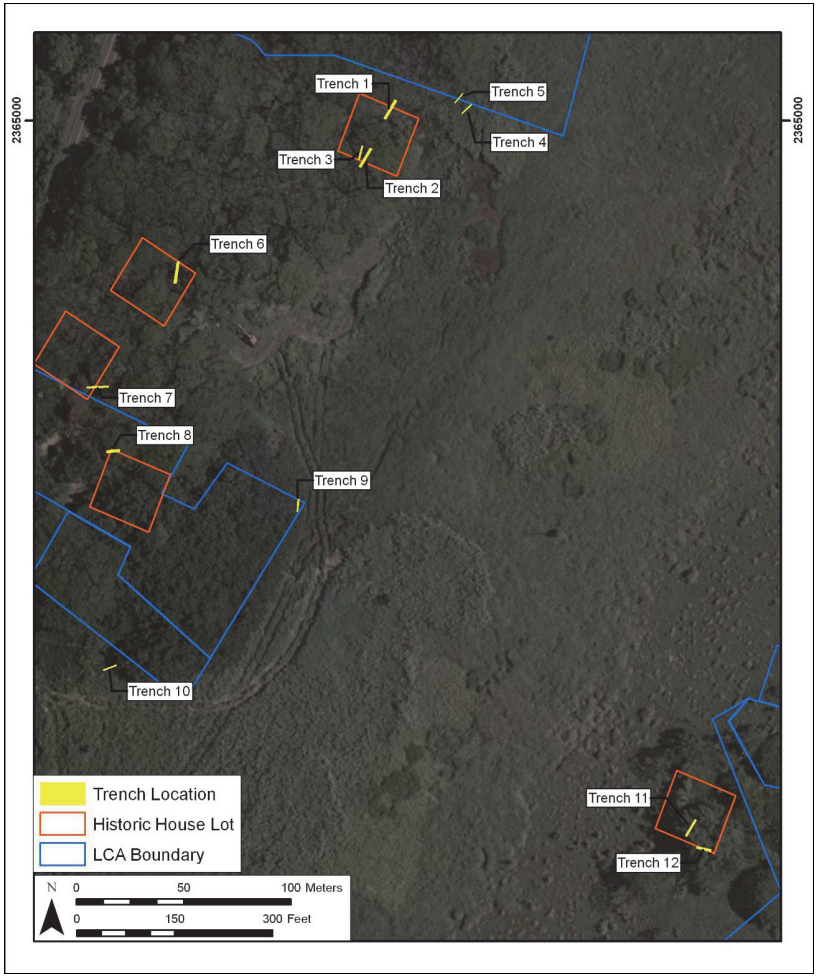

Figure 51. Aerial photograph showing the location of test trenches in relation to historic house lots and LCA boundaries within the project area (World Imagery 2006)

Evidence for traditional Hawaiian land use within the project area included the presence of two basalt flakes within Trench 2 (within possible footprint of 1928 house lot), one basalt flake within Trench 11 (within possible footprint of 1899 house lot/ SIHP 50-80-11-2029), one volcanic glass flake within Trench 12 (also within possible footprint of 1899 house lot SIHP 50-80-11-2029), and one basalt adze fragment that was surface-collected along the edge of the bulldozed road near Trench 8. A complete inventory and analysis of historic artifacts identified within the project area is provided within Section 5.2, Historic Artifacts analysis.

The presence of scattered traditional Hawaiian and historic artifacts at the location of the possible 1899 house lot provided additional evidence for early historic habitation and the inclusion of the footprint as a component of SIHP 50-80-11-2029. A description of SIHP 50-80-11-2029 as well as all other historic properties that were identified within the project area is provided within Section 4.7, Historic Property Descriptions.

Subsurface testing conducted at or near the boundaries of LCAs also failed to identify subsurface architectural remnants, which were considered to potentially consist of minimally constructed, low-profile *lo‘i* walls. No cultural material or stratigraphic anomalies were observed.

4.3 Test Trench Documentation

4.3.1 Test Trench 1

Test Trench 1, located within the possible footprint of a 1928 house lot, measured 10.2 m long by 1.2 m wide with a maximum depth of 0.83 m below surface (Figure 52 and Figure 53 and Table 8). Exposed stratigraphy within Trench 1 included possible previously disturbed or re-deposited clay loam (Stratum I) to the base of excavation (BOE). No artifacts or stratigraphic anomalies were encountered during the excavation of Trench 1.

4.3.2 Test Trench 2

Test Trench 2, located within the possible footprint of a 1928 house lot, measured 10.0 m long by 1.2 m wide with a maximum depth of 0.81 m below surface (Figure 54 and Figure 55 and Table 9). Exposed stratigraphy within Trench 2 included gravelly clay loam (A-Horizon/Stratum I) with a concentration of basalt cobbles overlying undisturbed sandy clay sub-soil (B-Horizon/Stratum II) to the BOE. The cobble concentration, which was located within the southwestern end and sidewall of Trench 2 may represent a historic or modern fill event, but seems unlikely to be related to a house or building foundation. Historic artifacts collected from Trench 2 included seven non-diagnostic dark olive bottle glass fragments (Accession # 1). Traditional Hawaiian artifacts collected from Trench 2 included two possible basalt debitage flakes (Accession #2 and 3).

4.3.3 Test Trench 3

Test Trench 3, located within the possible footprint of a 1928 house lot, measured 6.5 m long by 0.7 m wide with a maximum depth of 0.8 m below surface (Figure 56 and Figure 57 and Table 10). Exposed stratigraphy within Trench 3 included gravelly clay loam (A-Horizon/Stratum I) overlying undisturbed sandy clay sub-soil (B-Horizon/Stratum II) to the

Figure 52. Profile view of Trench 1, view to west

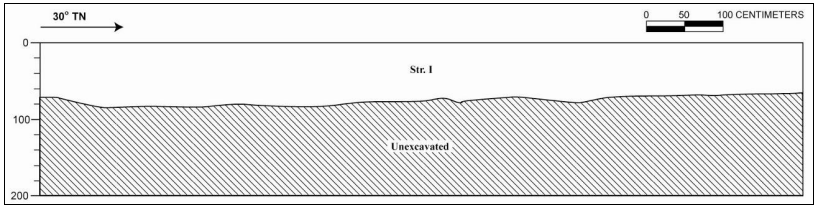

Figure 53. Stratigraphic profile of Trench 1, west wall

Table 8. Strata observed within Trench 1

Strata	Depth (cmbs)	Description
I	0-83 (BOE)	10 YR 5/4 dark yellowish brown with mottles of 10 YR 3/4 dark yellowish brown clay loam (moist); moderate, medium, crumb structure; firm moist consistency; slightly plastic; terrigenous origin; lower boundary not visible; many very coarse roots; indeterminate soil type; no cultural material; possibly previously disturbed/ re-deposited alluvium

Figure 54. Profile view of Trench 2, view to west

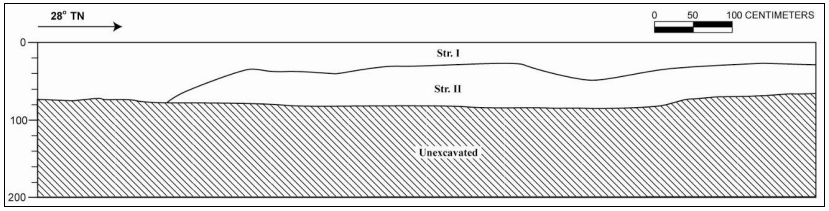

Figure 55. Stratigraphic profile of Trench 2, west wall

Table 9. Strata observed within Trench 2

Strata	Depth (cmbs)	Description
I	0-71	10 YR 2/2 very dark brown (moist) gravelly clay loam; moderate, medium, crumb structure; friable moist consistency; slightly plastic; terrigenous origin; clear smooth lower boundary; coarse roots common; A-Horizon; cobble concentration in southwestern sidewall may relate to modern/historic fill event
II	29-81 (BOE)	5 YR 3/3 dark reddish brown (moist) sandy clay; structureless, massive; friable moist consistency; slightly plastic; terrigenous origin; lower boundary not visible; few medium roots; B-Horizon; no cultural material observed; Sandy clay alluvium appears to be natural/undisturbed

Figure 56. Profile view of Trench 3, view to east

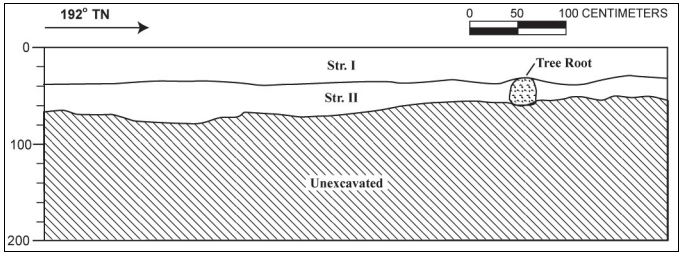

Figure 57. Stratigraphic profile of Trench 3, east wall

Table 10. Strata observed within Trench 3

Strata	Depth (cmbs)	Description
I	0-34	10 YR 2/2 very dark brown (moist) gravelly clay loam; moderate, medium, crumb structure; friable moist consistency; slightly plastic; terrigenous origin; clear smooth lower boundary; coarse roots common; A-Horizon
II	32-79 (BOE)	5 YR 3/3 dark reddish brown (moist) sandy clay; structureless, massive; friable moist consistency; slightly plastic; terrigenous origin; lower boundary not visible; few medium roots; B-Horizon

BOE. A large monkeypod tree root was observed, extending perpendicular to the trench near the southern end. No artifacts or stratigraphic anomalies were encountered during the excavation of Trench 3.

4.3.4 Test Trench 4

Test Trench 4, located along the border of LCA # 7588O (to Kamo‘onohu), measured 6.2 m long by 0.5 m wide with a maximum depth of 0.41 m below surface (Figure 58 to Figure 59 and Table 11). Groundwater was encountered at 0.23 m below surface. Exposed stratigraphy within Trench 4 included highly organic loamy clay (A-Horizon/Stratum I) to the BOE. No artifacts or stratigraphic anomalies were encountered during the excavation of Trench 4.

4.3.5 Test Trench 5

Test Trench 5, located on the border of LCA # 7588O (to Kamo‘onohu), measured 5.7 m long by 0.5 m wide with a maximum depth of 0.63 m below surface (Figure 60 and Figure 61 and Table 12). Groundwater was encountered at 0.59 m below surface and continued to rise. Exposed stratigraphy within Trench 5 included highly organic loamy clay (A-Horizon/Stratum I) overlying a developed clay sub-soil (B-Horizon/Stratum II) to the BOE. No artifacts or stratigraphic anomalies were encountered during the excavation of Trench 5.

4.3.6 Test Trench 6

Test Trench 6, located within the possible footprint of a 1949 house lot, measured 10.0 m long by 1.1 m wide with a maximum depth of 0.87 m below surface (Figure 62 and Figure 63 and Table 13). Exposed stratigraphy within Trench 6 included an organic horizon (O-Horizon/Stratum I) composed of leaf litter, seed pods, and scattered grasses overlying an organic-rich topsoil (A-Horizon/Stratum II), a mature subsoil (B-Horizon/Stratum III), and unconsolidated and solid basalt bedrock (R-Horizon/Stratum IV) to the BOE. Historic artifacts collected from Trench 6 included fragments from a one gallon jug of Fuji Sake Brewing Company’s “Fuji Shoyu” (Accession #4), aqua glass jar fragments with a manufacture date range of 1947-1949 (Accession #5), colorless glass jug fragments with a manufacture date range of 1939-1957 (Accession #6), and colorless glass jug fragments with a manufacture date range of 1939-1957 (Accession #7).

4.3.7 Test Trench 7

Test Trench 7, located within the possible footprint of a 1949 house lot, measured 10.0 m long by 0.5 m wide with a maximum depth of 0.68 m below surface (Figure 64 and Figure 65 and Table 14). Exposed stratigraphy within Trench 7 included a modern clay loam A-Horizon (Stratum I) overlying re-deposited silty clay fill (Stratum II) and gravelly sandy clay fill (Stratum III) to the BOE. Historic artifacts collected from Trench 7 included a non-diagnostic milk glass bowl fragment (Accession #8), two pieces of non-diagnostic ceramic vessels (Accession #9), one non-diagnostic dark olive glass bottle fragment (Accession #10), and four other non-diagnostic bottle glass fragments (Accession #11).

Figure 58. Profile view of Trench 4, view to southeast

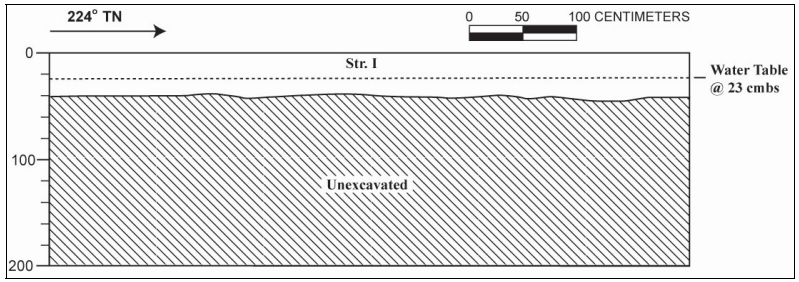

Figure 59. Stratigraphic profile of Trench 4, southeast wall

Table 11. Strata observed within Trench 4

Strata	Depth (cmbs)	Description
I	0-41 (BOE)	10 YR 3/2 very dark grayish brown (wet) loamy clay; structureless (massive); very sticky consistency; very plastic; no cementation; terrestrial origin; lower boundary not visible; A-Horizon

Figure 60. Profile view of Trench 5, view to northwest

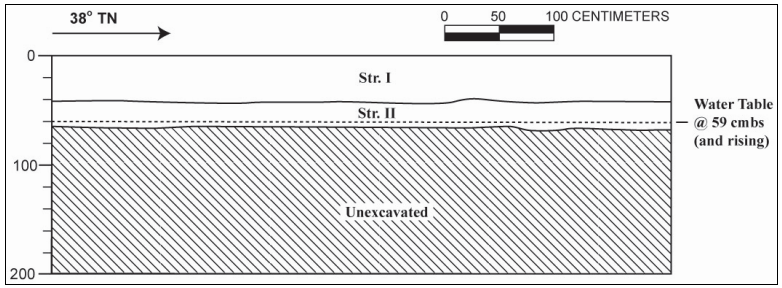

Figure 61. Stratigraphic profile of Trench 5, northwest wall

Table 12. Strata observed within Trench 5

Strata	Depth (cmbs)	Description
I	0-40	10 YR 4/3 brown (wet) loamy clay; weak fine crumb structure; very sticky consistency; plastic; no cementation; terrestrial origin; diffuse smooth lower boundary; common medium roots; A-Horizon
II	40-63 (BOE)	10 YR 4/4 dark yellowish brown (wet) clay; structureless (massive); very sticky consistency; very plastic; terrestrial origin; lower boundary not visible; B-Horizon

Figure 62. Profile view of Trench 6, view to west

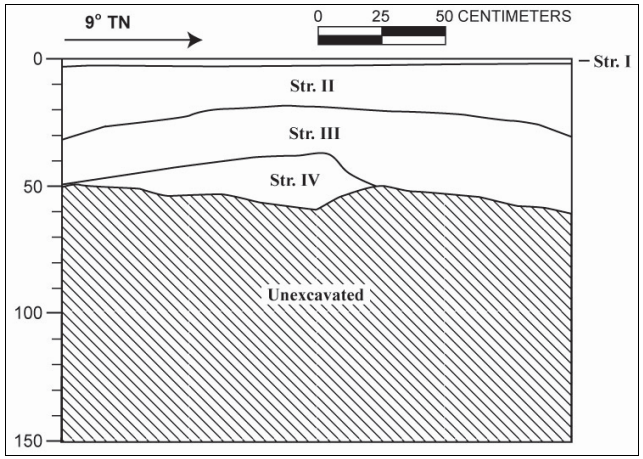

Figure 63. Stratigraphic profile of Trench 6, west wall

Table 13. Strata observed within Trench 6

Strata	Depth (cmbs)	Description
I	0-3	Organic detritus (monkey pod leaf litter detritus); difuse, smooth lower boundary; O-Horizon
II	3-30	5 YR 4/4 reddish brown (moist) clay loam; strong, medium, crumb structure; friable moist consistency; slightly plastic; no cementation; terrigenous origin; difuse, wavy lower boundary; glass bottle fragments; A-Horizon
III	17-60 (BOE)	5 YR 5/8 yellowish red (moist) sandy clay; strong, strong, coarse crumb structure; very firm moist consistency; plastic; terrigenous origin; clear, wavy lower boundary; B-Horizon
IV	37-57 (BOE)	10 YR 6/8 brownish yellow (moist) decomposing terrestrial bedrock; R-Horizon

Figure 64. Profile view of Trench 7, view to north

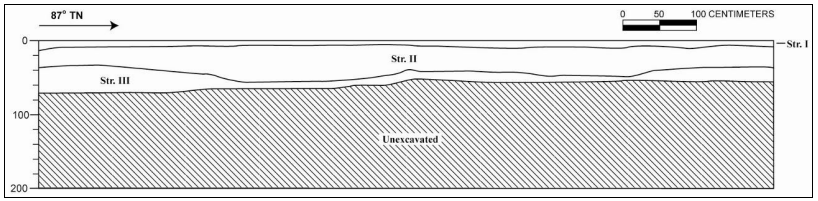

Figure 65. Stratigraphic profile of Trench 7, north wall

Table 14. Strata observed within Trench 7

Strata	Depth (cmbs)	Description
I	0-11	10 YR 3/6 dark yellowish brown (moist) clay loam; moderate, medium, crumb structure; friable moist consistency; plastic; no cementation; terrigenous origin; medium to large roots; clear, smooth lower boundary; A-Horizon
II	6-58	5 YR 4/6 yellowish red (moist) silty clay; weak, coarse, crumb structure; friable moist consistency; slightly plastic; no cementation; terrigenous origin; abrupt, smooth lower boundary
III	35-68 (BOE)	10 YR 3/3 dark brown (moist) gravelly sandy clay; strong, weak, coarse crumb structure; friable moist consistency; slightly plastic; terrigenous origin

4.3.8 Test Trench 8

Test Trench 8, located within the possible footprint of a 1928 house lot, measured 6.3 m long by 1.2 m wide with a maximum depth of 2.3 m below surface (Figure 66 and Figure 67 and Table 15). Exposed stratigraphy within Trench 8 included gravelly clay loam fill (Stratum I) overlying sandy loam fill (Stratum II) and sandy clay fill (Stratum III) to the BOE. Excavation beyond these fill strata was abandoned due to the presence of massive basalt boulders within Stratum III that could not be removed. Modern refuse included construction debris and plastic soda bottles were observed within Stratum I but not collected.

4.3.9 Test Trench 9

Test Trench 9, located at the northeastern corner of the boundary of LCA # 8797 (to Kao‘o), measured 5.5 m long by 0.5 m wide with a maximum depth of 0.42 m below surface (Figure 68 and Figure 69 and Table 16). Groundwater was encountered at 0.23 m below surface. Exposed stratigraphy within Trench 9 included an organic horizon (O-Horizon/Stratum I) overlying highly organic clay (A-Horizon/Stratum II) to the BOE. No artifacts or stratigraphic anomalies were encountered during the excavation of Trench 9.

4.3.10 Test Trench 10

Test Trench 10, located near the southwestern boundary of LCA #8797 (to Kao‘o), measured 6.4 m long by 0.7 m wide with a maximum depth of 1.4 m below surface (Figure 70 and Figure 71 and Table 17). Groundwater was encountered at 0.80 m below surface and continued to rise. Exposed stratigraphy within Trench 10 included an organic-rich clay top-soil (A-Horizon/Stratum I) overlying mottled clay sub-soil (B-Horizon/Stratum II) and gleyed clay sub-soil (Stratum III) to the BOE. No artifacts or stratigraphic anomalies were encountered during the excavation of Trench 10.

4.3.11 Test Trench 11

Test Trench 11, located within the possible footprint of an 1899 house lot, measured 9.0 m long by 1.0 m wide with a maximum depth of 0.74 m below surface (Figure 72 and Figure 73 and Table 18). Groundwater was encountered at 0.65 m below surface and continued to rise. Exposed stratigraphy within Trench 11 included an organic horizon (O-Horizon/Stratum I) composed of bamboo leaves and stalk fragments overlying an organic-rich clay loam (A-Horizon/Stratum II) to the BOE. A single basalt boulder was encountered within Stratum II near the BOE. Historic artifacts collected from Trench 11 included a complete, thread finish, colorless glass jar (Accession #12), a bright blue glass bead (Accession #13), and a metal wire fragments (Accession #15). Additionally one traditional Hawaiian artifact, a basalt flake (Accession #14), was collected.

4.3.12 Test Trench 12

Test Trench 12, located within the possible footprint of an 1899 house lot, measured 7.0 m long by 0.9 m wide with a maximum depth of 0.73 m below surface (Figure 74 and Figure 75 and Table 19). Exposed stratigraphy within Trench 12 included an organic horizon (O-Horizon/Stratum I) composed of bamboo leaves and stalk fragments overlying an organic-rich

Figure 66. Profile view of Trench 8, view to south

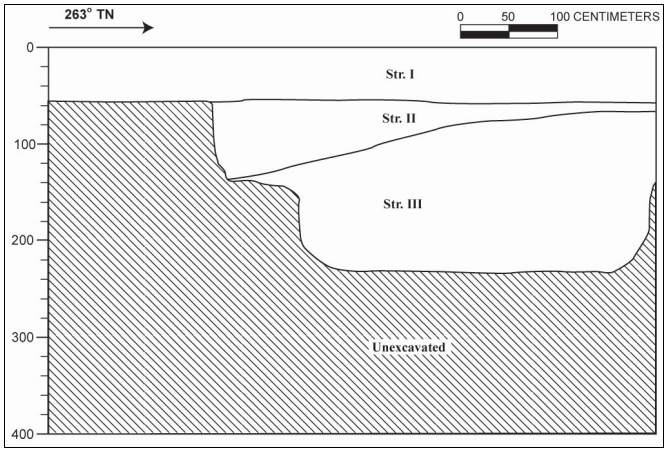

Figure 67. Stratigraphic profile of Trench 8, south wall

Table 15. Strata observed within Trench 8

Strata	Depth (cmbs)	Description
I	0-55	10 YR 3/3 dark brown (moist) gravelly clay loam fill; weak, medium, crumb structure; friable moist consistency; slightly plastic; no cementation; abrupt, smooth lower boundary; modern trash present
II	55-135	5 YR 2.5/2 dark reddish brown (dry) sandy loam fill; weak, medium, crumb structure; weakly coherent dry consistency; slightly plastic; no cementation; terrigenous origin; clear, irregular lower boundary
III	77-230 (BOE)	5 YR 3/3 dark reddish brown (dry) sandy clay fill; weak, medium crumb structure; slightly hard, dry consistency; slightly plastic; no cementation terrigenous origin; large basalt boulders present

Figure 68. Profile view of Trench 9, view to west

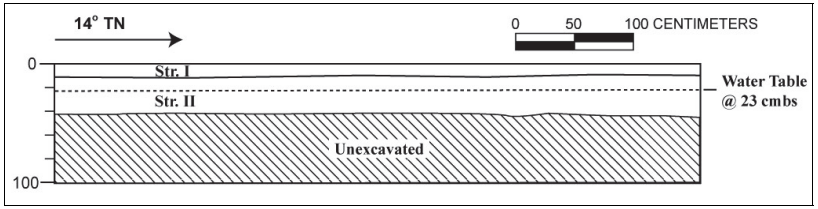

Figure 69. Stratigraphic profile of Trench 9, west wall

Table 16. Strata observed within Trench 9

Strata	Depth (cmbs)	Description
I	0-10	10 YR 4/3 brown (wet) loamy clay; weak fine crumb structure; very sticky consistency; plastic; no cementation; terrestrial origin; clear smooth lower boundary; contains organic detritus (grass stocks, leaf litter); O-Horizon
II	10-42 (BOE)	10 YR 3/2 very dark grayish brown (wet) loamy clay; structureless (massive); very sticky consistency; very plastic; no cementation; terrestrial origin; lower boundary not visible; A-Horizon

Figure 70. Profile view of Trench 10, view to northwest

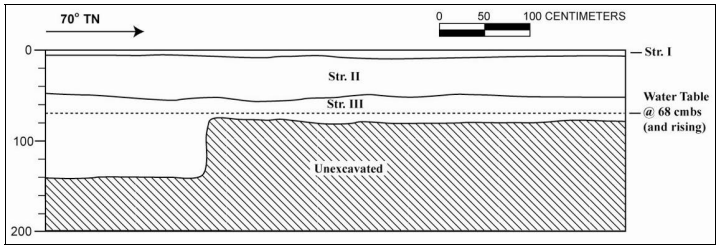

Figure 71. Stratigraphic profile of Trench 10, northwest wall

Table 17. Strata observed within Trench 10

Strata	Depth (cmbs)	Description
I	0-10	5 YR 3/2 dark reddish brown (wet) clay; structureless (massive); very sticky consistency; very plastic; no cementation; terrestrial origin; diffuse smooth lower boundary; A-Horizon
II	10-49	5 YR 4/6 yellowish red with 5 YR 5/1 grey mottles (40%) clay; weak coarse crumb structure; wet very sticky consistency; very plastic; no cementation; terrestrial origin; clear smooth lower boundary; B-Horizon
III	49-140 (BOE)	5 YR 2.5/1 Black (wet) clay; structureless (massive); very sticky consistency; very plastic; no cementation; terrestrial origin; lower boundary not observed

Figure 72. Profile view of Trench 11, view to southeast

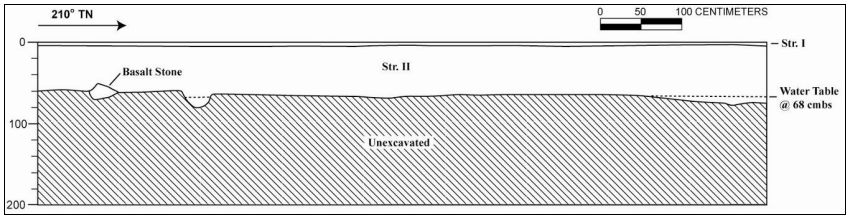

Figure 73. Stratigraphic profile of Trench 11, southeast wall

Table 18. Strata observed within Trench 11

Strata	Depth (cmbs)	Description
I	0-5	Organic layer composed of bamboo leaves and stalks, O-Horizon
II	5-74 (BOE)	10 YR 2/1 black (moist) gravelly clay loam; moderate, fine, crumb structure; firm moist consistency; plastic; no cementation; terrestrial origin; A-Horizon

Figure 74. Profile view of Trench 12, view to north

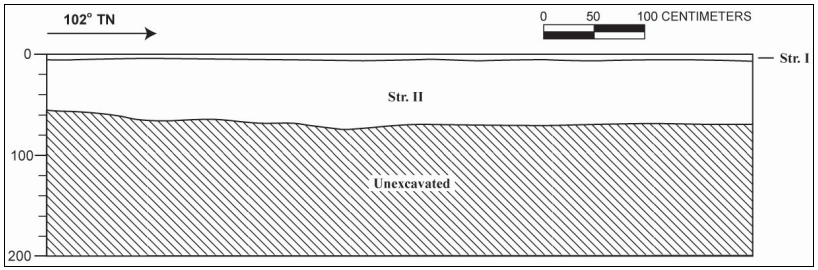

Figure 75. Stratigraphic profile of Trench 12, north wall

Table 19. Strata observed within Trench 12

Strata	Depth (cmbs)	Description
I	0-5	Organic layer composed of bamboo leaves and stalks, O-Horizon
II	5-73 (BOE)	10 YR 2/1 black (moist) gravelly clay loam; moderate, fine, crumb structure; firm moist consistency; plastic; no cementation; terrestrial origin; common fine roots; A-Horizon

clay loam (A-Horizon/Stratum II) to the BOE. One traditional Hawaiian artifact (Accession #16), a volcanic glass flake (debitage) was collected from Trench 12 near the BOE.

4.4 Results of Sediment Coring

A total of two sediment cores (Core Sample 1 and 2) were manually extracted from pre-selected locations within the project area, designated Core Location 1 and Core Location 2 respectively (Figure 76). Core Location 1 was located near the southern boundary of the project area, approximately 100 m southwest of the possible 1899 house lot and Trenches 11 and 12. Core Location 2 was located near the northwestern corner of the project area, approximately 430 m northeast of the possible 1928 house lot and Trench 1, 2, and 3. In both locations, CSH archaeologists successfully extracted sediment cores that were returned to the CSH laboratory to be opened, documented, and sampled.

Once opened, both core samples were measured and the lengths of the sediment cores were compared to the actual core depths in order to calculate the percentage of core compaction. The actual core depth at Core Location 1 was measured at 221 cm below surface while the corresponding length of Core Sample 1 was 80 cm. The percent of core compaction for Core Sample 1 was then calculated at 64 percent. Comparatively, the actual core depth at Core Location 2 was measured at 231 cm below surface while the corresponding length of Core Sample 2 was 103 cm. The percent of core compaction for Core Sample 2 was calculated at 55 percent. While the percent of compaction for both core samples was high compared to alternative coring methodologies, the relationship and superposition of each stratum remained constant.

Documentation of each core sample included the production of a scaled stratigraphic profile map, photographs, and a detailed description of each stratum using standard USDA soil description terminology. Detailed documentation of each core sample is presented in Section 4.5, Sediment Core Documentation, below.

Following documentation, a total of three sediment sub-samples were collected from three discrete locations along each sediment core. A portion of each sediment sub-sample was selected for submission to Beta Analytic, Inc. of Miami, Florida for radiocarbon dating while the remainder of each sub-sample was submitted to PaleoResearch Institute of Golden, Colorado for pollen analysis. The results of radiocarbon dating analysis are presented in Section 6.1 and pollen analysis for each sub-sample are presented in Section 6.2, Results of Laboratory Analysis, below.

4.5 Sediment Core Documentation

4.5.1 Core Sample 1 (Southern *Mauka* Location)

Strata present within Core Sample 1 consisted of a hydric soil sequence including decomposed organic plant matter with a 50 percent clay matrix (Stratum I), an organic-rich gleyed clay with fine to very fine rootlets (Stratum II), a reddish brown sandy clay containing less than 5 percent medium coarse sand grains (Stratum III), and a gleyed sandy clay containing 15-20 percent very fine to medium coarse sand (Stratum IV) (Figure 77 and Figure 78 and Table 20). Sediment sub-samples from Core Sample 1 included Sample 1-A from the lower boundary

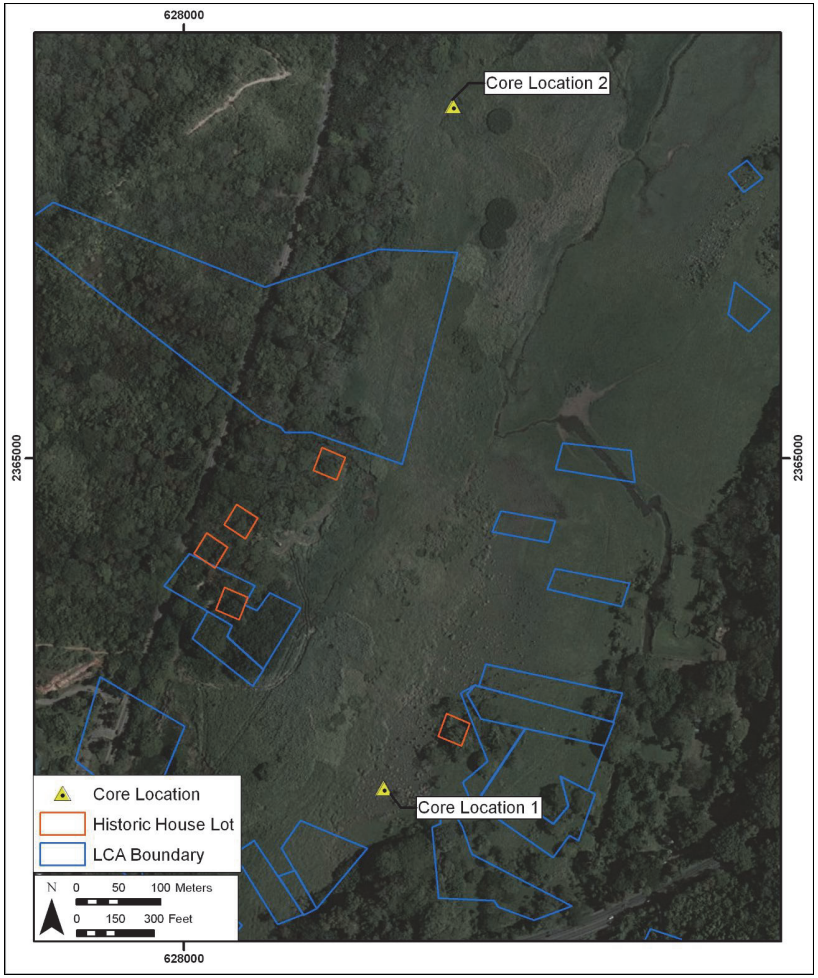

Figure 76. Aerial photograph showing the sediment core locations in relation to historic house lots and LCA boundaries within the project area (World Imagery 2006)

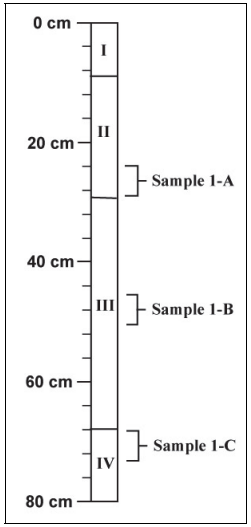

Figure 77. Stratigraphic profile of Core Sample 1 (Southern *Mauka* Location)

Figure 78. Photograph of Core Sample 1 (note: oriented with base of core in foreground)

Table 20. Strata observed within Core Sample 1 (Southern *Mauka* Location)

Strata	Relative Length	Description
I	0-9	10 YR 3/2 very dark grayish brown (wet) clay; structureless (massive); slightly sticky consistency; very plastic; terrestrial origin; diffuse smooth lower boundary; common fine to medium roots; contains decomposed plant matter (50%); O-Horizon
II	9-29	Gley 1 4/N dark grey with 5 YR 3/3 dark reddish brown mottles (30%) clay; structureless (massive); moist firm consistency; very plastic; terrestrial origin; diffuse smooth lower boundary; many very fine to fine roots; oxidation (mottles) are present within root casts; A-Horizon
III	29-68	5 YR 4/4 reddish brown with Gley 3/N very dark grey mottles (20%) sandy clay; structureless (massive); moist firm consistency; very plastic; terrestrial origin; very abrupt smooth lower boundary; no roots observed; contains medium coarse sand (5%)
IV	68-80	Gley 1 2.5/N black (wet) sandy clay; structureless (massive) slightly sticky consistency; plastic; terrestrial origin; lower boundary not visible; no roots observed; contains very fine sand (15%) and medium coarse sand (5%)

of Stratum II (24-28 cm), Sample 1-B from the middle of Stratum III (45-50 cm), and Sample 1-C from the upper boundary of Stratum IV (68-72).

4.5.2 Core Sample 2 (Northern *Makai* Location)

Strata present within Core Sample 2 consisted of a hydric soil sequence including decomposed organic plant matter with a 50 percent clay matrix (Stratum I), an organic-rich, homogenous, gleyed clay with fine to very fine rootlets (Stratum II), a thin lens of gleyed, mottled sandy clay containing 5-10 percent medium course sand (Stratum III), a gleyed, mottled silty clay with carbonized plant matter (Stratum IV), a gleyed, homogenous silty clay (Stratum V), a gleyed, homogenous clay (Stratum VI), and a gleyed, gravelly, silty sand containing marine components including shell and coral (Stratum VII) (Figure 79 and Figure 80 and Table 21). Sediment sub-samples from Core Sample 2 included Sample 2-A from the middle of Stratum II (25-30 cm), Sample 2-B from the middle of Stratum IV (46-51 cm), and Sample 2-C from the upper boundary of Stratum VI (68-72 cm).

4.6 Stratigraphic Summary

Stratigraphy within the project area consisted of dryland environmental sequences and fill events at the locations of possible historic house lots along Kapa‘a Quarry Road and the wetland environmental sequences of Kawainui Marsh at the locations of LCA boundaries, the possible 1899 house lot, and within extracted sediment cores.

An exemplary dryland stratigraphic sequence was recorded within Trench 6, which included an organic horizon (O-Horizon) composed of leaf litter, seed pods, and scattered grasses overlying an organic-rich topsoil (A-Horizon), a mature subsoil (B-Horizon), and unconsolidated and solid basalt bedrock (R-Horizon). A partially analogous sequence was observed within Trenches 1-3, however, excavation at these locations was terminated at a shallow depth within the B-Horizon, never exposing underlying stratigraphy. Fill layers exposed within Trench 7 and Trench 8 suggest that the area along the margins of the modern access road into the project area from Kapa‘a Quarry Road have been significantly disturbed through a combination of grading and filling events.

An exemplary wetland stratigraphic sequence of Kawainui Marsh was recorded within Core Sample 2, which consisted of a sequence of hydric soils including an organic horizon (O-Horizon) composed of living and decomposed plant matter overlying multiple lenses of highly organic topsoil and clays grading into homogenous organic clay and overlying marine clay with coral and marine shell. A partially analogous sequence was observed within Trenches 4, 5, 9-12, and Core Sample 1, however, excavation or coring at these locations was terminated within the homogenous organic clay, never exposing underlying stratigraphy.

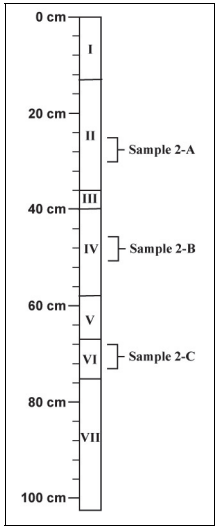

Figure 79. Stratigraphic profile of Core Sample 2

Figure 80. Photograph of Core Sample 2 (note: oriented with base of core in foreground)

Table 21. Strata observed within Core Sample 2 (Northern *Makai* Location)

Strata	Relative Length	Description
I	0-13	10 YR 3/2 very dark grayish brown (wet) clay; structureless (massive); slightly sticky consistency; very plastic; terrestrial origin; diffuse smooth lower boundary; common fine to medium roots; contains decomposed plant matter (50%); O-Horizon
II	13-36	Gley 1 3/N very dark grey (moist) clay; structureless (massive); firm consistency; very plastic; terrestrial origin; clear smooth lower boundary; no roots observed; A-Horizon
III	36-40	Gley 1 5/N grey with 5 YR 4/6 yellowish red mottles (20%) sandy clay; weak fine crumb structure; moist firm consistency; plastic; terrestrial origin; diffuse smooth lower boundary; no roots observed; contains 5-10% medium coarse sand
IV	40-58	Gley 1 2.5/1 greenish black with Gley 2.5/N black mottles (5%) silty clay; moderate fine crumb structure; moist firm consistency; plastic; terrestrial origin; diffuse smooth lower boundary; no roots observed; contains carbonized plant matter
V	58-67	Gley 1 2.5/N black (moist) silty clay; structureless (massive) friable consistency; plastic; terrestrial origin; clear smooth lower boundary; no roots observed
VI	67-75	Gley 1 2.5/N black (moist) clay; structureless (massive); firm consistency; very plastic; terrestrial origin; very abrupt smooth lower boundary
VII	75-103	Gley 4/N dark grey with Gley 6/1 greenish grey mottles (20%) gravelly silty sand; structureless (massive); wet slightly sticky consistency; non-plastic; mixed origin; lower boundary not visible; no roots observed; contains fine to medium coarse marine sand, sub-angular coral gravel and numerous marine shells

4.7 Historic Property Descriptions

4.7.1 SIHP# 50-80-11-2029

Site Type: Kawainui Marsh Archaeological-Cultural-Historical Complex
No. of Features: 1
Functional Interpretation: Indeterminate
Probable Age: Pre-Contact to Historic
Overall Dimensions: Indeterminate
Topography: Level to Steeply Sloping
Description:

SIHP 50-80-11-2029, the Kawainui Marsh archaeological-cultural-historical complex, was deemed eligible for listing on the National Register of Historic Places in 1979. The historic property complex has been identified and documented during previous archaeological studies (summarized in Section 3.3, above).

Two archeological studies conducted by Cordy (1978) and Allen-Wheeler (1981), consisted of subsurface test excavations. In both archaeological investigations, basalt-boulder alignments were documented. The alignments ranged in depth from visible on the ground surface to 60 cm below ground surface. Cultural deposits consisting of basalt and volcanic glass flakes were also recovered at a depth of 55-126 cm below surface. The Mann and Hammatt (2003) subsurface archaeological study also identified lithic debitage, volcanic glass flakes and a basalt adze at 70-97 cm below surface just above the water table. A mound of river cobbles may represent a local adaptation to water control utilizing immediately available resources (mounding river cobbles). The information gathered from these three subsurface studies suggests that intact cultural deposits consistent with *lo‘i* and rice agriculture still remain both on the surface, as well as buried beneath sediment deposits. The Mann and Hammatt (2003) subsurface archaeological study was undertaken just east of the present Kawainui Marsh Wetland Restoration and Habitat Enhancement Project area.

The present research has identified additional components of the SIHP 50-80-11-2029 complex that include a grinding stone and remnant components associated with historic habitation (Figure 81).

The grinding stone is located approximately 80 m to the southwest of the posited southeast corner of the former LCA 7588. The grinding stone artifact was identified by DOFAW staff during the reconnaissance survey. The grinding stone is somewhat characteristic of a traditional Hawaiian artifact of the Kawainui slopes (documented by Neller 1982, Athens 1983 a – see Figure 22, and others). This grinding stone lies at the base of a break in slope under a particularly large *noni* (*Morinda citrifolia*) tree (a tree mentioned in supporting documents for LCAs in the area but an uncommon tree in the general vicinity today).

The remnant components associated with historic habitation on the margins of Kawainui Marsh include a large rectangular stand of non-native bamboo, several pieces of lumber, and a post and barbed-wire fence line. Subsurface excavation of Trench 11 and Trench 12 within the area of these remnant components yielded sparse traditional Hawaiian artifacts which included

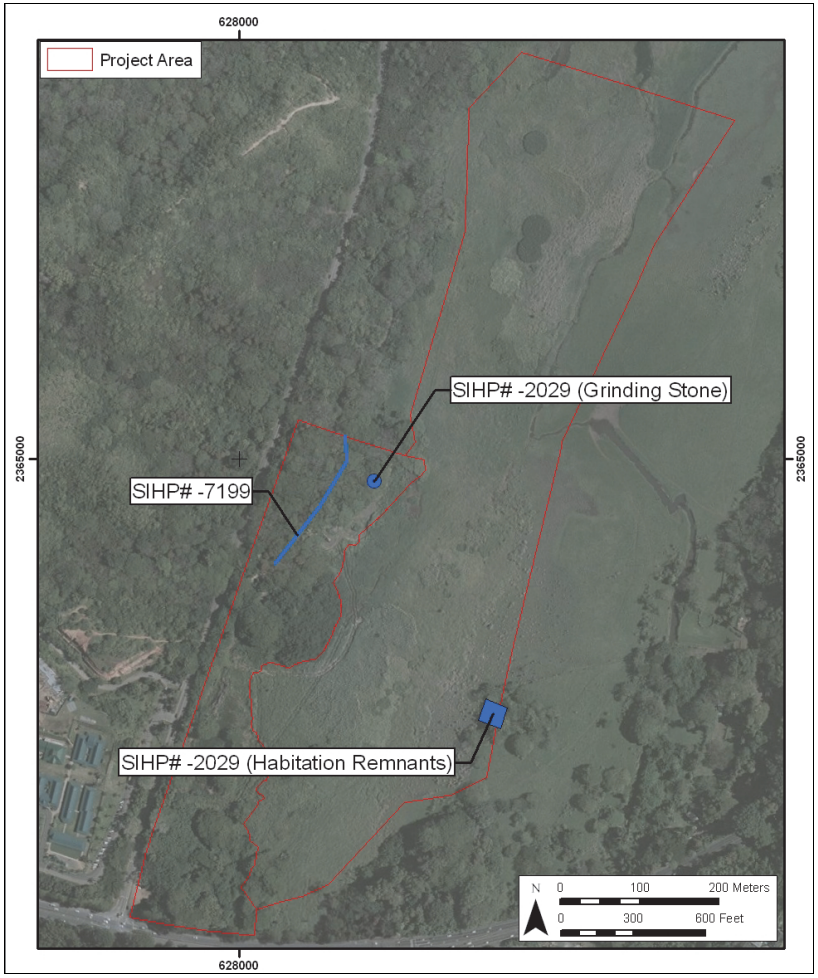

Figure 81. Aerial photograph showing the location of SIHP# 50-80-11-2029 (Kawainui Marsh Archaeological-Cultural-Historical Complex) grinding stone and habitation remnants features and the SIHP# 50-80-11-7199 Road (remnant) within the current project area

one basalt flake (Accession # 14) and one volcanic glass flake (Accession # 15) as well as several non-diagnostic historic artifacts. Additionally, one basalt boulder was indentified within the northern end of Trench 11, near the base of excavation (approximately 0.6 m below surface). The basalt boulder, along with several other basalt boulders that were observed on the present ground surface near Trench 11, may represent the remnants of a stone construction or possible house foundation although no stacking or alignments were discernable.

A review of historic maps indicates that the surficial habitation remnants and subsurface findings are located within or adjacent to a building or house that is depicted on an 1899 map by W. E. Wall (see Figure 6). The presence of subsurface traditional Hawaiian and historic artifacts, a stand of non-native bamboo, several pieces of lumber, and a post and barbed-wire fence line at the location of the possible 1899 house lot provided evidence for early historic habitation and the inclusion of the footprint as a component of SIHP 50-80-11-2029.

4.7.2 SIHP# 50-80-11-7199

Site Type: Road (remnant)
No. of Features: 1
Functional Interpretation: Transportation
Probable Age: Historic
Overall Dimensions: Extends approximately 400 m within the project area
Topography: Steep to moderate slope
Description:

SIHP# 50-80-11-7199 consists of a presently in-use section of roadway that extends roughly parallel to the western edge of Kawainui Marsh along the western boundary of the project area (see Figure 81). The extant portion of SIHP# 50-80-11-7199 measures approximately 400 m within the current project area. Present vehicular access to SIHP# 50-80-11-7199 is provided from a connecting modern entry road that extends from the southwestern end of SIHP# 50-80-11-7199 west to connect with Kapa‘a Quarry Road. SIHP# 50-80-11-7199 is comprised of an unpaved and unimproved worn road surface with no associated construction or infrastructure. While SIHP# 50-80-11-7199 appears to be related to a modern access point to Kawainui Marsh, a review of historic maps indicates that SIHP# 50-80-11-7199 closely aligns with a section of roadway depicted on the 1928 U. S. Geological Survey map and the 1943 War Department Map (see Figure 9 and Figure 10). The historic unpaved road extends from the present alignment of Auloa Road (former access corridor to the Pali Road) north along the base of the slope within the western portion of the project area. The historic road tapers into a cart road or trail just north of Core Location 2 along the western slope leading into Kawainui Marsh. SIHP# 50-80-11-7199 is likely a segment of a roadway that was constructed prior to 1928 and is therefore considered an historic property.

Section 5 Artifact Analysis

Artifacts recovered during fieldwork conducted within the project area were cleaned, accessioned, and cataloged according to provenience and type. A total of 17 artifacts were collected and returned to the CSH laboratory, including 5 traditional Hawaiian and 12 historic artifacts. Traditional Hawaiian artifacts included basalt and volcanic glass debitage and one basalt adze fragment. These artifacts are termed “traditional Hawaiian” in reference to their traditional manufacture technique and likely cultural affiliation. Traditional Hawaiian artifacts are attributed to the time period prior to and slightly after European contact, at which time stone tools were rapidly replaced by metal tools. Historic artifacts included complete and fragmentary glass bottles, ceramic fragments, a metal wire fragments, and a glass bead. In general, the artifact assemblage was collected from topsoil (A-Horizons) or fill layers at or near the modern land surface.

5.1 Traditional Hawaiian Artifacts

Traditional Hawaiian artifacts collected from within the project area include three basalt flakes (Accession # 2, 3, and 14), one volcanic glass flake (Accession #16), and one basalt adze fragment (Accession # 17).

Accession # 2 and Accession # 3 are basalt flakes that were collected from Stratum I of Trench 2. Both Accession # 2 and #3 are composed of relatively fine-grain basalt with minimal inclusions, and lack any use-wear or dorsal surface polish suggestive of use or function. Accession # 2 and #3 are considered to be debitage or “waste flakes” created during the reductive process of lithic manufacture.

Accession # 14 is a basalt flake that was collected from Stratum II of Trench 11. Accession # 14 is composed of very fine-grain, homogenous basalt with minimal inclusions and no indication of use-wear or dorsal surface polish. Accession # 14 is also considered to be debitage.

Accession # 16 is a volcanic glass flake that was collected from Stratum II of Trench 12. Accession # 16 is composed of high-quality volcanic glass within minimal inclusions and no indication of use-wear. Cortex was present near the platform and along the termination of the flake. Accession # 16 is also considered to be debitage.

Accession # 17 is a fragment of a groundstone basalt adze that was surface-collected along the edge of the bulldozed road near Trench 8 (Figure 82). Accession # 17 is composed of fine-grain homogenous basalt with minimal inclusions. The fragment appears to represent the back or hafted end of a finished or nearly completed adze. The surface of Accession # 17 is comprised of numerous flake scars with several areas of smooth flat polish. Accession # 17 is considered to be a fragment of a formal tool that was likely displaced from its original context during the construction of the bulldozed road or adjacent infrastructure.

Figure 82. Photograph of Accession # 17, a groundstone basalt adze fragment

5.2 Historic Artifacts

Historic artifacts collected within the project area include various diagnostic and non-diagnostic glass jug and bottle fragments (Accession # 1, 4-7, 10, and 11), one non-diagnostic milk glass container fragment (Accession # 8), non-diagnostic ceramic container fragments (Accession # 9), one complete non-diagnostic glass jar (Accession # 12), one non-diagnostic glass bead (Accession # 13), and one metal wire fragment (Accession # 15).

The only temporally diagnostic artifacts that were identified during the current fieldwork consisted of glass jar and jug fragments collected from Stratum II of Trench 6 (Accession # 4-7). These diagnostic artifacts include a range of manufacture between 1947 and 1963, which appears consistent with the location of Trench 6 within the possible footprint of a house lot depicted on a 1949 aerial photograph.

Accession # 4 consists of colorless glass jug neck and body fragments with embossing reading ‘One Gallon” and a round applied color label (ACL) on the body reading “Fuji Shoyu” at the top and partially reading “Brewed and Bottled, Fuji Sake Brewing Co, Honolulu” (Figure 83). Shurtleff and Aoyagi (2009:389-390) indicate that the Fuji Sake Brewing Company, Ltd. of Honolulu was introduced in 1947 and started producing sake and shoyu in 1948 until closing in 1963. The company information indicates that Accession # 4 was bottled between 1947 and 1963.

Accession # 5 consists of ten pieces of an aqua jar with partial body embossing reading “*alf”, suggesting a half-gallon sized jar. The base is embossed with an Owens, Illinois maker’s mark with “47” embossed to the right of the mark, indicating the bottle was manufactured in 1947 (Toulouse 1971:403 and Lockhart 2004). To the left of the maker’s mark “23” is embossed, indicating the item was made in Los Angeles, California. However, the Los Angeles company is documented as operating from 1949 to the present (Lockhart 2004). The date discrepancy (1947 vs. 1949) may be due to the use of an old mold or indication of a transitional period. Therefore, the date of manufacture for Accession # 5 is determined to be circa 1947-1949.

Accession # 6 and # 7 are both colorless glass jug bases that may be related to the colorless neck and body fragments of the Fuji Sake Brewing Company glass jug (Accession # 4). Both jug bases are embossed with a maker’s mark reading “LM” within a circle. This mark was used by the Latchford-Marble Glass Co from 1939-1957 (Toulouse 1971:332). The date of manufacture of Accession # 6 and # 7 (1939-1957) relate to the production time frame of Accession # 4 (1947-1963) further suggesting that Accession # 6 and # 7 may also be “Fuji Shoyu” jugs.

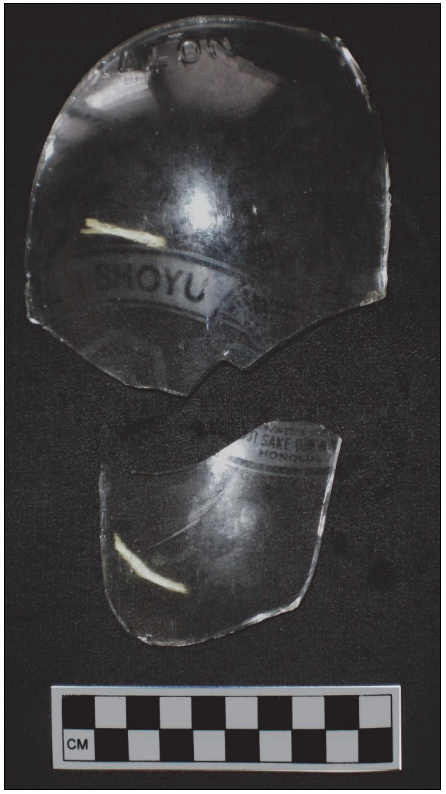

Figure 83. Photograph of Accession # 4, a one gallon glass shoyu bottle

Section 6 Sediment Core Analysis

6.1 Radiocarbon Analysis

A total of six sediment sub-samples (three each from Core Sample 1 and 2) were sent to Beta Analytic, Inc. of Miami, Florida for radiocarbon dating analysis using the Accelerator Mass Spectrometer (AMS) method (Table 22).

Sediment sub-samples from Core Sample 1 included Sample 1-A from the lower boundary of Stratum II (24-28 cm), Sample 1-B from the middle of Stratum III (45-50 cm), and Sample 1-C from the upper boundary of Stratum IV (68-72). Sediment sub-samples from Core Sample 2 included Sample 2-A from the middle of Stratum II (25-30 cm), Sample 2-B from the middle of Stratum IV (46-51 cm), and Sample 2-C from the upper boundary of Stratum VI (68-72 cm).

Analysis of Sample 1-A (Beta-301067), Sample 1-B (Beta-301068), and Sample 2-A (Beta-301070) concluded that the datable material within each sample contained more ^{14}C than did the modern reference standard, suggesting that these samples have a modern (post-1950) origin. Analysis of Sample 1-C (Beta-301069) yielded a calibrated 2-sigma date range of 420 AD to 580 AD (Figure 84). Analysis of Sample 2-B (Beta-301071) yielded two possible date ranges with a calibrated 2-sigma date range of 1430 AD to 1530 AD (82.8%) being the most probable (Figure 85). Analysis of Sample 2-C (Beta-301072) yielded a calibrated 2-sigma date range of 880 AD to 1020 AD (Figure 86).

Table 22. Results of radiocarbon analysis

Sample ID	Provenience	Conventional Radiocarbon Age	C13/ C12 Ratio	OxCal Calibrated Calendar Age (2-sigma)
Sample 1-A (Beta-301067)	Core Sample 1 Stratum II (24-28 cm)	110.2 +/- 0.3 pMC	-19.2 o/oo	Modern
Sample 1-B (Beta-301068)	Core Sample 1 Stratum III (45-50 cm)	100.7 +/- 0.3 pMC	-20.9 o/oo	Modern
Sample 1-C (Beta-301069)	Core Sample 1 Stratum IV (68-72 cm)	1550 +/- 30 BP	-26.0 o/oo	420 AD to 580 AD (95.4%)
Sample 2-A (Beta-301070)	Core Sample 2 Stratum II (25-30 cm)	114.1 +/- 0.3 pMC	-16.3 o/oo	Modern
Sample 2-B (Beta-301071)	Core Sample 2 Stratum IV (46-51 cm)	410 +/- 30 BP	-24.7 o/oo	1430 AD to 1530 AD (82.8%) 1570 AD to 1630 AD (12.6%)
Sample 2-C (Beta-301072)	Core Sample 2 Stratum VI (68-72)	1100 +/- 30 BP	-27.5 o/oo	880 AD to 1020 AD (95.4%)

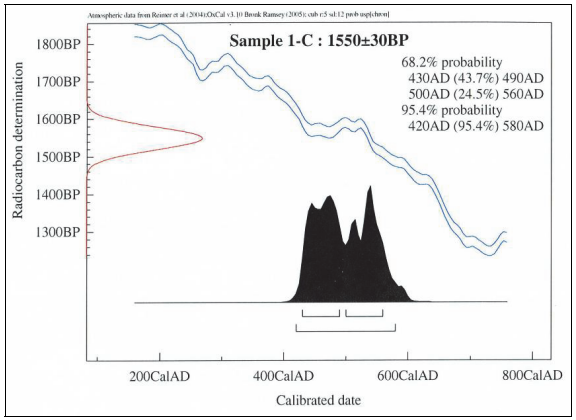

Figure 84. Graph showing the results of radiocarbon analysis of Sample 1-C

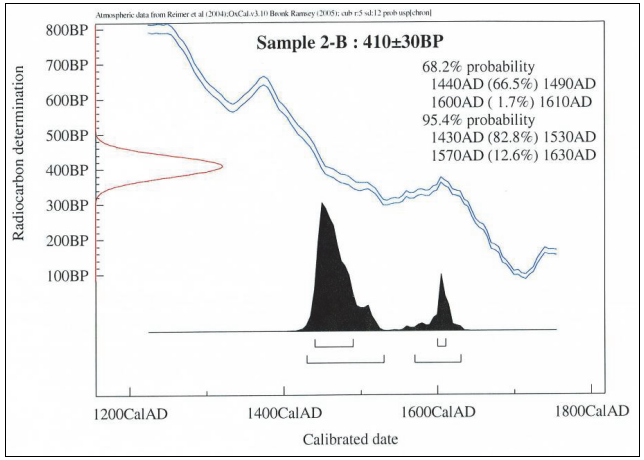

Figure 85. Graph showing the results of radiocarbon analysis of Sample 2-B

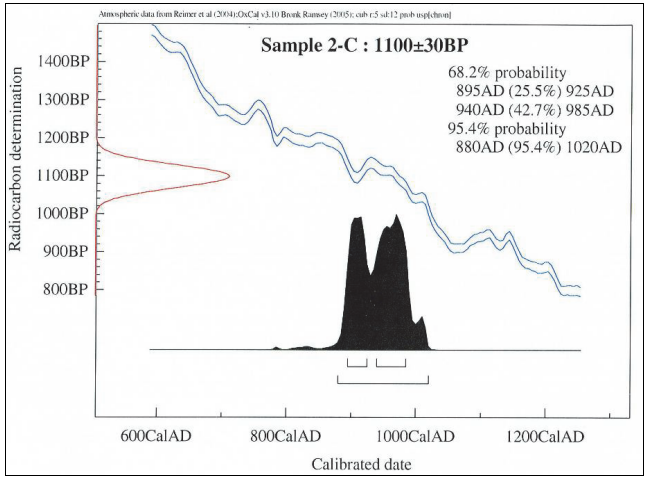

Figure 86. Graph showing the results of radiocarbon analysis of Sample 2-C

6.2 Pollen Analysis

The results of pollen analysis are reported in full in the present Appendix B: *Pollen Analysis of Samples from Kawai Nui Marsh, SIHP #50-50-11-2029* with a synopsis presented below followed by a discussion of conclusions from the Pollen Analysis. Two cores were collected in the marsh at locations approximately 1.5m above sea level, each of which was sampled at three depths to recover samples for pollen analysis. The depths were uniform between the two cores, at approximately 25–30, 45–50, and 68–73 cm below the surface. Pollen preservation in these samples varied from good to poor. Pollen analysis of these two cores yielded somewhat differing results. Much of the pollen analysis findings is summarized in the following Table 23.

6.2.1 Core 1 (southern core location)

Core 1 documents the presence of marshy deposits in all levels, particularly the uppermost and lowermost. The lowest sample from Core 1 provides evidence of more native plants and less evidence of cultivation than the upper two samples. *Saccharum* pollen, representing sugarcane (Table 2), is most abundant in the uppermost sample, declining in the middle sample. A small amount of *Saccharum* pollen is present in the lowest sample. In the absence of dates from these deposits, it is not possible to identify whether this lowest sample represents a time period where sugarcane cultivation makes sense. If not, it is likely that recovery of a very small quantity of *Saccharum* pollen at this depth reflects downward movement of this pollen.

The lowest sample (1C) (Beta-301069 dated this sample at 420 AD to 580 AD at a 95.4% confidence), collected at a depth of 68–73 cm, contains a small quantity of *Alnus* (temperate *Alder* species) pollen that is present through some sort of contamination, probably atmospheric. This sample contains pollen from *Anacardiaceae*, *Antidesma*, *Colubrina*, *Myrtaceae*, *Pritchardia*-type, and *Kadua*, representing trees, shrubs, and herbaceous plants that are part of the pre-Polynesian vegetation community on O‘ahu. Recovery of a large quantity of *Cyperaceae* pollen in this sample indicates that this location was a marsh at the time this sediment accumulated. Modest quantities of fern spores indicate that a variety of ferns also grew in the vicinity of the marsh. Microscopic charcoal fragments reflect burning, whether natural or cultural. The total pollen concentration of the lowest sample is approximately 1200 pollen per cubic centimeter (cc) of sediment. Recovery of a scolecodont fragment is evidence of polycheat worms. No distinction between geologic and modern forms is made.

The middle sample (1B) (Beta-301068 dated this sample as “modern”) collected at a depth of approximately 45–50 cm, yielded a different pollen record. The increase in *Saccharum* pollen indicates an established sugarcane field in the area, which appears to have displaced the sedges of the marsh. Increases in Cheno-am, Low-spine Asteraceae, and High-spine Asteraceae pollen indicate local growth of *Chenopodium* and members of the sunflower family, all of which are probably weedy. *Leucaena* pollen is observed in this sample, indicating the introduction of *koa haole* by this time. *Pritchardia* (*loulu* palm) is retained on the landscape, although apparently in diminishing quantities. Ferns increase, as noted by increases in both monolete and trilete spores. Microscopic charcoal spikes during this interval, probably representing burning fields to clear them. The recovery of foraminifera from this sample suggests the possibility of sea water incursion into the marsh.

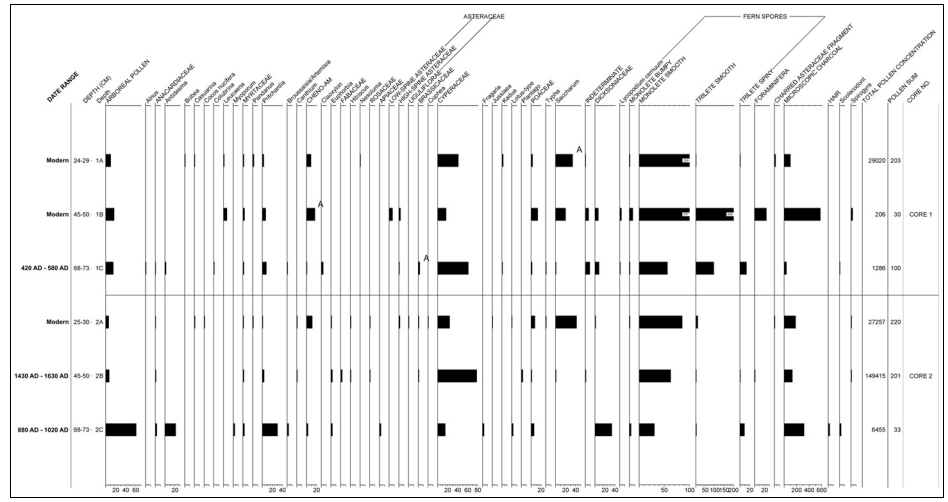

Table 23. Pollen Diagram for Two Cores from Kawainui Marsh, O’ahu with Corresponding Radiocarbon Dates

The uppermost sample (1A) (Beta-301067 dated this sample as “modern”) from this core displays the largest quantity of *Saccharum* pollen, indicating continued use of the marsh for sugarcane agriculture. An increase in Cyperaceae pollen suggests that weedy sedges were growing in the marsh as well. A decrease in microscopic charcoal suggests the possibility that burning fields was not as common. Pandanus pollen is noted in this sample, as is *Casuarina*, suggesting the growth of *hala* and Australian pine along the coast.

6.2.2 Core 2 (northern core location)

The lowest sample from Core 2 (2C) (Beta-301072880 dated this sample at 880 AD to 1020 AD at a 95.4% confidence) is marked by large quantities of *Antidesma* and *Pritchardia* pollen, representing *hame* and *loulu* palms growing along the coast. The recovery of small quantities of Anacardiaceae, *Myoporum*, and Myrtaceae pollen indicates local growth of a member of the cashew family, *naio*, and a member of the myrtle family such as guava or *Metrosideros*. Cyperaceae pollen is depressed in this sample, suggesting that this area was not as marshy as the Core 1 location. A surprising recovery of *Fragaria* pollen in this sample suggests the growth of native strawberry plants in this area. The recovery of a moderately large quantity of Dicksoniaceae fern spores suggests the local growth of a variety of tree ferns. Other fern spores are not particularly abundant. Microscopic charcoal is moderately abundant, suggesting the possibility of local fires. A rather large-diameter hair fragment that has no match in our reference collection was noted in this sample. The diameter indicates a coarse hair, at least double to triple the width of human hair. This sample also yielded very small, round, dark spherical bodies that might represent petroleum deposits. No petroleum smell accompanied the processing of this sample.

The middle sample (2B) (Beta-301071 provided two date ranges of 1430 AD to 1530 AD at 82.8% confidence and 1570 AD to 1630 AD at 12.6% confidence) indicates that during the middle interval this area was very marshy. Dominance of the pollen record by Cyperaceae pollen suggests that this particular location either was not cultivated or that it was used for taro production. Although no *Colocasia* pollen was recovered, it is usually observed in very small quantities. The over-production of Cyperaceae pollen may have obscured this pollen, which is too small to be obvious when scanning a pollen slide at low magnification. Additionally, this particular sample was very rich in deteriorated organic matter, which makes observation of large quantities of the sample in search of *Colocasia* pollen difficult. This sample yielded the largest total pollen concentration, nearly 150,000 pollen per cc of sediment, which is consistent with a dense growth of sedges. Only a small quantity of *Saccharum* pollen was noted in this sample, which may reflect sugar cane growing near, but not directly in, this portion of the marsh. The relatively small quantity of microscopic charcoal recovered from this sample does not indicate the use of local fires to clear land for agriculture. A reduction in *Pritchardia* pollen in this sample may be an artifact of the greatly increased quantity of Cyperaceae pollen rather than an indication of a severe reduction in quantity of loulu palms growing along the coast.

The upper sample (2A) (Beta-301070 dated this sample as “modern”) contains a large quantity of *Saccharum* pollen, indicating that this area was planted in sugarcane relatively late. By this time weedy plants such as *Chenopodium* have increased. The recovery of small quantities of *Casuarina* and *Cocos nucifera* represent Australian pine and coconut trees growing along the coast. *Pritchardia* pollen continues to be part of the record, indicating the continued

presence of *loulu* palm. This sample contained a large quantity of fungal spores, suggesting appropriate conditions for fungal growth in the sediments.

6.2.3 Conclusions

The pollen researcher, Linda Scott Cummings, concluded the following:

> Evidence for the use of this marsh for growing sugarcane during the middle and late portions of time represented in Core 1 and late in Core 2 is provided by the recovery of moderate to large quantities of *Saccharum* pollen. The location of Core 1 supported a marsh prior to this use, while the location of Core 2 did not. The Core 2 location became more marshy by the middle time interval. Both cores exhibit at least small quantities of Foraminifera in the middle samples, suggesting sea water incursions. Sugarcane is particularly well established in both locations by the time period represented by the upper sample. No taro pollen was observed in any of the samples examined. However, it should be mentioned that the rather large quantities of total pollen concentration and abundant organic matter for these samples may have swamped the record, reducing the possibility that taro pollen would be observed.

<u>Pre-Contact to Post-Contact Environmental Change</u>

Three of the pollen samples (1-A, 1-B, 2-A) were eventually dated to “modern”. The presence of *Casuarina* (iron wood) and *Leucaena* (*haole koa*) pollen is thus no surprise. It is reassuring that *Casuarina* and *Leucaena* pollens were only detected in “modern” dated sediments as this suggests relatively stable pollen profiles with little mixing or downward movement of modern, historically introduced pollens. The seemingly strong signature for *Saccharum* (sugar cane) pollen is a bit of a surprise. The Kailua area is not typically associated with sugar cane production but one could imagine sugar cane as a dominant pollen on O‘ahu for much of the modern period and large sugarcane plantations were as close as Waimānalo. Small amounts of sugar cane pollen were observed in the pre-Contact samples 1C and 2B presumably relating to Polynesian introduction and cultivation but this greatly increases in the modern samples 1A, 1B and 2A presumably relating to commercial, plantation cultivation.

As a sweeping generalization what was expected was a decrease in the pollen of native trees and shrubs as one moves from pre-Contact to post-Contact times. There is some support for this in the distribution of Anacardiaceae pollen (cashew, mango family). Dr. Cummings posits that the presence of Anacardiaceae pollen in the three pre-Contact samples (1C, 2B, and 2C) reflects the pre-Polynesian vegetation community on O‘ahu. This could reflect species such as the lowland and lower forest zone small tree *Neneleau*, *Neleau*; *Rhus sandwicensis*). In the southern Core 1 this is present in the pre-Contact sample and drops out of the two post-Contact samples. In the northern Core 2 there is a relatively strong signature in the two pre-Contact samples that weakens in the post-Contact sample. We see *Antidesma* (most likely *Hame* trees) pollen in two of the three pre-Contact samples and then as not present in any of the three modern samples. In the case of Colubrina (most likely *‘Anapanapa* shrubs*)* and *Myoporum* (most likely *Naio* trees) we see presence in one pre-Contact sample and no post-Contact presence. In the case of *Brousssaisia*/*Artemisia* (most likely *Kanawao* trees) we see presence in two of the pre-Contact samples and none of the post-Contact samples. In the case of *Claoxylon* (most likely *Po‘olā*

trees) we see presence in one pre-Contact sample and no post-Contact samples. In the case of *Pritchardia* (*loulu* palms) both pollen cores show a loss of pollen moving into modern times. Thus there appears to be clear evidence supporting the loss of native plant species moving into post-Contact times. This was never really in question.

It is worth noting the Native-species type pollen that does extend into modern times. Hibiscus pollen (most likely mostly *Hau*, *Hibiscus tiliaceus*) is about the same in pre-Contact sample 2B as in post-Contact sample 2A. Possibly the general abundance of *hau* at Kawainui has not changed much. *Pandanus* (*Hala;* present in 1A and 2A) and Coconut (*Niu*, *Cocos nucifera;* present in 2A) are only shown as present in modern times – possibly reflecting modern treads such as the historic development of the “Coconut Grove area” and domestic landscaping.

As a generalization, the trend we see from late Pre-Contact times to modern times is general decrease in Cyperaceae (sedges) and a general increase in Poaceae (grasses). This would appear to reflect a general trend towards eutrophication and the conversion of marsh to meadow as a result of increasing nutrient loading and siltation resulting from environmental degradation of the uplands starting in late pre-Contact times but intensifying in modern times. This is also reflected in the large percentage of the cores recovered that are “modern”. While some differential compaction would be expected (with more recent sediments being less compacted in the core) it is worth noting that in Core 1 it appears that modern sediment accumulation accounts for the relatively thick top 50 (+) cm of sediment and in Core 2 modern sediment accumulation accounts for the relatively thick top 30 (+) cm of sediment.

Pre-Contact Environmental Change

Our data for the record of environmental change in pre-Contact times is reflected in Table 24 where we report pollen compositions from three pre-Contact dated samples of A.D. 420-580, A.D. 880-1020 and A.D. 1430-1630. It should be noted that these are not all from the same core location and that that variable introduces certain possible vagaries in the record.

It is also worth pointing out that there is substantial re-thinking regarding the likely timeframe of first Polynesian settlement in Hawai‘i – with something of a sea change in archaeologist’s beliefs toward belief in later settlement (perhaps as late as circa AD 1,000 according to some). It seems probable that the A.D. 420-580 pollen record reflects a pristine pre-human island eco-system or a time of very early Polynesian settlement. Some archaeologists would now argue that the timeframe of A.D. 880-1020 could reflect a time of very early Polynesian settlement or even a pristine pre-human island eco-system.

Microscopic charcoal was identified in seemingly significant concentrations in all samples. This could support a hypothesis of Hawaiian occupation and burning for field creation as early as the A.D. 420-580 timeframe but we cannot rule out downwards migration due to tidal flux. The Microscopic charcoal concentrations in the A.D. 880-1020 timeframe (again suggested to reflect burning for field creation) appears strong. This definitely calls into question a prior conclusion “that fire has had little or no effect on natural vegetation communities in the Kawainui Basin watershed.” (Athens and Ward 1991:105-106).

The pattern indicated in the samples from A.D. 420-580 and A.D. 880-1020 specifically of decreasing Cyperaceae (sedges), increasing Poaceae (grasses) and increasing microscopic charcoal show what we would expect as a reflection of Polynesian land clearing activity in the

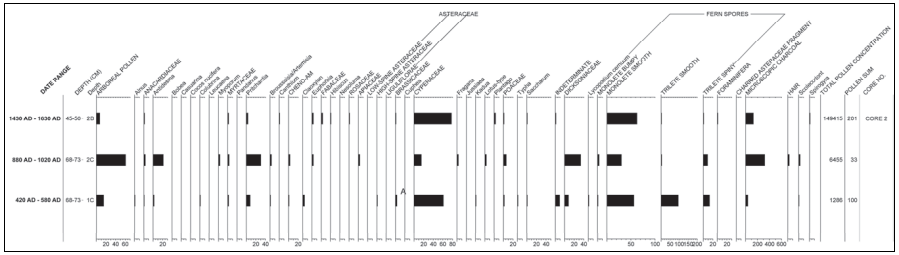

Table 24. Chronological Superimposition of Three Pollen Samples from Pre-Contact Kawainui (note these three samples are from two different core locations)

interval favoring a trend from marsh to meadow due to environmental degradation, increased siltation and increased nutrient loading. Somewhat surprisingly all three trends appear to reverse as we move from A.D. 880-1020 to A.D. 1430-1630. Athens and Ward (1991:106) also noted "The sedge pollen curve begins a steep rise after about A.D. 1000…" and posit the explanation that it had to do with the shallowing of Kawainui in a transition from open water to marsh and the development of a peat layer that improved sedge habitat. While our data also shows this steep rise in sedge pollen after about A.D. 1000 we show that there had been a steep drop in the prior 500 years – calling into question the explanation.

A key marker pollen species, *Pritchardia* (*loulu* palms) has been suggested to reflect pre-Contact Polynesian environmental change. Direct human consumption of fruits for food and wood for timber and fuel, ancillary impacts of human use of fire for land clearing, and the effects of Polynesian-introduced pigs, dogs, and particularly Pacific rats appear to have decimated native stands of *loulu* palms in pre-Contact times. This appears to be supported by the trend of apparent radical reduction of *Pritchardia* pollen between the A.D. 880-1020 to A.D. 1430-1630 timeframes. However no reduction of *Pritchardia* in the interval from the A.D. 420-580 timeframe to the A.D. 880-1020 timeframe is indicated by this data.

The pollen data suggesting a decline in a variety of native species in Polynesian times includes the following:

- *Antidesma* (most likely *Hame* trees) pollen is present in the A.D. 420-580 and A.D. 880-1020 timeframes but not in the A.D. 1430-1630 timeframe,
- Colubrina (most likely *‘Anapanapa* shrubs*)* pollen is present in the A.D. 420-580 timeframe but not in the A.D. 1430-1630 timeframe,
- *Myoporum* (most likely *Naio* trees) pollen is present in the A.D. 880-1020 timeframe but not in the A.D. 1430-1630 timeframe,
- *Brousssaisia*/*Artemisia* (most likely *Kanawao* trees) pollen is present in the A.D. 420-580 and A.D. 880-1020 timeframes but not in the A.D. 1430-1630 timeframe,
- *Claoxylon* (most likely *Po‘olā* trees) pollen is present in the A.D. 420-580 timeframe but not in the A.D. 1430-1630 timeframe
- Apiaceae (Cf. *Sanicula sandwicensis*, an endemic Hawaiian "snakeroot" species) pollen is present in the A.D. 880-1020 timeframe but not in the A.D. 1430-1630 timeframe,
- *Fragaria* (perhaps *ōhelo papa*) is present in the A.D. 880-1020 timeframe but not in the A.D. 1430-1630 timeframe,
- *Kadua* (now *Hedyotis*) (*‘āwiwi* herbs, *pilo* shrubs and kin) is present in the A.D. 420-580 timeframe but not in the A.D. 1430-1630 timeframe

It is worth looking at what shows up relatively late (the A.D. 1430-1630 timeframe), but not earlier in the pre-Contact pollen record including:

- Canthium (probably *alahe‘e*),
- Fabaceae, (probably mostly *Acacia koa*, *koa*)
- Hibiscus (probably *hau*)
- Rosaceae (mostly *Osteomeles anthyllidifolia*, *‘ūlei* ?)
- *Plantago(Laukahi)*

As a generalization these are hardier species may have flourished (relatively) as botanical diversity decreased.

A Lack of Cultigens

It is worth noting that the only clear identification of Native Hawaiian cultigens are Coconut (*Niu*, *Cocos nucifera;* present only in the modern 2A sample)– possibly reflecting modern treads such as the historic development of the "Coconut Grove area" or modern landscaping and *Saccharum* pollen, representing sugarcane, which is again overwhelmingly from modern samples. We do see *Saccharum* pollen reported from Sample 1C (A.D. 420-580) and Sample 2B (A.D. 1430-1630). This suggests that *kō* or sugarcane may have been a more important cultigens (useful as a windbreak as well as for sweet carbohydrates) in pre-Contact Kailua than previously appreciated. The identification of a Polynesian-introduction in a relatively early timeframe of A.D. 420-580 could be construed as evidence of relatively early colonization but given the abundance of *Saccharum* pollen in overlying modern layers and the possibility of downwards contamination through tidal flux we would not overly emphasize this point.

Dr. Cummings noted the striking absence of *Colocasia* (taro or *kalo*) pollen recovered, commenting that it is usually observed in very small quantities and further that the over-production of Cyperaceae (sedge) pollen may have obscured this pollen, which is too small to be obvious when scanning a pollen slide at low magnification. It is still striking that no core food plant's (yam, sweet potato, taro, breadfruit, banana) pollen was observed at all. Possibly the concept of Kawainui as a "former breadbasket" of Polynesian-introduced cultigens has been overemphasized. Athens and Ward (1991:104) in their work at Kawainui also noted that their "pollen record for the presumed Polynesian-introduced species is very sparse."

Salt Water Intrusion at Kawainui

Dr. Cummings notes that: Recovery of a large quantity of *Cyperaceae* (sedge) pollen in Sample 1C dated to A.D. 420-580 indicates that this location was a marsh at the time this sediment accumulated. It appears to us that Kawainui has been a marsh since at least as far back as the A.D. 420-580 timeframe and hence probably for the entire history of human experience of the vicinity. This is consistent with earlier conclusions that Kawainui was cut off from the ocean at an earlier date. Independent relatively close timeframe estimates for Kawainui's transitioning from a marine to largely freshwater basin have been suggested of BCE 295-AD 12 (Hammatt et al. 1990:49) or perhaps slightly earlier circa B.C.E. 394-91 (Athens and Ward 1991:73).

Foraminifera, indicating possible salt water intrusion, were noted in two samples: 1B (modern) and 2B (A.D. 1430-1630). This is suggested to possibly relate to relatively brief periods of tsunami, hurricane, or severe storm induced saltwater inundation rather than any period of embayment or true circulation with Kailua Bay.

Implications for "Early" Polynesian Settlement

As noted above, caution is recommended in construing the presence of the Polynesian introduced *Saccharum* pollen and microscopic charcoal in the Sample 1C (dated to the A.D. 420-580 timeframe) as evidence of Polynesian cultivation and use of fire at that time. That could be the case or we may just be seeing downwards migration of pollen and microscopic charcoal in the stratigraphy or contamination. We do, however, note that the apparent trends of decreasing Cyperaceae (sedge) pollen, increasing Poaceae (grasses) pollen and increasing microscopic

charcoal from Sample 1 C (dated to the A.D. 420-580 timeframe) to Sample 2C (A.D. 880-1020 timeframe) suggests substantial Polynesian land transformation in the interval between the two date ranges. A counter argument is suggested by the *Pritchardia* (*loulu* palms) pollen which still appears robust in Sample 2C (A.D. 880-1020 timeframe) although it does appear to have dropped significantly by the A.D. 1430-1630 timeframe.

Comparisons with Earlier Kawainui Pollen Studies

The Hammatt et al. (1990) analysis of pollen changes concluded that “a tremendous increase in the presence of grasses began in pre-European times in the general timeframe of A.D. 1410-1650” and that “The pollen of Pritchardia sp. dramatically collapses” (sometime prior to A.D. 1670) (Hammatt et al. 1990:53, 51) .

It was suggested that there were a number of exciting aspects to the newly appreciated “striking changes” in the pre-Contact pollen record including a transformation of our general understanding of the likely mesic lowland forest composition of pristine Hawai‘i, the import of *Pritchardia* for Hawaiian settlement, the capacity of the land to provide food for arriving Polynesian settlement, the indications of very substantial environmental transformation in pre-Contact times, and even for a possible botanical basis for local myths of Makalei and Ka-lalo-i-ka-wai-ma-ku‘u-kao that indicate a great abundance that disappeared in pre-Contact times.

The work of Athens and Ward (1991) at Kawainui significantly refined our understanding of the timeframe of vegetation change. They posited “After about A.D. 1000 the [*loulu; Pritchardia* sp.] palm forests rapidly declined.” (Athens and Ward 1991:104). Our present data supports that a major change occurred between a circa A.D. 880-1020 timeframe and a circa A.D. 1430-1630 timeframe.

Section 7 Summary and Recommendations

A reconnaissance survey within the current project area has identified two historic properties including components of SIHP# 50-80-11-2029, the previously identified Kawainui Marsh archaeological-cultural-historical complex, and SIHP# 50-80-11-7199, an in-use, early 20th century road remnant.

Limited subsurface testing within the project area identified a sparse amount of historic and traditional Hawaiian artifacts, some of which appear to be linked with habitation within the possible footprint of a house lot that appears on an 1899 map, and considered here to be components of SIHP# 50-80-11-2029. Limited subsurface testing did not expose subsurface cultural deposits or modification within the project area. The documentation of backhoe test trenches that were excavated along LCA boundaries and within possible 20th century house lots failed to identify any associated rock or sediment walls (*lo‘i* walls), foundations, or associated features.

Sediment coring at two locations within Kawainui Marsh has provided additional palynological and radiocarbon data. Pollen analysis has indicated that Kawainui sediments still hold pollen data that can refine and expand our knowledge of Polynesian settlement and pre-Contact change. Some earlier conclusions have been supported and others have been called into question. Radiocarbon analysis suggested that the uppermost strata within the project area consist of deposits of decomposed plant matter overlying relatively modern alluvium. Radiocarbon analysis of Core Sample 1 indicated that, minimally, the upper 68 cm of the 80 cm core sample (upper 85%) was composed of modern-aged sediment. Radiocarbon analysis of Core Sample 2 indicated that, minimally, 36 cm of the 103 cm core sample (upper 35%) was composed of modern-aged sediment. Average core compaction of Core Samples 1 and 2 were calculated at 64 percent and 55 percent, respectively. The relative vertical thickness of modern-aged deposition within Kawainui Marsh indicates that the proposed project’s subsurface impact, which includes recreating certain areas of shallow (8 to 30 cm) open water on the west side of the south end of Kawainui Marsh, will pose little or no impact on subsurface historic properties within the project area.

Based on the results of this archaeological reconnaissance survey with limited subsurface testing report, it is recommended that: 1) an archaeological monitoring program be developed to address the impact of subsurface disturbance within the project area, and 2) that preservation, in the form of protection through avoidance, be considered for the two components of SIHP# 50-80-11-2029 (grinding stone and habitation area) that were identified during the current project.

The proposed archaeological monitoring program was discussed in the course of a face-to-face meeting with Mike Vitousek and Deona (“Nona”) Naboa of the SHPD on June 2, 2011. They were in favor of an archaeological monitoring program as a as a mitigative measure. The SHPD suggested that a condition should be included in the monitoring plan for the post-review of historic properties if any are encountered during construction activities. As an example, data recovery work would be conducted if historic walls were found, and this would be documented in a data recovery report prepared and submitted to the SHPD. The archaeological monitoring plan would codify that should additional historic properties be identified during construction activities that any such properties might be appropriately subject to additional data recovery

documentation (to be determined in consultation with the SHPD). Furthermore, the SHPD suggested that a synthesis evaluating any historic properties encountered in relation to the Kawainui Marsh historic site should be included in the data recovery report. This would be an additional point to be codified in a draft archaeological monitoring plan for SHPD review.

In the discussion with the SHPD it was tentatively agreed that the grinding stone should be left in place and avoided and that the historic house area by the bamboo stand should be avoided and that they could both be rregarded as features of the Kawainui Marsh historic property.

No further archaeological work is recommended for SIHP# 50-80-11-7199 (road remnant).

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Appendix A Land Commission Award Data

A.1 LCA No. 2544 Lalapa

No. 2544, Lalapa, December 30, 1847

N.R. 548v3

To the Land Commissioners, Greetings: I hereby state my claim for my mo`o at Mana in the `ili of Ukikolo in Kailua, and my house. I got it in the time of Kaiola. Some orange and lemon trees are at Hoauloa

LALAPA

Kailua, Koolau, Oahu.

F.T. 203v14

No. 2544, Lalapa, Claimant

Kekalei, sworn, say I know the land of Claimant in Kailua in the ili of Manu, and consists of 4 taro patches and a house lot.

No. 1 is bounded:

Mauka by the taro of Noulu

Kaneohe by waste land

Makai by land of Ukikolo

K. [Waimanalo] by a Creek.

No. 2 is bounded:

Mauka by Upland

Kaneohe by stone fence

Makai by a grove of hao trees

K. [Waimanalo] by Upland.

Claimant had his land from Makai in the time of Kaahumanu and had it in peace to the year 1848, when it was taken from them by the Konohiki, but without any good reason. It should be given to claimant.

Holo, sworn, says the above is true. Claimant has a small Orange & Lime grove in the ili of Hoaoloa, which was planted by himself.

[Award 2544; R.P. 2291; Kalaiopuu Kailua Koolaupoko; 1 ap.; 6.46 Acs; Manu Kailua Koolaupoko; 1 ap. 1.38 Acs]

A.2 LCA No. 2575, Hekona

LCA No. 2575, Hekona, December 31, 1847

N.R.562v3

To the Land Commissioners, Greetings: I hereby state my claim for an `ili, Manulele, and a kula which I got in the time of Kaleohano. I have one mala ipu [gourd garden] in the kula of Pohakupu. In the kula of Koahaleole I have 1 lo`i, in the `ili of Makaloa. The second of my `ili is Olohana, Kailua, Koolau, Oahu. The Konohiki is Kalama.

HEKONA

F.T. 288v14

Helu 2575, Hekona (Make), See 338 P

Kuna, Hoohikiia, Ua ike au i kona aina ma Kailua Ili o Manulele.

Apana 1. 10 Loi.

Apana 2. Kahuahale.

Apana 1 na palena:

Mauka, aina o ke Aupuni

Kaneohe, Kahawai

Makai, Ili o Kapia

K.[Waimanalo], kula.

Apana 2: Ua puni i ke Kula na aoao a pau.

Na Honaunau mai loaa ia`u i ka wa ia Liliha. aole keakeaia. Ua make ka mea nona keia Kuleana i ka M. H. 1849 a oia hooili i kana Wahine ia Makakau.

Maile, Hoohikiia, Ua like no ko`u me Kuna i hai ae nei.

F.T. 328v14

No. 2575, Kekona, Claimant

Kuna, sworn, says I know the land of claimant. It is in the Ili of Manulele in Kailua as follows

No. 1. 10 taro patches.

No. 2. House Lot.

No. 1 is bounded:

Mauka by government land

Kaneohe by a Creek

Makai by the Ili of Kapia

K. [Waimanalo] by upland

No. 2 is bounded: On all sides by upland

Claimant had his land from Honaunau in the time of Liliha and held it in peace to the time of his death in the year 1849. His widow Kamakakau is his heir.

Maile, sworn, says the above is all true.

[Award 2575; R.P. 2318; Olohana Kailua Koolaupoko; ; 1 ap.; .25 Ac; Manulele Kailua Koolaupoko, 2 ap. ; 1.54 Acs; (2.29 Acs)]

A.3 LCA No. 6153, Nanawahine

N.R. 248v5

The Land Commissioners, Greetings: I hereby state my claim for land. I have two lo'i at Manulele in the land of Kekona. In the upland of Hekala is a mala of bananas in the land of Aahoaka. At Kawailoa is a mala of wauke, Kikoi is the Konohiki. At Kailua, Island of Oahu. I got these in the time of Kalola.

NANAWAHINE

F.T. 296v14

Helu 6153, Nawahine See 348 Page

Kuna, Hoohikiia, Ua ike au i kona aina ona Kailua Ili o Manulele.

Apana 1 - 2 loi.

Apana 2 - 1 mala wauke i ke ili o Kawailoa.

Apana 1 na palena:

Mauka, Aina o Makakau

Koolauloa, Nahelehele

Makai, aina o Makakau

K.[Waimanalo], Kula.

Apana 2: Puni i ke Kula o Kawailoa na aoao a pau.

Na Kekona mai i ka wa ia Liliha aole Keakeaia.

F.T. 348v14

No. 6153, Nanawahine, Claimant, From page 295

Kuna, sworn says, I know the land of claimant in Kailua in Manulele as follows:

No. 1 - 2 lois.

No. 2 - a kapa field.

No. 1 is bounded:

Mauka by the land of Makakau

Koolauloa by Waste land

Makai by Land of Makakau

K.[Waimanalo] by Upland.

No. 2 is bounded: On all sides by the Upland of Kawaaloa.

Claimant had his land from Kekona in the time Liliha and has had it in peace to this time.

[Award 6153; no R.P.Manulele Kailua Kooluapoko; 1 ap.; .22 Ac.]

A.4 LCA No. 6162, Punipeli, [Punipeki]

N.R. 251v5

The Land Commissioners, Respectful Greetings: I hereby state my claim for my twelve lo`i at Olohana; the Konohiki is Kumaikona. A small kula is a Pohakupu; the Konohiki is Kaluainanea. Kailua, Island of Oahu. I got these in the year 1846.

PUNIPELI

N.T. 210v14

No. 6162, Punipeki, Claimant

Miomioi, sworn, I know this land, It is in Kailua in the ili of Olohana and consists of 2 taro patches.

No. 1 is bounded:

Mauka by the land of Kinikahiko

Koolauloa by taro patch of Konohiki

Makai by Waste land

K.[Waimanalo] by the taro land of Ukikolo.

Claimant had his land from the Konohiki Kekona about the year 1846 and has had it in peace to this time.

[Award 6162; R.P. 2135; Olohana Kailua Koolaupoko; 1 ap.; .47 Ac.]

A.5 LCA No. 6807, Kapano

N.R. 398v5

To the Land Commissioners, Greetings: I hereby state my claim for a mo`o, in the `Ili of Kamakalepo, Ahupua`a of Kailua, District 6, Division 2, Island of Oahu. Eleven lo`i together are in the `ili of Kaaimoku, adjoining Nakanelua's are four lo`i, in another place in this same mo`o. Next to the mo`o of Kaula, next to the mo`o of Poniuohua are one kula and one house lot. 1833* It is a true right from the konohiki, until this day on which I petition.

K. KAPANO

/* Probable date of acquisition/

F.T. 289v14

Helu 6807, Kapano, See page 340

Keliikanakaole, hoohikiia, Ua ike au i kona Aina ma Kailua Ili o Kamakalepo.

Apana 1 - 4 Loi.

Apana 2 - 8 Loi.

Apana 3 - 4 Loi mea ka Ili o Pehialii a Haimilo

Apana 4 - Kahuahale.

Apana 1 na palena:

Mauka, na loi o Kuula

K., na loi o Kaleo

Makai, nahelehele

K.[Waimanalo], nahelehele.

Apana 2:

Mauka, Kula

Koolauloa, na loi o Kamakaliilii

Makai, na loi o Kaaimoku

K. [Waimanalo], na loi o Mahoe.

Apana 3:

Mauka, na loi o Manoha

Koolauloa, na loi o Kaumi

Makai, na loi o Manoha

K. [Waimanalo], Ili o Kapalai.

Apana 4: Puni i ke Kula na aoao a pau.

Na Kaualua mai i ka wa ia Kinau aole keakeaia.

F.T. 340v14

No. 6807, Kapano, Claimant, From Page 289

Keliikamakaole, sworn, I know this land in Kailua in the Ili of Kamakalepo as follows:

No. 1 - 4 Loi.

No. 2 - 8 Loi.

No. 3 - 4 Loi in the Ili of Pehialii & Haimilo.

No. 4 - House Lot.

No. 1 is bounded:

Mauka by the lois of Kuula

Koolauloa by lois of Kaleo

Makai by waste Land

K. [Waimanalo] by waste land.

No. 2 is bounded:

Mauka by Upland

Koolauloa by the lois of Kamakaliilii

Makai by Land of Kaaimoku

K. [Waimanalo] by lois of Mahoe.

No. 3 is bounded:

Mauka by the lois of Manoha

Koolauloa by lois of Kaumi.

Makai by lois of Manoha

K. [Waimanalo] by Ili of Kapalai.

No. 4 is bounded: On all sides by Upland

Claimant had his land from Nakaualiia in the time of Kinau & has had it in peace to this time.

[Award 6807; R.P. 2141; Kamakalepo Kailua Koolaupoko; 2 ap.; 11.59 Acs; Pehialii Kailua Koolaupoko; 1 ap.; 1.76 Acs]

A.6 LCA No. 6808, Poniuohua

N.R. 398-99v5

To the Land Commissioners, Greetings to you all: I hereby state my claim for a mo`o, in the `Ili of Kamakalepo, in the Ahupua`a of Kailua, District 6, Division 2, Island of Oahu. There are fifteen taro lo`i. Adjoining the `Ili of Kaoo, next to the mo`o of Kaumi are one kula, one hala grove, one kukui grove, one mala of `awa. Next to the `Ili of Peleleu, next to the `Ili of Moolau are three fruit trees. 1846* It is a true right from the konohiki, until this day on which I petition.

PONIUOHUA

/* Probable date of acquisition/

F.T. 278v14

Helu 6808, Naponiuohua, See 341 Page

Keliikanakaole, hoohikiia, Ua ike au i kona Aina ma Kailua Ili o Kamakalepo.

Apana 1 - 15 Loi.

Apana 2 - Kahuahale ma ka Ili o Haimilo.

Apana 1:

Mauka, Ili o Haimilo

Koolauloa, Kula

Makai, aina o Kaoo

K.[Waimanalo], Kahawai.

Apana 2: Puni i ke Kula ma aoa a pau.

Na Nakauelua mai loaa iau i ka M. K. 1843 aole keakea ia.

F.T. 341v14

No. 6808, Poniuohua, Claimant, From page 290 [278]

Keliikanakaole, sworn says, I know this land in Kailua in the Ili of Kamakalepo as follows:

No. 1 - 15 Loi.

No. 2 - House Lot in Haimilo.

No. 1 is bounded:

Mauka by Ili of Haimilo

Koolauloa by Upland

Makai by land of Kaoo

K.[Waimanalo] by a Creek.

No. 2 is bounded: On all sides by Upland.

Claimant had his land from Nakauelua in the time of in or about the year 1843 and has had it in peace to this time.

[Award 6808; R.P. 3761; Kamakalepo Kailua Koolaupoko; 3 ap.; 5.254 Acs]

A.7 LCA No. 6813, Keliikanakaole

N.R. 400v5

To the Land Commissioners, Greetings to you all: I hereby state my claim for a mo'o in the 'Ili of Kamakalepo, Ahupua'a of Kailua, District 6, Division 2, Island of Oahu. Twelve lo'i are together in the 'ili of Leoiki, adjoining the 'Ili of Kuula are two lo'i in another place, in the 'ili of Manoha is one lo'i, in the mo'o of Kanakaole is one kula. Eight hala trees are in the 'ili of Leoiki. One house lot is in the 'ili of Nakanelua. 1833 /acquisition date/ It is a true right from the konohiki, until this day on which I petition.

/No signature/

F.T. 292v14

Helu 6813, Keliikanakaole, See 343 page

Kapano, hoohikiia, Ua ike au i kona aina ma Kailua Ili o Kamakalepo:

Apana 1 - 13 Loi.

Apana 2 - 2 Loi.

Apana 3 - 4 Loi.

Apana 4 - 1 Loi ma ka Ili o Kapalai.

Apana 5 - 1 Loi ma ka Ili o Moapilau.

Apana 6 - Kahuahale.

Apana 1:

Mauka, Kula

Koolauloa, Kula

Makai, na Ili o Waipakiki & Kaaihee

K..[Waimanalo], 3 Kanaka e pili pu ana.

Apana 2:

Mauka, Ili o Palawai

Koolauloa, Kula

Makai, Ili o Palawai

K.[Waimanalo], Ili o Palawai.

Apana 3:

Mauka, na loi o Kapano

Koolauloa, Kahawai

Makai, Kahawai

K.[Waimanalo], Kahawai.

Apana 4:

Mauka, Kahawai

Koolauloa, Kahawai

Makai, Kula

K,[Waimanalo], Kula.

Apana 5:

Mauka, na loi o Kuula

Koolauloa, Nahelehele

Makai, na loi o Piho

K. [Waimanalo], Kula.

Apana 2 [6]: Ua puni i ke kula na aoao a pau.

Na Nakanelua mai i ka wa e ola ana o Kinau. Aole keakea ia. 2 kumu alani i ka Ili o Kahanaiki, he mau kumu hala 7 ma ka Ili o Haimilo.

F.T. 343v14

No. 6813, Keliikanakaole, Claimant, From Page 292

Kepano, sworn says, I know this land in Kailua in the Ili of Kamakalepo as follows:

No. 1 - 13 Lois.

No. 2 - 2 Lois.

No. 3 - 4 Lois.

No. 4 - 1 Loi in the ili of Kapalai.

No. 5 - 1 Loi in the ili of Moapilau

No. 6 - House Lot.

No. 1 is bounded:

Mauka by Upland

Koolauloa by Upland

Makai by the Ili of Waipakiki & Aihee

K.[Waimanalo] by the lois of Kanakaliilii ma.

No. 2 is bounded:

Mauka by the Ili of Palawai

Koolauloa by the Upland

Makai by the Ili of Palawai

K. [Waimanalo] by the Ili of Palawai.

No. 3 is bounded:

Mauka by my Lois

Koolauloa by a Creek

Makai by a Creek

K. [Waimanalo] by a Creek.

No. 4 is bounded:

Mauka by a Creek

Koolauloa by a Creek

Makai by Upland

K. [Waimanalo] by Upland.

No. 5 is bounded:

Mauka by the Lois of Kaula

Koolauloa by waste land.

Makai by the lois of Piho

K. [Waimanalo] by Upland.

No. 6 is bounded: On all sides by the Upland.

Claimant had his land from Nakauealua in the time of Kinau & has had it in peace to this time.

Claimant has Orange trees in the Ili of Kahanaiki & Lauhala trees in the Ili of Haimilo

[Award 6813; R.P. 2139; Kamakalepo Kailua Koolaupoko; 3 ap.; 7.126 Acs]

A.8 LCA No. 7113, Keaka

N.R. 279v5

Keaka's share. One half Manu `ili in kailua, Koolaupoko, Oahu. That is my one-half right from the Mo`i. That is my statement to you, the Land Commissioners. My residence is at Kapamoo.

KEAKA X, his mark

Honolulu, 10 February 1848

N.T. 235v10

No. 7113, Keaka

Keaka's one half property in the Mahele Registry.

1/2 Manu ili for Kailua, Koolaupoko, Oahu.

TRUE COPY

Interior Department, 11 June 1853

A.G. Thruston, Clerk

[Award 7113; R.P. 1652; Manu Kailua Koolaupoko; 2 ap.; 13.54 Acs]

A.9 LCA No. 7588*O, Kamoonohu

N.R. 359v5

To the Honorable Land Commissioners, Greetings: I, Kamoonohu, hereby enter my lands divided by the Mo`i, for myself and my heirs forever. The names are Palahele `Ili, Kailua, Koolaupoko, Oahu and Mooiki Ahupua`a, Hamakua, Hawaii.

I am, respectfully

KAMOONOHU

Honolulu, Oahu, 8 February, 1858

F.T. 236-237v3

Cl. 7588, Kamoonohu counter claimant for the Mooiki Ahupuaa, Hamakua, Hawaii.

The counter claimant made oath that he gave in his counter claim to Mr. Smith, the Secretary of the Land Commission on the 13th-14th of February 1848 (It cannot be found in the Register)

Paalau, sworn, I know the Mooiki in dispute between Kamoonoho and Kalaimamahu about the year 1831 or 1832, Keaniani gave this land to Kahipu to take care of, and he did it up to his death in 1846 and the present counter claimant is the true child of Keaniani and his heir. Kamoonohu is the sister of Keaniani.

Z. Kaauwai, sworn, after the death of Keaniani, this dispute was taken before the Governor of Oahu, and John Ii, and after a trial both the Governor and Mr. Ii decided on the 6th of April 1847, that this land belonged to Kalaimamahu and their decision was filed in the office of the Miister of the Interior. Kalaimamahu is now in possession of the land.

N.T. 573v3

No. 7588, Kamoonohu, December 26. 1849 vs. No. 7588B, Kalaimamahu

Kalaimamahu, sworn, I have taken a document rejecting Kamoonohu's claim for this land of the Mooiki Ahupuaa which is in Hamakua, Hawaii, directly to J. H. Smith, secretary, in the month ? (not completed).

Palaau, sworn, I had seen that land at the time it was taken by Kaleiapu of Hamakua, Hawaii, during Kuakini's governorship on Oahu. It was given by Keaniani who died in 1846. I have known since the first time it was given to the present, Keaniani has owned this land personally and it has been inherited by his son, Kalaimamalu. Kamehameha II had given Keaniani his land, but Kamoonohu is saying this is his land. I am denying that he has the slightest interest in this land, and

Z. Kaauwai, sworn, After the death of Keaniani, Kamoonohu (plural) filed a suit with the governor with an objection for the heir of Keaniani. On April 6, 1847 the governor, M. Kekuanaoa, passed the verdict that Kalaimamalu, Keaniani's son, is the heir; he and no other person would inherit Keaniani's entire estate. Kalaimamalu's servant now lives there.

[Award 7588; R.P. 7285; Palapule Kailua Koolaupoko; 1 ap.; 7.88 Acs]

A.10 LCA No. 8797, Kaoo

N.R. 384v4

To the Land Commissioners, Greetings to you all:I hereby state my claim for land, in the 'Ili of Kapalaoa, Ahupua'a of Kailua, Island of Oahu, District, Division 2. There is one kula, one house lot, and one hala tree. It is a true right from the Mo'i, until this day on which I petition.

KAOO

F.T. 523v3

No. 8797, Kaoo

Keliikanakaole, sworn, says he knows the land of Kaoo, at Kapalaoa, Kailua, Oahu. It lies all together in one piece and consists of Kalo land, Kula, and House site.

It is bounded:

Makai by Kaiipaka's land

Waimanalo side by Kapia's land

Mauka by the konohiki's land

Kaneohe side by the same.

Claimant received this land, His Majesty in the time of Liliha, and held it without [p.524] dispute up to the time of his death of the small pox, a few months ago.

Kaiho, sworn, says he knows the land of claimant. I formerly cultivated a part of it under Kaoo. The boundaries are correctly set forth by last witness, whose testimony the present witness confirms.

[Award 8797; R.P. 2142; Kapaloa Kailua Koolaupoko; 2 ap.; 2.61 Acs]

A.11 LCA No. 8799, Kauakamalii (Kekauakamalii)

N.R. 385v4

To the Land Commissioners, Greetings to you all: I hereby state my claim. There are two lo'i, one kula, one house lot, in the 'ili of Kaoo in Kapalaoa, Ahupua'a of Kailua, District 6, Division 2, Island of Oahu. I have one lo'i in the 'ili of Kaunui in Haimilo. One kula, one mala of 'awa are in the kula of the 'ili of Aahoaka in Kainamu, Ahupua'a of Kailua, District 6, Division 2, Island of Oahu. It is a true right from the Konohiki, until this day on which I state this.

KAUAKAMALII

F.T. 296v14

Helu 8799, Kekauakamalii, 28 Jan. 1852

Kaumi, hoohikiia. Ua ike au i kona aina ma Kapaloa, Kailua Oahu. 9 Loi & Apana Kula

Penei na palena,

Mauka aina i kapaia o "Kamakalepo"

Kaneohe, aina o Konohiki

Makai, aina i kapaia o "Kapia"

Waimanalo, aina i kapaia "Kamakalepo."

Ua loaa ia ia keia Apana aina no Kaliu mai kona kupuna kane i ka M. H. 1839 a ua loaa ia Kaliu no Keano mai no i kona wa e ola ana - a ua noho oluolu a hiki i keia wa, aole mea Keakea.

F.T. 296v14 Translation

No. 8799, Kekauakamalii, 28 January 1852

Kaumi, sworn,I know his land at Kapaloa, Kailua, Oahu. There are 9 lo`i and a kula parcel.

Bounded as follows:

Mauka, land called "Kamakalepo"

Kaneohe, land of Konohiki

Makai, land called "Kapia"

Waimanalo, land called "Kamakalepo".

He received this apana of land from his grandfather, Kaliu, in 1839, and Kaliu acquired it from Keano during his lifetime. It has been occupied peacefully and without dispute until now.

[Award 8799; R.P. 2528; Kapaloa Kailua Koolaupoko; 1 ap.; 2.658 Acs]

Appendix B Pollen Analysis

POLLEN ANALYSIS OF SAMPLES FROM
KAWAI NUI MARSH, SIHP #50-50-11-2029,
OAHU, HAWAI'I

By

Linda Scott Cummings

PaleoResearch Institute
Golden, Colorado

PaleoResearch Institute Technical Report 11-089

Prepared for

Cultural Surveys Hawaii
Waimanalo, Hawaii

October 2011

INTRODUCTION

Kawai Nui marsh is located on the northeast coast of Oahu. This site is described as having been used traditionally for taro cultivation. Two cores were taken from the marsh, and individual pollen samples were extracted from the cores and submitted for analysis.

METHODS

Pollen

A chemical extraction technique based on flotation is the standard preparation technique used in this laboratory for removing pollen from the large volume of sand, silt, and clay with which it is mixed. This particular process was developed for extracting pollen from soils where the preservation has been less than ideal and the pollen density is lower than in peat. It is important to recognize that it is not the repetition of specific and individual steps in the laboratory, but rather mastery of the concepts of extraction and how the desired result is best achieved, given different sediment matrices, that results in successful recovery of pollen for analysis.

Hydrochloric acid (10%) was used to remove calcium carbonates present in the soil, after which the samples were screened through 250-micron mesh. The samples were rinsed until neutral by adding water, letting the samples stand for 2 hours, then pouring off the supernatant. A small quantity of sodium hexametaphosphate was added to each sample once it reached neutrality, then the samples were allowed to settle according to Stoke's Law in settling columns. This process was repeated with ethylenediaminetetraacetic acid (EDTA). These steps remove clay prior to heavy liquid separation. The samples then were freeze dried. Sodium polytungstate (SPT), with a density 1.8, was used for the flotation process. The samples were mixed with SPT and centrifuged at 1500 rpm for 10 minutes to separate organic from inorganic remains. The supernatant containing pollen and organic remains was decanted. Sodium polytungstate again was added to the inorganic fraction to repeat the separation process. The supernatant was decanted into the same tube as the supernatant from the first separation. This supernatant was then centrifuged at 1500 rpm for 10 minutes to allow any silica remaining to be separated from the organics. Following this, the supernatant was decanted into a 50-ml conical tube and diluted with distilled water. These samples were centrifuged at 3000 rpm to concentrate the organic fraction in the bottom of the tube. This pollen-rich organic fraction was rinsed, then all samples received a short (20–30 minute) treatment in hot hydrofluoric acid to remove any remaining inorganic particles. The samples then were acetylated for 3–5 minutes to remove any extraneous organic matter.

A light microscope was used to count pollen at a magnification of 500x. Pollen preservation in these samples varied from good to poor. Comparative reference material collected at the Intermountain Herbarium at Utah State University and the University of Colorado Herbarium was used to identify the pollen to the family, genus, and species level, where possible.

Pollen aggregates were recorded during identification of the pollen. Aggregates are clumps of a single type of pollen and may be interpreted to represent either pollen dispersal over short distances or the introduction of portions of the plant represented into an

archaeological setting. The aggregates were included in the pollen counts as single grains, as is customary. The presence of aggregates is noted by an "A" next to the pollen frequency on the pollen diagram. The pollen diagrams were produced using Tilia 2.0 and TGView 2.0.2. Total pollen concentrations were calculated in Tilia using the quantity of sample processed in cubic centimeters (cc), the quantity of exotics (spores) added to the sample, the quantity of exotics counted, and the total pollen counted and expressed as pollen per cc of sediment.

"Indeterminate" pollen includes pollen grains that are folded, mutilated, or otherwise distorted beyond recognition. These grains were included in the total pollen count since they are part of the pollen record. The microscopic charcoal frequency registers the relationship between pollen and charcoal. The total number of microscopic charcoal fragments was divided by the pollen sum, resulting in a charcoal frequency that reflects the quantity of microscopic charcoal fragments observed, normalized per 100 pollen grains.

DISCUSSION

Kawai Nui Marsh, located at the confluence of Maunawili Stream and Kahana Iki Stream on the northeast coast of Oahu, is reported to have been a traditional site of taro agriculture. Today, the local vegetation includes sugarcane, taro, banana, grasses, and exotic shrubs such as monkey pod and hau. Two cores were collected in the marsh at locations approximately 1.5m above sea level, each of which was sampled at three depths (Table 1) to recover samples for pollen analysis. The depths were uniform between the two cores, at approximately 25–30, 45–50, and 68–73 cm below the surface.

Pollen analysis of these two cores yielded somewhat differing results. Core 1 documents the presence of marshy deposits in all levels, particularly the uppermost and lowermost. The lowest sample from Core 1 provides evidence of more native plants and less evidence of cultivation than the upper two samples. *Saccharum* pollen, representing sugarcane (Table 2), is most abundant in the uppermost sample, declining in the middle sample. A small amount of *Saccharum* pollen is present in the lowest sample. In the absence of dates from these deposits, it is not possible to identify whether this lowest sample represents a time period where sugarcane cultivation makes sense. If not, it is likely that recovery of a very small quantity of *Saccharum* pollen at this depth reflects downward movement of this pollen.

The lowest sample (1C), collected at a depth of 68–73 cm, contains a small quantity of *Alnus* pollen that is present through some sort of contamination, probably atmospheric. This sample contains pollen from Anacardiaceae, *Antidesma*, *Colubrina*, Myrtaceae, *Pritchardia*-type, and *Kadua,* representing trees, shrubs, and herbaceous plants that are part of the pre-Polynesian vegetation community on Oahu. Recovery of a large quantity of Cyperaceae pollen in this sample indicates that this location was a marsh at the time this sediment accumulated. Modest quantities of fern spores indicate that a variety of ferns also grew in the vicinity of the marsh. Microscopic charcoal fragments reflect burning, whether natural or cultural. The total pollen concentration of the lowest sample is approximately 1200 pollen per cubic centimeter (cc) of sediment. Recovery of a scolecodont fragment is evidence of polycheat worms. No distinction between geologic and modern forms is made.

Sample 1B, collected at a depth of approximately 45–50 cm, yielded a different pollen record. The increase in *Saccharum* pollen indicates an established sugarcane field in the area, which appears to have displaced the sedges of the marsh. Increases in Cheno-am, Low-spine Asteraceae, and High-spine Asteraceae pollen indicate local growth of *Chenopodium* and members of the sunflower family, all of which are probably weedy. *Leucaena* pollen is observed in this sample, indicating the introduction of *koa haole* by this time. *Pritchardia* (loulu palm) is retained on the landscape, although apparently in diminishing quantities. Ferns increase, as noted by increases in both monolete and trilete spores. Microscopic charcoal spikes during this interval, probably representing burning fields to clear them. The recovery of foraminifera from this sample suggests the possibility of sea water incursion into the marsh.

The uppermost sample (1A) from this core displays the largest quantity of *Saccharum* pollen, indicating continued use of the marsh for sugarcane agriculture. An increase in Cyperaceae pollen suggests that weedy sedges were growing in the marsh as well. A decrease in microscopic charcoal suggests the possibility that burning fields was not as common. *Pandanus* pollen is noted in this sample, as is *Casuarina*, suggesting the growth of *hala* and Australian pine along the coast.

The lowest sample from Core 2 (2C) is marked by large quantities of *Antidesma* and *Pritchardia* pollen, representing *hame* and loulu palms growing along the coast. The recovery of small quantities of Anacardiaceae, *Myoporum*, and Myrtaceae pollen indicates local growth of a member of the cashew family, *naio*, and a member of the myrtle family such as guava or *Metrosideros*. Cyperaceae pollen is depressed in this sample, suggesting that this area was not as marshy as the Core 1 location. A surprising recovery of *Fragaria* pollen in this sample suggests the growth of native strawberry plants in this area. The recovery of a moderately large quantity of Dicksoniaceae fern spores suggests the local growth of a variety of tree ferns. Other fern spores are not particularly abundant. Microscopic charcoal is moderately abundant, suggesting the possibility of local fires. A rather large-diameter hair fragment that has no match in our reference collection was noted in this sample. The diameter indicates a coarse hair, at least double to triple the width of human hair. This sample also yielded very small, round, dark spherical bodies that might represent petroleum deposits. No petroleum smell accompanied the processing of this sample.

Sample 2B indicates that during the middle interval this area was very marshy. Dominance of the pollen record by Cyperaceae pollen suggests that this particular location either was not cultivated or that it was used for taro production. Although no *Colocasia* pollen was recovered, it is usually observed in very small quantities. The over-production of Cyperaceae pollen may have obscured this pollen, which is too small to be obvious when scanning a pollen slide at low magnification. Additionally, this particular sample was very rich in deteriorated organic matter, which makes observation of large quantities of the sample in search of *Colocasia* pollen difficult. This sample yielded the largest total pollen concentration, nearly 150,000 pollen per cc of sediment, which is consistent with a dense growth of sedges. Only a small quantity of *Saccharum* pollen was noted in this sample, which may reflect sugar cane growing near, but not directly in, this portion of the marsh. The relatively small quantity of microscopic charcoal recovered from this sample does not indicate the use of local fires to clear land for agriculture. A reduction in *Pritchardia* pollen in this sample may be an artifact of the greatly increased quantity of Cyperaceae pollen rather than an indication of a severe reduction in quantity of loulu palms growing along the coast.

Sample 2A contains a large quantity of *Saccharum* pollen, indicating that this area was planted in sugarcane relatively late. By this time weedy plants such as *Chenop[odium* have increased. The recovery of small quantities of *Casuarina* and *Cocos nucifera* represent Australian pine and coconut trees growing along the coast. *Pritchardia* pollen continues to be part of the record, indicating the continued presence of loulu palm. This sample contained a large quantity of fungal spores, suggesting appropriate conditions for fungal growth in the sediments.

SUMMARY AND CONCLUSIONS

Evidence for the use of this marsh for growing sugarcane during the middle and late portions of time represented in Core 1 and late in Core 2 is provided by the recovery of moderate to large quantities of *Saccharum* pollen. The location of Core 1 supported a marsh prior to this use, while the location of Core 2 did not. The Core 2 location became more marshy by the middle time interval. Both cores exhibit at least small quantities of Foraminifera in the middle samples, suggesting sea water incursions. Sugarcane is particularly well established in both locations by the time period represented by the upper sample. No taro pollen was observed in any of the samples examined. However, it should be mentioned that the rather large quantities of total pollen concentration and abundant organic matter for these samples may have swamped the record, reducing the possibility that taro pollen would be observed.

TABLE 1
PROVENIENCE DATA FOR SAMPLES FROM KAWAI NUI MARSH, SIHP # 50-80-11-2029,
NEAR THE NORTHEAST COAST OF OAHU ISLAND

Sample No.	Core No.	Stratum	Depth (cmbs)	Provenience/ Description	Analysis
1-A	1	II	24-29	Soil from Core 1, from a fresh water marsh, approx 1.5 m above sea level.	Pollen
1-B	1	III	45-50		Pollen
1-C	1	IV	68-73		Pollen
2-A	2	II	25-30	Soil from Core 1, from a fresh water marsh, approx 1.5 m above sea level.	Pollen
2-B	2	IV	45-50		Pollen
2-C	2	VI	68-73		Pollen

TABLE 2
POLLEN TYPES OBSERVED IN SAMPLES FROM KAWAI NUI MARSH, SIHP # 50-80-11-2029,
NEAR THE NORTHEAST COAST OF OAHU ISLAND

Scientific Name	Common Name	Nat	Pol	End	Ind
TREES:					
Anacardiaceae	Mango family; includes mango, sumac	x		x	
Antidesma	*Hame*, (*ha'a, ha'amaile, hamehame, mehame, mehamehame*)			x	
Bobea	*'Ahakea lau li'i, 'akupa, 'Ahakea lau nui*			x	
Casuarina	Australian pine; includes common ironwood, *Paina*, saltmarsh ironwood	x			
Cocos nucifera	Coconut; *niu, ololani*		x		
Myoporum sandwicense	False sandalwood; *Naio, naeo, naieo*				x
Myrtaceae	Myrtle family	x	x	x	x
Pandanus tectorius	*Hala*, (*pū hala*)				x
Pritchardia	Loulu palm; *loulu hiwa, Moloka'i*			x	
Leucaena	*Koa haole, 'ekoa, lilikoa*	x			
Colubrina	*'Anapanapa, kauila 'anapanapa*				x
SHRUBS:					
Broussaisia/Artemisia	*Kanawao, pu'ahanui*	x		x	
Canthium doratum	*Alahe'e*, (*'āhe'e, walahe'e*)				x
Cheno-am	Includes *Achyranthes, Chenopodium oahuense, Amaranthus, Charpentiera*, etc.	x		x	
Claoxylon	*Po'olā, laukea*			x	
Euphorbia	Spurge; includes *kaliko*, Mexican fireplant, wild poinsettia, petty spurge	x		x	
Fabaceae	Legume or pea family	x	x	x	x
Leucaena leucocephala	*Koa haole, 'ekoa, lilikoa*	x			

Scientific Name	Common Name	Nat	Pol	End	Ind
Hibiscus	*Aloalo, hau, koki'o ke 'oke'o, hau hele, koki'o kea, pamakani, ma'o hau hele, kaiohala, akiahala, hau hele wai, koki'o 'ula'ula, maku, aloalo waikahuli, waikahuli*, large-leaved hau, cotton or confederate rose	x		x	x
Kadua (now *Hedyotis)*	*'Uiwi, 'awiwi, kamapua'a, pilo*			x	
Nesoluma	*Āla'a, āulu, ēla'a, kaulu*			x	
Rosaceae	Rose family	x		x	x
HERBS:					
Apiaceae		x		x	
Low-spine Asteraceae	Sunflower family, includes ragweed, and others	x		x	x
High-Spine Asteraceae	Sunflower family, includes *Bidens* (*ko'oko'olau*)	x		x	x
Liguliflorae	Sunflower family, Lactuceae tribe	x			
Brassicaceae	Mustard family				
Commelina	*Honohono*	x			
Cuphea	*Kīkā, pua kīkā*, tarweed, false heather, cigar flower	x			
Fragaria	*Ōhelo papa*, strawberry	x			x
Jussiaea	False loosetrife, water primrose, *Kamole, alohalua, kamole lau li'i, kamole lau nui*, primrose willow	x	x?		
Lotus		x			
Plantago	*Laukahi kuahiwi*, Plantain	x		x	
GRASSES, etc.:					
Cyperaceae	Sedge family	x		x	x
Poaceae	Grass family (includes rice)	x		x	x
Typha	Cattail	x			
Indeterminate					

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Scientific Name	Common Name	Nat	Pol	End	Ind
SPORES:					
Monolete (smooth and bumpy)	Ferns				
Lycopodium cernuum	Club moss; *wawae 'iole*			x	
Dicksoniaceae	Tree fern; *hāpu'u*			x	x
Trilete (smooth and spiny)	Ferns				

Plant names and information derived from Wagner *et al.* (1990).
Fern (spore) names derived from Selling (1946).

Nat = Naturalized
Pol = Polynesian introduction
End = Endemic
Ind = Indigenous

Pollen identification to species was made based on the fact that only one species is reported by Wagner *et al.* (1990). Species identification was not made based on morphologic characteristics observed under the microscope.

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Selling, Olof H.
1946 *Studies in Hawaiian Pollen Statistics: Part I, The Spores of the Hawaiian Pteridophytes*. Bernice P. Bishop Museum Special Publication 37. Bishop Museum, Honolulu, Hawaii.

Wagner, Warren L., Derral R. Herbst, and S. H. Sohmer
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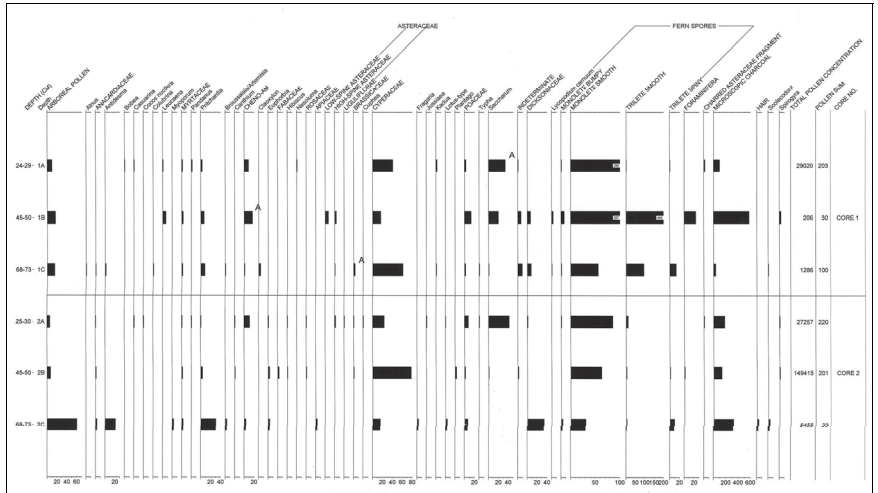

FIGURE 1. POLLEN DIAGRAM FOR TWO CORES FROM KAWAI NUI MARSH, OAHU.

APPENDIX D
Engineering Reports

Preliminary Engineering Report; Conceptual Drainage Improvements for Kawainui Marsh Wetland Restoration and Habitat Enhancement Project (May 2011)

Prepared by: AECOM

PRELIMINARY ENGINEERING REPORT
(FINAL)

CONCEPTUAL DRAINAGE IMPROVEMENTS
FOR

KAWAINUI MARSH WETLANDS RESTORATION AND HABITAT ENHANCEMENT PROJECT

KAILUA, OAHU, HAWAII

Prepared For:
HELBER HASTERT & FEE PLANNERS, INC.

ARDALAN R. NIKOU
LICENSED PROFESSIONAL ENGINEER
No. 6198-C
HAWAII, U.S.A.

Expiration date 4/30/2012
This work was prepared by me
or under my supervision

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MAY 2011

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APPENDIX

A. Photos
B. Hydrologic/Hydraulic Calculations
C. Preliminary Construction Cost Estimate
D. Le Jardin Academy Phase II Drainage Report by Sam O. Hirota, Inc.

REFERENCES

Rules Relating to Storm Drainage Standards, Department of Planning and Permitting, City and County of Honolulu, January 2000.

Standard Specifications for Roadway and Bridge Construction, State of Hawaii Department of Transportation Highways Division, 2005.

Cost Data Book, Naval Facilities Engineering Command, Pearl Harbor, Hawaii, January 2002.

INTRODUCTION

Project Location

The Kawainui Marsh, designated as a Wetland of International Importance in 2005, encompasses approximately 830 acres of land and is the largest remaining wetland in the State of Hawaii. The overall proposed project involves a total of 80 acres (60 acres wetland and 20 acres forested slopes) at Kawainui Marsh Wetlands situated east (makai) of Kapaa Quarry Road. The overall project area is identified under TMK Number (1) 4-02-013: portions of 005, 022 is owned by the State of Hawaii. This preliminary engineering report will evaluate the drainage culverts that discharge into Kawainui Marsh Wetlands along Kapaa Quarry Road.

Project Purpose

The purpose of this preliminary engineering report is to evaluate the existing drainage conditions along Kapaa Quarry Road and provide recommendations for improvements. This preliminary engineering report is being provided in support of the Environmental Assessment to restore habitat for native Hawaiian birds and wildlife species located in the Kawainui Marsh. The State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife has obtained Federal funding to develop wetland restoration improvement plans and prepare the required environmental documentation.

Project Description

Based upon site investigation for drainage improvements along Kapaa Quarry Road, four locations were identified to have a direct impact to the Kawainui Marsh Wetland. The “Le Jardin Academy Phase II, Revised Drainage and Surface Runoff Mitigation Report, January 2005” (See Appendix D) was used to determine the offsite contribution from the school located along the west side of the road. However, it should be noted that there have been subsequent improvements upslope of the school since this drainage report has been produced. Based on the current project scope of work, our general hydrologic evaluation reflects only the design flows generated from the improvements identified in the report, plus additional off-site flows that could enter the respective drainage areas for each of the culverts. Based on this cumulative flow, the hydraulics of the existing pipe culverts were evaluated and their adequacy estimated. The project will require the design of drainage improvements for three culverts as well as an area that collects surface flow, see Figure 1 – Location Map. Possible mitigation measures include backfilling eroded channels, installing erosion mat, grassing, installing grouted rip rap protection, reconstructing existing drainage structures and grass swales.

These improvements will help to greatly restore the Wetlands to pre-existing conditions, promote better drainage as well as reduce the potential for future erosion. Preparation of this preliminary engineering report will identify potential problematic areas and provide the State with design recommendations for improvements at each location.

Storm water runoff analysis was performed using the Rational Method in accordance with the guidelines outlined in the City and County of Honolulu, Department of Planning and Permitting, Rules Relating to Storm Drainage Standards. Hydraulic analysis for drainage facilities was performed using Haestad Methods FlowMaster. Drainage improvements and structures shall be designed in accordance with City and County of Honolulu, Standard Specifications for Public Works Construction and the State of Hawaii, Department of Transportation design standards.

BACKGROUND

Existing Condition

Kapaa Quarry Road borders the west side of the Kawainui Marsh Wetlands and currently serves as access to Le Jardin Academy as well as the Kapaa Quarry. There are three existing culverts which convey storm water across Kapaa Quarry Road from the mauka side (Le Jardin Academy) to the makai side (Kawainui Marsh Wetlands). There is also one location which collects overland sheet flow coming across the road from Le Jardin Academy. Over a period of time, these four locations have experienced heavy erosion due to poor existing conditions and deteriorated drainage structures. In some areas, continuous erosion may have begun to undermine the structural stability of Kapaa Quarry Road.

There is also an existing 24” reinforced concrete pipe (RCP) culvert that conveys storm water across Kalanianaole Highway at the intersection with Kapaa Quarry Road and then discharges into a rectangular concrete ditch along the south side of Kawainui Marsh. This culvert was not included in the evaluation of the existing culverts along Kapaa Quarry Road since it is within State DOT Right of Way and would not be affected by the proposed restoration improvements for the Wetlands. In addition, the culvert appears to be in good condition and the surrounding areas are lined with erosion mat and some vegetation, see Photos 1 & 2.

Drainage Culvert 1

Drainage Culvert 1 is a 36” RCP that conveys storm water across Kapaa Quarry Road and into a CMU junction box structure, see Photo 3. Flow then enters a 36” corrugated metal pipe, discharges onto a shotcrete swale, see Photo 4, and then into the Kawainui Marsh Wetlands. The existing CMU junction box is broken in numerous areas with signs of storm water overtopping, see Photo 5. The existing trees and roots in the area have also contributed to undermining the structural stability of the existing junction box. Overtopping of the junction box has contributed to erosion adjacent to the box and the exposing of the existing 36” corrugated metal pipe, see Photo 5. The existing shotcrete swale at the outlet of the corrugated metal pipe also show signs of undermining, see Photo 6.

Based upon site investigations and research of record drawings, the contributing area for Culvert 1 comes from an existing catch basin fed by the majority of Le Jardin Academy, see Figure 2A. Hydrologic calculations were performed using the Rational Method in conformance with the City Storm Drainage Standards for a 50-year design storm as well as from calculations performed by others in a previous drainage report for Le Jardin Academy, see Appendix D. Calculations from the drainage report were checked and verified to be 38.00 cfs. This quantity combined with the calculations performed using the Rational Method resulted in a design peak discharge of 58.46 cfs. Hydraulic calculations determined a normal depth and full flow capacity of 1.23 ft and 166.07 cfs, respectively. These calculations indicate that the existing 36” RCP is adequate to handle the peak flow from a projected 50-year storm, see Appendix B for detailed calculations. Surface runoff was evaluated to have relatively minimal impact on erosion as compared to the current overtopping of the existing CMU junction box.

Drainage Culvert 2

Drainage Culvert 2 is an 18” RCP that conveys storm water across Kapaa Quarry Road and discharges directly into Kawainui Marsh Wetlands. Due to heavy erosion and soil instability, an existing portion of RCP, headwall and concrete apron have separated from the main portion of the pipe. There is currently about one foot of separation, see Photo 7. The areas on Kailua bound side of the culvert also show signs of erosion, see Photo 8.

Based upon site investigations and research of record drawings, the contributing area for Culvert 2 comes from an existing catch basin on the opposite side of Kapaa Quarry Road that is fed by a portion of Le Jardin Academy, see Figure 2A. Based on a 50-year design storm, the design peak discharge was calculated to be 9.97 cfs. Hydraulic

calculations determined a normal depth and full flow capacity of 0.56 ft and 33.38 cfs, respectively. These calculations indicate that the existing 18" RCP is adequate to handle the peak flow from a projected 50-year storm, see Appendix B for detailed calculations. However, surface runoff over the unprotected slope, frequent heavy vehicle traffic and poor soil conditions may have contributed to the progressive weakening and separating of the existing 18" RCP.

Drainage Culvert 3

Drainage Culvert 3 is a 30" RCP that conveys storm water across Kapaa Quarry Road and discharges directly into Kawainui Marsh Wetlands. Both the concrete rubble masonry headwalls as well as pipe culvert are in good condition. However, there may be some signs of erosion on the side slopes on the upstream end, see Photo 9 and erosion at the outlet of the downstream end. The invert of the pipe discharging into the Kawainui Marsh Wetlands is now roughly one foot above the existing eroded surface, see Photo 10.

Based upon site investigations and aerial images, the contributing area for Culvert 3 comes from the large area of steep forested terrain upslope of the culvert, see Figure 2B. Based on a 50-year design storm, the design peak discharge was calculated to be 125.91 cfs. Hydraulic calculations determined a normal depth and full flow capacity of 1.92 ft and 134.16 cfs, respectively. These calculations indicate that the existing 30" RCP is adequate to handle the peak flow from a projected 50-year storm, see Appendix B for detailed calculations. Some indications of erosion may be attributed to the unprotected inlet and outlet areas of the culvert.

Drainage Area 4

Drainage Area 4 is a small area on the Kawainui Marsh Wetlands side that collects surface runoff that sheet flows across Kapaa Quarry Road from Le Jardin Academy. Inspection of Drainage Area 4 showed major signs of erosion, see Photos 11 & 12. There is no existing drainage structure in this area.

Based upon site investigations and evaluations, it appears the contributing surface flow area comes from a portion of Le Jardin Academy, see Figure 2A. The surface flow is conveyed down the steep entrance road, sheet flows across Kapaa Quarry Road and finally discharges over the unprotected slope into Kawainui Marsh Wetlands. Based on a 50-year design storm, the design peak discharge was calculated to be 7.14 cfs, see Appendix B for detailed calculations. Over time, this peak surface flow has caused serious erosion issues for this unprotected area of slope.

DESIGN RECOMMENDATIONS

Drainage Culvert 1

The proposed mitigation for Drainage Culvert 1 is to replace the existing junction box with a concrete drop manhole structure, remove the existing 36” corrugated metal pipe, headwall and shotcrete swale, remove existing trees, backfill voids, re-grade slopes, install erosion mat and grass the eroded channel and adjacent slope areas. A new 36” RCP will be installed at the outlet of the new manhole and grouted rip rap protection installed at the downstream end of the new 36” RCP, see Figure 3. Estimated construction cost for these improvements is $119,215.

Flow through the existing 36” RCP will enter the new concrete drop manhole, be conveyed through the new 36” RCP and discharged onto the grouted rip rap surface. Surface flow will then be taken through a series of terraced dry lands for cultivating of various crops and plantings. The proposed mitigation method restores the existing drainage structure, promotes excellent drainage, dissipates storm water energy and minimizes the potential for future erosion. In addition, these improvements would work in conjunction with the proposed plan for wetland enhancement and blend in well with the surroundings.

Drainage Culvert 2

The proposed mitigation for Drainage Culvert 2 is to reconstruct and connect a new 18” RCP and concrete headwall, backfill voids, re-grade slopes, install erosion mat and grass the adjacent slope areas and install a grouted rip rap apron. Downstream of the rip rap apron, a grass swale will be constructed, see Figure 4. Estimated construction cost for these improvements is $53,900.

Flow through the reconstructed 18” RCP will discharge onto the grouted rip rap apron and be intercepted by the grass swale. The grass swale will be constructed alongside the maintenance and access dirt road. Surface flow will then be conveyed into an open grassed settling basin area for percolation. The proposed mitigation method will promote good drainage, restore the functionality of the existing drainage structure and reduce the potential for future erosion. The grouted rip rap slope protection allows for energy dissipation and channelization of surface flow onto the rip rap apron. Furthermore, the grass swale and settling basin provide a low impact design and promotes ground water recharge.

Drainage Culvert 3

The proposed mitigation for Drainage Culvert 3 is to install a grouted rip rap apron, erosion mat and grass on the downstream end of Culvert 3, see Figure 5. Estimated construction cost is $16,310.

Flow through the existing 30" RCP will discharge onto the grouted rip rap apron and follow an existing grass ditch into an open grassed settling basin area for percolation. This improvement provides energy dissipation and a more permanent erosion protection at the outlet of the culvert. Utilizing the existing drainage ditch also minimizes additional grading. Furthermore, the grass settling basin will promote ground water recharge.

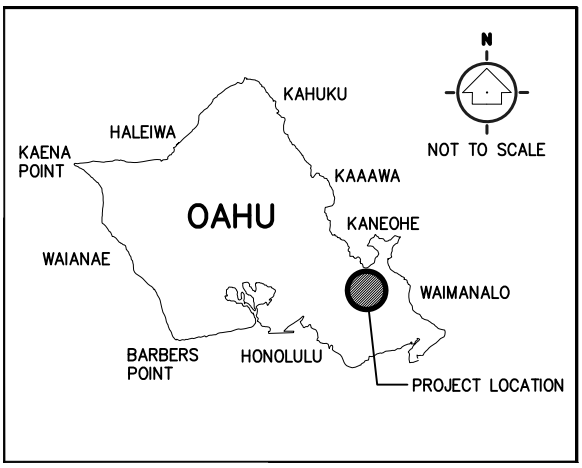
Drainage Area 4

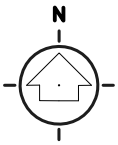
The proposed mitigation for Drainage Area 4 is to backfill the heavily eroded ditch, install grouted rip rap slope protection, install erosion mat and grass the adjacent slope areas. Downstream of the grouted rip rap, a grass swale would be constructed, see Figure 6. Estimated construction cost for these improvements is $113,775.

Surface runoff will flow over the grouted rip rap slope protection and then be intercepted by the grass swale. The grass swale will be constructed alongside the maintenance and access dirt road, connect to the Drainage Culvert 2 grass swale and be conveyed into an open grassed settling basin area for percolation. The proposed mitigation method will fill the existing eroded cavity and protect the slope from surface runoff. It also provides a permanent solution for future erosion while dissipating storm water energy. Furthermore, the grass settling basin promotes ground water recharge.

Cost Estimate

Preliminary construction cost estimates for each culvert and area is attached. A summary of the design recommendations for the project is provided with a total estimated construction cost of $365,000.





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KAWAINUI WETLANDS
RESTORATION AND HABITAT
ENHANCEMENT PROJECT

FIGURE 1
LOCATION MAP

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KAWAINUI WETLANDS
RESTORATION AND HABITAT
ENHANCEMENT PROJECT

FIGURE 2A
DRAINAGE BASIN MAP

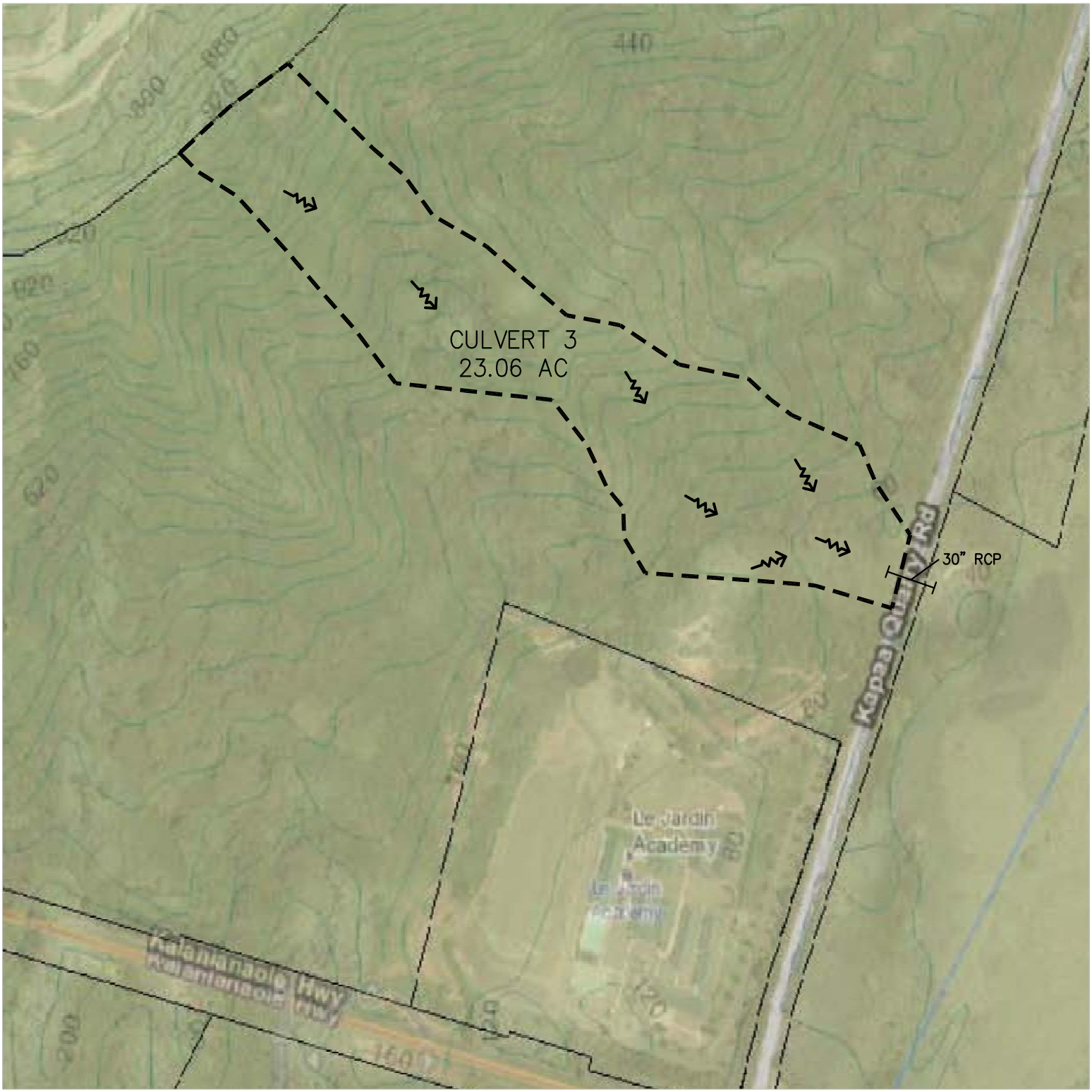

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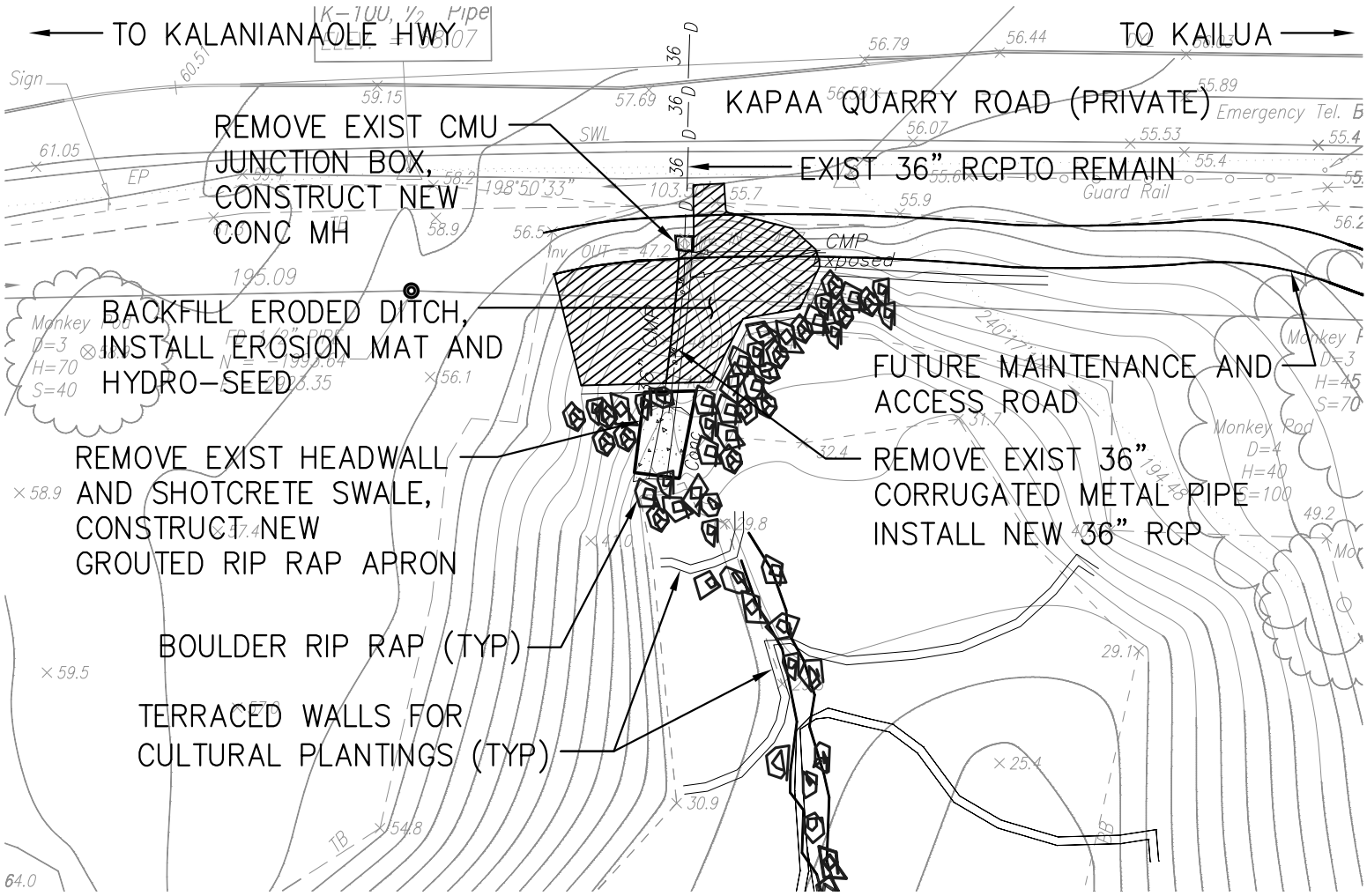
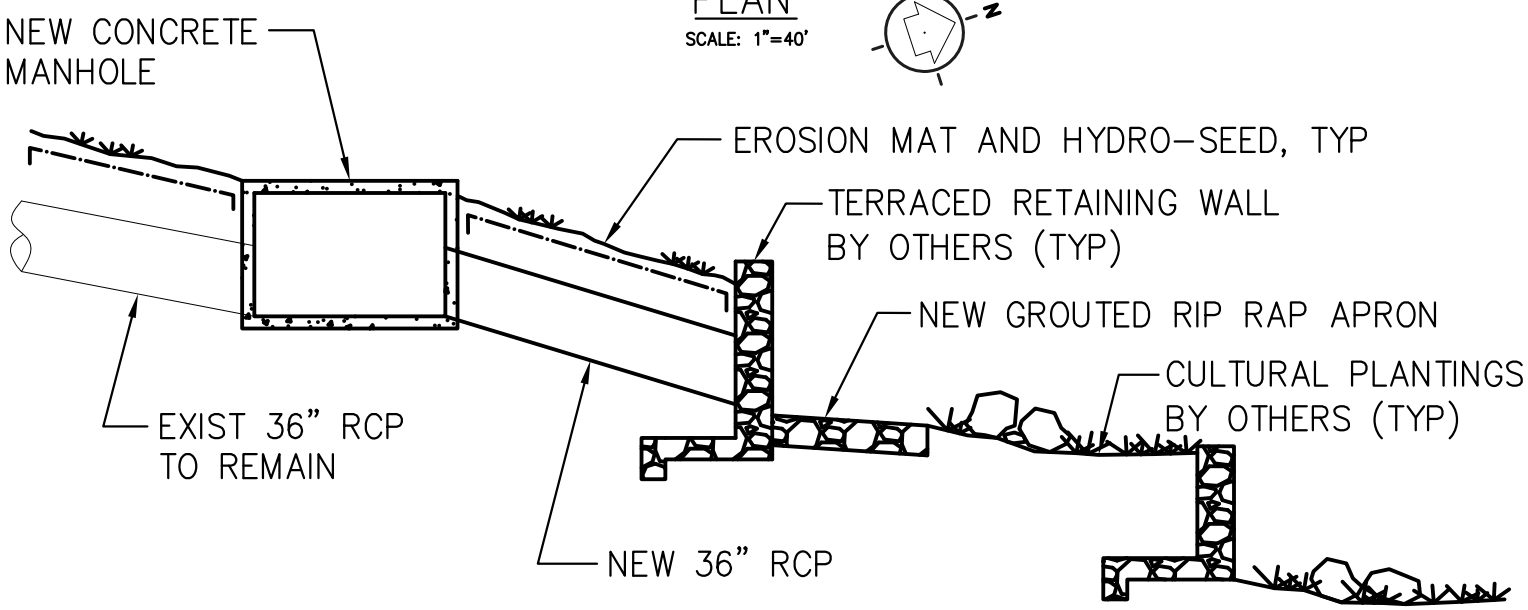
FIGURE 2B
DRAINAGE BASIN MAP



PLAN
SCALE: 1"=40'



SECTION
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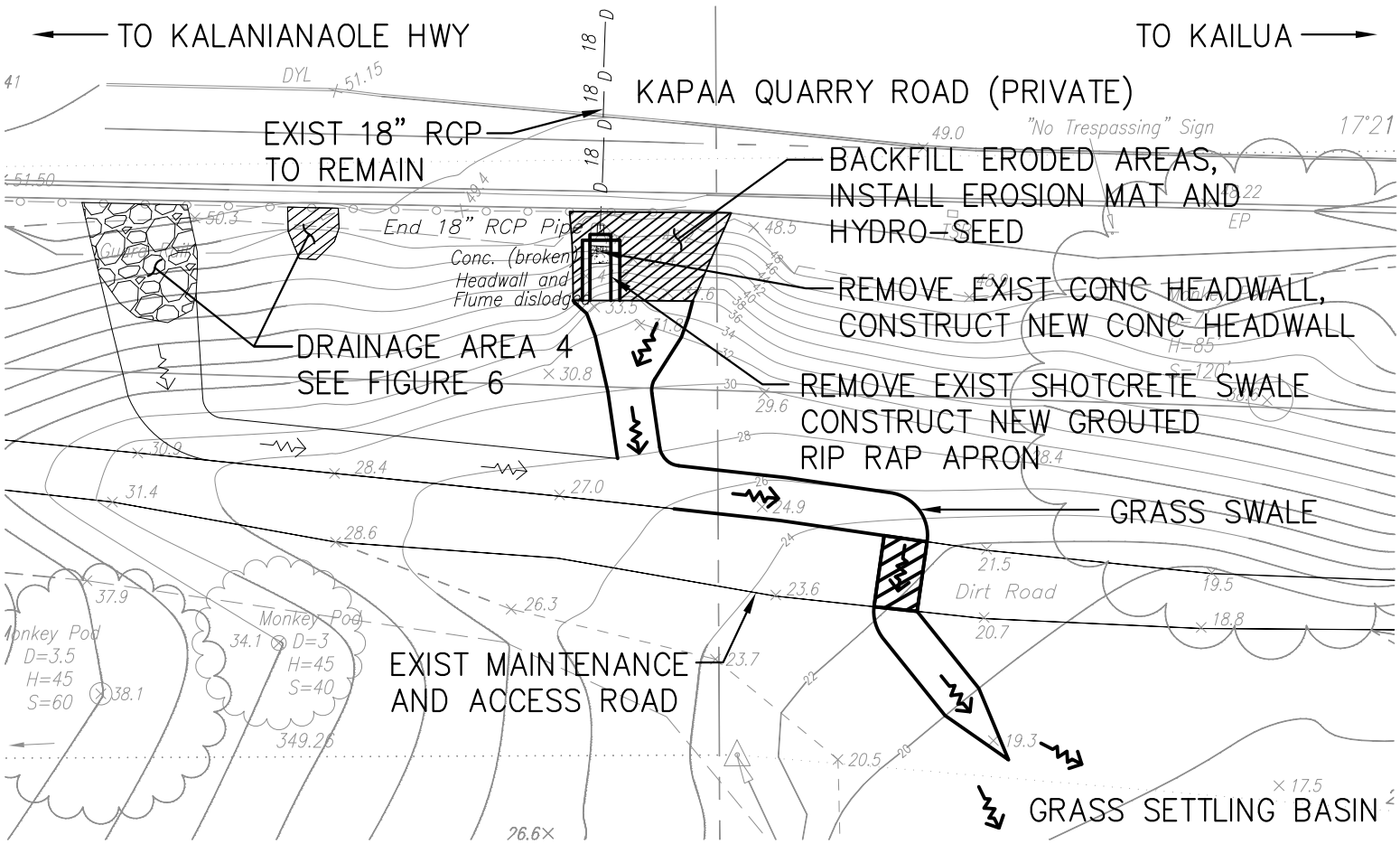
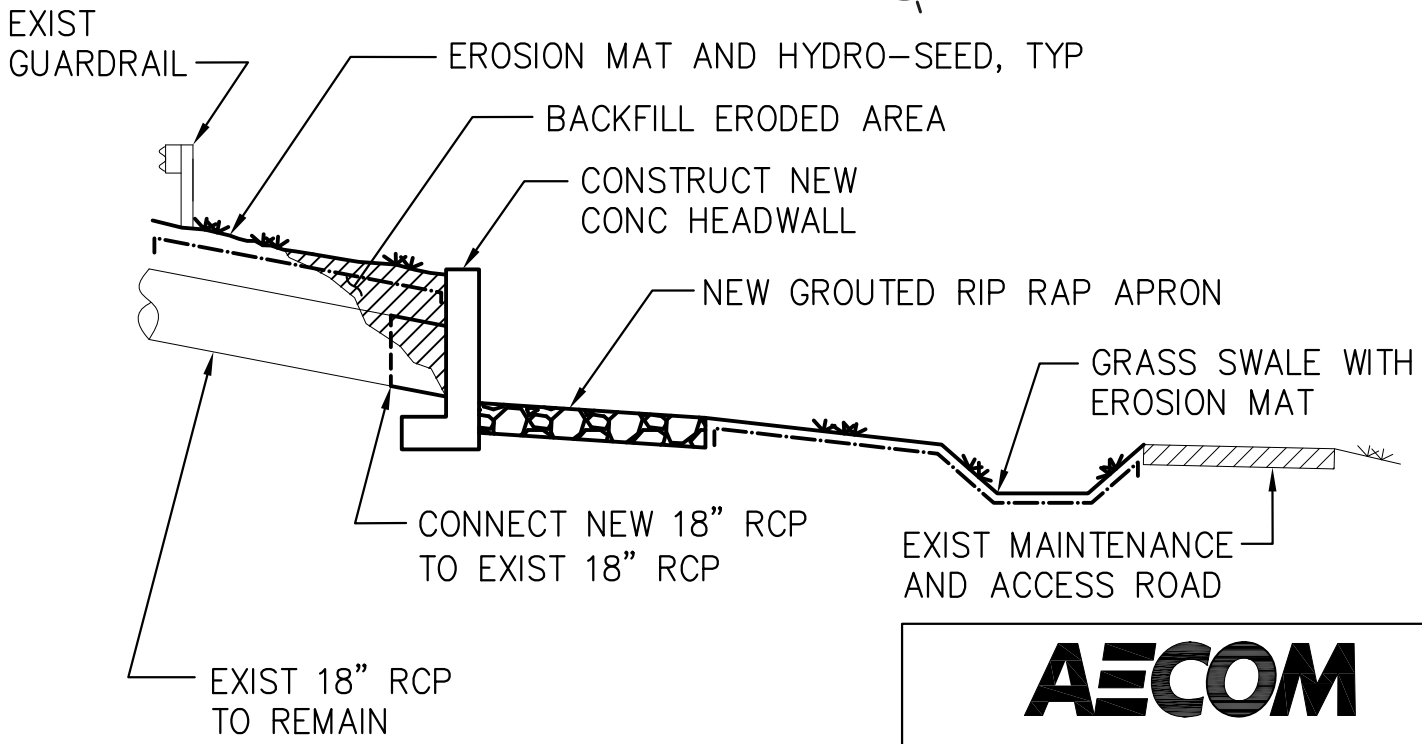
FIGURE 3 – DRAINAGE CULVERT 1



PLAN

SCALE: 1"=40'



SECTION

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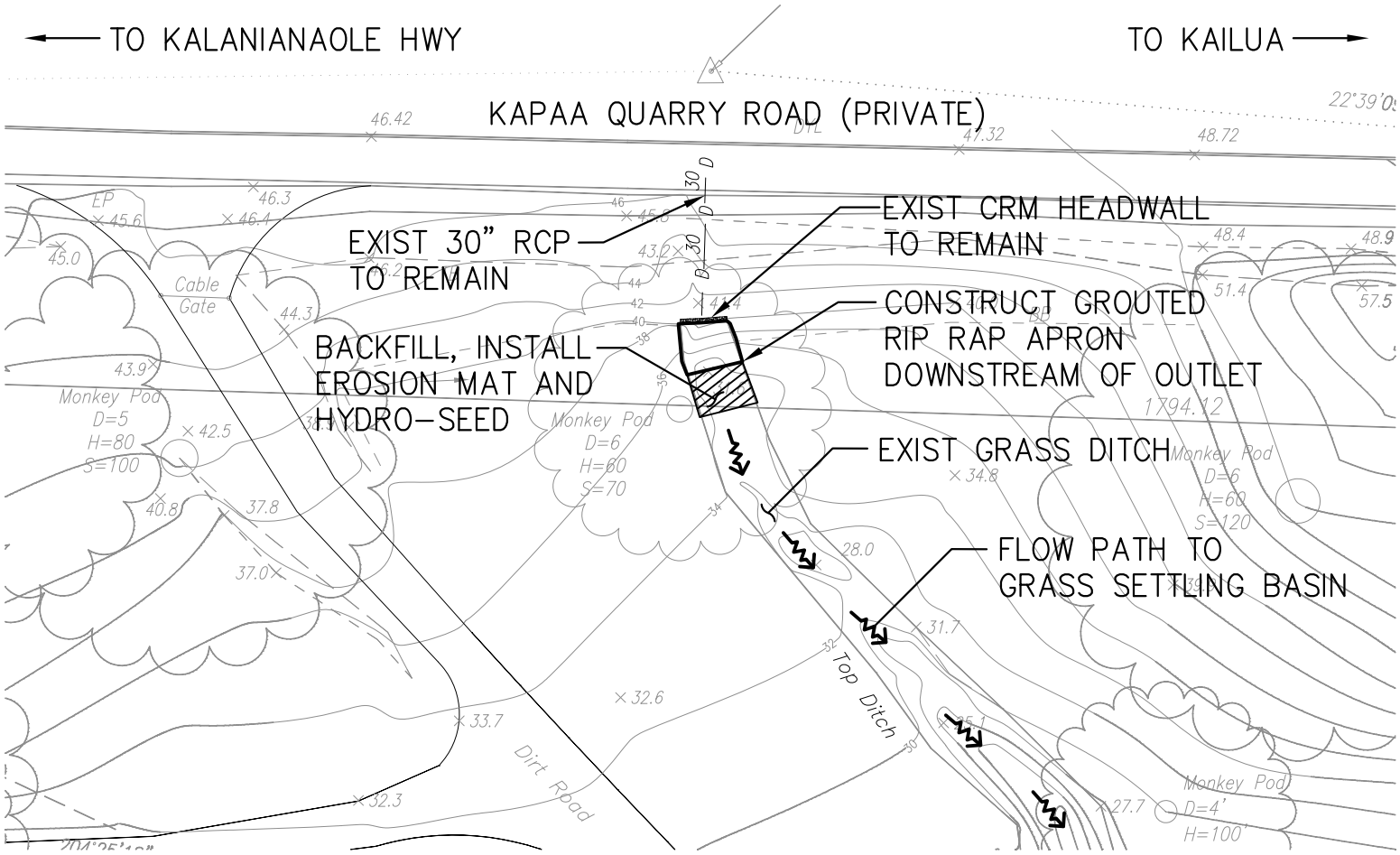
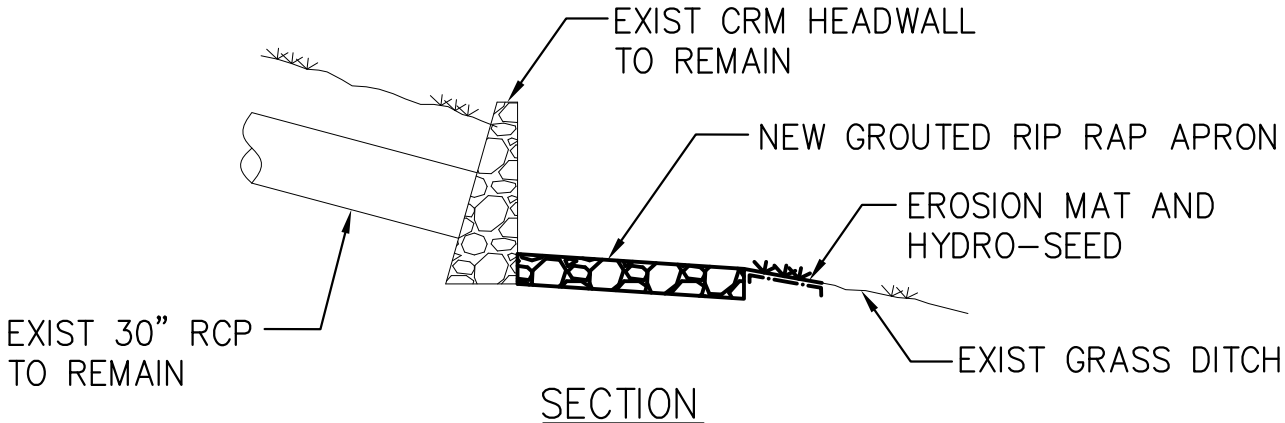
KAWAINUI WETLANDS RESTORATION AND HABITAT ENHANCEMENT PROJECT

FIGURE 4 – DRAINAGE CULVERT 2



PLAN

SCALE: 1"=40'



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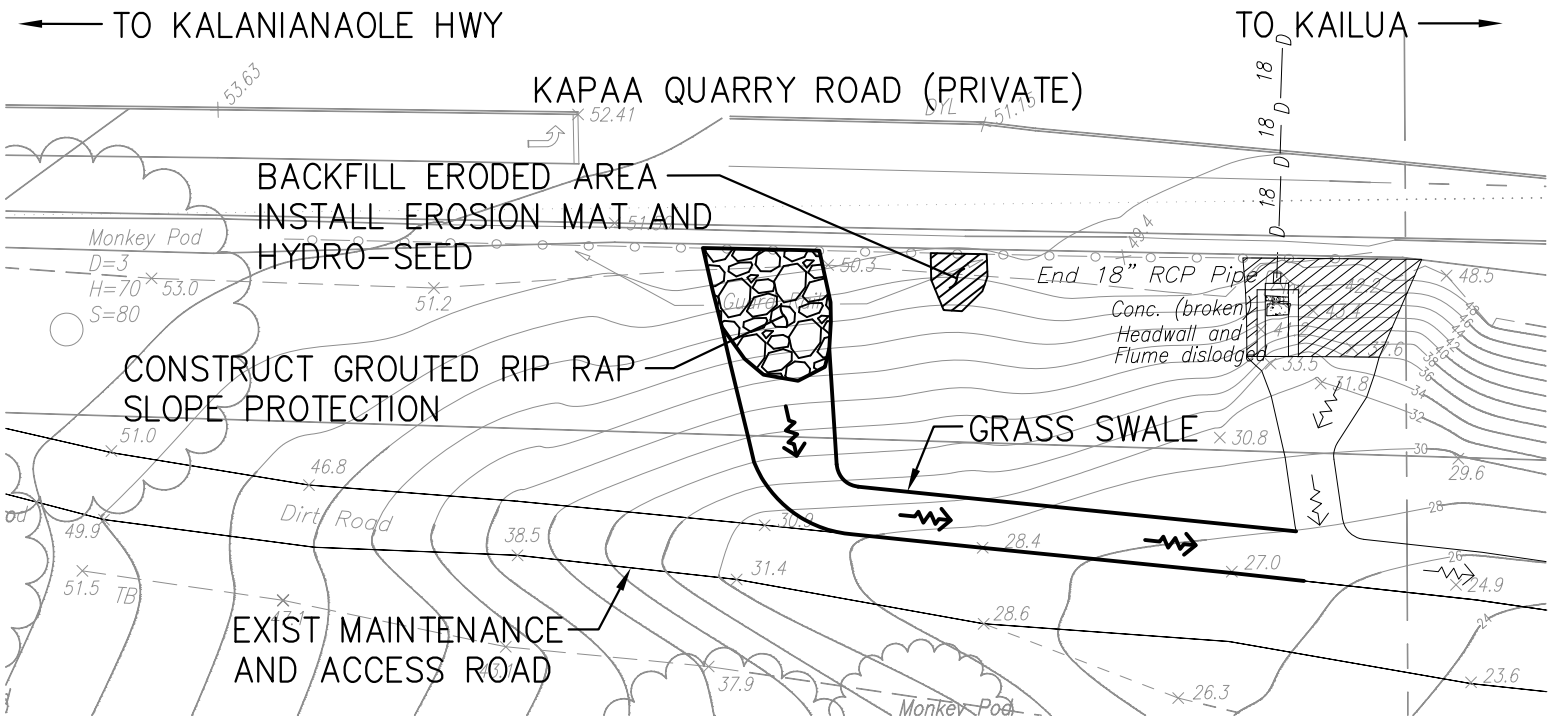
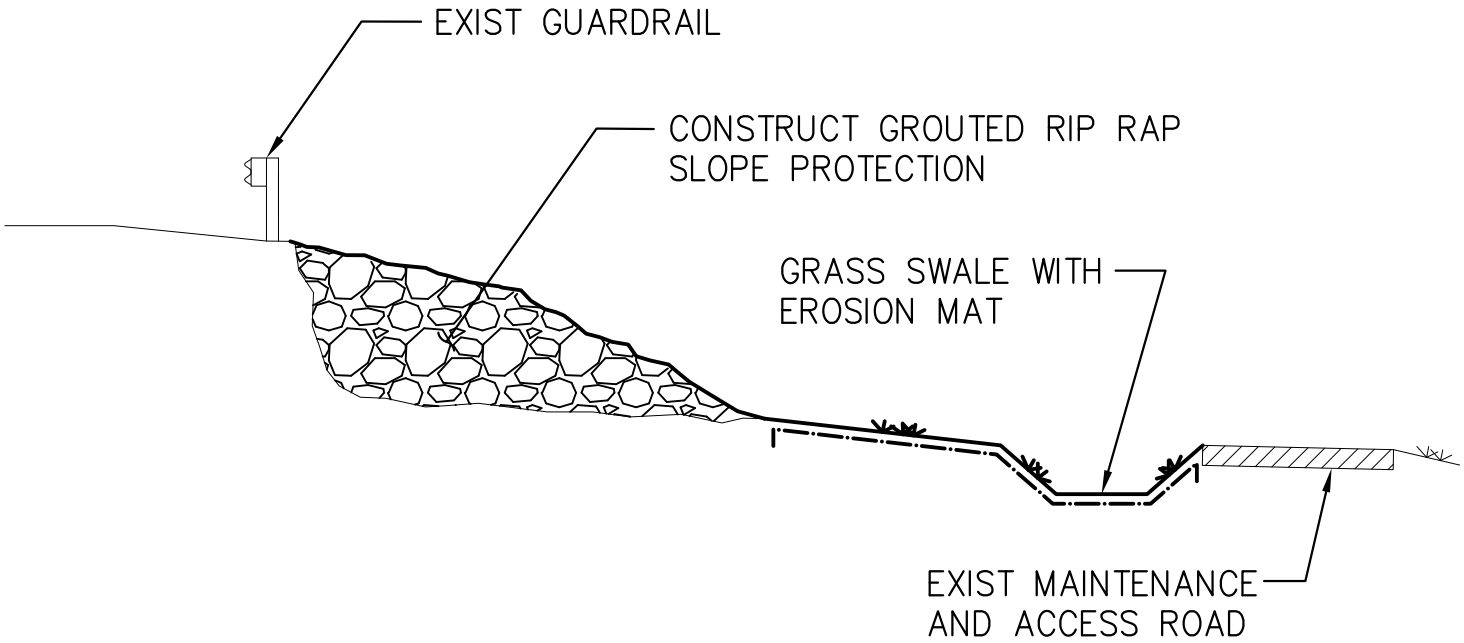
ENHANCEMENT PROJECT

FIGURE 5 – DRAINAGE CULVERT 3



PLAN

SCALE: 1"=40'



SECTION

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KAWAINUI WETLANDS
RESTORATION AND HABITAT
ENHANCEMENT PROJECT

FIGURE 6 – DRAINAGE AREA 4

APPENDIX A

PHOTOS

PHOTOS

Photo 1: 24" RCP culvert at the intersection of Kalanianaole Highway and Kapaa Quarry Road. Culvert still in good condition

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Photo 2: Some debris in the concrete channel, however the side slopes are stabilized with erosion mat and vegetation

Photo 3: Culvert 1 – Damaged CMU junction box. 36" RCP outlet from across Kapaa Quarry Road and 36" Corrugated Metal Pipe inlet.

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Photo 4: Culvert 1 – Downstream end of corrugated metal pipe. Headwall is still in fairly good condition as flow gets discharged onto the shotcrete swale

Photo 5: Culvert 1 – Signs of overtopping junction box (red arrow), heavily eroded channel (blue arrow) and exposed corrugated metal pipe (yellow arrow)

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Photo 6: Culvert 1 – Shotcrete swale showing initial signs of undermining in some areas (red arrow)

Photo 7: Culvert 2 – 18" RCP and headwall broken and separated from main portion of culvert (red arrow)

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Photo 8: Culvert 2 – Surface areas on the Kailua bound side experiencing some erosion (red arrow)

Photo 9: Culvert 3 – 30" RCP with CRM headwall in good condition (upstream end). Some signs of erosion on the side slopes (red arrows)

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Photo 10: Culvert 3 – Culvert and headwall still in pretty good condition (downstream end). Some signs for potential erosion/scour problems at outfall (red arrow)

Photo 11: Drainage Area 4 – Severely eroded channel from surface flow

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Photo 12: Drainage Area 4 – Severely eroded channel from surface flow

APPENDIX B

HYDROLOGIC/HYDRAULIC CALCULATIONS

Reference: Rules Relating to Storm Drainage Standards DPP, CCH, January 2000

Rational Method (for areas less than 100 acres), Q=CIA (for Tm=10 year storm)

EXISTING CONDITION – CULVERT 1

Hydrology

Q1 = 38.00 cfs (see Appendix D, Le Jardin Acedemy Phase II Drainage Report)

C = 0.70 (Vegetative grass slope)
Tc: L = 70', HP = 120', LP = 86', S = 0.49; Tc = 7.5 (Dense Grass, Plate 3)
I = 3.5 (Plate 1) * CF, CF = 2.5 (Plate 4); I = 3.5 * 2.5 = 8.75 in/hr
A = 145,490 SF = 3.34 AC

Q2 = CIA = (0.70)(8.75)(3.34) = 20.46 cfs

Q = Q1 + Q2 = 38.00 + 20.46 = 58.46 cfs

Hydraulics

36" RCP: S = 0.062
Normal Depth = 1.23 ft
Full Flow Capacity = 166.07 cfs

Drainage Culvert 1 - Normal Depth

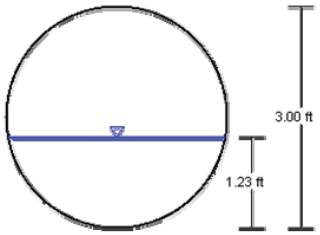
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.06200	ft/ft
Normal Depth	1.23	ft
Diameter	3.00	ft
Discharge	58.46	ft³/s

Cross Section Image



Drainage Culvert 1 - Full Flow Capacity

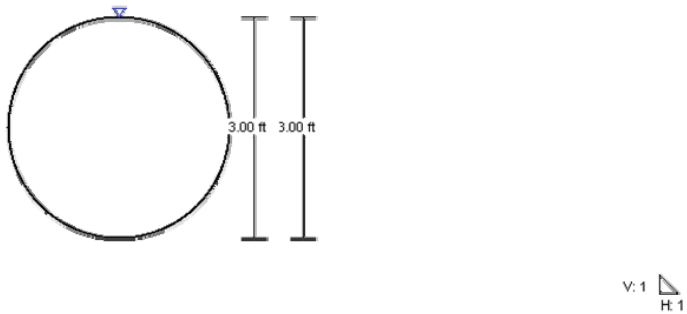
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.06200	ft/ft
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	166.07	ft^3/s

Cross Section Image



EXISTING CONDITION – CULVERT 2

Hydrology

C = 0.90 (Concrete/AC Paved)
Tc: L = 585', HP = 145', LP = 63', S = 0.14; Tc = 5 (Paved, Plate 3)
I = 3.5 (Plate 1) * CF, CF = 2.8 (Plate 4); I = 3.5 * 2.8 = 9.8 in/hr
A = 49,223 SF = 1.13 AC

Q = CIA = (0.90)(9.8)(1.13) = 9.97 cfs

Hydraulics

18" RCP: S = 0.101
Flow Depth = 0.56 ft
Full Flow Capacity = 33.38 cfs

Drainage Culvert 2 - Normal Depth

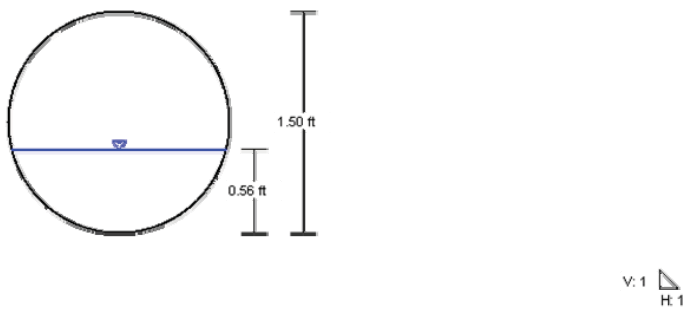
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.10100	ft/ft
Normal Depth	0.56	ft
Diameter	1.50	ft
Discharge	9.97	ft^3/s

Cross Section Image



Drainage Culvert 2 - Full Flow Capacity

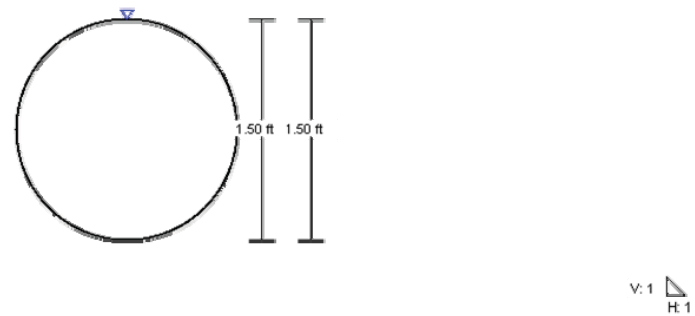
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.10100	ft/ft
Normal Depth	1.50	ft
Diameter	1.50	ft
Discharge	33.38	ft^3/s

Cross Section Image



EXISTING CONDITION – CULVERT 3

Hydrology

C = 0.60 (steep forested slope)
Tc: L = 2850', HP = 900', LP = 45', S = 0.30, K = 5.2; Tc = 5.5 (Plate 5)
I = 3.5 (Plate 1) * CF, CF = 2.6 (Plate 4); I = 3.5 * 2.6 = 9.10 in/hr
A = 1,004,381 SF = 23.06 AC

Q = CIA = (0.60)(9.10)(23.06) = 125.91 cfs

Hydraulics

30" RCP: S = 0.107
Flow Depth = 1.92 ft
Full Flow Capacity = 134.16 cfs

Drainage Culvert 3 - Normal Depth

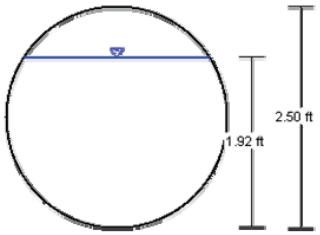
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.10700	ft/ft
Normal Depth	1.92	ft
Diameter	2.50	ft
Discharge	125.91	ft^3/s

Cross Section Image



Drainage Culvert 3 - Full Flow Capacity

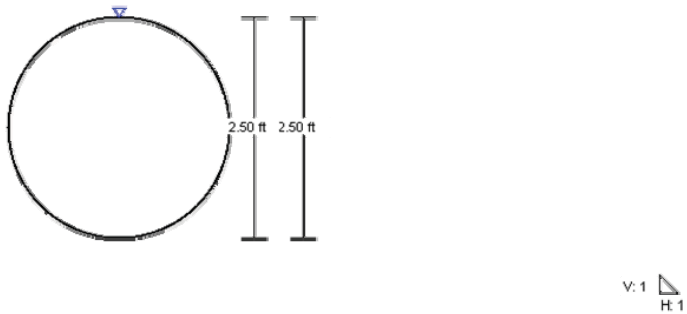
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.10700	ft/ft
Normal Depth	2.50	ft
Diameter	2.50	ft
Discharge	134.16	ft^3/s

Cross Section Image



EXISTING CONDITION – DRAINAGE AREA 4

Hydrology

C = 0.90 (Concrete/AC Paved)
Tc: L = 410', HP = 120', LP = 51', S = 0.17, Tc = 5 (Paved, Plate 3)
I = 3.5 (Plate 1) * CF, CF = 2.8 (Plate 4); I = 3.5 * 2.8 = 9.8 in/hr
A = 35,284 SF = 0.81 AC

Q = CIA = (0.90)(9.8)(0.81) = 7.14 cfs

APPENDIX C

PRELIMINARY CONSTRUCTION COST ESTIMATE

PRELIMINARY CONSTRUCTION COST ESTIMATE
Kawainui Wetlands Restoration and Habitat Enhancement Project
May 2011

ITEM NO.	ITEM	APPROX. QUANTITY	UNIT	UNIT PRICE	AMOUNT
	Drainage Culvert 1:				
	Remove Exist Drainage Structures	15	CY	$ 1,500.00	$ 22,500.00
	Backfill	615	CY	$ 75.00	$ 46,125.00
	Erosion Control Mat	1,660	SF	$ 5.00	$ 8,300.00
	Grass Hydro-Seed	185	SY	$ 7.00	$ 1,295.00
	Temporary Irrigation and Maintenance	1,660	SF	$ 2.00	$ 3,320.00
	Remove Trees	2	EA	$ 400.00	$ 800.00
	Concrete Manhole Structure	1	EA	$ 5,000.00	$ 5,000.00
	36" Reinforced Concrete Pipe	35	LF	$ 125.00	$ 4,375.00
	Grouted Rip Rap Apron	10	CY	$ 2,500.00	$ 25,000.00
	Traffic Control and Signage	1	LS	$ 2,500.00	$ 2,500.00
				Subtotal	**$ 119,215.00**
	Drainage Culvert 2:				
	Remove Exist Drainage Structures	1	CY	$ 1,500.00	$ 1,500.00
	Backfill	133	CY	$ 75.00	$ 9,975.00
	Erosion Control Mat	515	SF	$ 5.00	$ 2,575.00

PRELIMINARY CONSTRUCTION COST ESTIMATE
Kawainui Wetlands Restoration and Habitat Enhancement Project
May 2011

ITEM NO.	ITEM	APPROX. QUANTITY	UNIT	UNIT PRICE	AMOUNT
	Grass Hydro-Seed	60	SY	$ 7.00	$ 420.00
	Temporary Irrigation and Maintenance	515	SF	$ 2.00	$ 1,030.00
	18" Reinforced Concrete Pipe	10	LF	$ 100.00	$ 1,000.00
	Concrete Headwall	1	CY	$ 1,500.00	$ 1,500.00
	Grouted Rip Rap Apron	3	CY	$ 2,500.00	$ 7,500.00
	Excavation for Grass Swale	185	CY	$ 70.00	$ 12,950.00
	Erosion Control Mat for Grass Swale	1,665	SF	$ 5.00	$ 8,325.00
	Grass Hydro-Seed for Grass Swale	185	SY	$ 7.00	$ 1,295.00
	Temporary Irrigation and Maintenance for Grass Swale	1,665	SF	$ 2.00	$ 3,330.00
	Traffic Control and Signage	1	LS	$ 2,500.00	$ 2,500.00
				Subtotal	**$ 53,900.00**
	Drainage Culvert 3:				
	Backfill	3	CY	$75.00	$ 225.00
	Erosion Control Mat	140	SF	$5.00	$ 700.00
	Grass Hydro-Seed	15	SY	$7.00	$ 105.00
	Temporary Irrigation and Maintenance	140	SF	$2.00	$ 280.00

PRELIMINARY CONSTRUCTION COST ESTIMATE
Kawainui Wetlands Restoration and Habitat Enhancement Project
May 2011

ITEM NO.	ITEM	APPROX. QUANTITY	UNIT	UNIT PRICE	AMOUNT
	Grouted Rip Rap Apron	5	CY	$ 2,500.00	$ 12,500.00
	Traffic Control and Signage	1	LS	$ 2,500.00	$ 2,500.00
				Subtotal	**$ 16,310.00**
	Drainage Area 4:				
	Backfill	45	CY	$ 75.00	$ 3,375.00
	Erosion Control Mat	1,170	SF	$ 5.00	$ 5,850.00
	Grass Hydro-Seed	130	SY	$ 7.00	$ 910.00
	Temporary Irrigation and Maintenance	1,170	SF	$ 2.00	$ 2,340.00
	Grouted Rip Rap Slope Protection	30	CY	$ 2,500.00	$ 75,000.00
	Excavation for Grass Swale	170	CY	$ 70.00	$ 11,900.00
	Erosion Control Mat for Grass Swale	1,530	SF	$ 5.00	$ 7,650.00
	Grass Hydro-Seed for Grass Swale	170	SY	$ 7.00	$ 1,190.00
	Temporary Irrigation and Maintenance for Grass Swale	1,530	SF	$ 2.00	$ 3,060.00
	Traffic Control and Signage	1	LS	$ 2,500.00	$ 2,500.00
				Subtotal	**$ 113,775.00**

PRELIMINARY CONSTRUCTION COST ESTIMATE
Kawainui Wetlands Restoration and Habitat Enhancement Project
May 2011

ITEM NO.	ITEM	APPROX. QUANTITY	UNIT	UNIT PRICE	AMOUNT
	DESIGN RECOMMENDATIONS:				
	Culvert 1				$ 119,215.00
	Culvert 2				$ 53,900.00
	Culvert 3				$ 16,310.00
	Drainage Area 4				$ 113,775.00
	SUM OF CONSTRUCTION ITEMS				$ 304,000.00
	Mobilization/Demobilization (10%)				$ 30,400.00
	Contingency (10%)				$ 30,400.00
	ESTIMATED BUDGETARY CONSTRUCTION COST				**$ 365,000.00**

APPENDIX D

LE JARDIN ACADEMY PHASE II DRAINAGE REPORT

SAM O. HIROTA, INC

LE JARDIN ACADEMY

LE JARDIN ACADEMY
PHASE II

REVISED DRAINAGE and SURFACE RUNOFF
MITIGATION REPORT

DENNIS I. HIROTA
LICENSED PROFESSIONAL ENGINEER
No. 3377-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION

EXPIRES APRIL 2006

Sam O. Hirota, Inc.
Engineers & Surveyors

January 2005

LE JARDIN ACADEMY
PHASE II

REVISED
DRAINAGE AND SURFACE
RUNOFF MITIGATION
REPORT

Prepared for
LE JARDIN ACADEMY

Prepared by
SAM O. HIROTA, INC.
864 South Beretania Street
Honolulu, Hawaii 96813
TEL: 808-537-9971
FAX: 808-524-6313

January 2005

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I. EXECUTIVE SUMMARY

Le Jardin Academy is located on a 24.06-acre campus, identified by Tax Map Key 4-2-14:14, located at the site of the former Kailua Drive-in Theater in Koolaupoko, Oahu. In 1999, Phase I of this campus was completed with the opening of elementary and middle school facilites. Currently, LeJardin is in the process of planning for Phase II, which will include classrooms to house the high school students, along with additional facilities for all their students. Planned expansion shall continue on through the 2014-2015 school year, when the school will meet its maximum student body size of 1,200 students.

This report is a follow-up to the initial Drainage and Surface Runoff Mitigation report, prepared by Sam O. Hirota, Inc. in February 1998. The updated report contains stormwater runoff and erosion calculations for the proposed Phase II facilities

The following table is a summary of the drainage calculations.

	Total Flow (cfs)	
	10-yr, 1hr storm event	50-yr, 1-hr storm event
Original Condition (Kailua Drive-In)	145.34	193.79
Current Condition (LJA Phase I)	113.25	151.00
Proposed Condition (LJA Phase II)	119.85	159.79

The proposed project is expected to reduce the storm water runoff from the original drive-in site by approximately 17.5%. The total runoff reaching Drainage Structure 1 (WKK1-205) is reduced by 25%, and the total runoff reaching Structure 3 is reduced by 13%. This should improve runoff water quality and quantity of accumulated wind blown sediments, decomposing organic materials and trash dumped on the existing site and transported to Kawai Nui Marsh by the existing drainage system.

The estimated annual soil loss during the Phase II construction period is 1.78 tons/ac/year, which is below the 5 tons/ac/yr allowed by county standards. LeJardin has actively promoted the reduction of sediment laden runoff during the past 6 years and shall continue these practices through the construction of the Phase II facilities.

II. INTRODUCTION

In 1999, Le Jardin Academy (LJA) completed the first phase of development of its new 24.06-acre campus, identified by Tax Map Key 4-2-14:14, located at the site of the former Kailua Drive-in Theater in Koolaupoko, Oahu. Phase I included 80,055 square feet of administrative, elementary, and middle school facilities. These facilities currently serve the 471 students enrolled at Le Jardin Academy in kindergarten through ninth grade (as of the 2002-03 school year). The school's high school program, which began this school year (2002-03) with two sections of ninth graders, is temporarily housed in buildings that will be permanently used for the middle school. The completion of Phase II will allow for the school to continue its high school program and expand its elementary and middle school programs by one section per grade. Expansion is limited by an ultimate school population of 1,200 agreed to in the "Unilateral Agreement and Declaration for Conditional Zoning" for Ordinance No. 96-78, Bill 100, CD1 (1996). Following completion of Phase II facilities, enrollment is expected to increase to 1,170 students by the 2014-2015 school year.

This report focuses on the original drive-in, current elementary school, and future drainage conditions at the LeJardin Site. It also addresses best management practices during construction and permanent erosion control measures. All calculations and recommendations follow requirements of the City and County of Honolulu Dept. of Planning & Permitting. This report is a follow-up to the initial Drainage and Surface Runoff Mitigation report, prepared by Sam O. Hirota, Inc. in February 1998.

III. PROJECT BACKGROUND

III.1 PROPOSED PROJECT

The project site abuts the signalized intersection of Kalanianaole Highway and Kapaa Quarry Access Road; the latter being the stem of the "T"-intersection entering from the north. Kapaa Quarry Access Road is privately owned by the Harold K.L. Castle Foundation in the area of the project site and is maintained by the City & County of Honolulu. The City and Ameron HC&D have a road and utility easement over the roadway. The road is unimproved (no gutters, sidewalks or planter strips), has a pavement width of 30 feet, and has shoulders consisting of either dirt or base rock. Storm water runoff from the highway and Kapaa Quarry Road are carried by drainage facilities within the respective right-of-ways to the Kawai Nui Marsh (Reference 1).

III.2 TOPOGRAPHIC FEATURES

A detailed topographic survey has been completed by Community Planning, Inc. (CPI) in 1994. The information available includes a drawing at 1in.=40 ft. mapping with 2 foot contours. The property ranges in elevation from 60 to approximately 150 feet. The majority of the site is gently sloping toward the south, with a depression adjacent to the culvert passing under Kalanianaole Highway.

III.3 RAINFALL

Annual rainfall for the project site may be estimated from two State of Hawaii gauges listed below:

788.1	Pali Golf Course	85.6 inches	(Reference 5)
790.0	Olomana Subdivision	52.0 inches	(Reference 5)

IV. DRAINAGE CONDITIONS

IV.1 ORIGINAL KAILUA DRIVE-IN SITE

The site is designated on the Flood Insurance Rate Map (FIRM) as Zone D, which indicates that the area does not have the flood hazards determined.

Existing runoff of the original Kailua Drive-In Theater site and adjoining mauka property, discharges flows into three drainage structures shown in Figure 1.

Structure 1 (City Drainage Structure No. WKK1-205), owned and maintained by the State of Hawaii, Department of Transportation, discharges flows collected by a perimeter swale system for the adjoining mauka property area, (A-1 in Figure 1) and directs the flow along the western side of the parking area. This collected sheet flow is then combined with flow from a small gulch within area, A-1 and a 6-inch drain from the original drive-in theater retail area into a manhole near the exit road to Kalanianaole Highway. The flow is then transported to a drop manhole by a 24 inch reinforced concrete drain to a depression adjacent to the property along Kalanianaole Highway. Sheet flow from area A-3a is also collected at the same location, combined and passed under the highway by a 36 inch reinforced concrete culvert constructed in 1949 as part of the original highway. The flow passes over approximately 800 feet of flat pasture grass land on the Maunawili side of the highway, finally reaching Kahanaiki Stream on the mauka side of the Kalanianaole bridge (see Figure 1, Structure 1)

Structure 2 (City Drainage Structure No. WKK1-24P), Area A-2 is drained by curb inlets at the bottom of the entry and exit roads. The flow is then transported under the Kailua Quarry Road and into the marsh by a 18 inch reinforced concrete drain pipe (see Figure 1, Structure 2).

Structure 3 (City Drainage Structure No. WKK1-22P) collects flow from two box inlets that were constructed by the drive-in theater to capture sheet flow runoff from area, A-3b. The two inlets collect the storm runoff on the south side of the pavement edge near the former entry, at the top of the entry drive. A 24 inch reinforced concrete pipe connects the two inlets, which flows into a 36 inch reinforced concrete pipe under the entry drive, crossing the Kapaa Quarry Road and into the marsh (see Figure 1, Structure 3).

Calculations for the 10 and 50 year storm events were made following the drainage design standards of the City and County of Honolulu (Reference 4). Although not required by the City, 50 year storm calculations have been included for comparison purposes. A table of the calculations is provided in Appendix A.1. The estimated runoff for the original Kailua Drive-In site was 145.34 cfs for the 10-year 1-hour storm event, and 193.79 for the 50-year 1-hour storm event.

IV. 2 CURRENT LEJARDIN ACADEMY SITE

During Phase I construction, runoff patterns remained similar to prior drive-in conditions. The runoff from the lower portion of the campus, which houses the elementary and middle school, is collected in a series of grate inlets and 18" RCP. This pipe system is connected to the existing Structure 1 (see Figure 2).

The mauka portion of campus, which currently includes the athletic fields and back service road, drains through a series of pipes along the roadway. These pipes connect to existing Structure 3 (see Figure 2).

Calculations for the two areas described above are included in Appendix A.2. With the assumption that flows from Areas A-1 and A-2a&b (see Figure 1), were not affected by the construction of Phase I, the total estimated runoff for the site is 113.25 cfs and 151.00 cfs for the 10-year and 50-year storm event respectively.

IV. 3 PROPOSED SITE

Construction of Phase II facilities will not alter the current drainage patterns significantly. All runoff around the new buildings will be directed into the existing pipe systems and will outlet into either Structure 1 or Structure 3 (see Figure 3). The quantity of runoff will increase slightly from the current condition because of the increase in pavement and roof surfaces. The proposed runoff for the 10 year and 50 year storm events is 119.85 cfs and 159.79 cfs (see Appendix A.3).

Overall, the amount of runoff from the existing drive-in site to the proposed LJA campus will be reduced by 17.5%. This reduction can be attributed to the reduced amounts of pavement and increased amount of grass/landscaping.

V. GRADING and SOIL EROSION POTENTIAL

V.1 GRADING

The majority of the grading on the LeJardin site occurred during Phases I and IA. Construction of Phase II will disturb approximately 2 acres of the site. The disturbance will include fine grading and construction of retaining walls. Large amounts of excavation or embankment work is not anticipated. Figure 4 shows the original Kailua Drive-In, the existing LJA campus, and the proposed Phase II contours.

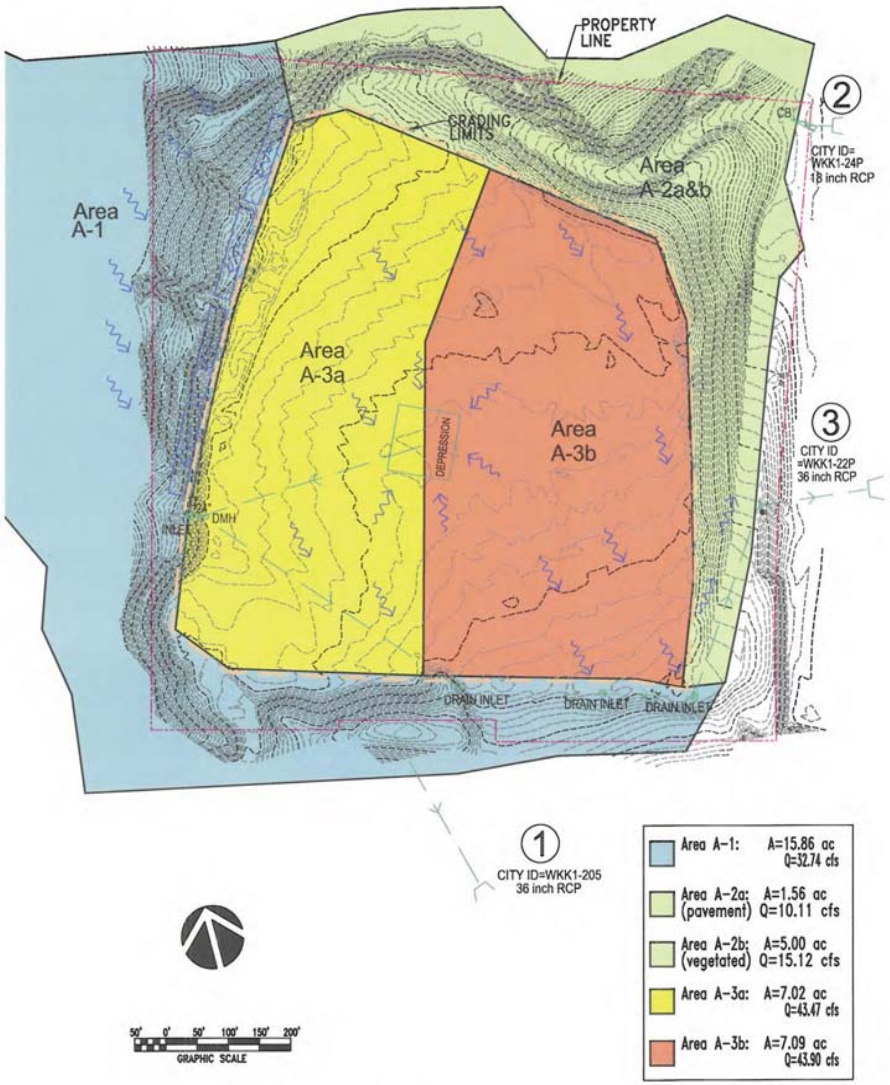


Figure 1: Original Kailua Drive-In Drainage Condition

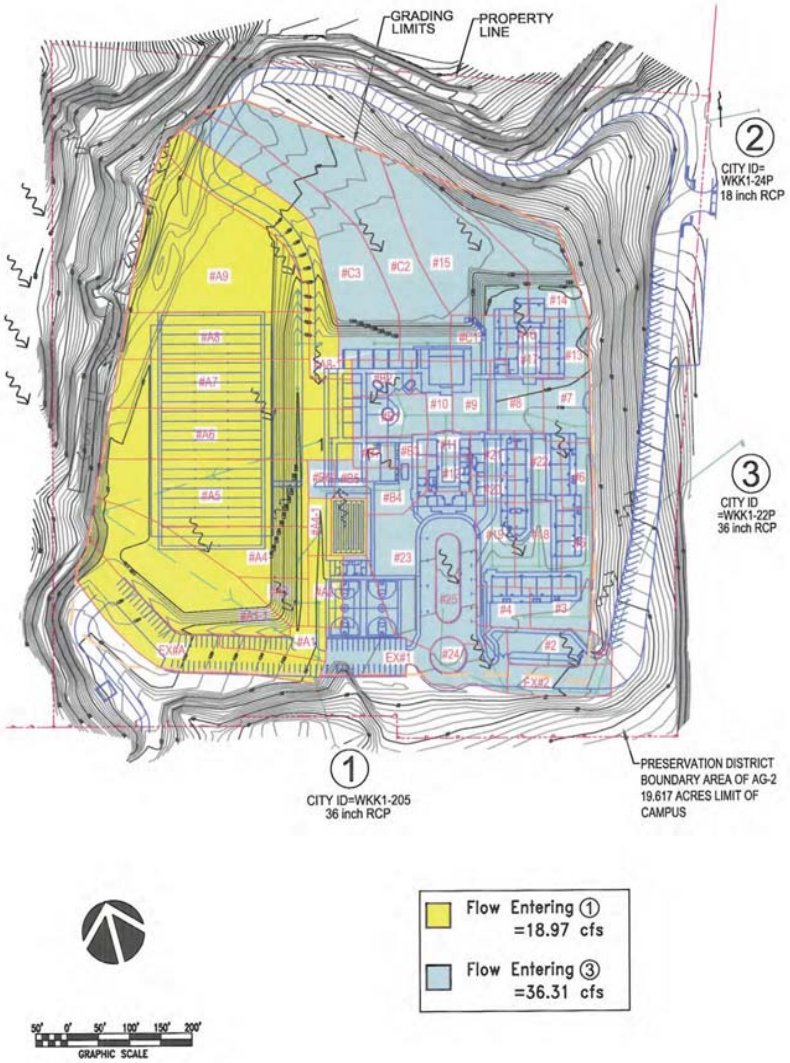


Figure 2: Current Drainage Condition

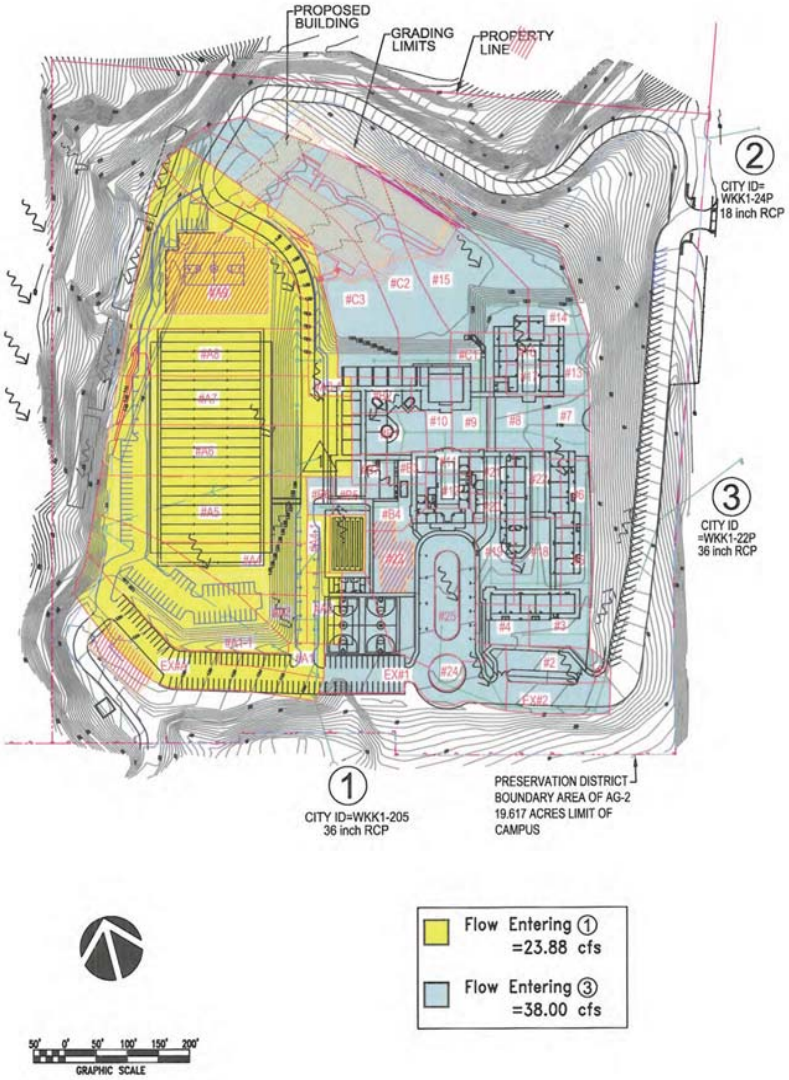


Figure 3: Future Drainage Condition

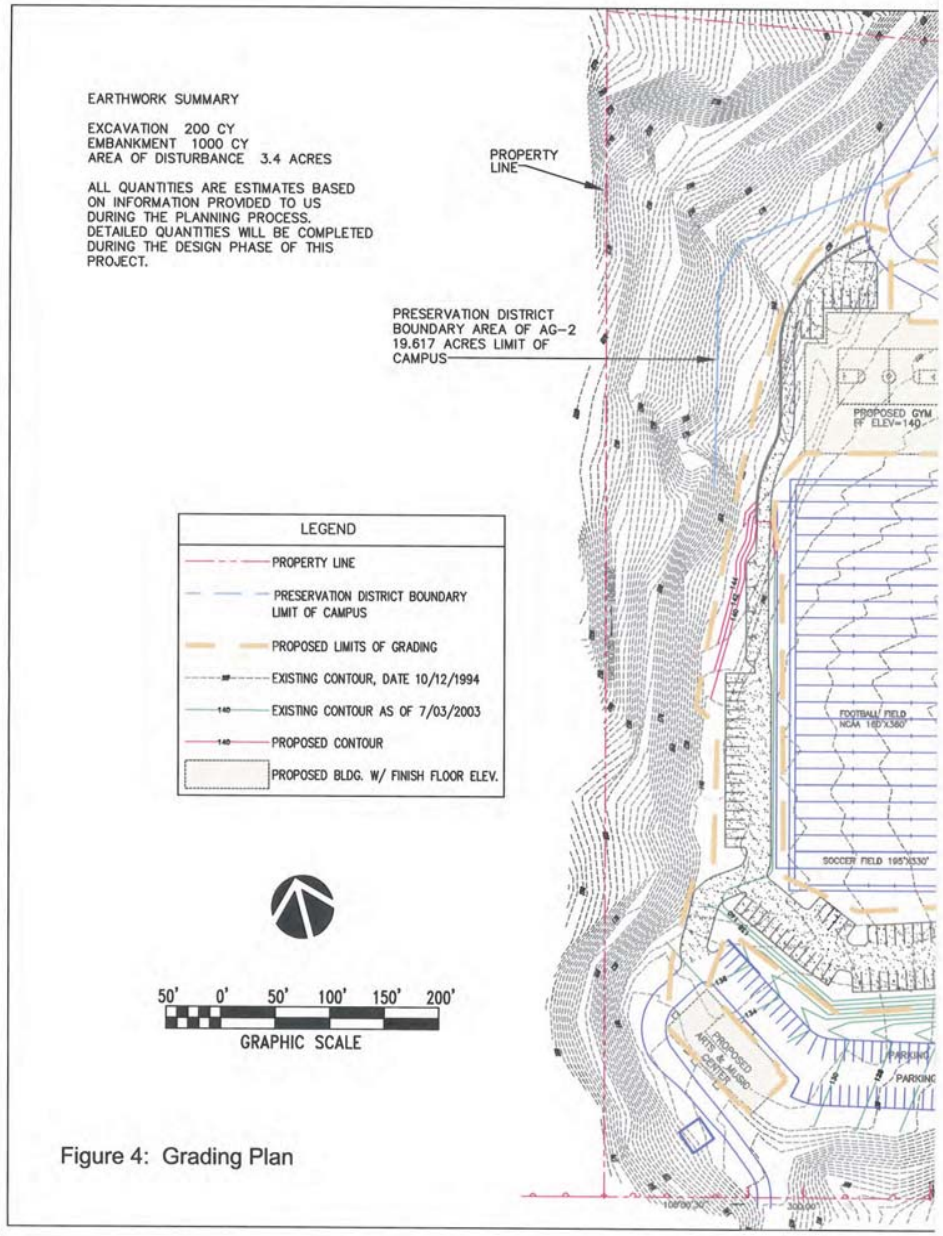
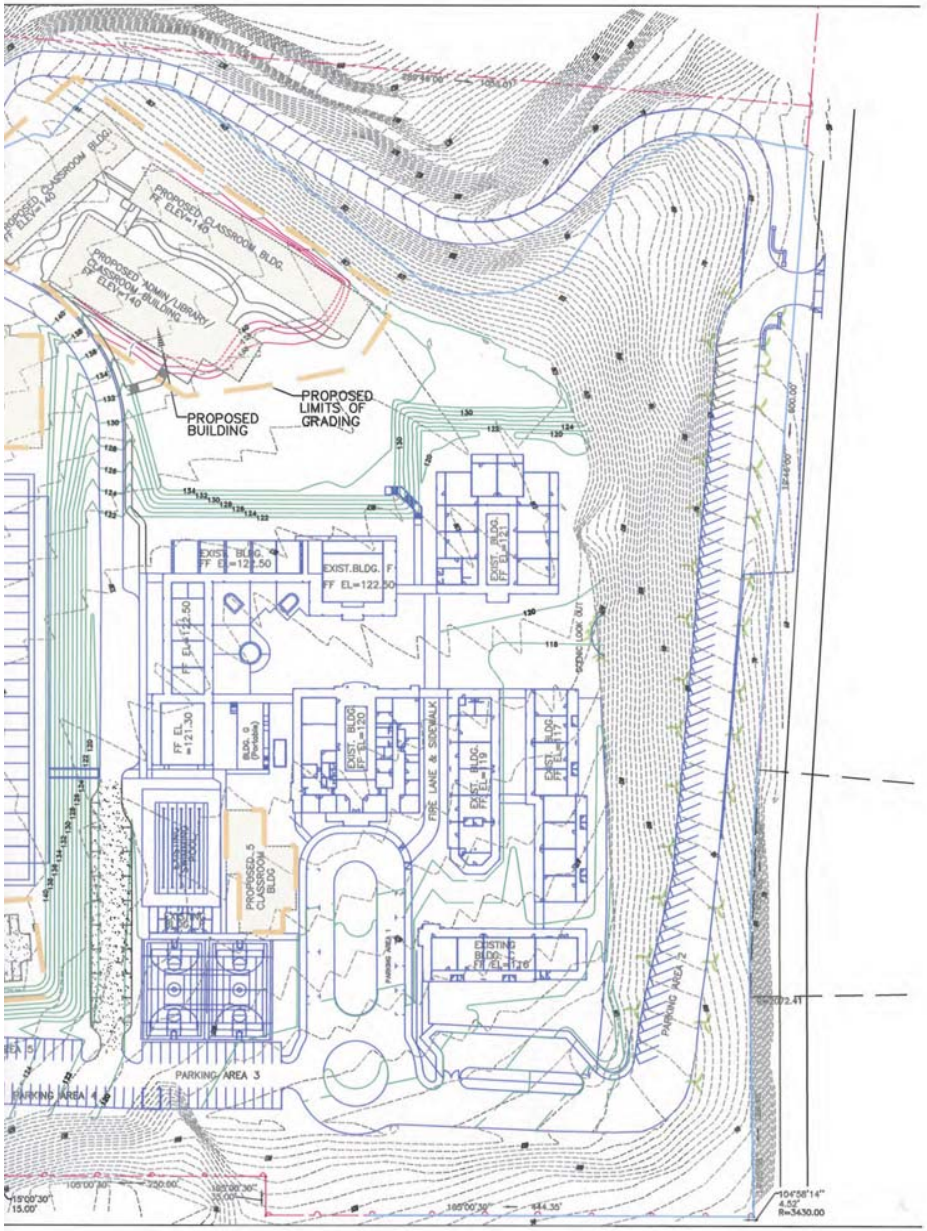


Figure 4: Grading Plan



V.2 SOIL EROSION POTENTIAL

Soil losses have been estimated using the Universal Soil Loss Equation as described in the City and County of Honolulu standards (Reference 2). This document is for planning purposes and a construction schedule has not been developed at this time, so all dates are approximate.

CALCULATION OF THE ANNUAL SOIL LOSS

Universal Soil Loss Equation

A = Annual Soil Loss per unit area (tons/acre/year)

A = RKLSCP

R = Rainfall Erosion Effect Factor

R = 450 (0.529-0.470) =26.55 (clearing & grubbing, May 1 – June 1)
R = 450 (0.616-0.529) =39.15 (grading June 1 – September 1)

K = Soil Erodibility Factor
The project is to be constructed on ALF
Alaeloa silty clay (Reference 3)

K = 0.10

LS = Slope-Length and Slope Gradient Factor
Average Slope Length = 200ft
Average Slope Gradient = 2%

LS = 0.248

C = Cover and Management Factor

C = 1 for cleared land
C = 0.10 for grassed land

P = Erosion Control Factor
Use of silt fences, filter inlets and other measures

P = 0.8

Annual Soil Loss Pre- Construction
A = 450 * 0.10 * 0.248 * 0.01 * 1 = 0.11 tons/ac/yr

Annual Soil Loss During Clearing & Grubbing
A = 26.55 * 0.10 * 0.248 * 1 * 0.80 = 0.527 tons/ac/yr

Annual Soil Loss During Grading
A = 39.15 * 0.10 * 0.248 * 1 * 0.80 = 0.777 tons/ac/yr

Annual Soil Loss Post Construction
A = 450 * 0.10 * 0.248 * 0.01 * 1 = 0.11 tons/ac/yr

Per C&C Standards, the acceptable soil loss rate is 5 tons/ac/year. The maximum soil loss calculated for Phase II construction would be 0.777 tons/ac/year, which occurs during grading, as shown above. It is anticipated that the soil loss once the project is complete will be relatively small due to the permanent erosion control measures, which are discussed later in this report.

V.3 BEST MANAGEMENT PRACTICES DURING CONSTRUCTION

Planning considerations to minimize discharge and erosion of the construction site focus on two objectives, increase of water quality while minimizing the quantity of water discharged from the site

Water Quantity: Onsite temporary detention will decrease runoff volume and reduce peak flow.

Water Quality: Potential to trap sediment and sediment-attached substances carried by runoff.

TEMPORARY CONSTRUCTION MEASURES

During construction a system of controls will be put into place to meet the objectives stated above. The following list includes the measures that are to be implemented:

1. A silt fence will be placed along the north, east, and south facing sides of the grading limits.
2. A temporary access driveway, consisting of #2 crushed rock, will be located along the existing drive-in theater access road.
3. Watering will be used to control dust during the grading phase.
4. All graded areas will be hydromulched and seeded as final grades are achieved.

Locations of the temporary control measures are shown in Figure 5. Details of each erosion control structure is contained in Appendix B.

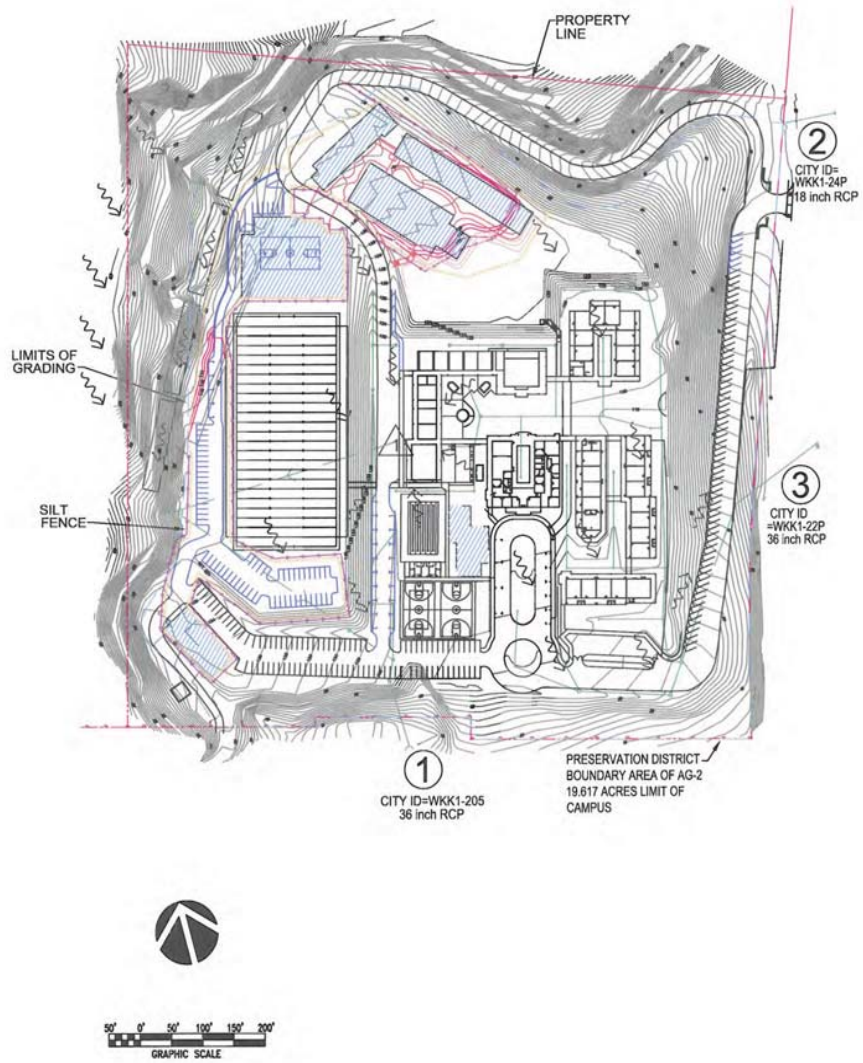


Figure 5: Temporary Best Management Practices

V.4 PERMANENT EROSION CONTROL MEASURES

During design of Phase I, permanent erosion control measures were included to minimize the effects of runoff, sediment-laden runoff, and pollution on the surrounding streams and Kawai Nui Marsh. Techniques included the following:

1. Leveling of the site to increase the time of concentration and detention time for storm runoff
2. Grassing and landscaping of approximately 10 acres
3. Landscaping and lawn maintenance control - control of the use of fertilizers
4. Curb cuts that allow for runoff to travel over grassed or landscaped areas before reaching the final destination
5. Cleaning of parking lots and streets to reduce the sediment load and pollutants
6. Dry detention basins to trap suspended solids and sediment
7. The use of landscaping buffers and easements to increase time of concentration and detention time

During the design of the Phase II facilities similar techniques will be implemented to further reduce future erosion.

VI. UNILATERAL AGREEMENT

The 1996 Unilateral Agreement and Declaration for Conditional Zoning (Reference 6) required LeJardin Academy to submit a detailed Drainage and Surface Runoff Mitigation Report with the application of Site Plan Review for the Phase I facilities. Several requirements were set forth in the Unilateral Agreement and were addressed within the initial report. This information regarding requirements for Phase I has been included in Appendix C.

VII. CONCLUSIONS

The following table is a summary of the drainage calculations.

	Total Flow (cfs)	
	10-yr, 1hr storm event	50-yr, 1-hr storm event
Original Condition (Kailua Drive-In)	145.34	193.79
Current Condition (LJA Phase I)	113.25	151.00
Proposed Condition (LJA Phase II)	119.85	159.79

The proposed project is expected to reduce the storm water runoff from the original drive-in site by approximately 17.5%. The total runoff reaching Drainage Structure 1 (WKK1-205) is reduced by 25%, and the total runoff reaching Structure 3 is reduced by 13%. This

should improve runoff water quality and quantity of accumulated wind blown sediments, decomposing organic materials and trash dumped on the existing site and transported to Kawai Nui Marsh by the existing drainage system.

The estimated annual soil loss during the Phase II construction period is 1.78 tons/ac/year, which is below the 5 tons/ac/yr allowed by county standards. LeJardin has actively promoted the reduction of sediment laden runoff during the past 6 years and shall continue these practices through the construction of the Phase II facilities.

VIII. REFERENCES

1. "KAWAI NUI MARSH MASTER PLAN", State of Hawaii, July 1994.
2. "RULES RELATING TO SOIL EROSION STANDARDS AND GUIDELINES", Department of Planning and Permitting, City and County of Honolulu, April 1999.
3. "SOIL SURVEY OF THE ISLAND OF KAUAI, OAHU, MAUI, MOLOKAI, AND LANAI, STATE OF HAWAII", U,S. Department of Agriculture, Soil Conservation Service, in cooperation with the University of Hawaii Agricultural Experiment Station, August 1972.
4. "RULES RELATING TO STORM DRAINAGE STANDARDS" Department of Planning and Permitting, City and County of Honolulu, January, 2000.
5. "Kawai Nui Marsh Environmental Restoration Study, Figure 5, Mudflat/Shallow Pond System", US Army Corps of Engineers, 1997
6. "Unilateral Agreement and Declaration for Conditional Zoning", Bureau of Conveyances, State of Hawaii, December 1996.

DTS: City & County of Honolulu Department of Transportation Services
DOT: State of Hawaii Department of Transportation
BWS: City & County of Honolulu Board of Water Supply
DPP: City & County of Honolulu Department of Planning & Permitting
COE: United States Corps of Engineers

APPENDIX A CALCULATIONS

A.1 ORIGINAL KAILUA DRIVE-IN SITE DRAINAGE CONDITION

10-year storm, 1-hour rainfall

Drainage Area	C	Tc (min)	i (in/hr)	CF	A (acres)	Q (cfs)
A-1	0.43	25.0	3.0	1.6	15.86	32.74
A-2a**	0.90	8.0	3.0	2.4	1.56	10.11
A-2b**	0.42	8.0	3.0	2.4	5.00	15.12
A-3a	0.86	8.5	3.0	2.4	7.02	43.47
A-3b	0.86	8.5	3.0	2.4	7.09	43.90
					Total	145.34

50-year storm, 1-hour rainfall*

Drainage Area	C	Tc (min)	i (in/hr)	CF	A (acres)	Q (cfs)
A-1	0.43	25.0	4.0	1.6	15.86	43.65
A-2a**	0.90	8.0	4.0	2.4	1.56	13.48
A-2b**	0.42	8.0	4.0	2.4	5.00	20.16
A-3a	0.86	8.5	4.0	2.4	7.02	57.96
A-3b	0.86	8.5	4.0	2.4	7.09	58.54
					Total	193.79

* 50-year storm calculations were included for comparison purposes only.
** Area A-2 is divided into pavement area (A-2a) and vegetated area (A-2b) for calculations only but is labeled A-2 on the map.

A.2 CURRENT LJA DRAINAGE CONDITION (10YR-1HR)

Drainage Area	C	Tc (min)	i (in/hr)	CF	A (acres)	Q (cfs)
EX#1	0.89	5.0	3.0	2.8	0.57	4.26
EX#2	0.77	5.0	3.0	2.8	0.18	1.16
#1	0.71	5.0	3.0	2.8	0.02	0.12
#2	0.72	7.0	3.0	2.7	0.18	1.05
#3	0.53	9.0	3.0	2.4	0.15	0.57
#4	0.61	7.0	3.0	2.7	0.13	0.64
#5	0.65	6.5	3.0	2.7	0.14	0.74
#6	0.66	6.5	3.0	2.7	0.11	0.59
#7	0.45	11.0	3.0	2.3	0.17	0.53
#8	0.52	9.5	3.0	2.4	0.18	0.67
#9	0.57	7.5	3.0	2.6	0.15	0.67
#10	0.68	6.0	3.0	2.7	0.13	0.72
#11	0.88	5.0	3.0	2.8	0.06	0.44
#12	0.90	5.0	3.0	2.8	0.09	0.68
#13	0.59	6.0	3.0	2.7	0.14	0.67
#14	0.49	14.0	3.0	2.0	0.15	0.44
#15	0.50	20.0	3.0	2.8	0.08	0.34
#16	0.90	5.0	3.0	2.8	0.08	0.60
#17	0.90	5.0	3.0	2.8	0.07	0.53
#18	0.65	6.5	3.0	2.7	0.23	1.21
#19	0.67	6.5	3.0	2.7	0.19	1.03
#20	0.81	5.0	3.0	2.8	0.06	0.41
#21	0.83	5.0	3.0	2.8	0.11	0.77
#22	0.76	5.0	3.0	2.8	0.18	1.15
#23	0.82	7.0	3.0	2.7	0.71	4.72
#24	0.40	9.0	3.0	2.4	0.06	0.17
#25	0.40	14.0	3.0	2.0	0.11	0.26
EX#A	0.83	6.5	3.0	2.7	0.55	3.70
#A1	0.80	5.0	3.0	2.8	0.13	0.87
#A1-1	0.42	19.5	3.0	1.8	0.75	1.70
#A2	0.80	5.0	3.0	2.8	0.14	0.94
#A3	0.45	5.0	3.0	2.8	0.12	0.45
#A4	0.42	17.0	3.0	1.9	0.32	0.77
#A4-1	0.75	5.0	3.0	2.8	0.08	0.50
#A5	0.42	19.5	3.0	1.8	0.75	1.70
#A6	0.42	20.0	3.0	1.8	0.72	1.63
#A7	0.42	20.0	3.0	1.8	0.62	1.41
#A8	0.42	25.0	3.0	1.6	0.50	1.01
#A8-1	0.42	7.0	3.0	2.7	0.49	1.67
#A9	0.42	16.0	3.0	2.0	1.04	2.62
#B1	0.67	6.0	3.0	2.7	0.17	0.92
#B2	0.88	5.0	3.0	2.8	0.12	0.89
#B3	0.77	5.0	3.0	2.8	0.07	0.45
#B4	0.65	5.0	3.0	2.8	0.15	0.82
#B5	0.81	5.0	3.0	2.8	0.06	0.41
#B6	0.81	5.0	3.0	2.8	0.06	0.41
#B7	0.75	5.0	3.0	2.8	0.06	0.38
#C1	0.62	5.0	3.0	2.8	0.15	0.78
#C2	0.45	22.0	3.0	1.7	1.40	3.12
#C3	0.45	20.0	3.0	1.8	1.23	2.99
					Total	**55.28**

CURRENT LJA DRAINAGE CONDITION (50YR-1HR)

Drainage Area	C	Tc (min)	i (in/hr)	CF	A (acres)	Q (cfs)
EX#1	0.89	5.0	4.0	2.8	0.57	5.68
EX#2	0.77	5.0	4.0	2.8	0.18	1.55
#1	0.71	5.0	4.0	2.8	0.02	0.16
#2	0.72	7.0	4.0	2.7	0.18	1.40
#3	0.53	9.0	4.0	2.4	0.15	0.76
#4	0.61	7.0	4.0	2.7	0.13	0.86
#5	0.65	6.5	4.0	2.7	0.14	0.98
#6	0.66	6.5	4.0	2.7	0.11	0.78
#7	0.45	11.0	4.0	2.3	0.17	0.70
#8	0.52	9.5	4.0	2.4	0.18	0.90
#9	0.57	7.5	4.0	2.6	0.15	0.89
#10	0.68	6.0	4.0	2.7	0.13	0.95
#11	0.88	5.0	4.0	2.8	0.06	0.59
#12	0.90	5.0	4.0	2.8	0.09	0.91
#13	0.59	6.0	4.0	2.7	0.14	0.89
#14	0.49	14.0	4.0	2.0	0.15	0.59
#15	0.50	20.0	4.0	2.8	0.08	0.45
#16	0.90	5.0	4.0	2.8	0.08	0.81
#17	0.90	5.0	4.0	2.8	0.07	0.71
#18	0.65	6.5	4.0	2.7	0.23	1.61
#19	0.67	6.5	4.0	2.7	0.19	1.37
#20	0.81	5.0	4.0	2.8	0.06	0.54
#21	0.83	5.0	4.0	2.8	0.11	1.02
#22	0.76	5.0	4.0	2.8	0.18	1.53
#23	0.82	7.0	4.0	2.7	0.71	6.29
#24	0.40	9.0	4.0	2.4	0.06	0.23
#25	0.40	14.0	4.0	2.0	0.11	0.35
EX#A	0.83	6.5	4.0	2.7	0.55	4.93
#A1	0.80	5.0	4.0	2.8	0.13	1.16
#A1-1	0.42	19.5	4.0	1.8	0.75	2.27
#A2	0.80	5.0	4.0	2.8	0.14	1.25
#A3	0.45	5.0	4.0	2.8	0.12	0.60
#A4	0.42	17.0	4.0	1.9	0.32	1.02
#A4-1	0.75	5.0	4.0	2.8	0.08	0.67
#A5	0.42	19.5	4.0	1.8	0.75	2.27
#A6	0.42	20.0	4.0	1.8	0.72	2.18
#A7	0.42	20.0	4.0	1.8	0.62	1.87
#A8	0.42	25.0	4.0	1.6	0.50	1.34
#A8-1	0.42	7.0	4.0	2.7	0.49	2.22
#A9	0.42	16.0	4.0	2.0	1.04	3.49
#B1	0.67	6.0	4.0	2.7	0.17	1.23
#B2	0.88	5.0	4.0	2.8	0.12	1.18
#B3	0.77	5.0	4.0	2.8	0.07	0.60
#B4	0.65	5.0	4.0	2.8	0.15	1.09
#B5	0.81	5.0	4.0	2.8	0.06	0.54
#B6	0.81	5.0	4.0	2.8	0.06	0.54
#B7	0.75	5.0	4.0	2.8	0.06	0.50
#C1	0.62	5.0	4.0	2.8	0.15	1.04
#C2	0.45	22.0	4.0	1.7	1.40	4.16
#C3	0.45	20.0	4.0	1.8	1.23	3.99
					Total	**73.71**

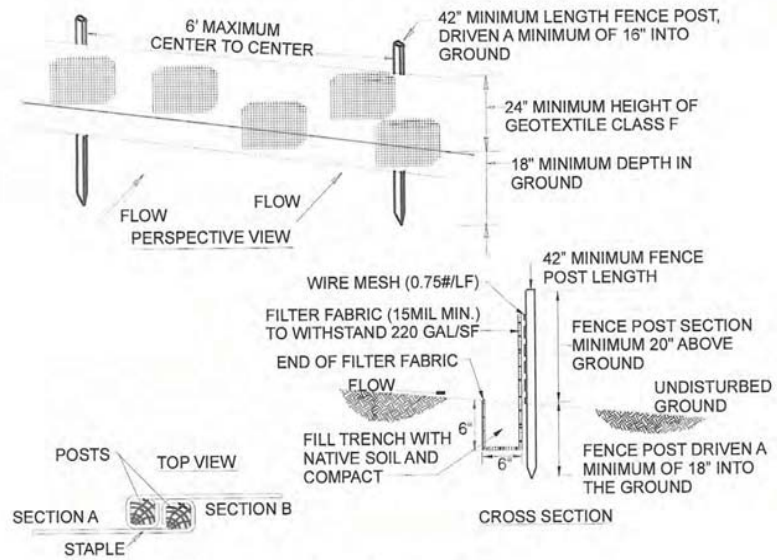
A.3 PROPOSED LJA DRAINAGE CONDITION (10YR-1HR)

Drainage Area	C	Tc (min)	i (in/hr)	CF	A (acres)	Q (cfs)
EX#1	0.89	5.0	3.0	2.8	0.57	4.26
EX#2	0.77	5.0	3.0	2.8	0.18	1.16
#1	0.71	5.0	3.0	2.8	0.02	0.12
#2	0.72	7.0	3.0	2.7	0.18	1.05
#3	0.53	9.0	3.0	2.4	0.15	0.57
#4	0.61	7.0	3.0	2.7	0.13	0.64
#5	0.65	6.5	3.0	2.7	0.14	0.74
#6	0.66	6.5	3.0	2.7	0.11	0.59
#7	0.45	11.0	3.0	2.3	0.17	0.53
#8	0.52	9.5	3.0	2.4	0.18	0.67
#9	0.57	7.5	3.0	2.6	0.15	0.67
#10	0.68	6.0	3.0	2.7	0.13	0.72
#11	0.88	5.0	3.0	2.8	0.06	0.44
#12	0.90	5.0	3.0	2.8	0.09	0.68
#13	0.59	6.0	3.0	2.7	0.14	0.67
#14	0.49	14.0	3.0	2.0	0.15	0.44
#15	0.50	20.0	3.0	2.8	0.08	0.34
#16	0.90	5.0	3.0	2.8	0.08	0.60
#17	0.90	5.0	3.0	2.8	0.07	0.53
#18	0.65	6.5	3.0	2.7	0.23	1.21
#19	0.67	6.5	3.0	2.7	0.19	1.03
#20	0.81	5.0	3.0	2.8	0.06	0.41
#21	0.83	5.0	3.0	2.8	0.11	0.77
#22	0.76	5.0	3.0	2.8	0.18	1.15
#23	0.82	7.0	3.0	2.7	0.71	4.72
#24	0.40	9.0	3.0	2.4	0.06	0.17
#25	0.40	14.0	3.0	2.0	0.11	0.26
EX#A	0.83	6.5	3.0	2.7	0.55	3.70
#A1	0.80	5.0	3.0	2.8	0.13	0.87
#A1-1	0.70	19.5	3.0	1.8	0.75	2.84
#A2	0.80	5.0	3.0	2.8	0.14	0.94
#A3	0.58	5.0	3.0	2.8	0.12	0.58
#A4	0.48	17.0	3.0	1.9	0.32	0.88
#A4-1	0.75	5.0	3.0	2.8	0.08	0.50
#A5	0.48	19.5	3.0	1.8	0.75	1.94
#A6	0.54	20.0	3.0	1.8	0.72	2.10
#A7	0.46	20.0	3.0	1.8	0.62	1.54
#A8	0.42	25.0	3.0	1.6	0.50	1.01
#A8-1	0.72	7.0	3.0	2.7	0.49	2.86
#A9	0.66	16.0	3.0	2.0	1.04	4.12
#B1	0.67	6.0	3.0	2.7	0.17	0.92
#B2	0.88	5.0	3.0	2.8	0.12	0.89
#B3	0.77	5.0	3.0	2.8	0.07	0.45
#B4	0.65	5.0	3.0	2.8	0.15	0.82
#B5	0.81	5.0	3.0	2.8	0.06	0.41
#B6	0.81	5.0	3.0	2.8	0.06	0.41
#B7	0.75	5.0	3.0	2.8	0.06	0.38
#C1	0.62	5.0	3.0	2.8	0.15	0.78
#C2	0.56	22.0	3.0	1.7	1.40	3.88
#C3	0.59	20.0	3.0	1.8	1.23	3.92
					Total	**61.88**

PROPOSED LJA DRAINAGE CONDITION (50YR-1HR)

Drainage Area	C	Tc (min)	i (in/hr)	CF	A (acres)	Q (cfs)
EX#1	0.89	5.0	4.0	2.8	0.57	5.68
EX#2	0.77	5.0	4.0	2.8	0.18	1.55
#1	0.71	5.0	4.0	2.8	0.02	0.16
#2	0.72	7.0	4.0	2.7	0.18	1.40
#3	0.53	9.0	4.0	2.4	0.15	0.76
#4	0.61	7.0	4.0	2.7	0.13	0.86
#5	0.65	6.5	4.0	2.7	0.14	0.98
#6	0.66	6.5	4.0	2.7	0.11	0.78
#7	0.45	11.0	4.0	2.3	0.17	0.70
#8	0.52	9.5	4.0	2.4	0.18	0.90
#9	0.57	7.5	4.0	2.6	0.15	0.89
#10	0.68	6.0	4.0	2.7	0.13	0.95
#11	0.88	5.0	4.0	2.8	0.06	0.59
#12	0.90	5.0	4.0	2.8	0.09	0.91
#13	0.59	6.0	4.0	2.7	0.14	0.89
#14	0.49	14.0	4.0	2.0	0.15	0.59
#15	0.50	20.0	4.0	2.8	0.08	0.45
#16	0.90	5.0	4.0	2.8	0.08	0.81
#17	0.90	5.0	4.0	2.8	0.07	0.71
#18	0.65	6.5	4.0	2.7	0.23	1.61
#19	0.67	6.5	4.0	2.7	0.19	1.37
#20	0.81	5.0	4.0	2.8	0.06	0.54
#21	0.83	5.0	4.0	2.8	0.11	1.02
#22	0.76	5.0	4.0	2.8	0.18	1.53
#23	0.82	7.0	4.0	2.7	0.71	6.29
#24	0.40	9.0	4.0	2.4	0.06	0.23
#25	0.40	14.0	4.0	2.0	0.11	0.35
EX#A	0.83	6.5	4.0	2.7	0.55	4.93
#A1	0.80	5.0	4.0	2.8	0.13	1.16
#A1-1	0.70	19.5	4.0	1.8	0.75	3.78
#A2	0.80	5.0	4.0	2.8	0.14	1.25
#A3	0.58	5.0	4.0	2.8	0.12	0.78
#A4	0.48	17.0	4.0	1.9	0.32	1.17
#A4-1	0.75	5.0	4.0	2.8	0.08	0.67
#A5	0.48	19.5	4.0	1.8	0.75	2.59
#A6	0.54	20.0	4.0	1.8	0.72	2.80
#A7	0.46	20.0	4.0	1.8	0.62	2.05
#A8	0.42	25.0	4.0	1.6	0.50	1.34
#A8-1	0.72	7.0	4.0	2.7	0.49	3.81
#A9	0.66	16.0	4.0	2.0	1.04	5.49
#B1	0.67	6.0	4.0	2.7	0.17	1.23
#B2	0.88	5.0	4.0	2.8	0.12	1.18
#B3	0.77	5.0	4.0	2.8	0.07	0.60
#B4	0.65	5.0	4.0	2.8	0.15	1.09
#B5	0.81	5.0	4.0	2.8	0.06	0.54
#B6	0.81	5.0	4.0	2.8	0.06	0.54
#B7	0.75	5.0	4.0	2.8	0.06	0.50
#C1	0.62	5.0	4.0	2.8	0.15	1.04
#C2	0.56	22.0	4.0	1.7	1.40	5.17
#C3	0.59	20.0	4.0	1.8	1.23	5.23
					Total	**82.50**

APPENDIX B SAMPLE RUNOFF MANAGEMENT DETAILS



CONSTRUCTION SPECIFICATION FOR ST-IV

1. FENCE POSTS SHALL BE A MINIMUM OF 36" LONG DRIVEN 16" MINIMUM INTO THE GROUND. WOOD POSTS SHALL BE 1-1/2" X 1-1/2" SQUARE (MIN.) CUT, OR 1-3/4" DIAMETER (MIN.) ROUND AND SHALL BE OF SOUND QUALITY HARDWOOD. STEEL POSTS WILL BE STANDARD T OR U SECTION WEIGHTING NOT LESS THAN 1.00 POND PER LINEAR FOOT.

2. GEOTEXTILE SHALL BE FASTENED SECURELY TO EACH FENCE POST WITH WIRE TIES OR STAPLES AT TOP AND MID-SECTION AND SHALL MEET THE FOLLOWING REQUIREMENTS FOR GEOTEXTILE CLASS F:

TENSILE STRENGTH	50 LBS/IN (MIN.)	TEST: MSMT 509
TENSILE MODULUS	20 LBS/IN (MIN.)	TEST: MSMT 509
FLOW RATE	0.3 GAL^2 FT/MIN. (MAX.)	TEST: MSMT 322
FILTERING EFFICIENCY	75% (MIN.)	TEST: MSMT 322

3. WHERE ENDS OF GEOTEXTILE FABRIC COME TOGETHER, THEY SHALL BE OVERLAPPED, FOLDED AND STAPLED TO PREVENT SEDIMENT BYPASS.

4. SILT FENCE SHALL BE INSPECTED AFTER EACH RAINFALL EVENT AND MAINTAINED WHEN BULGES OCCUR OR WHEN SEDIMENT ACCUMULATION REACHES 50% OF THE FABRIC HEIGHT.

U.S. DEPARTMENT OF AGRICULTURE *NATURAL RESOURCES CONSERVATION SERVICE* *SYRACUSE, NEW YORK*	*SILT FENCE*	*STANDARD SYMBOL*

APPENDIX C UNILATERAL AGREEMENT

The following is a list of covenants required by the 1996 Unilateral Agreement. Each item was addressed in the 1997 Drainage and Surface Runoff Mitigation Report, as documented in this Appendix.

1. *The Declarant shall submit a detailed Drainage and Surface Runoff Mitigation Report to the Department of Public Works (DPW) and Department of Land Utilization (DLU) with the application for a Site Plan Review (SPR) for Phase I facilities. The Report shall incorporate government standards and the recommendations of the DPW and the U.S. Fish and Wildlife Service (USFWS) including but not limited to, the following:*

    a. *Confirmation that the Project will not impact the wetland restoration project proposed for Kawainui Marsh (the "Marsh") by the U.S. Army Corps of Engineers and the State Department of Land and Natural Resources, Division of Fisheries and Wildlife (DOFAW).*

Original Conditions

The flow that travels through Drainage Structure 1 (WKK1-205), located within State DOT Right-of-Way, is 49.25 cfs for a 10-year storm event, of which 16.51 cfs is runoff from within the proposed construction limits. The flow reaching Structure 1 is reduced by 35%. Total runoff travelling through Structures 2 and 3 is 46.33 cfs for a 10-year storm event. The flow reaching Structures 2 and 3 from within the construction limits is 21.10 cfs.

Kawai Nui Marsh has 6 sub-basins located within its watershed, totaling 8.24 sq. mi, which directly impact the proposed restoration project. The six sub-basins have a total sediment load equal to 6,685 tons/year. The LeJardin project site, 24 acres in size, is located in Kawai Nui Marsh Sub-basin 5, shown in Figure 6. Currently, Sub-basin 5, equal to 1,230 ac in size, delivers 1,470 tons/year of sediment to the marsh.

During Construction

Calculations for the proposed grading areas show that the total sediment load for the construction grading period is 78 tons, which equals 0.12 % of the total sediment load reaching the Marsh during a normal, non-raining season . The sediment leaving the project site corresponds to 0.0067 uniform inches of soil loss within the graded areas.

Post Construction

Post construction flows that travel through Drainage Structure 1 (WKK1-205) are estimated at 49.25 cfs for a 10-year storm event, of which 16.51 cfs is from within the construction limits. Total runoff travelling through Structures 2 and 3 is estimated at 46.33 cfs for a 10-year storm event, of which 21.10 cfs is from within the construction limits. A reduction in runoff rates of 57% have been calculated comparing existing and post conditions from within the construction limits.

The sediment leaving the project after construction is complete is equal to 0.006 uniform inches of soil loss within the project site. The corresponding sediment load is approximately 5 ton/acre/year, which equals 80 tons/year for the LeJardin site.

b. Identification of the type and location of the specific measures to reduce sediment runoff into the Marsh during the construction phase.

Specific sediment reduction measures have been included throughout the initial report. They include silt fencing, straw bales and sediment filters.

c. A Best Management Practice (BMP) Plan to control and reduce the discharges of pollutants resulting from construction operations, into the municipal storm drain system. The BMP Plan shall include the provision that no grading of the site will take place during the months of November through March.

A BMP has been included showing the control and reduction of pollutant discharge. A provision that on-site mass grading will not take place during the months of November through March has been included.

d. Post-construction monitoring plan to evaluate characteristics of runoff discharged to the Marsh from the school.

Post construction monitoring to evaluate characteristics of the runoff discharged into the Marsh from the school is detailed within Appendix C.

e. Information regarding the location, ownership and sizes of the culvert and detention basin which cross Kalanianaole Highway, as well as the easements for the culvert and detention basin.

The location and ownership of the existing drainage facilities has been included. It should be noted that the depression located along Kalanianaole Highway is owned and maintained by the Department of Transportation, State of Hawaii.

MONITORING CONTROL PLAN FOR SEDIMENT DISCHARGE

Sediment-laden runoff can have adversely damaging effects on streambeds and natural wetland areas. Suspended sediment can carry harmful bacteria, and alter the functioning of an aquatic community within a stream.

In planning for the LeJardin Academy project site, permanent erosion control measures were included to minimize the effects of runoff and sediment-laden runoff on the surrounding streams and Kawai Nui Marsh. Techniques include the following:

1. Leveling of the site to increase the time of concentration, from 8 minutes to 20 minutes, and detention time for storm runoff
2. Grassing and landscaping of approximately 10 acres, which is currently asphalt parking
3. Landscaping and lawn maintenance control - control of the use of fertilizers
4. Curb cuts that allow for runoff to travel over grassed or landscaped areas before reaching the final destination
5. Cleaning of parking lots and streets to reduce the sediment load and pollutants
6. Dry detention basins to trap solids
7. The use of buffers and easements to increase time of concentration and detention time

All of these measures have been included to ensure that damage to the marsh and surrounding wetlands will not occur.

To ensure that control measures are achieving the goals that have been set, a monitoring plan has been developed. Monitoring will take place at four catch basins located along the perimeter of the LeJardin project site. Three of the catchbasins are located along Kalanianaole Highway, and the fourth is located along Kapaa Quarry Road. Grab samples will be taken after each storm event greater than 1 inch, not less than quarterly. From these samples, sediment loads will be determined. A visual inspection of each structure will also be completed to further determine the quality and quantity of sediment that is leaving the site.

The monitoring plan will help to determine if the sediment load is abnormally high. If high levels of sediment are found during one phase of the monitoring, the contractor will be observed to see if proper techniques have been followed. The erosion control plan will be re-evaluated for effectiveness.

OPERATIONAL AND MAINTENANCE PLAN

The Department of the Army has recommended that an operational and maintenance plan be developed to assure that mitigation measures are actively implemented after construction is complete. LeJardin Academy has agreed to implement the following mitigative measures in an attempt to keep damage to the marsh at a minimum:

1. It is estimated that there are over 70 paperbark trees, which is known to be damaging to the marsh ecosystem, on the proposed LeJardin Academy campus. LeJardin agrees to conduct a removal and replacement plan for the existing paperbark trees between 1998 and 2003. In situations where adverse visual effects or slope/stability problems will result, the paperbark trees will not be removed. No additional paperbark trees will be planted.

2. To minimize the damage of the existing paperbark trees, LeJardin agrees to conduct an ongoing program to clean-up tree litter and seeds. On a weekly basis, litter will be collected and properly removed of in a City and County of Honolulu landfill.

LeJardin agrees to properly maintain all sediment reducing structures. Cleaning of all swales and drainage structures will take place after every significant rainfall, not less than once monthly. All sediment collected from these structures will be properly.