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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 4, 2016

Mr. Scott Glenn, Interim Director
Office of Environmental Quality Control
Department of Health, State of Hawaii
235 S. Beretania Street, Room 702
Honolulu, Hawaii 96813

RECEIVED
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OFC. OF ENVIRONMENTAL QUALITY CONTROL

Dear Mr. Glenn:

Draft Environmental Assessment
State DLNR, Division of Forestry and Wildlife
Makiki Baseyard Improvements Project
Honolulu, Oahu, Hawaii
Tax Map Key: (1) 2-5-019: portion of 008

The State of Hawaii, Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) is proposing the subject project situated at TMK (1) 2-5-019: portion of 008. This project involves an Agency Action, and 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 determination.

Please publish notice of the availability of this Draft EA in the March 23, 2016 issue of *The Environmental Notice*. We have enclosed a completed OEQC Publication Form, a hard copy of the Draft EA, copy of the Draft EA document in Adobe Acrobat PDF format on a CD, and an electronic copy of the publication form as a Microsoft Word file.

If you have any questions, please contact Mr. David Smith, DOFAW Administrator 587-0168.

Sincerely,

SUZANNE D. CASE
Chairperson

Enclosures
cc: Ronald A. Sato, AICP, HHF Planners

AGENCY
PUBLICATION FORM

Project Name:	State DLNR, Division of Forestry and Wildlife, Makiki Baseyard Improvements Project
Project Short Name:	DOFAW Makiki Baseyard Improvements Project
HRS §343-5 Trigger(s):	Use of State lands and funds, and use within Conservation District land.
Island(s):	Oʻahu
Judicial District(s):	Honolulu Judicial District
TMK(s):	(1) 2-5-019: portion of 008
Permit(s)/Approval(s):	Conservation District Use Permit, NPDES Permit (construction activities), Construction Noise Permit, Water Use Permit, Building Permit, Grading Permit
Proposing/Determining Agency:	State of Hawaiʻi, Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW)
Contact Name, Email, Telephone, Address	Mr. Jason Misaki (DOFAW); Jason.C.Misaki@hawaii.gov (808) 973-9786, 2135 Makiki Heights Drive, Honolulu, Hawaiʻi 96822
Accepting Authority:	N/A (for EIS submittals only)
Contact Name, Email, Telephone, Address	N/A (for EIS submittals only)
Consultant:	HHF Planners
Contact Name, Email, Telephone, Address	Ronald A. Sato, AICP, rsato@hhf.com, (808) 457-3172, 733 Bishop Street, Suite 2590, Honolulu, Hawaiʻi 96813

Status (select one)	**Submittal Requirements**
_X_ DEA-AFNSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
____ FEA-FONSI	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the proposing agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.
____ FEIS Acceptance Determination	The accepting authority simultaneously transmits to both the OEQC and the proposing agency a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
FEIS Statutory Acceptance	Timely statutory acceptance of the FEIS under Section 343-5(c), HRS, is not applicable to agency actions.
____ Supplemental EIS Determination	The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.

____ Withdrawal — Identify the specific document(s) to withdraw and explain in the project summary section.

____ Other — Contact the OEQC if your action is not one of the above items.

Project Summary
Provide a description of the proposed action and purpose and need in 200 words or less.

The State of Hawai'i, Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) is proposing facility and infrastructure improvements for its existing baseyard facility located in the Makiki district of the Island of O'ahu. Baseyard facility growth has been incremental in nature, resulting in the development of temporary structures which DOFAW has outgrown. A master plan has been prepared for DOFAW's baseyard, and improvements planned will provide permanent and improved facilities to address existing inefficiencies and better support their operations. Improvements include development of additional facilities, replacement of temporary structures with permanent facilities, renovation of existing facilities, and improvements to existing infrastructure. Low impact design elements are incorporated as part of proposed improvements to ensure the project does not impact nearby natural resources. These improvements will increase DOFAW capacity to manage their islandwide operations and more effectively implement program activities.

STATE DLNR DIVISION OF FORESTRY AND WILDLIFE

MAKIKI BASEYARD
IMPROVEMENTS PROJECT

DRAFT ENVIRONMENTAL ASSESSMENT

MARCH 2016

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Mason Architects

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HAWAII

STATE DLNR DIVISION OF FORESTRY AND WILDLIFE

MAKIKI BASEYARD
IMPROVEMENTS PROJECT

DRAFT ENVIRONMENTAL ASSESSMENT

MARCH 2016

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TABLE OF CONTENTS

LIST OF FIGURES

APPENDICES

CHAPTER 1
INTRODUCTION AND BACKGROUND

The State of Hawaiʻi (State), Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) is proposing to improve its existing Makiki Baseyard facility to better support their island-wide operations. The facility is located in Makiki Valley on the Island of Oʻahu. This project is referred to as the "Makiki Baseyard Improvements Project" and a State Environmental Assessment document is being prepared.

1.1 Purpose for Environmental Assessment

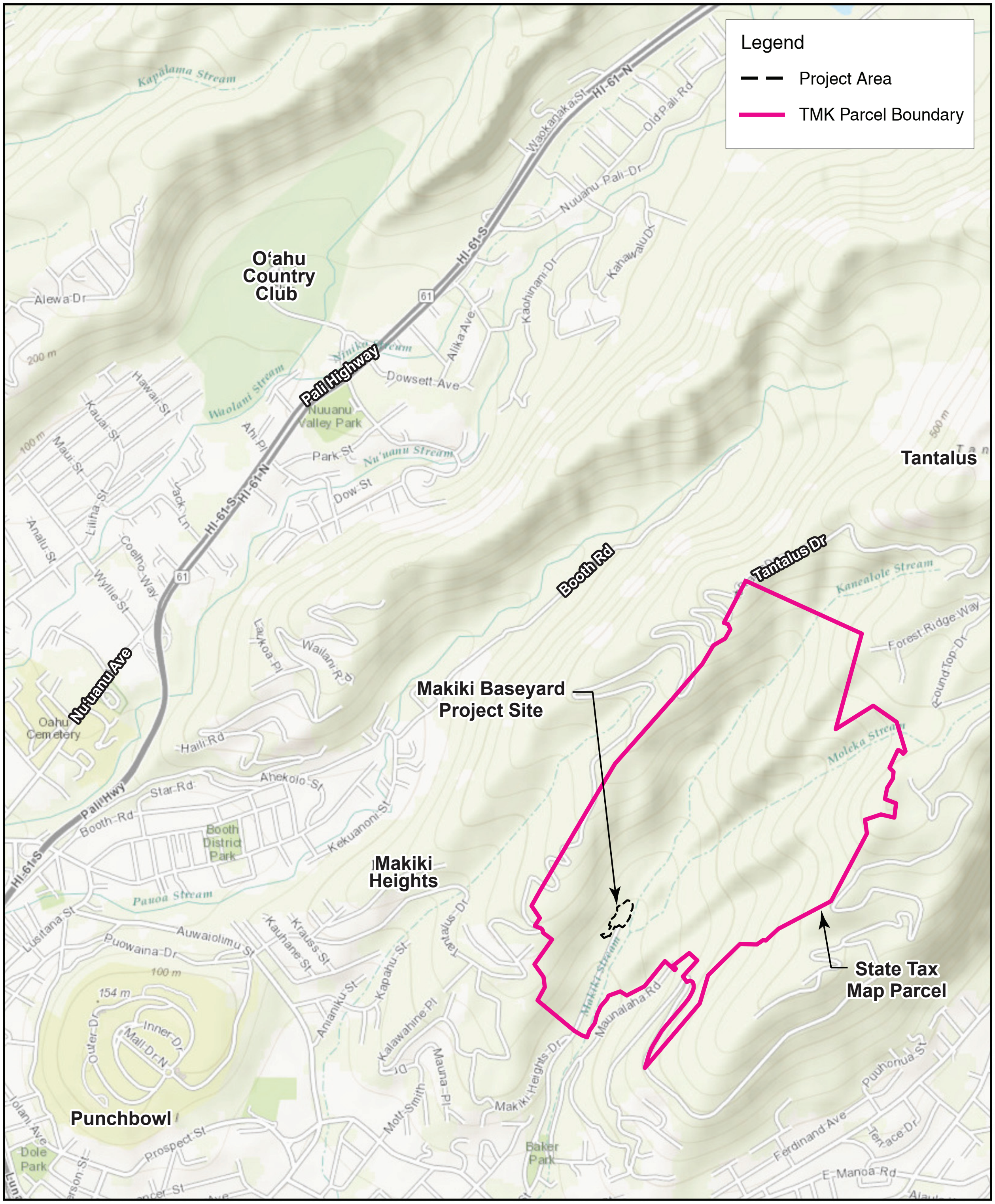
A master plan was prepared for DOFAW by Mason Architects, Inc. (MAI) that programs future improvements for this facility. Improvements generally involve: 1) construction, expansion, and renovation of DOFAW facilities; 2) installation of roadway and parking improvements; and 3) other site improvements to address wastewater, drainage, and landscaping needs. Project improvements are planned to occur within a 3.05-acre area located within a larger 346-acre property owned by the State of Hawaiʻi. Figure 1.1 is a project location map showing the project site in relation to the larger State parcel.

The State DLNR has funded implementation of the first phase of this master plan, and the project site is owned by the State under the regulatory jurisdiction of DOFAW. The project site is also located within the State's "Conservation District" and therefore, falls under the regulatory jurisdiction of the State Board of Land and Natural Resources (BLNR). Permitted uses within the State Conservation District are described in Title 13, Chapter 5, Hawaiʻi Administrative Rules (HAR) (State of Hawaiʻi, 2011).

Since the project uses State funds and lands and is located within the State Conservation District, the project is subject to environmental documentation requirements prescribed under Chapter 343 (Environmental Impact Statements), Hawaiʻi Revised Statutes (HRS), as amended (State of Hawaiʻi, 2007) and Title 11, Chapter 200 (Environmental Impact Statement Rules), Hawaiʻi Administrative Rules (HAR), as amended (State of Hawaiʻi, 2008). This environmental document was developed in compliance with these regulations.

Applicant and Approving Agency

HHF Planners 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 the action. The State DLNR will also serve as the "Approving Agency" for this Environmental Assessment. Table 1.1 provides a summary of pertinent project information.



DOFAW Makiki Baseyard Improvements Project

Figure 1.1 – Project Location Map

Honolulu, Hawai'i

0 3000 Feet

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Table 1.1 Project Summary

Project Name:	Makiki Baseyard Improvements Project
Applicant:	Division of Forestry and Wildlife Department of Land and Natural Resources State of Hawai'i 1151 Punchbowl Street, Room 325 Honolulu, Hawai'i 96813 Contact: Jason Misaki, Wildlife Manager Telephone: (808) 973-9786
Authorized Agent:	HHF Planners Pacific Guardian Center, Makai Tower 733 Bishop Street, Suite 2590 Honolulu, Hawai'i 96813 Contact: Mr. Ronald A. Sato, AICP Telephone: (808) 457-3172
Approving Agency:	Division of Forestry and Wildlife Department of Land and Natural Resources State of Hawai'i
Project Location:	Project located in *mauka* area of the Makiki district, comprising a portion of a 346-acre property owned by the State of Hawai'i.
Tax Map Key:	(1) 2-5-019: portion of 008
Project site:	The project site comprises 3.05 acres.
Project Description:	Construction of additional buildings and improvements to existing facilities to enhance DOFAW's ability to manage their island-wide operations and more effectively implement organization activities.
Existing Use:	DOFAW facilities make up the majority of existing uses at the project site. There are a total of 21 structures present. Some are permanent, but most are temporary facilities. These include DOFAW's administrative office, storage spaces for DOFAW programs, containers converted to storage space, vehicle sheds, and a plant nursery. A City Board of Water Supply chlorinator facility is also located on this site, but it is not currently in use.
State Land Use District Classification:	Conservation District, Resource Subzone
City Primary Urban Center Development Plan:	Preservation Area
Special Management Area:	Not applicable. Project site is not within the City SMA boundary.
City Zoning District:	P-1, Restricted Preservation District
Flood Zone Designation:	Zone X – Areas outside the 500-year (0.2% annual chance) floodplain.

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 government agencies and neighborhood organizations as part of the environmental review process. Consultation efforts are discussed in detail later in this document. Comment letters received from parties consulted and associated responses are included in Appendix A of this document.

1.2 Project Background

The project site is generally located in Makiki, a neighborhood in the City and County of Honolulu (City). The DOFAW Makiki Baseyard presently encompasses both permanent and temporary buildings. The development of the baseyard has been driven by incremental growth in DOFAW operations that has been organic in nature. As a result, many existing baseyard facilities are temporary structures consisting of sheds and trailers. These temporary facilities do not effectively or efficiently support DOFAW operations because the organization's operations have outgrown existing accommodations. The project will provide permanent facilities to replace existing temporary structures, providing better support for DOFAW's administrative and operational needs.

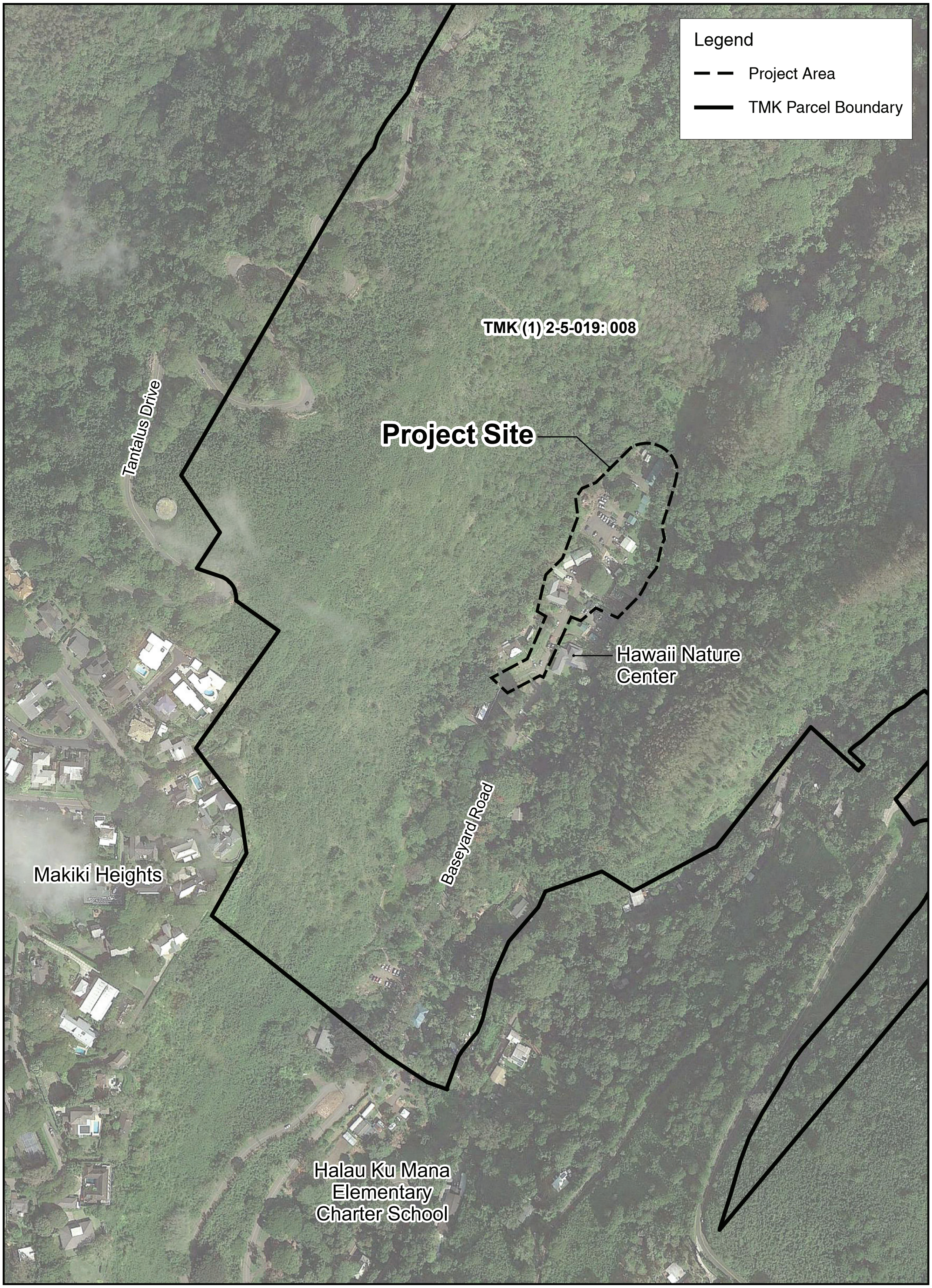
Applicant (DOFAW) Background

DOFAW is one of 11 divisions under the State DLNR responsible for the management of public natural resources in the State of Hawaiʻi. The organization's mission is to effectively manage Hawaiʻi's natural, cultural, and historic resources for current and future generations. This includes the people of Hawaiʻi and its visitors.

DOFAW representatives are natural resource managers who play a pivotal role in protecting the State's watersheds, forest resources, and endangered species. DOFAW manages several programs geared to these ends, including the Hawaiʻi Conservation Resource Enhancement Program, the Hawaiʻi Endangered Bird Conservation Program, and the Hawaiʻi Youth Conservation Corps.

1.3 Project Location and Surrounding Uses

The project site is located in Makiki Valley within the Makiki neighborhood that is a subarea of the Makiki-Tantalus region. This existing baseyard site is situated within a larger 346-acre property owned by the State that is also part of the larger Honolulu Watershed Forest Reserve. Figure 1.2 is a vicinity map that includes an aerial photograph showing the baseyard and other uses in the immediate vicinity.



DOFAW Makiki Baseyard Improvements Project

Figure 1.2 – Project Vicinity Map

Honolulu, Hawaiʻi

0 400 Feet

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Vehicular access to the DOFAW baseyard is provided through a paved access road located off Makiki Heights Drive. This access road passes through the State property leading to the baseyard (Exhibit 1.1). The DOFAW Makiki Baseyard is situated about 1,400 feet (0.27 miles) further from the driveway entrance at Makiki Heights Drive. Exhibit 1.2 shows the entrance to the baseyard. Upslope of the Makiki Baseyard is the Honolulu Watershed Forest Reserve.


Exhibit 1.1 South View Driveway Through Property


Exhibit 1.2 Entrance to DOFAW Baseyard

The lower area of this State property from Makiki Heights Drive up to DOFAW's facility is under the jurisdiction of the State DLNR, Division of State Parks (DSP), and is used for the Makiki Valley State Recreational Area. This recreational area includes a gravel parking lot (Exhibit 1.3) and access to the Makiki Arboretum Trail that connects to other hiking trails located upslope (*mauka*) including the Kanealole and Maunalaha Trails. The Hawai‘i Nature Center (HNC) is located below (*makai*) the baseyard site (Exhibit 1.4) which is under the oversight of DLNR's DSP. A cottage with associated structures are located *makai* of DOFAW's Makiki Baseyard and across the HNC. This cottage is used by both the HNC and DOFAW. Other uses situated along the driveway leading to the baseyard are two residences.


Exhibit 1.3 Parking Area and Hiking Trails Access


Exhibit 1.4 Hawai‘i Nature Center

Kanealole and Moleka Streams run downslope from the mountainous interior region of the Makiki Watershed and are tributaries of Makiki Stream. These streams converge into Makiki Stream near the project site. Makiki Stream then runs east and downslope of the project site as shown on Exhibit 1.5.

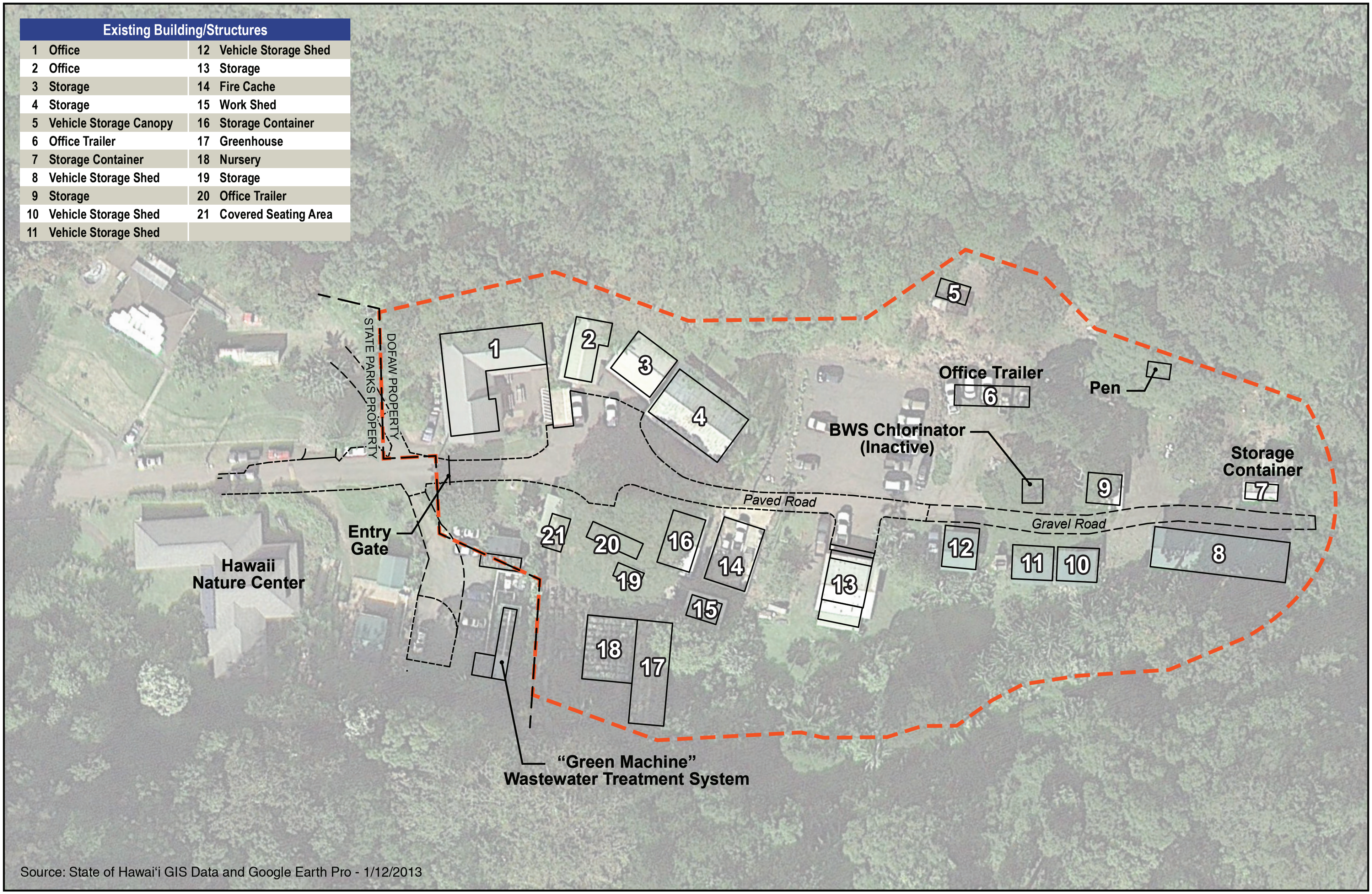

Exhibit 1.5 Makiki Stream, Downslope (East) of Green Machine

The HNC operates an onsite wastewater treatment facility called the Green Machine that processes wastewater from both the HNC and DOFAW's baseyard. The Green Machine operates as an above-grade constructed wetland treatment system. This wastewater system is a form of ecological sewage treatment designed to mimic the cleansing functions of wetlands. Treated secondary effluent processed by the Green Machine is discharged as recycled water (R-2) into onsite subsurface irrigation fields located nearby within the DSP jurisdictional area. This Green Machine was constructed about 20 years ago for an off-site use. The HNC acquired the Green Machine in 2004 to service their facility and moved it to the site. The irrigation fields that currently receive waters processed by the Green Machine were installed when the HNC's new administration building was constructed.

1.4 DOFAW Makiki Baseyard Facilities

The Makiki Baseyard serves as the main operations facility for implementing DOFAW's conservation and education programs. Baseyard facilities include DOFAW's administrative office and various program storage spaces. Exhibit 1.6 shows an oblique aerial view of the project site. Programs administered from the project site include the Natural Area Reserve System, the Na Ala Hele Hawai'i Trails and Access System, and the organization's wildlife program. The project site also supports the operation of satellite baseyards throughout O'ahu along with field operations in the Northwestern Hawaiian Islands. Figure 1.3 includes an existing site map identifying existing buildings and structures within this facility along with the jurisdictional boundary separating DOFAW's baseyard from the DSP recreational area.

Exhibit 1.6 Oblique Aerial View of Project Site



Source: State of Hawai'i GIS Data and Google Earth Pro - 1/12/2013

DOFAW Makiki Baseyard Improvements Project

Figure 1.3 – Existing Site Map

Honolulu, Hawai'i

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Existing Facilities

Over the years, the Makiki Baseyard has expanded in a reactionary manner to meet the growing programmatic and functional needs of its programs through the addition of temporary office and storage structures. There are 21 structures on-site ranging in size and form and include both permanent and temporary buildings. Many of the temporary structures are comprised of office trailers, metal shipping containers converted to storage structures, and steel-framed carports to partially shelter vehicles and equipment. The total floor area of existing facilities is 13,500 SF. This figure does not include the floor area of the Nursery/Green House Structure that is present on site. This structure was not included in total floor area calculations for existing facilities because it does not house DOFAW equipment or personnel, nor is it intended for long-term occupation. Table 1.2 outlines the distribution of existing floor area for the project in greater detail.

Table 1.2 Distribution of Floor Area, Existing Facilities

Description	Gross Floor Area (SF)
1. Administration Building	2,500
2. Open Air Pavilion (Building 21)	300
3. Office and Storage Buildings	6,000
4. Vehicle Storage Sheds and Canopies	4,100
5. Trailers	600
Total Floor Area	*13,500**

*Excludes Nursery/Green House Structures (3,000 SF) because structure does not house DOFAW equipment or personnel nor is it intended for long-term habitation.

The most recent addition to the site is the Fire Cache building, which was completed in 2013. This building is shown in Exhibit 1.7. Other structures are older and have been used for several decades. The administration building is located at the *makai* end of the project site and was constructed in 1994. This permanent structure is roughly 2,500 SF and is shown in Exhibit 1.8. The Natural

Exhibit 1.7 Fire Cache Building

Exhibit 1.8 Administration Building

Area Reserves System (NARS) storage building is made up of two shipping containers (Building 16, Figure 1.3) connected with a wooden roof, and is about 700 SF. This structure (Exhibit 1.9) is used to store supplies and materials under a covered workspace. DOFAW uses a building (Building 4, Figure 1.3) that once served as the original administrative facility to store equipment and supplies, which is about 1,600 SF. Next to this storage building is a roughly 800 SF structure (Building 3, Figure 1.3) that serves as the storage and staging area for the Na Ala Hele Trails and Access System program. This structure was constructed from shipping containers and was originally built as a shared woodshop (Exhibit 1.10). DOFAW's wildlife program operations are housed in a masonry structure that is currently used as the main work area for Wildlife Staff (Building 2 Figure 1.3). A wooden structure (Building 13 Figure 1.3), serves as the main storage area for DOFAW's wildlife program. Other project site structures consist of steel-framed carports with metal roofing for vehicles (Exhibit 1.11) and equipment storage.

Exhibit 1.9. NARS Office and Storage Building

Exhibit 1.10 Na Ala Hele Storage Building (Left)

Exhibit 1.11 Steel Framed Carports

Exhibit 1.12 Plant Nursery with Greenhouse

DOFAW also has a plant nursery located within this facility comprised of several greenhouses (Exhibit 1.12). The nursery area total about 3,000 SF. A City Board of Water Supply (BWS) chlorinator facility is located at the *mauka* end of the baseyard (facility shown on Figure 1.3). The chlorinator facility (Exhibit 1.13) is not in use by the BWS. Vacant gravel areas are also located on site and are used for staff parking.

Exhibit 1.13 BWS Chlorinator Facility

Exhibit 1.14 Leach Field Site in Fronting Cottage.

As previously discussed, the HNC's Green Machine wastewater treatment facility is located adjacent and *makai* of the project site within the DSP jurisdictional area. The Green Machine provides wastewater treatment for DOFAW's baseyard, the HNC, and a cottage located outside the project site. Treated secondary effluent is discharged as recycled water (R-2) to a subsurface irrigation field located *makai* of DOFAW's administrative office. The subsurface irrigation field is located on DSP property and is not on lands under DOFAW jurisdiction. It occupies approximately 4,000 SF in area and is located in front of a cottage shared by DOFAW and the HNC (Exhibit 1.14)

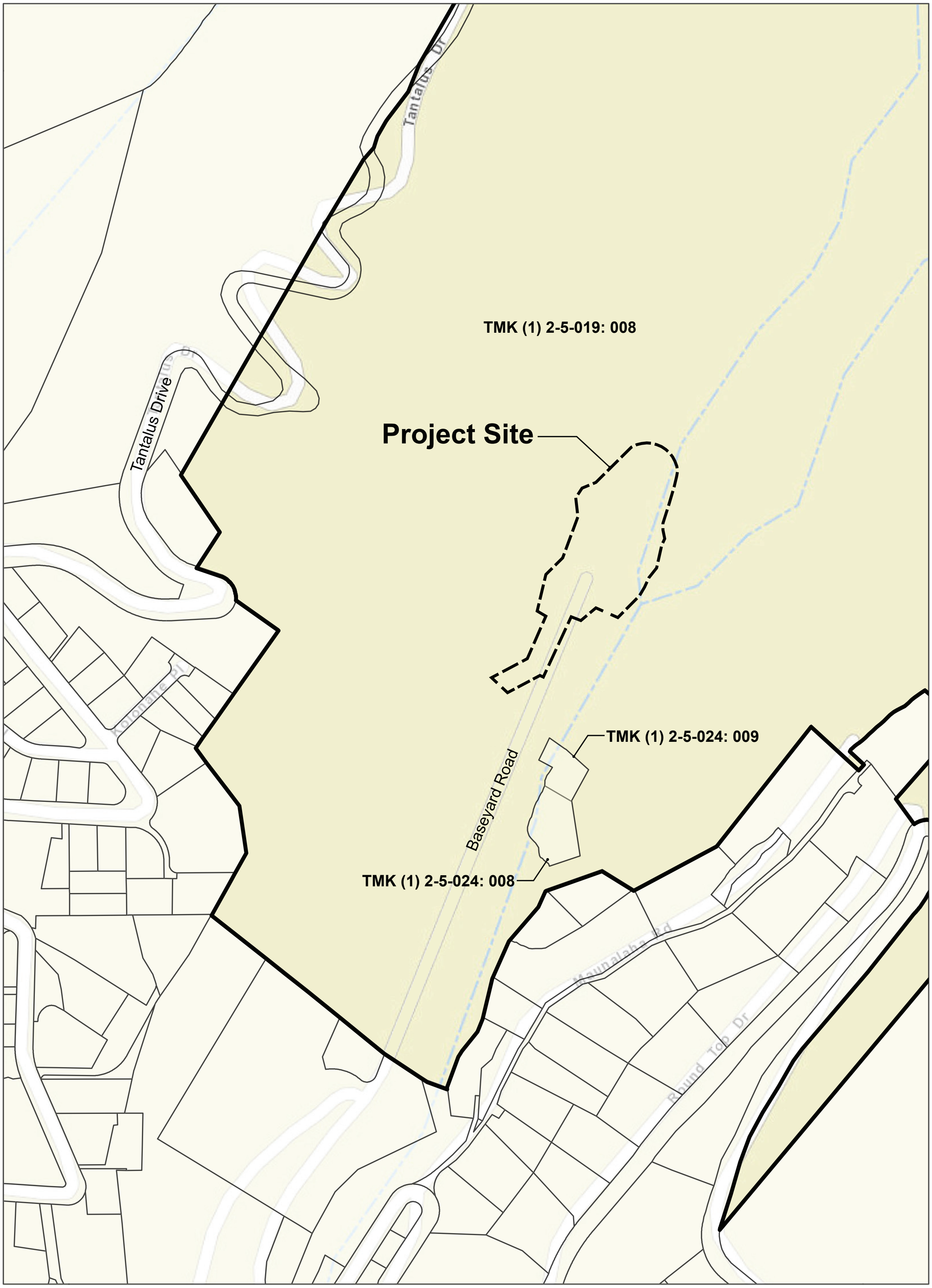
1.5 Property Information

The project site is a portion of the parcel identified by Tax Map Key (TMK) No. (1) 2-5-019: 008. The larger parcel that includes the project site is owned by the State of Hawai‘i with the Makiki Baseyard site under the jurisdiction of DOFAW, and the area below the project site under DSP jurisdiction. Figure 1.4 shows the project site in relation to Tax Map parcel boundaries.

There are also two small State owned parcels, (1) 2-5-024: 009 (0.24 acres) and (1) 2-5-024: 008 (0.52 acres), that are located within the larger State parcel. Both parcels are situated across (east of) Makiki Stream within the area under DSP jurisdiction, and are leased to private parties.

A summary of information on the larger parcel and the project site is provided below.

Tax Map Key Parcel:
(1) 2-5-019: 008: 346.4 acres
DOFAW Baseyard Project site: 3.05 acres



DOFAW Makiki Baseyard Improvements Project

Figure 1.4 – TMK Map

Honolulu, Hawaiʻi

0 400 Feet

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CHAPTER 2
PROJECT DESCRIPTION AND ALTERNATIVES

The growth of the Makiki Baseyard over time has been organic in nature and reactionary to meet the growing programmatic and functional needs of DOFAW's programs. Over time, this has resulted in the addition of temporary office and storage structures. The master plan prepared by Mason Architects, Inc. (MAI) is intended to be a guide for DOFAW to implement future facility improvements that will support their agency mission, the public interest, and sustain and enhance their operations on the Island of Oʻahu. This section discusses the purpose and need for the improvements included in the master plan and overall project objectives.

2.1 Purpose and Need

The project site is the operational headquarters for DOFAW's Oʻahu based activities. However, DOFAW operations have outgrown the use of the project site's limited permanent structures such as the main administration building, an office building, and a storage building. Existing baseyard facilities presently do not effectively and efficiently support agency operations. Other existing structures are temporary in nature. These temporary structures include metal shipping containers repurposed as storage structures or sheds comprised of pole-framed carports used to cover equipment or vehicles (see Chapter 1 Exhibits).

The proper storage of equipment and other supplies within permanent and secure storage buildings is needed to support DOFAW's operational and management activities. Adequate facilities would reduce equipment exposure to the elements and protect equipment from deterioration over time. Permanent, secure facilities would also reduce the potential for vandalism and theft.

DOFAW administrative staff, along with staff of DOFAW programs such as the Wildlife Program, require adequate office space. With the exception of the administration building, other structures at the site used for offices are temporary in nature and do not provide an adequate working environment for staff.

Existing facilities are unable to accommodate DOFAW's future operational needs. In 1994, there were only four sheds to accommodate DOFAW's 22 staff members. Since that time, the main administration building was constructed, and other structures (including office trailers, storage spaces, and vehicle sheds) were added to accommodate growth in staffing. These temporary solutions must be replaced by permanent facilities.

Currently, about 30 staff members operate out of the baseyard with about 25 of those staff members leaving for other operational sites on Oʻahu. In the future, it is anticipated that DOFAW will employ an additional 24 staff members for a total of 54 staff. Increases in staffing will be needed to effectively manage the island's resources and support DOFAW's programs that are operated from the baseyard. Therefore, baseyard facilities must have the capacity to accommodate additional staff members. Given anticipated increases in staffing and the inadequacy of existing baseyard facilities, a master plan was needed to program future facility requirements. This pressing need resulted in the development of the proposed conceptual plan for the baseyard. Improvements identified in this master plan can be programmed for funding and implemented over time, providing permanent facilities to replace the temporary structures.

2.2 Project Objectives

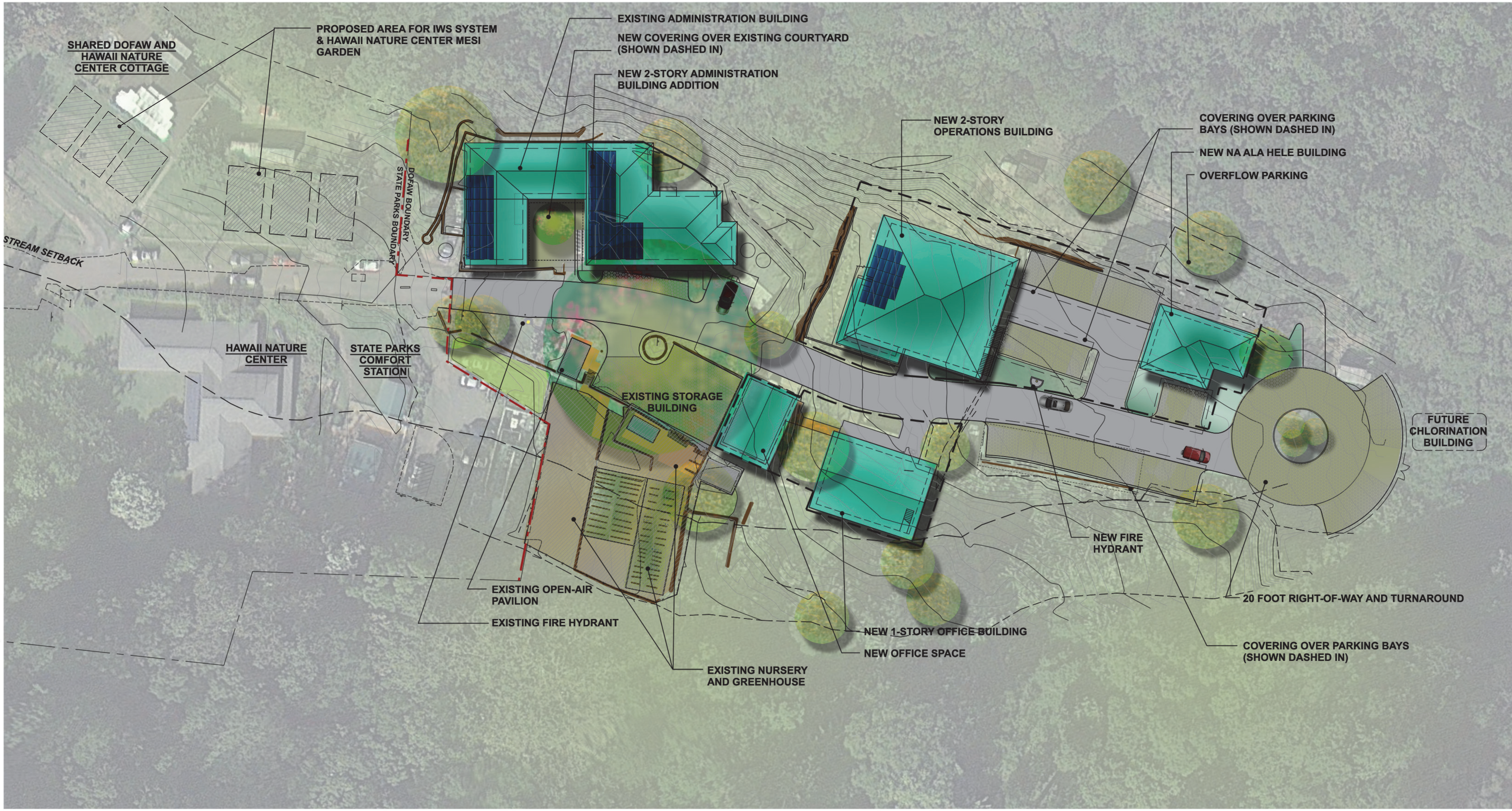
The objective of this project is to provide improved, permanent facilities at DOFAW's Makiki Baseyard to allow for the efficient programming and implementation of facility improvements. These improvements will be guided by the master plan already prepared. Improved facilities would support DOFAW's ability to effectively manage O'ahu's natural resources, improve the organization's operational efficiency, and support the agency's mission. Permanent and secure facilities would reduce risk of vandalism or theft and protect equipment from the elements. Improved facilities would provide staff with a better working environment, enhancing their quality of life and increasing the efficiency of their daily activities.

2.3 Project Description

The MAI conceptual master plan serves as the framework to guide future improvements at the baseyard (Figure 2.1). Implementation of this master plan would facilitate improved operational efficiency in a manner that is sensitive to the environment, supports the agency's mission, and allows for programming of future budget requests.

The master plan layout limits development to previously disturbed areas. It does not propose extensive site work or construction of major retaining walls. The master plan layout respects site terrain and therefore minimizes the environmental impact of project construction while lowering project costs. Connectivity between buildings and functional circulation is an important theme incorporated into the master plan layout. Building themes and architectural style are important elements that were considered to create a cohesive, campus-like setting that aligns with DOFAW's mission, enhances the working environment, and improves the quality of life for employees and visitors.

Sustainability elements would be incorporated into the design of facilities and site development, including: 1) utilization of rainwater catchment systems; 2) Low Impact Development (LID) stormwater strategies; 3) solar energy technology; 4) natural lighting of interior spaces, and 5) energy efficient lighting and equipment selections. Incorporation of these sustainability concepts aligns with DOFAW's mission to protect the State's valuable natural resources.



Source: Mason Architects

DOFAW Makiki Baseyard Improvements Project

Figure 2.1 – Conceptual Master Plan

Honolulu, Hawai'i

2.3.1 Buildings and Structures

As shown on Figure 2.1, the conceptual site plan proposes to eliminate temporary structures, while renovating or demolishing select existing structures. Plan implementation will result in the creation of six main buildings (including the existing Administration Building). The existing nursery and green house structures along with the open-air pavilion would remain. An interior sprinkler system would be installed within the new and renovated buildings to comply with fire code requirements

The floor area of existing project site facilities is 13,500 SF. Project improvements involve demolishing or renovating existing facilities and constructing new facilities. After project improvements occur, floor area will increase from 13,500 SF to 31,200 SF. Table 2.1 describes the change in floor area from existing to proposed improvements in greater detail. The increase in lot coverage will not be significant. Existing lot coverage is 10 percent of the 3.05 acre project site and would increase to 23 percent as a result of project implementation.

Table 2.1 Distribution of Floor Area, Proposed Improvements

Description	*Existing Floor Area (SF)*	*Floor Area Demolished (SF)*	*Existing Floor Area, Undemolished or Renovated (SF)*	*Floor Area of New Construction (SF)*	*Floor Area at Project Buildout (SF)*	INCREASE IN FLOOR AREA (EXISTING TO PROPOSED) (SF)
			Existing facilities			
Administration Building	2,500	0	2,500	0	2,500	0
Open Air Pavilion (Building 21)	300	0	300	0	300	0
			New Construction			
Office and Storage Buildings	6,000	-4,600	1,400	21,900	23,300	17,300
Vehicle Storage Sheds and Canopies	4,100	-4,100	0	5,100	5,100	1,000
			Demolished Facilities			
Trailers	600	-600	0	0	0	-600
Total Floor Area (SF)***	13,500	-9,300	4,200	27,000	31,200	17,700

***Includes Administration building expansion (8,500 SF), Operations Building (9,800 SF), Office Building (Former Building 13) (2,100 SF), Na Ala Hele Building (1,500 SF).*
*** Includes new office renovated from former Fire Cache (1,100 SF).*
****Total Floor Area calculation excludes Nursery/Green House Structures (3,000 SF) because structure does not house DOFAW equipment or personnel nor is it intended for long term habitation.*

The expansion of the Administration Building will involve demolishing an existing office (Building 2) and two storage buildings (Buildings 3 and 4) situated upslope and to the northeast of the existing Administration Building. The addition will be a two-story building with a height of about 35 feet. This extension would serve as the main administrative center with offices, meeting rooms, a library, storage, and other staff amenities. The existing Administration Building interior would be renovated and converted to predominantly office work areas for DOFAW program staff. A new covering will be provided over the existing central courtyard located between the Administration Building and the building addition as shown on Figure 2.1.

A new two-story operational support building (9,800 SF) would be constructed *mauka* of the Administration Building extension where an unpaved gravel parking area is currently located. This building would be used by DOFAW operational staff and will include storage space, offices, and lockers. This two-story building would have a height of about 35 feet. Further *mauka* of the new Operations Building will be a new single-story building that will serve staff of the Na Ala Hele Trails and Access Program. The Na Ala Hele Building is planned to provide storage space for the Na Ala Hele program and the baseyard fire equipment.

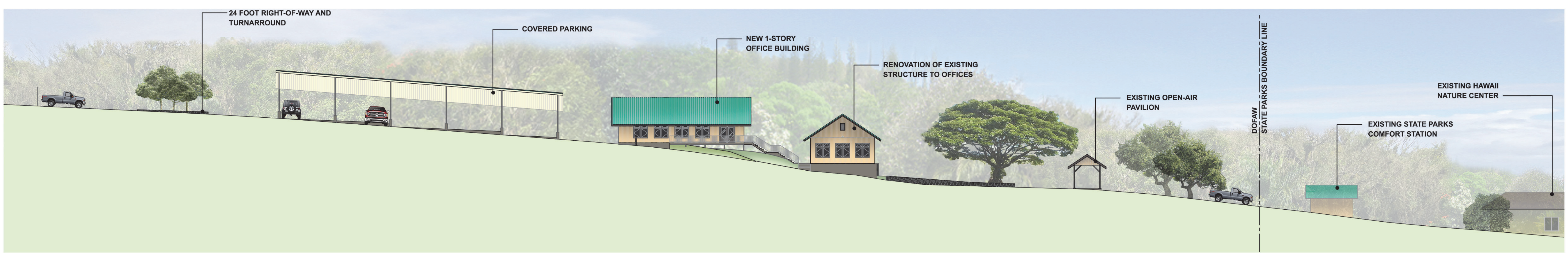
Existing Building 14, the former Fire Cache (1,100 SF) is generally situated across from the new Operations Building, and will be renovated for office space. Existing Building 13, (Wildlife storage building), situated *mauka* of Building 14, will be demolished so that a new single-story building can be constructed there. This new building (2,000 SF) will be used as additional office and storage space for DOFAW.

An existing open-air pavilion situated across from the existing Administration Building will remain. Other structures that will not be demolished are a work shed (Building 21), greenhouse (Building 17), nursery (Building 18), and storage building (Building 19). All other structures, including the City BWS chlorinator building, will be demolished.

2.3.2 Site Development and Infrastructure Improvements

Site development is intended to minimize cut and fill activities within the property that generally slopes upward toward the north. Figure 2.2 illustrates project site topographic conditions and how the buildings would be incorporated into the topography. A few retaining walls would be required behind the existing Administration Building and for the new Operations Building. Site development will include improvements to the driveways running through the project site, walkways around buildings, and parking areas. A 20-foot-wide roadway with a vehicle turnaround at the *mauka* end of the site would be provided to comply with fire code requirements (see Figure 2.1).

FROM PROPOSED ROAD LOOKING TOWARDS MOUNTAIN



FROM PROPOSED ROAD LOOKING TOWARDS STREAM

Source: Mason Architects

DOFAW Makiki Baseyard Improvements Project

Figure 2.2 – Conceptual Section Views of Buildings

Honolulu, Hawai'i

0 100 Feet

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Sustainability elements would also be incorporated in the design of infrastructure and site development. Green infrastructure improvements would promote groundwater recharge and reduce stormwater discharge from increased impermeable surfaces related to increases in floor area. Low impact design (LID) elements such as, bioswales, rain gardens, bioretention areas, and rain catchment systems, along with photovoltaic systems would be considered in the project's design for their feasibility and practicability. Further details on planned drainage improvements are discussed in Chapter 4.

A total of 69 parking stalls are proposed under the master plan. This includes four parking stalls meeting American Disability Act requirements. Parking areas are shown on Figure 2.1, and would be spread throughout the site. Most vehicular parking areas will be covered with the exception of the parking bay located at the top of the baseyard driveway that will be uncovered. The covered parking would be an open-air design likely consisting of metal frames with a metal roof.

An existing Hawaiian Electric Company (HECO) easement running through the project site would be realigned as part of the site redevelopment. DOFAW will coordinate with HECO to ensure this realignment complies with HECO regulations. DOFAW will also coordinate with the City BWS to establish an easement for new waterline improvements.

Wastewater System Improvements

Existing wastewater flows generated from DOFAW facilities are treated using an onsite Green Machine wastewater treatment system operated by the HNC. The Green Machine is located just outside the baseyard in between the nursery facility and the HNC. This treatment system processes flows from DOFAW and HNC. Chapter 3 discusses this existing treatment system in greater detail.

Due to rehabilitation improvements that would be required to maintain the shell and structural supports of the Green Machine, future wastewater flows generated from the proposed project, the HNC, and the Ranger Cottage will be transferred to a new subsurface constructed wetlands system. The proposed system is capable of accommodating future wastewater from these facilities in a manner sensitive to the fragile nature of project site natural resources. Separate septic systems will function as the primary method of treatment for wastewater from these facilities. Treated wastewater will flow from the septic system to the subsurface constructed wetland system for secondary treatment. The proposed location for this system is the area *makai* of the DOFAW baseyard within the subsurface irrigation fields currently utilized by the Green Machine. This location is shown in Figure 2.1. Secondary treated effluent will be discharged to an onsite disposal field proposed for the location of the existing leach field in front of the Ranger Cottage.

Unlike the existing wastewater system, the majority of wastewater from the proposed system will not be chlorinated for reuse. A small portion of treated effluent will be chlorinated, flowing to a small educational demonstration area located on HNC property. This reused water will support the growth of native Hawaiian plant material and will show visitors how wastewater might be repurposed. The current Green Machine will be decommissioned. Chapter 4 discusses projected flows and the new wastewater system in greater detail.

Landscape Improvements

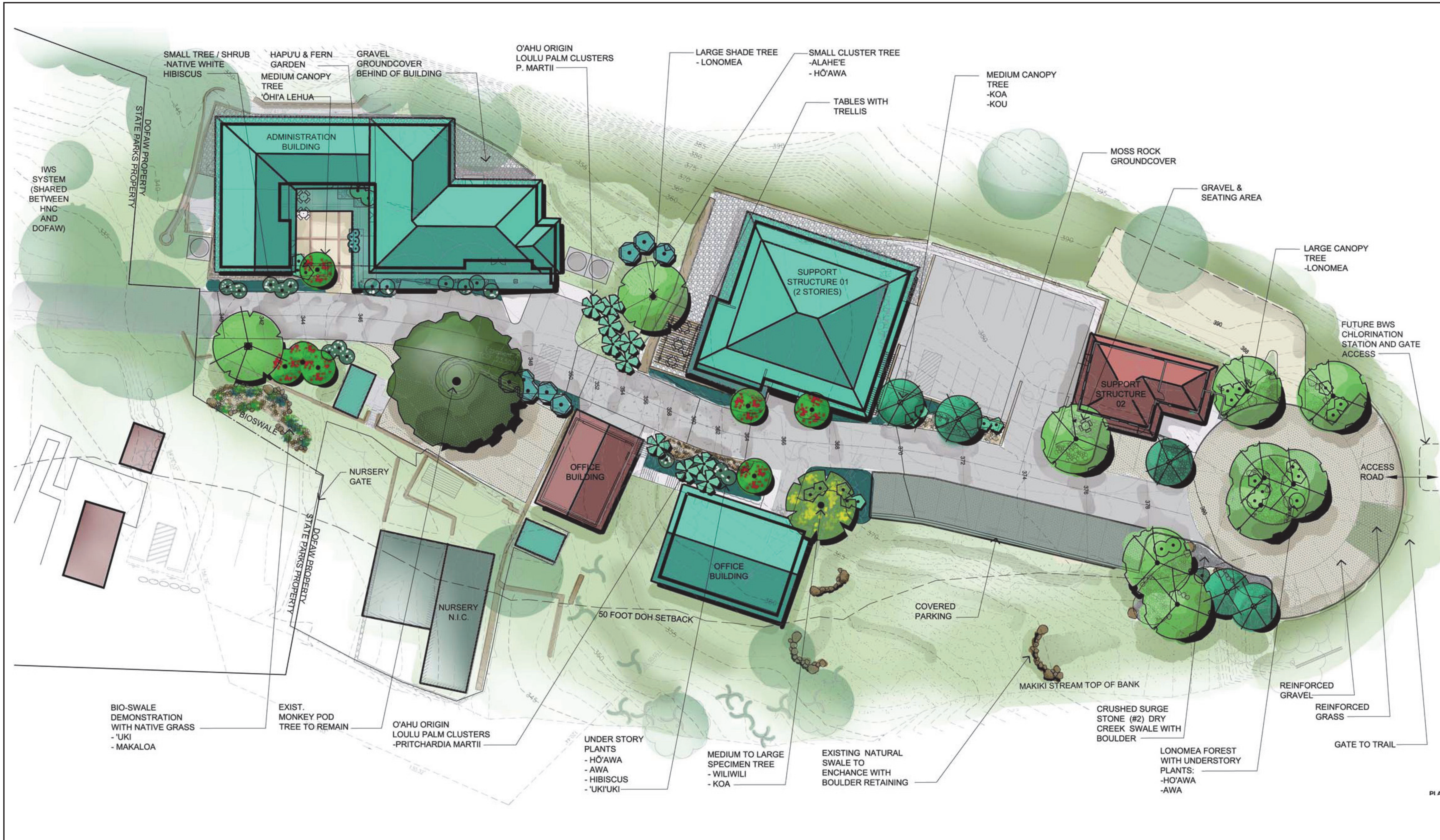
Proposed landscaping improvements are guided by DOFAW's environmental stewardship and sustainability goals. Careful consideration of these goals allows a balance to be attained between the organization's desire to expand their facility and its mission to encourage environmental sustainability. A preliminary conceptual landscaping plan shown in Figure 2.3 incorporates native vegetation in planned landscaped areas, aligning with DOFAW's mission to foster the growth of Hawai'i's native plants. These native plants could also serve as a living onsite repository for native plants and seeds. Figure 2.4 shows some of the native plants that would be included as part of landscape improvements.

2.3.3 Project Phasing and Estimated Costs

The master plan developed for DOFAW's Makiki Baseyard will serve as a guide for future site development. All improvements included under this master plan can only be implemented subject to available funding from the State Legislature. There may be changes occurring over time that alter DOFAW organizational priorities, which would impact the feasibility and practicability of constructing proposed facilities. However, this master plan provides the overall framework on which to base future decisions, and establishes priorities for funding requests to the State Legislature or other sources, such as grants.

Proposed improvements can be implemented once the environmental review process is completed and applicable land use entitlements are obtained. The first phase of necessary ministerial permits would also be obtained as part of the design and implementation phase. The environmental review and entitlement processes are planned to be completed by the end of fall of 2016.

The master plan incorporates phasing of site and facility improvements to allow implementation to occur in stages as funds become available. Phase 1A of implementation would involve construction of the new Na Ala Hele Building, covered parking area, and upper site improvements (e.g. driveway, parking, utilities). Phase 1 construction is anticipated to start at the beginning of 2017. Phase 1B of implementation is anticipated to occur soon after and would involve the design of the Administration Building along with remaining site work. Future phases of the project would be determined based upon funding availability and DOFAW program priorities. Project improvements are planned to occur over 10 years with project buildout anticipated in 2027. The estimated total cost of project improvements is just over $16 million.



DOFAW Makiki Baseyard Improvements Project

Figure 2.3 – Preliminary Landscaping Plan

Honolulu, Hawai'i

0 40 Feet

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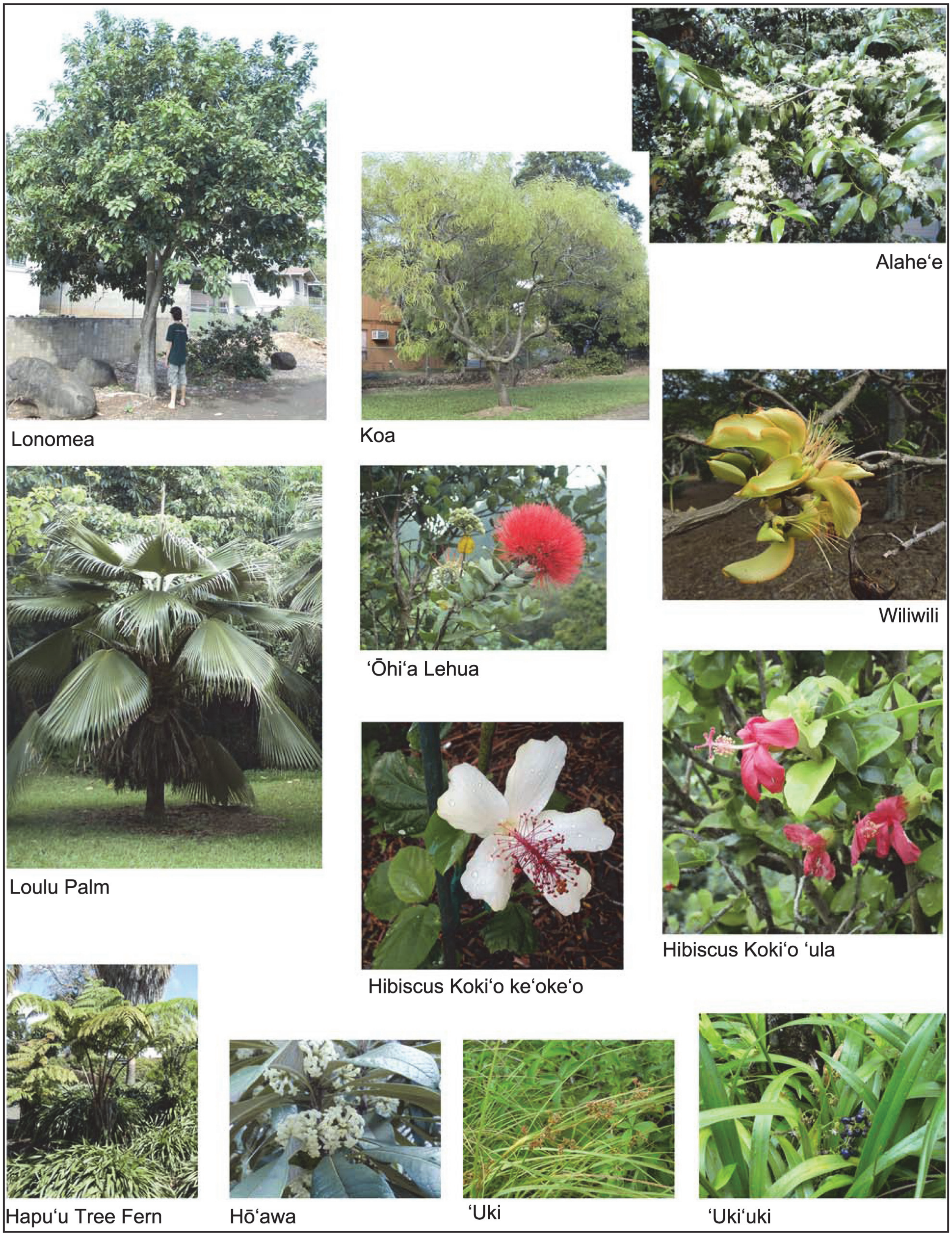

DOFAW Makiki Baseyard Improvements Project

Figure 2.4 - Proposed Plants, Project Site Landscaping

Honolulu, Hawai‘i

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2.3.4 List of Permits and Approvals

The proposed project may require the following discretionary land use approvals and ministerial permits.

State of Hawai‘i

Department of Health

- National Pollutant Discharge Elimination System (NPDES) Permit - Construction Activities
- Approval for Usage of Permanent Wastewater System Within No Pass Zone
- Construction Noise Permit

Department of Land and Natural Resources

- Conservation District Use Permit

Department of Land and Natural Resources, Commission of Water Resource Management

- Water Use Permit

Department of Land and Natural Resources, Historic Preservation Division

- Chapter 6E, HRS, Historic Preservation Review

City and County of Honolulu

Board of Water Supply

- Approval to Work in BWS Utilities

Department of Planning and Permitting

- Building Permit
- Grading Permit

2.4 Alternatives Considered

This section discusses alternatives to the Makiki Baseyard Improvements Project that were considered: 1) not implementing project improvements, otherwise referred to as the “No-Action Alternative” and 2) implementing improvements developed under a previous master plan created for the project site (2011 Master Plan). These alternatives were eliminated from further consideration due to several factors discussed below. The No Action Alternative would serve to establish baseline conditions (conditions if the project was not implemented) to assess impacts resulting from the proposed project.

2.4.1 No Action Alternative

The No-Action Alternative assumes the master plan is not implemented. Under this alternative, DOFAW’s existing facilities would continue to be used for their operations. Wastewater flows generated would continue to be treated by the Green Machine system. Over the next 10 years, anticipated increases in demands placed on DOFAW’s resource management initiatives and programmatic growth would likely create pressure to increase staffing and provide more temporary space.

This alternative was eliminated from consideration because it would not meet the purpose and need for the project. The Makiki Baseyard has grown over the years in a reactionary manner to meet the growing programmatic and functional needs of DOFAW's programs. Under the No Action Alternative, this situation would worsen due to the pressure from increased program demands placed on existing facilities. Over time, DOFAW would need to increase the capacity of their baseyard by adding more temporary offices and storage structures to support their operations. This condition would not support DOFAW's ability to effectively and efficiently meet agency missions, the public interest, nor would it sustain and enhance management of resources and operations on the island.

Existing facilities do not effectively and efficiently support agency operations. DOFAW operations have outgrown the use of limited permanent structures. Maintaining existing baseyard conditions into the future would negatively affect staff and operations. Equipment, parts, and other supplies would not be adequately stored in permanent and secure storage buildings, increasing the potential for theft, vandalism, or accelerated deterioration from the weather. Such conditions increase the frequency and costs for replacement parts and new equipment, which is difficult to sustain given limited budgets. These conditions would also affect the operations of other related agencies, such as NARS and Na Ala Hele, which operate out of this baseyard.

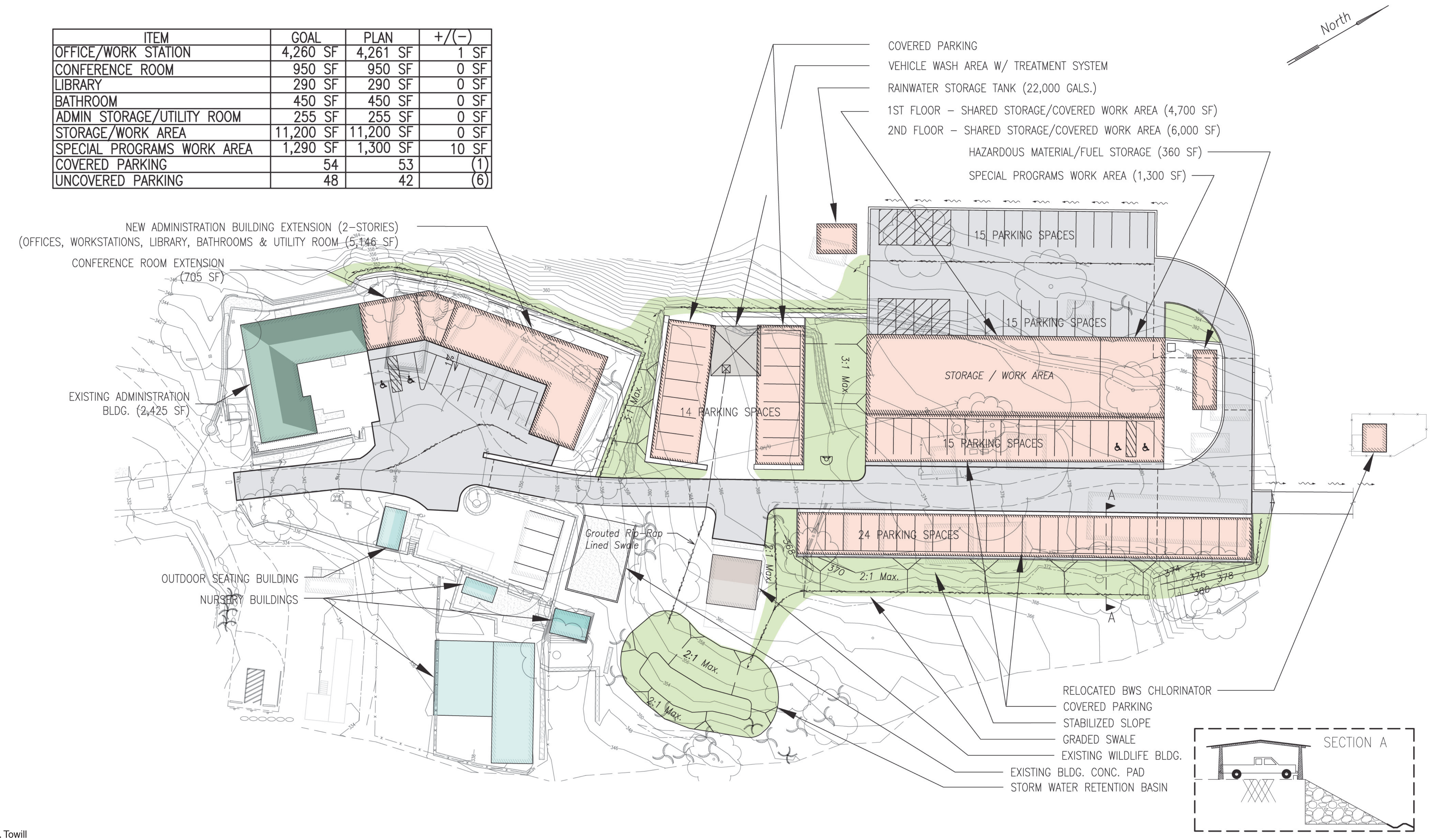
2.4.2 2011 Master Plan Alternative

A prior master plan for the project was prepared for DOFAW in 2011 (RMTC, 2011). This plan included new facilities, parking areas, and other site improvements to address future programmatic needs and proposed to remove temporary structures along with demolishing select buildings to accommodate new buildings. Figure 2.5 shows this earlier conceptual plan.

The 2011 plan proposed a two-story addition to the Administration Building to provide additional office space. Operational personnel and resources would be accommodated in a facility located on the northern side of the project site, away from the Administration Building. Surface parking would encompass a major portion of the project site. Construction of the operational building would require replacement or removal of several existing trees and replacement of the City BWS chlorinator facility. These improvements would require substantial grading and drainage improvements along with construction of additional retaining walls.

The 2011 master plan alternative was eliminated from consideration because proposed improvements would require a significant amount of site work and DOFAW desired a more environmentally sensitive design concept. The 2011 master plan would require more grubbing and grading activities, resulting in greater impacts to the site's topography and surrounding environment. A greater number of retaining walls would also be required, increasing construction costs. The 2011 plan's proposed parking area would require removal of a large amount of

ITEM	GOAL	PLAN	+/(−)
OFFICE/WORK STATION	4,260 SF	4,261 SF	1 SF
CONFERENCE ROOM	950 SF	950 SF	0 SF
LIBRARY	290 SF	290 SF	0 SF
BATHROOM	450 SF	450 SF	0 SF
ADMIN STORAGE/UTILITY ROOM	255 SF	255 SF	0 SF
STORAGE/WORK AREA	11,200 SF	11,200 SF	0 SF
SPECIAL PROGRAMS WORK AREA	1,290 SF	1,300 SF	10 SF
COVERED PARKING	54	53	(1)
UNCOVERED PARKING	48	42	(6)



Source: R.M. Towill

DOFAW Makiki Baseyard Improvements Project

Figure 2.5 – 2011 Master Plan Conceptual Plan

Honolulu, Hawai'i

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vegetation along with a significant amount of the hillside at the northwest end of the property (see Figure 2.5). Expansion of the Administration Building would similarly require extensive alteration of the hillside above the existing building. The design concept for buildings were more industrial in appearance compared to existing facilities. DOFAW preferred a building aesthetic that was more compatible with the design of the existing Administrative Building.

After careful consideration, DOFAW desired a conceptual master plan for the baseyard that would be more sensitive to existing site conditions and topography, better incorporate existing vegetation and landscaping and include more aesthetically compatible building design concepts. Consequently, DOFAW had another master plan developed for this facility that better met their design objectives, and was more compatible with the surrounding environment. A new master plan was prepared in October 2012 by HHF Planners that served as the basis for their current master plan (HHF, 2012). MAI subsequently refined the master plan to meet DOFAW's current priorities resulting in the proposed master plan for this project.

CHAPTER 3
DESCRIPTION OF AFFECTED ENVIRONMENT

This chapter describes the existing environmental setting of the project site and establishes baseline conditions for environmental resources that may be directly or indirectly affected by the project. Chapter 4 evaluates the project's environmental consequences in comparison to the baseline conditions established in this chapter.

Climate

The State of Hawai'i's climate is moderate throughout the island chain although climatic differences occur due to topographical variation between islands. On O'ahu, the Ko'olau and Wai'anae mountain ranges are oriented almost perpendicular to trade winds, resulting in regional climatic differences. O'ahu's temperature has little seasonal variation such that local temperatures vary on average only 7 degrees between the warmest months (August and September) and the coolest months (January and February). Temperatures vary about 12 degrees between day and night.

Historic climate data for Honolulu shows annual average temperatures ranging from a low of 67.4 degrees to a high of 84.4 degrees Fahrenheit (WRCC 2015). Rainfall averages annually between 73.4 and 64.2 inches per year in the project site (Giambelluca et al 2013).

Winds predominantly flow from the northeast in a "trade wind" pattern except for periods when "Kona" storms generate strong southerly winds, or when the trade winds are weak leading to on shore sea breezes. Wind speeds typically vary between 10 and 20 miles per hour providing relatively good ventilation. Lower velocities (less than 10 mph) occur when dominant trade wind patterns shift, giving way to light and variable wind conditions. Light and variable wind conditions occur through the winter and into early spring. The project site is located in the basin of Makiki Valley, and is relatively sheltered while the valley's exposed ridgelines are often buffeted by strong gusts.

3.1 Geography, Topography, and Soils

3.1.1 Geography

O'ahu is volcanic in terms of geologic origin. The landscape of the island has been shaped over time by natural forces resulting in physiographic features like coastal plains, uplands, cliffs, and valleys. The island is considered a volcanic doublet, which is formed by the Wai'anae Range on the west and the younger Ko'olau Range on the east. Both mountain ranges are the eroded remnants of great shield volcanoes that have lost most of their original shield outlines and are now long narrow ridges. Honolulu is located on the southern side of the Ko'olau Range. Eruptions in this region resulted in the formation of tuff and cinder cones, which are now prominent Honolulu geological landmarks. The most significant volcanic feature relevant to the project area is Mount

Tantalus (*Pu‘u Ohia*). Makiki Valley is bounded by the Ko‘olau Mountain Range summit on the inland (*mauka*) side and is located between the steep ridges that comprise Mount Tantalus.

3.1.2 Topography

The project site slopes gradually in a *mauka* to *makai* direction. Elevation at the project site ranges from a low of roughly 337 feet above mean sea level (AMSL) near the entrance to the baseyard to a high of nearly 388 feet AMSL near the rear of the project site. Lateral variation in elevation increases moderately from the project site's general elevation of 343 feet AMSL to 396 feet AMSL on the western portion of the project site. The project site slopes downward on its eastern flank to a low of 335 feet AMSL. Figure 3.1 illustrates the general topographic characteristics of the project site.

3.1.3 Soils

The U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NCRS) (formerly the Soil Conservation Service) has established a system to classify soil by characteristics. The project site is comprised of the following types of soils: 1) Kaena stony clay soils (KaeD); 2) Rock land (rRK); and 3) Tantalus silt loam (TAF) soils. Figure 3.2 highlights the distribution of these soil types within the project site. Rock land and Kaena stony clay series soils comprise the majority of soil in the project site. The USDA Soil Conservation Service's Hawai‘i soil survey report provides characteristic information for each soil type (SCS 1972). Characteristics of these soils are discussed in detail below.

- Kaena Stony Clay Soils, 12 to 20 Percent Slopes (KaeD). This soil type is part of the Kaena soil series and consists of deep, poorly drained and stony soils on alluvial fans and talus slopes. However, the presence of stones in this soil does not prevent cultivation. Permeability is characteristically slow with medium runoff rates. These soils are sticky and very plastic with slight to neutral acidity. Workability of this soil is difficult and erosion risk is moderate.
- Rock Land (rRK). This soil type can be found in areas where exposed rock covers 25 to 90 percent of the surface. This soil is associated with rock outcrops and is very sticky and plastic. It has a high shrink-swell potential, and is susceptible to movement when saturated. These soils can be found across a range of elevations.
- Tantalus Silt Loam 40 to 70 Percent Slopes (TAF). Tantalus silt loam soil is part of the Tantalus soil series. This soil series encompasses well-drained soils on the island of O‘ahu. Tantalus silt loam and other soils within the series are located in upland areas of volcanic spurs and cinder cones. These soils are characterized by moderately rapid permeability with medium to rapid runoff rates. Acidity is neutral in the surface and subsoil layers. Erosion risk is severe.

DOFAW Makiki Baseyard Improvements Project

Figure 3.1 - Topographic Survey Map

Honolulu, Hawai'i

0 67 Feet

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DOFAW Makiki Baseyard Improvements Project

Figure 3.2 - Soil Survey Map

Honolulu, Hawai'i

0 83 Feet

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3.2 Natural Hazards

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

3.2.1 Earthquake Hazards

Earthquakes in the state are primarily caused by volcanic activity. Earthquakes may occur from the underground movement of magma toward the surface or during an eruption. Earthquakes also occur from the shifting of tectonic plates. Other than the Island of Hawaiʻi, the Hawaiian Islands are generally not situated in a high seismicity area subject to numerous large earthquakes (Macdonald, Abbott & Peterson, 1983).

The central region of the State, encompassing the islands of Maui and Oʻahu is subject to seismicity related to tectonic activity on the seafloor near the Hawaiian Islands. Tectonic activity capable of generating hazardous earthquakes are related to seafloor fractures and suspected faults near the islands. The largest seismic areas relevant to Oʻahu are the Molokaʻi Seismic Zone and the Diamond Head Fault as shown on Exhibit 3.1.

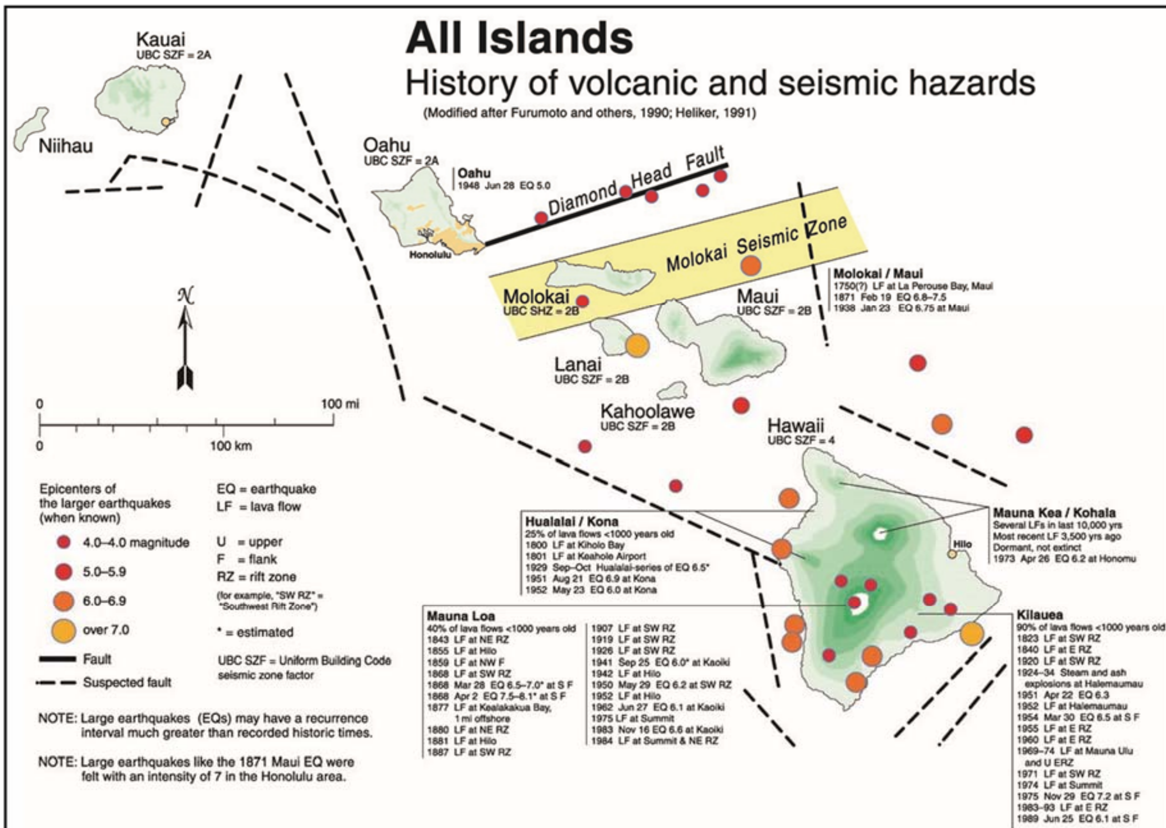


Exhibit 3.1 History of Volcanic and Seismic Hazards (USGS, 2002)

The Diamond Head Fault passes through Koko Crater and extends along the seafloor northeast of Oʻahu. Several earthquakes of 4.0 to 5.0 magnitude have occurred along this fault. The Molokaʻi Fracture Zone is an extension of a transform fault from the East Pacific Rise that extends from Molokaʻi 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 earthquakes in 1871 and 1938 have occurred along the fracture, it became referred to as the Molokaʻi Seismic Zone.

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 Oʻahu extending from Mākaha east around Diamond Head and Makapuʻu and north up to Kāneʻohe Bay was assigned a volcanic/seismic risk ranking of "3" due the regions proximity to the Molokaʻi Seismic Zone. The remainder of the island is ranked "2" with respect to volcanic/seismic hazard (USGS 2002). The project site is situated within the southern half of Oʻahu and has a moderately high (3 ranking) seismic risk ranking.

3.2.2 Hurricane Hazards

Hurricanes are tropical storms with winds greater than or equal to 74 miles per hour. They have affected every island in the State and can cause major damage and injury from high winds, marine over-wash, and heavy rains that result. 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 passed directly through the State, and actual hurricane strikes on the Hawaiian Islands are uncommon in the modern record. Near misses generating large swells and moderately high winds are more common. Near miss events cause varying degrees of damage. Exhibit 3.2 illustrates the paths of recent hurricanes affecting the Hawaiian Islands. The greatest threat related to hurricanes result from water-level rise from wave forces rather than wind forces. All coastal areas of the state are equally vulnerable to hurricane impacts, and the only mitigating variables are local in nature (e.g. slope, elevation, geology, offshore barriers) (USGS, 2002).

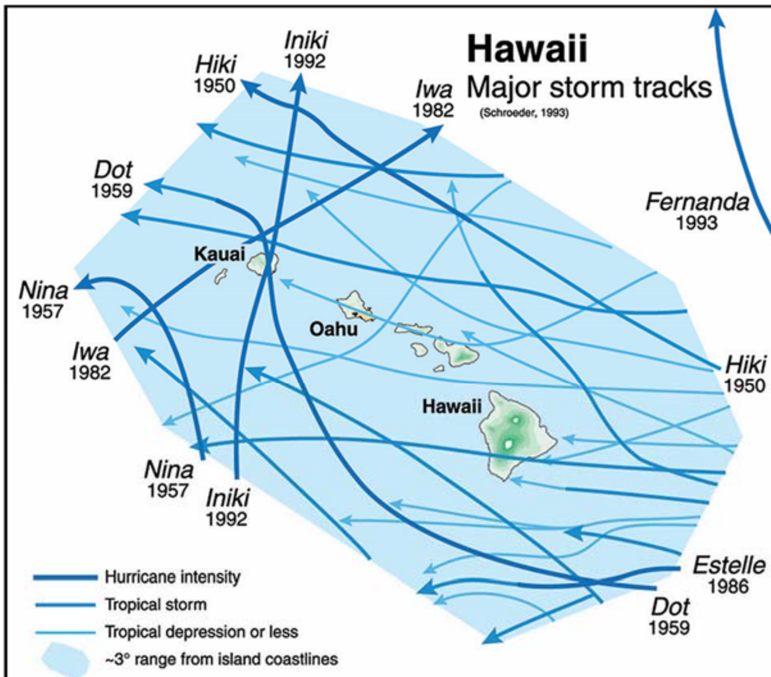


Exhibit 3.2 Major Storm Tracks (USGS, 2002)

Hurricane Iselle was the most recent hurricane that significantly affected the State of Hawai‘i. The hurricane made landfall on Hawai‘i Island on August 5th, 2014 resulting in significant damage to the southeast Ka‘u coast of the island. Damage from Hurricane Iselle resulted in the destruction of 11 residences and major to minor damage to 47 residences (FEMA 2014). Hurricane Iniki was the most significant hurricane event to impact the State prior to Hurricane Iselle. Hurricane Iniki made landfall on Kaua‘i on September 11th, 1992 resulting in severe damage to island homes (Post, Buckley, Schuch, & Jernigan, Inc. 1993). This hurricane also damaged the leeward coast of O‘ahu. Prior to the Hurricane Iniki event in 1992, nine hurricanes approached within 300 nautical miles (about one days travel time) of Hawai‘i coastlines during the period between 1970 and 1992 (Federal Emergency Management Association 1993). Most hurricanes affecting the islands have focused on Kaua‘i. Based upon a tracking of hurricanes since 1950, there appears to be no geographic or meteorological reason why hurricanes tend to steer toward Kaua‘i.

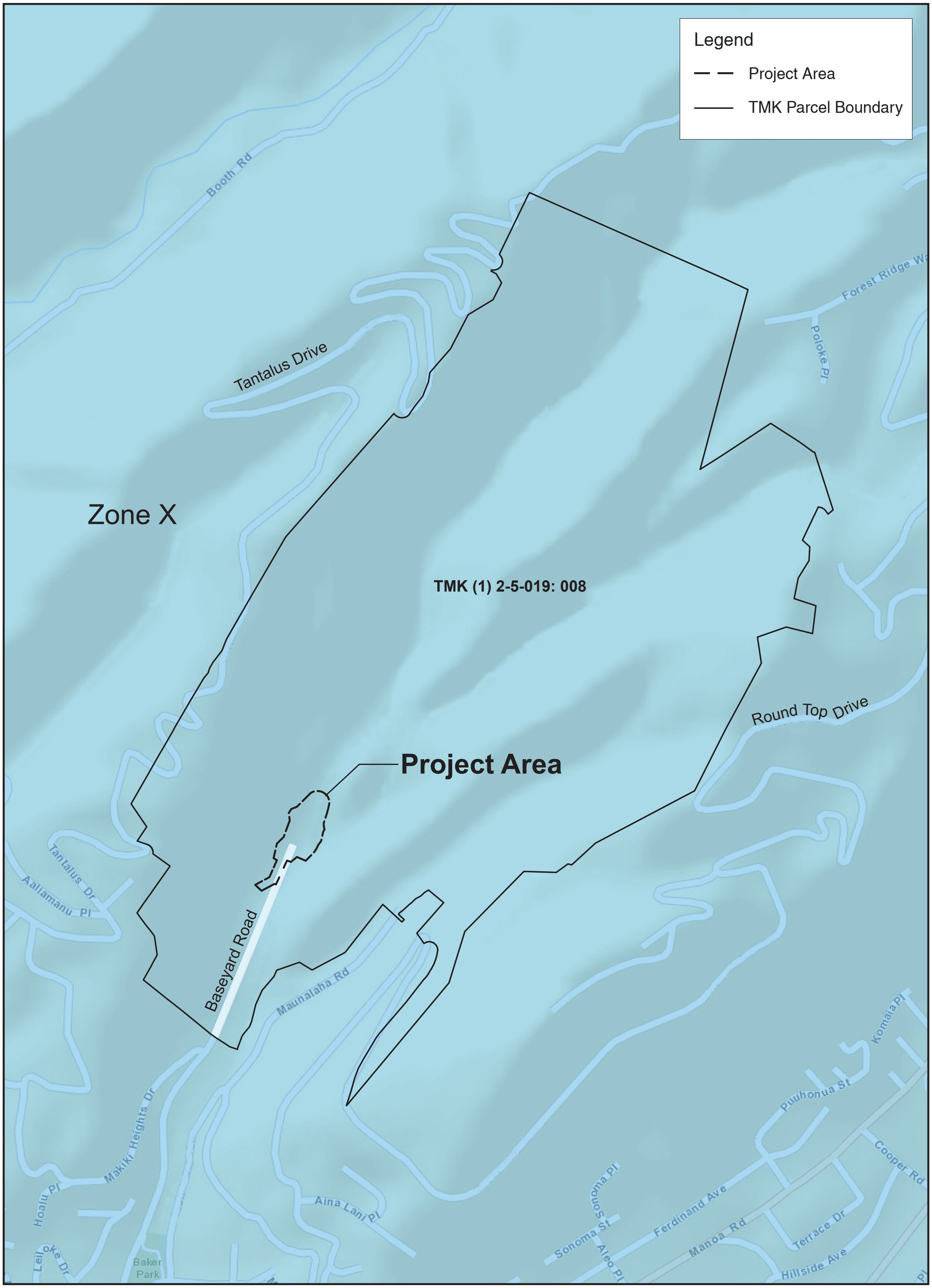
3.2.3 Tsunami and Flood Hazards

The project and associated improvements are not susceptible to impacts from tsunami events because of the project site’s inland location. The project site is outside the City and County of Honolulu’s tsunami evacuation zone.

Flooding

Floods caused by heavy rainfall and strong winds are most common during winter months. Historic rainfall data for Honolulu conforms to this pattern with highest rates of precipitation occurring from November to January with December having the highest average. Heavy rainfall is also possible during the Hawai‘i’s hurricane season that occurs between the months of June and November. Areas subject to recurrent rainstorm floods are generally coastal and flood plain areas (USGS 2002). Figure 3.3 shows the project site in relation to the Flood Insurance Rate Map (FIRM No. 15003C0360G, revised January 19, 2011) for the area.

The project site is situated within a non-special flood hazard area that is designated Zone X, areas determined to be outside the 0.2% annual chance floodplain. This Zone X designation applies to most of the entire larger State-owned parcel, and includes areas *makai* of the project site. Makiki Stream is located east and downslope of the project site. The flood map for this area (FIRM No. 15003C0360G) indicates that the stream does not pose additional flood risk for the project site.



DOFAW Makiki Baseyard Improvements Project

Figure 3.3 – Flood Map

Honolulu, Hawaiʻi

0 1000 Feet

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3.3 Hazardous Materials

3.3.1 Survey of Environmental and Historical Records

Environmental Data Resources Inc. conducted a survey of environmental and historical records pertaining to the property and the surrounding area in September 2015. This survey was conducted to determine environmental risks associated with the project site (Environmental Data Resources, Inc., September 2015). Records examined include the EPA National Priorities List (NPL), Resource Conservation and Recovery Act Corrective Actions Facilities records, and State Hazardous Waste Sites records among other relevant databases. Survey results show that there are few hazardous waste sites within a quarter and half-mile radius of the project site. Characteristics of existing hazardous material sites relevant to the project site are discussed below.

- State Hazardous Waste Sites (SHWS). SHWS records document the location of hazardous waste sites, leaking underground storage tanks (LUST), and underground storage tanks (UST) in the State of Hawai‘i. One SHWS is located within a 1.0-mile radius of the project site on the Punahou School campus. Lead contaminants were found in soil samples for this school site. However, records indicate that lead content is below State DOH Environmental Action Levels (EAL) for unrestricted residential use, resulting in a “No Hazard Present For Unrestricted Residential Use” designation. The site was given the status of “No further action” (NFA) and was not suspected to have an adverse environmental impact on the project site. SHWS records also note the presence of one LUST on Punahou School. Site cleanup was completed for the LUST leading to an NFA designation. The SHWS record for this site indicates that five USTs are present on Punahou School with two in use and three permanently out of use. The SHWS record also indicates that the presence of four USTs subject to Financial Assurance regulations on Punahou School. These USTs are all currently in use. These sites are located downslope from the project site and should not present additional contamination risk for the project site or nearby water bodies.
- Formerly Used Defense Sites Properties (FUDS). The database search revealed that there is one FUDs site located east and within a 1-mile radius of the project site. This site is located above Pu‘uhonua Street in Mānoa Valley, and is separated from the project site by one of the ridges that comprise Mount Tantalus. The site is owned by the State and is not occupied. The property is known or expected to contain military munitions and exploded ordnances and therefore may present an explosive hazard. However, the FUDS site is located a considerable distance from the project site and should not present additional contamination threat to the project site.

3.3.2 Hazardous Materials Testing

Hazardous material sampling and testing of project site facilities was conducted to determine whether lead or asbestos was present on-site (Masa Fujioka & Associates 2015). Samples were collected from areas anticipated to be affected by the proposed project and analyzed for lead and asbestos. Twenty–two paint chip samples were collected for lead testing while 27 bulk samples and nine homogenous suspect materials were collected for asbestos sampling. Asbestos testing results determined that samples collected contained no asbestos. Lead testing results determined that two of the samples contained lead based paints (lead concentrations greater than or equal to 5 percent). Six of the samples were lead containing, with lead concentrations greater than the lab detection limit but below the 5 percent concentration threshold.

3.4 Hydrology and Water Quality

3.4.1 Hydrogeological Resources

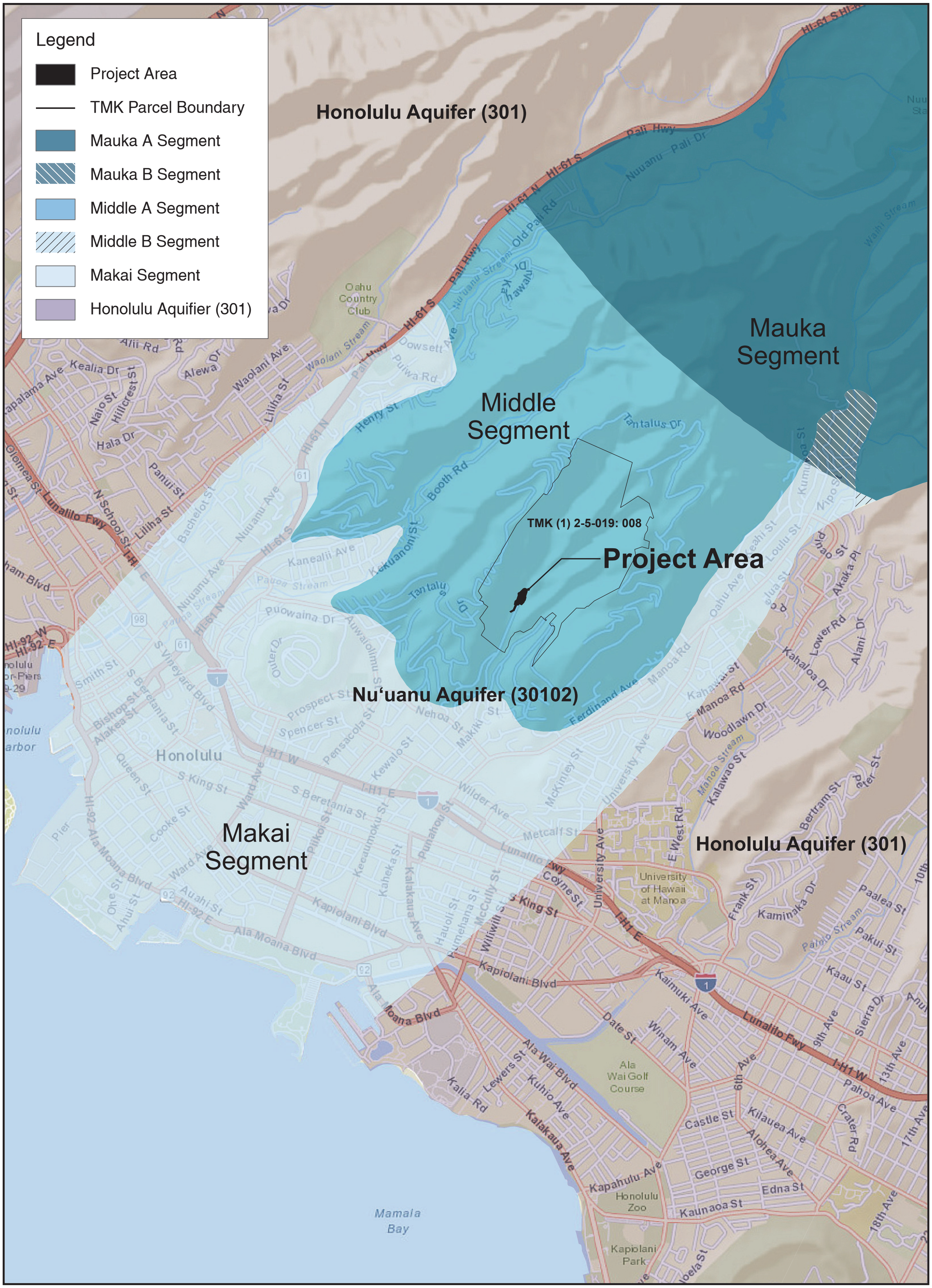
The State DLNR, Commission on Water Resource Management (CWRM) has established groundwater hydrologic units to provide a consistent basis for managing groundwater aquifers. The State's Water Resource Protection Plan establishes an aquifer coding system that classifies the State of Hawaiʻi's aquifers by geology and water characteristics. This coding system is comprised of Aquifer Systems located within larger State Aquifer Sectors.

The project site is located within the Nuʻuanu Aquifer System (30102111), which is situated within the larger Honolulu Aquifer Sector (301). This system spans from the Koʻolau Mountains to Honolulu's shoreline and is about 2.5 miles wide. The Nuʻuanu Aquifer System has an estimated sustainable yield of 14 million gallons per day (gpd) (CWRM 2008). This figure is based on analytical ground water models and represents the amount of water that may be drawn from the aquifer without impairing its ability to replenish itself. The Nuʻuanu Aquifer System's estimated water output is one of the largest contributions to the overall sustainable yield for the Honolulu Aquifer Sector.

Groundwater Hydrology

The majority of Oʻahu's groundwaters are stored in basal aquifers that are characterized by a lens of fresh water floating above an underlying layer of saltwater (Oki, D.S., Gingerich, S.B., and Whitehead, R.L. 1999). The majority of groundwater in the Nuʻuanu Aquifer System is stored within a basal aquifer. However, the hydrogeological characteristics of portions of the aquifer system differ slightly. As a result, discussion of the aquifer system's hydrogeological characteristics will be subdivided into *mauka*, middle, and *makai* segments. Figure 3.4 illustrates the location of the project site within the aquifer types comprising the Nuʻuanu Aquifer System.

Groundwater in the *mauka* segment of the aquifer system is stored within permeable lava located between impermeable lava dikes (Noted as *Mauka* A, Figure 3.4). These waters are currently used for drinking, are considered irreplaceable, and are highly vulnerable to contamination. A portion of the *mauka* segment differs from the surrounding aquifer due to the presence of distinct upper and lower basal aquifers (Noted as *Mauka* B, Figure 3.4). The upper portion of the *Mauka* B subaquifer is a basal aquifer possessing sedimentary geology and an unconfined water table.



DOFAW Makiki Baseyard Improvements Project

Figure 3.4 – Aquifier Map

Honolulu, Hawaiʻi

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This portion is currently used, but is not ecologically important. This aquifer is highly vulnerable to contamination with moderate salinity and is considered replaceable. In contrast, the lower portion of the *Mauka* B sub-aquifer is a basal aquifer that is considered irreplaceable. This portion of the aquifer is used for drinking, possesses freshwater salinity, and is not vulnerable to contamination. This lower portion possesses horizontal lava flow geology that confines this water body (DOH Aquifers 2011)

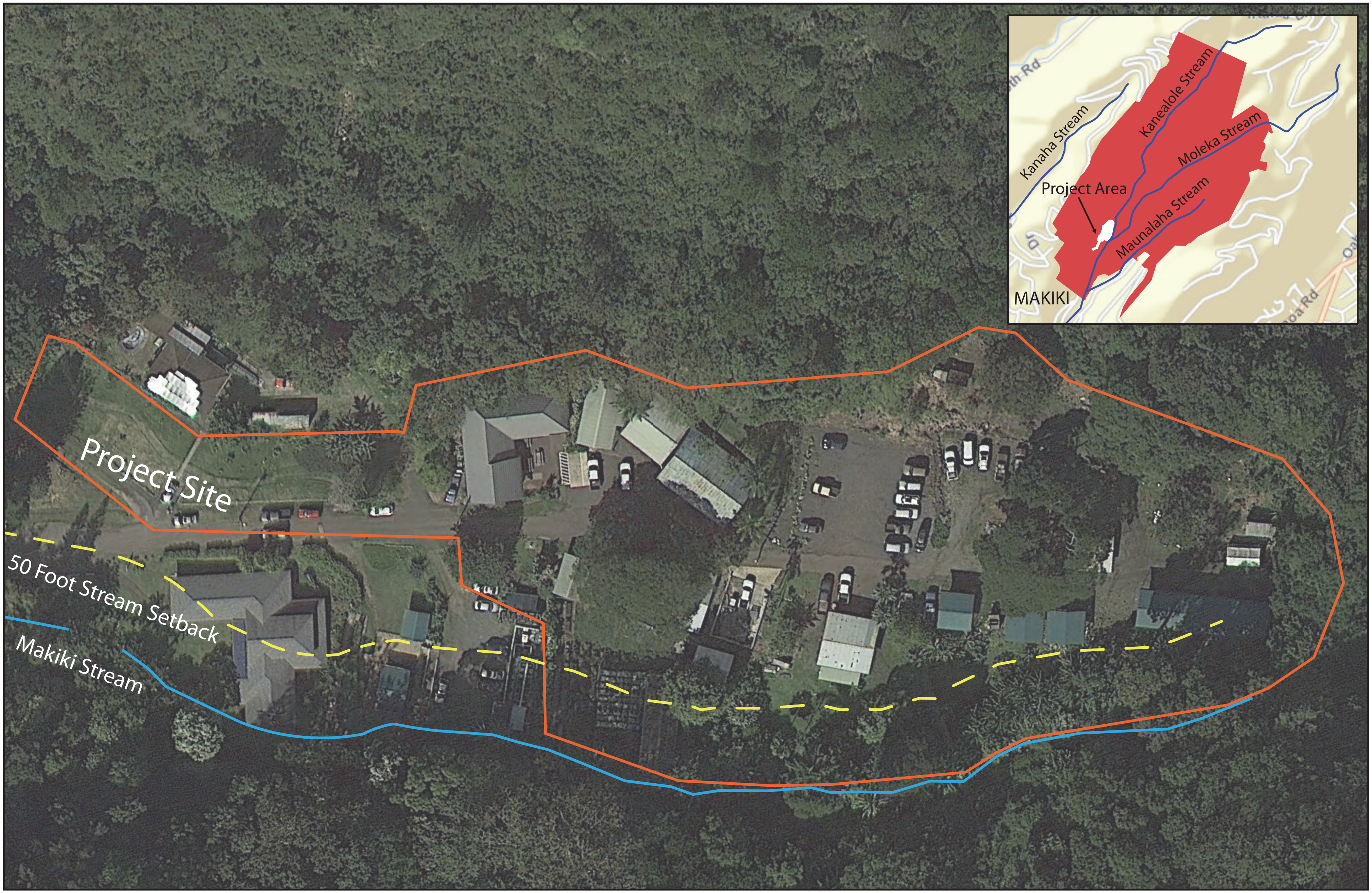
The middle segment of the aquifer system is classified as a basal aquifer. The project site is located over this aquifer segment (Noted as Middle A, Figure 3.4). The majority of this segment is characterized by horizontally extensive flank lava geology with a water table in the upper surface of the aquifer. This water is fresh, can be used for drinking, and is considered irreplaceable with high vulnerability to pollution. A smaller portion of this aquifer segment has freshwater salinity and is currently used for drinking (Noted as Middle B, Figure 3.4). These waters are irreplaceable and highly vulnerable to pollution. This portion of the aquifer segment is also basal with flank lava geology and a water table in the upper surface of the aquifer.

The *makai* aquifer segment contains two distinct upper and lower aquifers. The upper aquifer is characterized by sedimentary geology with an unconfined, basal water body. This segment of the aquifer is considered replaceable, is not ecologically important, and is not used for drinking. The lower aquifer is composed of confined basal water in flank lavas. Freshwater in the lower aquifer is considered irreplaceable and is used for drinking. This water source has a low vulnerability to contamination.

3.4.2 Surface Waters and Streams

The State DLNR, Division of Aquatic Resources (DAR) has established watershed areas across the State of Hawaiʻi. The project site is located within the Makiki Watershed (Hawaiʻi Statewide GIS Program 1995). Makiki Stream is an important stream within the Makiki Watershed due to its close proximity to the project site. Figure 3.5 illustrates the location of the project site in relation to Makiki Watershed and nearby streams.

Makiki Stream is approximately 3.5 miles long, and is classified as an interrupted, perennial stream; meaning that water flow is intermittent, discharging into the sea only during wet seasons. The stream was modified in 1930 to safeguard near stream developments from flooding. Modifications include culverts and channels to guide streamflow and concrete walls constructed on both banks of the stream (U.S. Fish and Wildlife Service 1978). Makiki Stream is monitored by USGS monitoring station 1623800, which is located at the intersection of Makiki Stream and the King Street Bridge (U.S. Geological Survey 2015).



DOFAW Makiki Baseyard Improvements Project

Figure 3.5 - Streams and Watershed Map

Honolulu, Hawaiʻi

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While USGS station 16247150 at Archie Baker Park captures stream characteristics closer to the project site, the King Street Bridge station's monitoring is more comprehensive and is therefore more useful for this analysis. The median discharge rate for Makiki Stream at this station was 0.72 cubic feet per second from January to September 2015. Median water heights during this period were 2.99 feet. Makiki Stream eventually flows into the Ala Wai Watershed, joining with Mānoa and Pālolo Streams in the Ala Wai Canal. The canal channels these waters into the Ala Wai Yacht Harbor.

Exhibit 3.3 Makiki Stream, Downslope of Baseyard Living Machine

Makiki Stream is fed by Kanahā, Kanealole, Moleka, and Maunalaha Streams. These perennial streams flow through the Makiki watershed and are major tributaries of Makiki Stream. Kanealole and Moleka Streams converge into Makiki Stream near the project site after traveling towards the ocean from the mountainous, interior region of the Makiki watershed.

Makiki Stream runs downslope relative to the baseyard's eastern boundary. The location of the stream downslope of the green machine sited at the project site's eastern boundary is shown in Exhibit 3.3. The distance between the baseyard and Makiki Stream varies from about three feet to nearly 50 feet. The portion of Makiki Stream near the project site is unlined and varies in width from about a foot to roughly four feet wide. The stream is relatively shallow with banks that are vegetated in some areas, with other sections lined with dirt and exposed rock (see Exhibit 3.4). There are no other surface water features within or near the project site boundaries or near the site. Figure 3.5 illustrates the location of the project site relative to Makiki Stream.

Exhibit 3.4 Makiki Stream, West Bank, Downslope of Project Site

Water Quality

The State DOH's Water Quality Standards (HAR Chapter 11-54-3) classifies Makiki Stream as a "Class 2" inland freshwater body. The Class 2 designation applies to waters protected for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping, and navigation. Class 2 waters shall not receive discharge that has not been treated or controlled in compliance with regulations for this water class (State of Hawaiʻi 2014).

In particular, usage criteria for Class 2 water bodies allows discharge of water covered by an NPDES general permit. Inland water quality standards outlined in HAR 11-54-5.2 are applicable to Makiki Stream. These standards are outlined in Table 3.1.

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					

The State DOH's 2014 State of Hawai'i *Water Quality Monitoring and Assessment Report* compares surface water quality data and related information to the State's Water Quality Standards to gauge the level of impairment for the water body (Department of Health 2014). Water bodies that are deemed impaired or not expected to meet water quality standards must develop and comply with a Total Maximum Daily Loads (TDML) pollution reduction plan. The 2014 assessment assigned Makiki Stream a "Category 3" and a "Category 5" designation. The Category 3 designation signifies that Makiki Stream lacks readily available data, though the assessment determined the stream exceeded State water quality standards. The "Category 5" designation is assigned to impaired bodies of water and requires development of a TMDL reduction plan. TMDL development priority for this stream was low. This impaired water designation applies to the entire inland freshwater portion of a stream system.

3.5 Botanical and Faunal Resources

A biological survey was conducted by Rana Biological Consulting Inc. in compliance with the environmental review process for this project (Rana Biological Consulting, Inc 2015). This report documents the biological characteristics of the area to understand whether botanical, avian, or mammalian species listed in Federal (U.S. Fish & Wildlife Service (USFWS 2005a, 2005b, 2014) or State (Department of Land and Natural Resources (DLNR) 1998) endangered species statutes are present. Results of this survey are discussed below.

There are no Federal Critical Habitat designated areas located on or adjacent to the project site.

3.5.1 Botanical Resources

The vegetal composition of the project site is a mixture of landscape plants and weeds. A forest surrounds the area, merging into an urban mixed forest on the *makai* side of the site. The area possesses a varied distribution of older non-native plants and more recently planted native trees and shrubs. The diverse vegetal composition of the area may relate to the history of human botanical uses in the area. Historical research identifies the presence of nurseries near the area.

A nursery was present in the 1920s, which supplied mostly non-native trees and shrubs for planting on State public lands. The presence of old palms and other trees on the project site may imply that planting for this nursery occurred in the area presently occupied by the project site. DLNR currently operates a nursery that specializes in growing native plants, which has resulted in the presence of more recent native trees and shrubs in the area.

The ratio of native to non-native plants (percentage of total species recorded) was 14 percent native for plants qualifying as indigenous or endemic. The ratio of native to non-native plants for native plants qualifying as naturalized since the arrival of the Cooke Expedition or naturalized due to early Polynesian introduction is 19 percent. While the percentage of native species is comparatively higher than most lowland areas on O‘ahu, species identified are mostly common species and primarily planted specimens. The results conclude that perhaps seven percent of native and early Polynesian plants were naturalized on the property. Over 138 species were recognized in the survey area (for additional details on floral species identified, see Appendix D). Several tree species could not be identified because they lacked floral or fruit characteristics to identify the trees. The survey concludes that unidentified species are likely ornamentals.

Two species of trees, *Hibiscus clayi* and *Pritchardia loulu* are present in the project site, and are on the U.S. FWS list of Hawai‘i endangered plant species. Details on these endangered plant species are discussed below:

- Hibiscus clayi is only found naturally on Kaua‘i. The specimens present on-site were introduced as landscape plantings, but still possess protected status. No changes are planned for this particular location.
- Pritchardia (Haw, loulu) is a genus containing 24 species found on the Hawaiian Islands. Eight species within this genus are considered endangered (including one candidate species for endangered status). A *loulu* specimen was identified on the project site downslope of building 13 (Exhibit 3.5). The *loulu* specimen is growing within a grove of other planted natives. This specimen

Exhibit 3.5 General Location of Loulu Specimen Identified.

was not identified, but is noteworthy given the number of species in the *loulu* genus that may be endangered. No improvements are proposed for this area.

No trees on the survey site are listed in the City's Exceptional Tree Program.

3.5.2 Avifaunal and Mammalian Resources

Avifaunal Resources

A total of 225 individual birds from 20 different species, representing 16 distinct families were documented in an avian survey. On average, 56 birds were recorded per station point count, which is relatively high. The Common Waxbill accounted for 26 percent of the birds recorded and was the most commonly tallied species in the project site. The Common Waxbill (*Estilda astrild*), Red-vented Bulbul (*Pycnonotus jocosus*), and Rose-ringed Parrot (*Psittacula krameri*), accounted for 58 percent of total birds recorded. All but one of the 20 species documented were non-endemic avian species. For additional details on avian species identified, see Appendix D.

The sole endemic species sighted was the White-tailed Tropicbird (*Phaeton lepterus*). The White-tailed Tropicbird is seen throughout the island. However, habitats for the White-tailed Tropicbird and other seabird species were not sighted within the project site. Although seabirds were not detected or expected on-site, two seabird species are especially vulnerable to mammalian predation and development. These species are the Wedge-tailed Shearwater (*Puffinus pacificus*) and Newell's Shearwater (*Puffinus auricularis newelli*). In particular, a common cause of mortality for these seabirds occurs when they collide with buildings after they are disoriented by building lights. There are no documented records of any downed seabirds in the general area of the project site, making the possibility of attraction to existing or future facility lights unlikely.

Mammalian Resources

Three non-endemic terrestrial mammalian species were documented in the project site. One Indian mongoose (*Herpestes auropunctatus*) was documented with several leashed dogs (*Canis familiaris*) seen in the lower baseyard. Two cats (*Felis catus*) were also seen in the project site.

Although no rodents were documented, it is likely species including the roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), European housemouse (*Mus musculus domesticus*), and possibly black rat species (*Rattus exulans hawaiiensis*) are present because of their attraction to human resources.

No Hawaiian hoary bats (*Lasiurus cinereus semotus*) were detected in the survey area. However, it is possible that the bats are present on a seasonal basis given the potential on-site vegetation provides for bat roosting.

None of the mammalian species documented in the survey area are listed under the Federal government or State of Hawai‘i’s endangered species statues.

3.6 Air Quality

Federal ambient air quality standards (AAQS) have been established by the U.S. Environmental Protection Agency (EPA) for six pollutants: carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), lead (Pb), ozone (O_3), and concentrations of particulate matter smaller than 10 microns (PM10) and 2.5 microns (PM2.5). The State of Hawai‘i has established ambient air quality standards (Title 11, Chapter 59, HAR) for selected pollutants that are comparatively more stringent than Federal standards. Table 3.2 presents a summary of Federal and State ambient air quality standards that apply to the project site.

Table 3.2
State and Federal Ambient Air Quality Standards

Air Pollutant	Averaging Time	Hawai‘i AAQS	Federal (NAAQS)	
			Primary	Secondary
Carbon Monoxide (CO)	1-hour 8-hour	9 ppm 4.4 ppm	35 ppm 9 ppm	-- --
Lead (Pb)	Rolling 3-month	1.5 µg/m^3	.15 µg/m^3	.15 µg/m^3
Nitrogen Dioxide (NO_2)	1-hour Annual	-- 0.04 ppm	0.100 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 24-hour	50 µg/m^3 150 µg/m^3	-- 150 µg/m^3	-- --
Particulate Matter ≤2.5 micrometers in diameter ($PM_{2.5}$)	Annual 24-hour	-- --	12 µg/m^3 35 µg/m^3	15 µg/m^3 35 µg/m^3
Hydrogen Sulfide (H_2S)	1-hour	0.025 ppm	None	None
Sulfur Oxides (SO_2)	Annual 24-hour 3-hour 1-Hour	0.03 ppm 0.14 ppm 0.50 ppm --	-- -- -- 0.075 ppm	-- -- 0.50 ppm --
Source: State Department of Health, 2015				

Air quality in the State is generally characterized as relatively clean and low in pollution. This results in part from Hawai‘i’s dominant trade wind pattern, which carries emissions and other air pollutants out toward the ocean. The State of Hawai‘i attained all National and State ambient air quality standards in 2014, excluding exceedances of pollutants from volcanic eruption on the Island of Hawai‘i (DOH, 2015).

The air quality around the project area is generally excellent year round. Much of O‘ahu’s particulate emissions originate from industrial and agricultural uses. Island specific particulate emission sources include the mineral products and agricultural industry. Sulfur oxides are emitted almost exclusively from point sources such as power plants and refineries. Nitrogen oxide emissions emanate primarily from industrial point sources. None of these uses are located near the project area.

Air quality in the project area is primarily affected by vehicular carbon monoxide (CO) emissions, and to a lesser extent by nearby homes and natural sources. Carbon monoxide (CO) emissions are generated by traffic along Makiki Heights Drive and vehicles traveling into the project site. Makiki Heights Drive is located about a quarter mile away and downwind of the project area. Additionally, dominant northeasterly tradewinds may push onsite vehicular emissions along with emissions from nearby homes and natural sources downwind, away from the project area. The location of the project area along with the relatively low traffic volumes on the DFOAW baseyard access road decrease the likelihood that air quality within the project site will be impacted by vehicle emissions.

3.7 Noise

Sources of noise near the project site emanate from Hawaiʻi Nature Center activities, a few homes in the area, vehicular traffic along the access roadway, and a nearby charter school. Visitors to the Hawaiʻi Nature Center and the Na Ala Hele Maunalaha Trail are the closest sources of noise near the project site. Noise disturbance from homes close to the project area is minimal given their location roughly 850 feet to the southwest of the project site. Noise from the nearby Hālau Kū Māna public charter school is also minimal due to the distance between the school and the project site (roughly 1,100 feet). Noise from vehicular traffic may emanate from Makiki Heights Drive to the south and Mount Tantalus Drive to the southwest. Vehicular noise is minimal because these roadways are over 1,000 feet from the project area. Additionally, lower vehicular traffic volumes on the access roadway compared to Makiki Heights and Mount Tantalus Drives contributes to the minimal impact vehicles provide to project area noise conditions.

All other existing sources of noise are from natural sources such as birds, stream water, rain, and wind.

3.8 Visual Resources

This section identifies existing visual resources that are associated with the 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 Primary Urban Center Development Plan (DPP August 2000) and *Coastal View Study* (Chu and Jones 1987).

3.8.1 Visual Resources Referenced

The City's Primary Urban Center Development Plan, adopted under Ordinance 04-14 presents guidelines, polices, and conceptual schemes that guide for more detailed zoning, maps, and regulations (DPP June 2004). The Plan identifies the region's important view corridors and indicates major view features along the coastal plain. Major view features identified include: 1) the Pacific Ocean, Honolulu Harbor, Kewalo Basin, Keʻehi Lagoon, Pearl Harbor's East Loch, and Ford Island; 2) Diamond Head, Punchbowl, and Aliamanu craters; and 3) the Koʻolau and Waiʻanae Mountain Ranges.

The project site is situated within a steep valley located in a *mauka* view corridor meaning that views are oriented from the shoreline towards the mountains. Nearby view features include Puʻu ʻUalakaʻa, the Koʻolau Mountains, and Punchbowl crater. The project site is also located within a City preservation zoning district. The Preservation zoning designation is given to lands reserved for conservation, preservation, and enhancement of scenic views and other significant sites.

The City's *Coastal View Study* (Chu and Jones, 1987) was completed for the City' Department of Land Utilization (now known as the Department of Planning and Permitting) that inventoried significant coastal views and coastal land forms which together comprise Oʻahu's scenic shoreline resources. The study identifies views from public viewing points and coastal roadways located within the City's Special Management Area. The study subdivides the island into viewsheds, which are entire surface areas visible to an observer from a viewing point. The viewshed most relevant to the project is the Primary Urban Center, South Shore Viewshed, which will be referred to as the South Shore Viewshed. This viewshed contains three visual resource typologies. A general description of these visual resources is provided below.

- Coastal Land Forms: Land masses that are prominent features within the coastal view.
- Stationary Views: A specific location such as a scenic lookout or a beach park where pedestrians can see significant views.
- Intermittent and Continuous Coastal Views: Views from stretches of coastal highways that provide drivers with unobstructed or intermittent views of the ocean, shoreline, or other coastal landforms.

The project site is situated within a steep valley located in the Koʻolau Range. The Koʻolau Range is recognized as an important Coastal Land Form within the South Shore Viewshed. A Stationary View from Sand Island looks *mauka* toward the Koʻolau Range, and is the only stationary view in this viewshed that may be impacted by the project. All other stationary Views are *makai* oriented and will not be impacted by the project. Intermittent and continuous views in the viewshed are all *makai* oriented and will not be impacted by the project.

3.9 Historic, Archaeological, and Cultural Resources

An archaeological literature review and field inspection (LRFI) for the project site was conducted by Cultural Surveys Hawaiʻi, Inc. (CSH) to facilitate project planning by documenting archaeological resources in the project site (Cultural Surveys Hawaiʻi 2015). The project remains subject to Hawaiʻi State historic preservation review legislation (Chapter 6E-8 HRS and Chapter 13,-276 HAR).

The literature review element of the LRFI includes research of archival sources, historic maps, Land Commission Awards (LCA) and previous archaeological reports to establish the history of land use in the project site and determine if archaeological sites have been documented. The field inspection element assessed whether any archaeologically or historically sensitive areas existed in the project site.

The LRFI results indicate that no subsurface historic properties are located within the project site. However, the project site is located within portions of four LCAs, which suggests the potential for pre-and/or post-contact land uses and associated sub-surface historic properties. Figure 3.6 provides additional detail on LCAs for areas surrounding the project site.

3.9.1 Results of Literature Review

The history of Makiki Valley has been documented in a number of studies and historical accounts. CSH examined these studies and accounts in the project's archaeological literature review to establish the cultural and historical background of Makiki Valley. Appendix C discusses the results of this research in detail. The results of this literature review are summarized below.

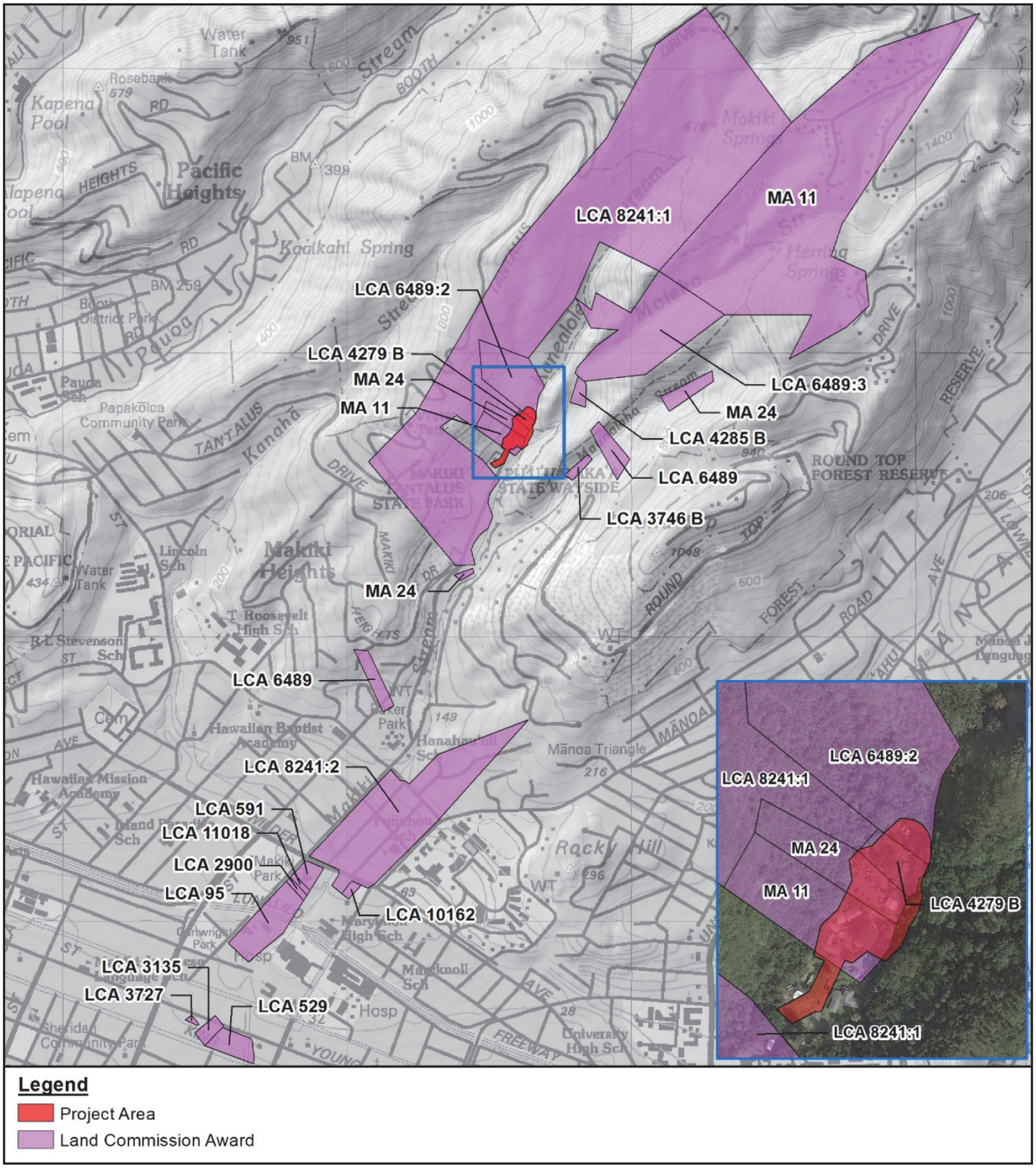
Early Descriptions of Makiki Valley

The earliest documented descriptions of Makiki were made in 1831 by Dr. Franz Julius Ferdinand Meyen, a 27-year old botanist who documented O‘ahu's floral, faunal, and cultural characteristics during his time on the island. Meyen's account highlighted the arid conditions of the area and native Hawaiian practice of gathering stones called *makiki* to make octopus lures. He noted that many areas in and around the project area were used for agricultural production but had become pastureland for cattle. Indeed, the area's mountain slopes were known as productive agricultural areas since pre-contact times especially for sweet potato due to its fine volcanic soil. Swampy, low land regions south of King Street were used to cultivate taro (*kalo)*.

Mid 1800s and the Māhele

In 1845, the Board of Commissioners to Quiet Land Titles, also referred to as the Land Commission was created to establish formal title to lands in Hawai‘i. The establishment of the Land Commission introduced the western system of private property ownership to Hawai‘i. This led to the Māhele, the division of lands between the king of Hawai‘i, the ali‘i (chiefs), and the common people. The subsequently awarded parcels were called Land Commision Awards (LCSs).

LCA documentation for Makiki Valley (area north of King Street) indicates a number of awards to claimants in areas along Kanealole and Moleka Streams with most of Makiki Valley land owned by the government. The largest awards in Makiki were for the *‘ili ‘aina* (strips of land in an ahupua‘a under care of a family) of Opu in Pawa‘a. This award was part of the large 253-acre Pawa‘a award to John Papa Ii.



Base Map: USGS Topographic Map, Honolulu (1998) Quadrangle / Google Earth Aerial Imagery (2013)
Data Sources: CSH

Source: Cultural Surveys Hawai'i

DOFAW Makiki Baseyard Improvements Project

Figure 3.6 – Land Commission Award Map

Honolulu, Hawai'i

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Late 19th Century to Present

An 1887 map of Honolulu illustrates prominent structures in the area, which include the Makiki Church, the C. Judd home, Oʻahu College, the Makiki Cemetery, the Lunalilo Asylum, and Thomas Square. Many large land grants for Makiki lands were awarded to foreigners during this time. In particular, remnants of historic settlements built on land grant property issued during this period are located adjacent to and slightly overlap the project site. Honolulu's water supply was still primitive during this period with water supplied from a brick reservoir until artesian wells were drilled in 1880.

In 1904, the Division of Forestry acquired upper Makiki Valley. A concrete dam midway along Kanealole Stream was built which created a small reservoir. The Division of Forestry also built a nursery near the present day location of the project site access road. The Makiki State Recreation Area was built in 1957 as part of the Makiki-Tantalus State Park and is located seaward (*makai*) of the project site. Examination of historic maps conducted in the LRFI literature review indicates minimal development within the project site in the 20th century.

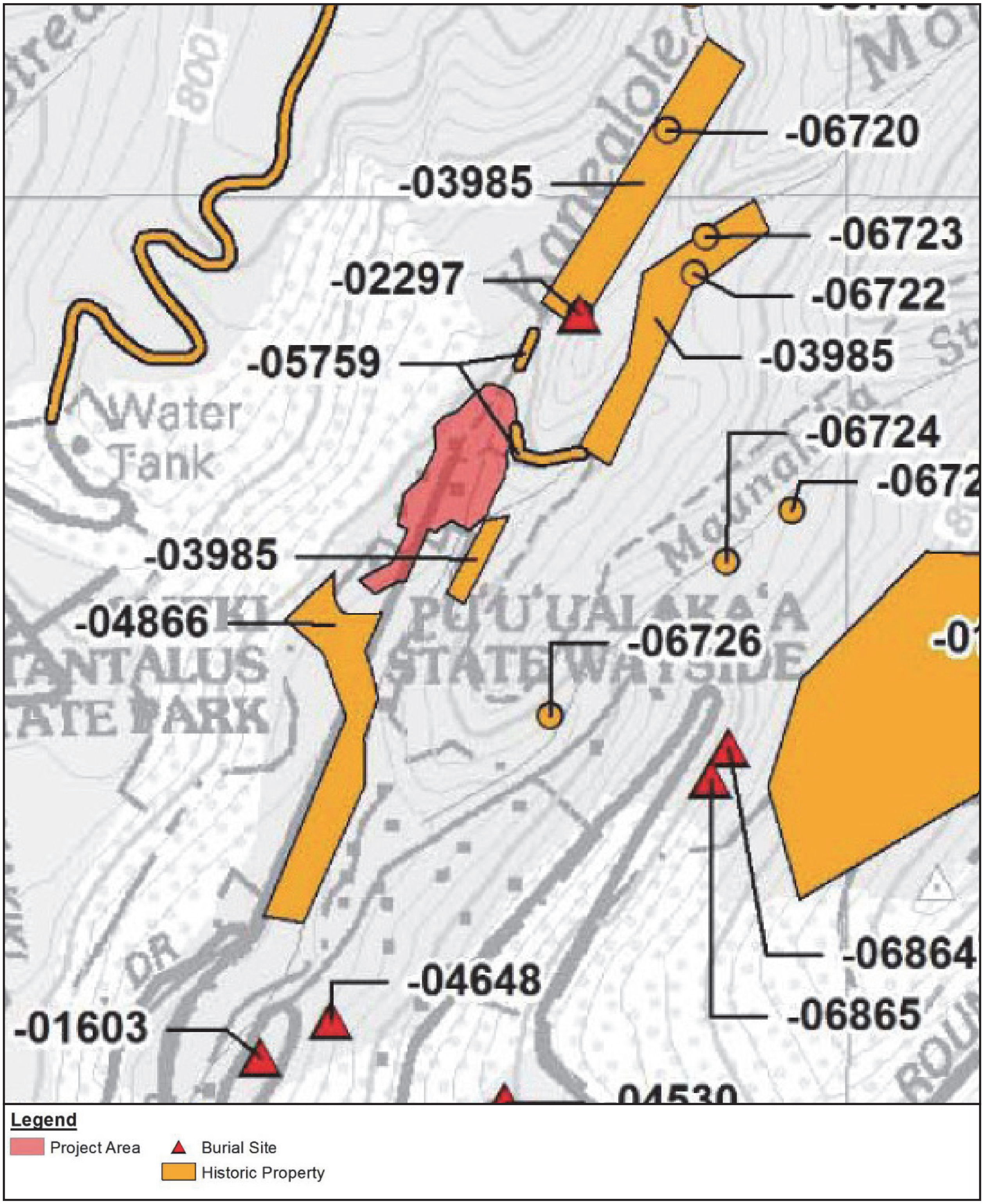
3.9.2 Historic and Archaeological Resources

Twentieth century archaeological research in Makiki has primarily occurred in the valley surrounding the project site. A number of burials have been found in valley caves, on the west side of Round Top under roads and houses, and in Makiki Park. Pre-contact sites indicating traditional agricultural use along with more contemporary historic sites have been documented in the vicinity of the project site. The spatial distribution of existing archaeological studies in the project area are illustrated in Figure 3.7.

Existing Historic Properties Previously Identified

Four historic properties have been identified within a 300-meter radius of the project site. All of these historic properties are not located within the project site. Figure 3.8 highlights the spatial distribution of previously identified historic sites in the vicinity of the study area.

- SIHP #50-80-14-2297 refers to a site 100 meters north of the project site containing a single burial. Bones (*iwi*) in the site were disturbed before Bishop Museum archaeologists could properly document them. Two historic period artifacts were found in association with the burial. These artifacts were a cane knife handle and a portion of a small, round wooden box. A second mound suspected to be of historic age was also observed adjacent to the disturbed burial, but was not further investigated.
- SIHP #50-80-14-3985 refers to 28 features documented in the first systematic archaeological survey of Makiki Valley conducted by Martha Yent and Jason Ota in 1980. This survey encompassed five areas along Kanealole and Moleka Streams, identifying a variety of pre-contact and historic sites. These sites reflect traditional settlement/subsistence pattern, agricultural fields along streams, and rock shelter habitation.



Base Map: USGS Topographic Map, Honolulu (1998) Quadrangle
Data Sources: CSH

Source: Cultural Surveys Hawaiʻi

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Figure 3.7 – Existing Archaeological Studies in Project Vicinity

Honolulu, Hawaiʻi

0 500 Feet

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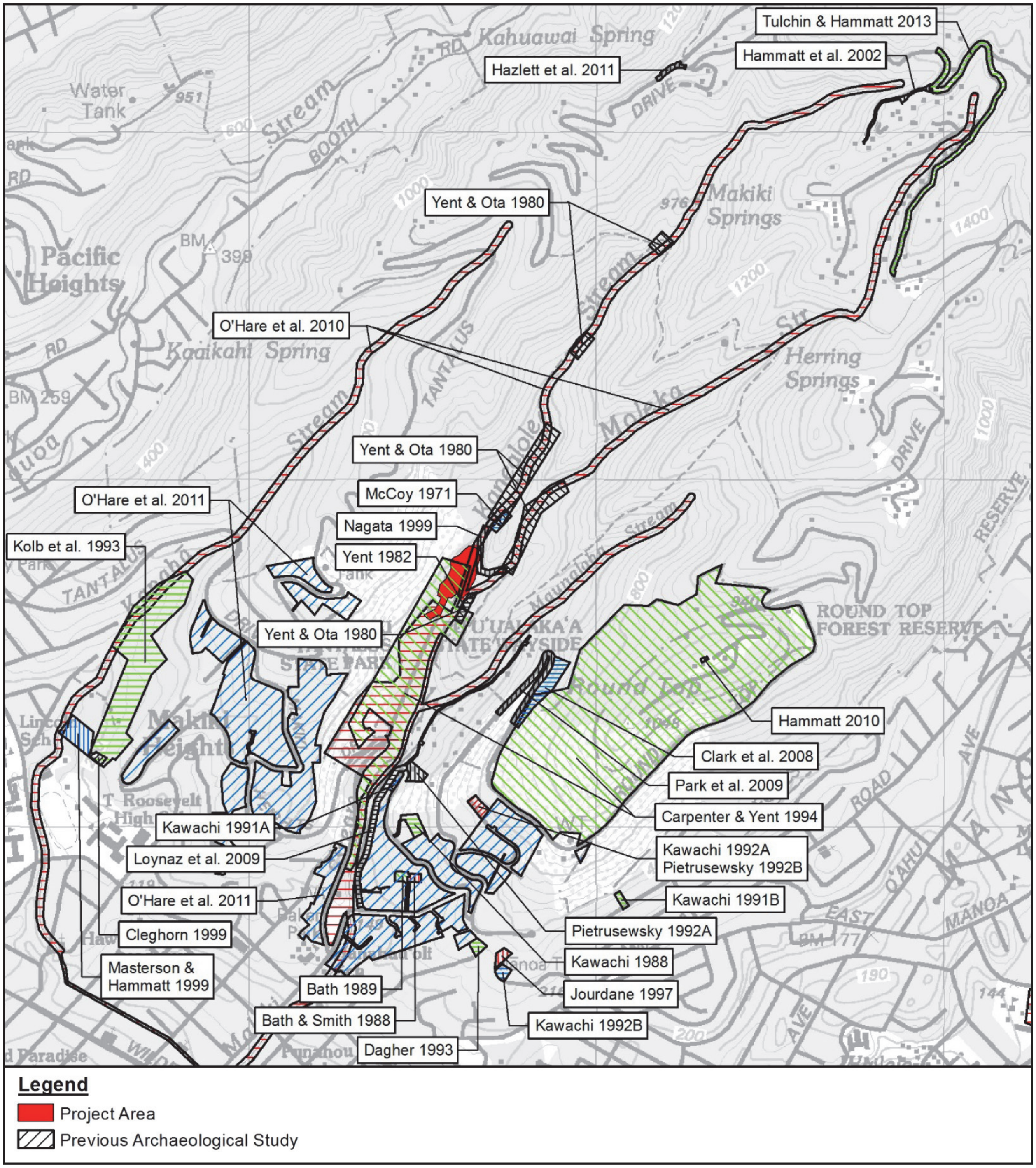

Base Map: USGS Topographic Map, Honolulu (1998) Quadrangle
Data Sources: CSH

Source: Cultural Surveys Hawaiʻi

DOFAW Makiki Baseyard Improvements Project

Figure 3.8 – Previously Identified Historic Sites in Vicinity of Project Area

Honolulu, Hawaiʻi

0 2000 Feet

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- SIHP #50-80-14-4866 refers to a site that included at least nine terraces in the general vicinity of the project site. This survey was conducted as part of a larger survey of 90 acres of Pu‘u ‘Ualaka‘a State Wayside and a discreet 3,000-foot long strip of Makiki Valley State Recreation Area. A portion of that survey area included the baseyard project site. This survey indicated that the general project area has been in use since the early 1900s as part of the first tree nursery in the Territory of Hawai‘i. Rows of concrete slabs used as potting benches may still exist under the *makai* end of DOFAW's present nursery. Retaining walls identified within the project site were recorded, and it was concluded that these walls were not significant historic properties. They were constructed and maintained as part of the modern DOFAW baseyard development. Figure 3.8 shows the location of Site -4866 in relation to the project site.
- SIHP #50-80-14-5759 refers to a field investigation of a cart road remnant in the Forrest Reserve near the Makiki Valley State Recreation Area. The cart road and its associated features were developed by J.M. Herring, who received land commission awards for several parcels along Kanealole and Moleka Streams in the mid 19th century.

Results of Current Field Inspection

A field inspection was conducted by CSH that documented 21 structures within the project site that are associated with DOFAW operations including many retaining walls. These structures include the DOFAW main office located west of the entrance, the DOFAW Makiki nursery and greenhouse, a multi-tier parking area, and other structures used for DOFAW daily operations and storage.

In addition to the 21 modern DOFAW structures, three basalt and mortar retaining walls were observed primarily at the southern and central portions of the project site. The results were consistent with the documentation presented by Yent and Carpenter (1994). No significant historic properties were identified within the project area during the field inspection. Figure 3.9 highlights the location of these retaining walls relative to existing project site facilities, and were designated by temporary number (CSH 1, CSH 2, and CSH 3a–c).

CSH 1 is about a 120-foot-long retaining wall to the south and west of DOFAWs main administration office. CSH 2 is a 120-foot-long retaining wall surrounding an existing storage building and nursery area. CSH 3a is a 82-foot-long retaining wall located to the south of the lower tier parking area. CSH 3b is a 90-foot-long retaining wall that separates the upper and lower tier parking areas. CSH 3c is a 60-foot-long retaining wall located west of the upper tier parking area and abutting CSH 3b. Yent and Carpenter (1994) also identified and recorded these retaining walls, and concluded these walls were constructed and maintained as part of the modern DOFAW base yard development and thus were not considered to be significant historic properties. The results of the current field inspection were consistent with the documentation presented by Yent and Carpenter (1994). Therefore, no significant historic properties were identified within the project site during the field inspection.

Base Map: Google Earth Aerial Imagery (2013)
Data Sources: CSH

Source: Cultural Surveys Hawai'i

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Figure 3.9 - Existing Facilities Relative to Existing Retaining Walls

Honolulu, Hawai'i

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Assessment of Existing Buildings

Figure 3.6 Building 2 and Building 4

Two existing buildings may qualify as historic properties under Hawai‘i State Historic Preservation Review Regulations: 1) an office housing DOFAW wildlife program operations (Exhibit 3.6, Building 2); and 2) a storage building (Exhibit 3.6, Building 4) (Chapter 6E-8 HRS and Chapter 13,-275 HAR). Under these regulations, buildings or structures older than 50 years old may qualify as historic properties and would be subject to historic preservation requirements. Although the construction dates of Buildings 2 and 4 have not been determined, historic Territorial survey maps indicate that the buildings were in place as early as 1944 to 1945, suggesting that the buildings have existed for over 50 years. It is important to note that no buildings within the project site have been nominated for inclusion on the National Register of Historic Places.

The Hawai‘i State Register of Historic Places (HAR § 13-284-6) establishes criteria to determine whether a site qualifies as being a historic property. The criteria are identified below.

- Criterion “a.” Associated with events that have made an important contribution to the broad patterns of our history.
- Criterion “b.” Associated with the lives of persons important in our past.
- Criterion “c.” Embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value.
- Criterion “d.” Have yielded, or is likely to yield information important for research on prehistory or history.
- Criterion “e.” Have an important value to the Native Hawai‘ian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property, or due to the associations with traditional beliefs, events, or oral history accounts; these associations being important to the group’s history and cultural identity.

Buildings 2 and 4 should not be considered eligible as being historic properties because they do not meet these criteria. Buildings 2 and 4 are not known to be associated with important historical events, and are not known to be related to the lives of historically important individuals. Building 2 is a wooden structure and Building 4 is a masonry and concrete structure. They should not be considered as structures having high artistic value, are not known to have been designed by a noted architect, and do not appear to embody the distinctive characteristics of architecture for that period (1940s). These buildings are unlikely to yield information important to research on prehistory or history. These buildings are also unrelated to the cultural practices and histories of native Hawaiians and other cultural groups.

3.9.3 Cultural Resources

The project site is located in the Makiki Ahupuaʻa within the Honolulu (Kona) district on the island of Oʻahu. Makiki is bounded by the Kahauiki Ahupuaʻa on the northwest, the Kapālama Ahupuaʻa on the southeast, and the ocean on its *makai* side. An understanding of the cultural resources related to the project site and the larger Makiki Ahupuaʻa was gained through the project's archaeological study (Cultural Surveys Hawaiʻi 2015) and cultural impact assessments for other recent projects near the project site (Social Research Pacific, Inc. 2005, Scientific Consultants Services, Inc. 2013, PBR Hawaiʻi & Associates, Inc. 2014). Cultural resources identified are discussed below.

Wahi Pana (Storied Places)

No heiau (traditional cultural place of worship), hōlua (sled courses) or other major pre-Contact Hawaiian sites were reported within the project site or in the immediate vicinity of the site. *Moʻolelo* (legends) of Makiki Valley describe significant natural landmarks such as stones and cinder cones in the larger region (Cultural Surveys Hawaiʻi 2015).

In legends related to Makiki, a place and sometimes a (stone) called Anianikū is mentioned. Anianikū translates to "stand beckoning", from the legend of a Papakōlea girl who stood at the stone's location beckoning to a girl chanting in Mānoa. Anianikū also may have been a marker for the post-Contact boundary of the Makiki Ahupuaʻa, signifying the boundary between Makiki and Pauoa along with the larger land units of Honolulu and Waikīkī. Anianikū was located as the place now called Papakōlea.

Many legends surround the three cinder cones that bound Makiki, which include Mount Tantalus (*Puʻu Ohia*), Sugarloaf (*Puʻu Kakea*), and Round Top (*Puʻu ʻUalakaʻa*). Mount Tantalus once had a heiau called *Pepeiaoohikiau* or *Pepeiao o Hikiea* which was associated with human sacrifices at Punchbowl Crater (*Puowaina*). Sugarloaf was named after the strong storm winds of Mānoa Valley. Round Top translates to "rolling sweet potato hill" and is associated with the sweet potato in many legendary and historical accounts. Documentation of agricultural production in the Makiki area continued into early contact periods.

Cultural Practices

There are no known native Hawaiian or traditional cultural practices occurring within the project site. The project site is under jurisdiction of the State DOFAW and is occupied by the organizations facilities and personnel for daily operations. The project site can only be accessed by DOFAW staff or authorized guests. The project site does not impede access to areas around it where cultural practices could be occurring. These areas can be accessed through existing trail systems that surround the project site and lead into the valley.

Gathering Practices

Some plants found in the project site are known to have cultural uses including plants valued for construction materials (*ʻohe, hau, kou*), for food (*kalo, hōʻio fern*, avocado, banana, guava,*ʻohiʻa ʻai, ki, ko, niu, uhi, ʻulu, ʻuala*), for medicine (*kaoli ʻawa, kukui, olena*), for tools (*Cordia subcordata*), and for fragrance (*ʻawapuhi keʻokeʻo awapuhi kuahiwi*) (Rana Biological Consulting, Inc 2015). However, there are no known cultural gathering practices occurring within the project site.

Burial Sites

A number of burial sites have been inadvertently discovered in Makiki Valley, including bones in burial caves and at least eight burials found under roads and houses on the west side of Round Top (Cultural Surveys Hawaiʻi 2015). No known documented burial sites have been discovered within the project site.

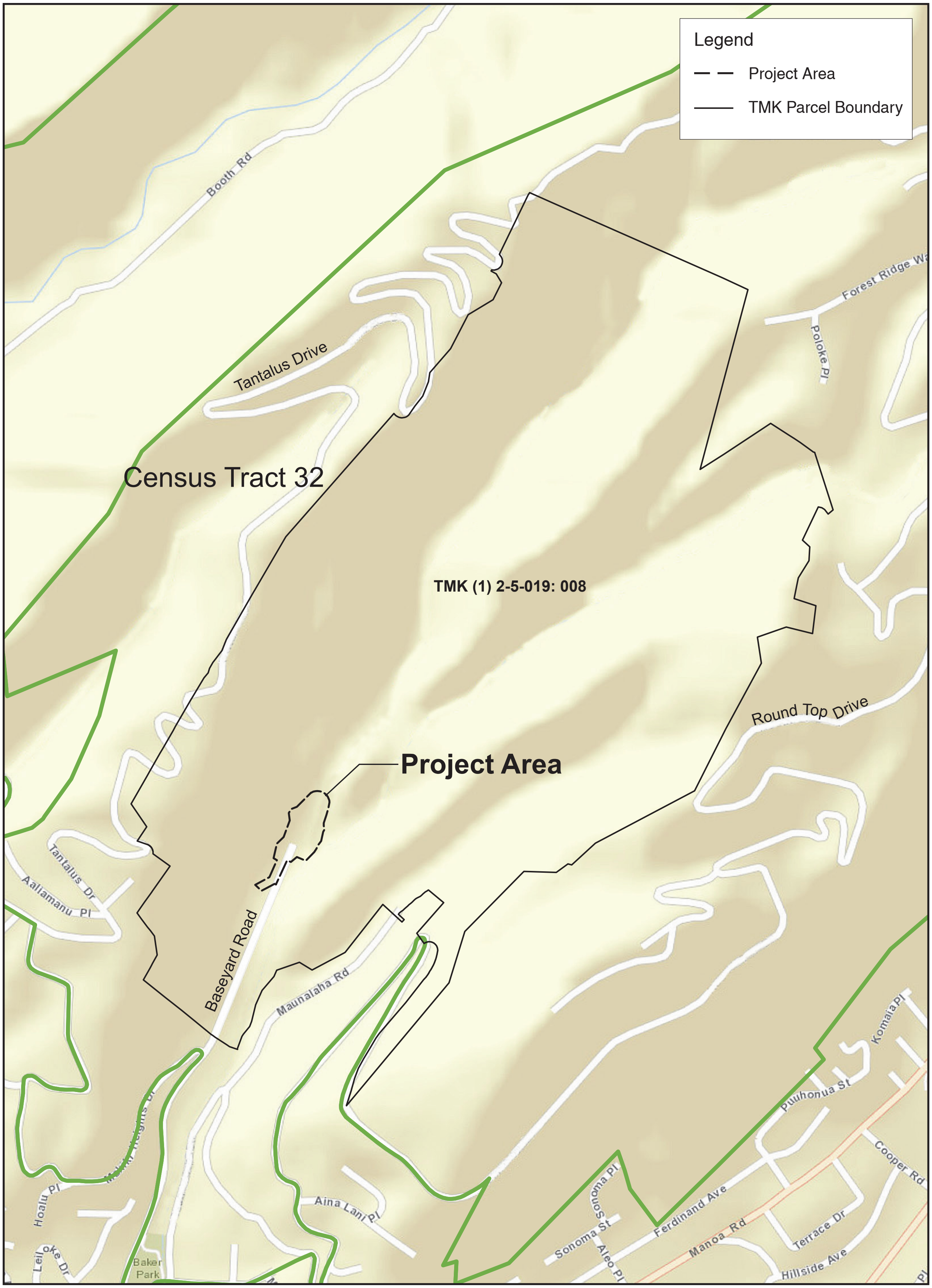
Trails

The Honolulu Mauka Trail system spans the ridgeline surrounding the project site. This trail system is accessed by a trailhead located just south of the project site at the Hawaiʻi Nature Center. The trail system as a whole is maintained by the State DLNR Na Ala Hele Trails and Access system. An additional system of braided trails was noted in 1919 War Department Fire Control quad maps for trails beginning *makai* of the project site and inland to the west of the Puʻu ʻŌhiʻa trail (Mānoa Cliffs Trail 2 alignment). It is believed that the relatively large population of the lowland Kona District, Oʻahu probably accessed the upland in the vicinity of Puʻu ʻŌhiʻa for forest resources and recreation (PBR Hawaiʻi & Associates, Inc. 2014). However, it is unknown whether these trails are maintained and functional or utilized.

3.10 Social and Economic Characteristics

Information on existing social and economic characteristics for the project area were obtained from the U.S. Census Bureau's 2013 American Community Survey. The American Community Survey (ACS) is similar to the Decennial Census, but is conducted more frequently, providing the most recent demographic data for the United States.

The project site is located within Census Tract 32, which is situated within the Urban Honolulu Census Designated Place (Honolulu). For the purposes of this EA, Census Tract 32 is used a proxy for the Makiki Valley area that the project site is located in. This tract level geography is referred to as Makiki Valley. Analysis of potential impacts to social, economic, and neighborhood characteristics will focus on changes to Makiki Valley since the valley area is closest and most relevant to this project. Figure 3.10, illustrates the relationship between the project site and Census Tract 32 representing Makiki Valley.



Makiki Baseyard Environmental Assessment

Figure 3.10 – Census Tracts

Honolulu, Hawaiʻi

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3.10.1 Population and Housing

Table 3.3 compares demographic and economic characteristics of individuals in Makiki Valley to individuals living in Honolulu. In 2010, Honolulu had an estimated population of 340,639 (American Community Survey 2013). The number of individuals living in Makiki Valley was 936, comprising about two percent of Honolulu's population. The valley has a relatively older population than Honolulu with a median age of 45.3 years compared to 40.7 years, respectively. This is also reflected in the comparatively higher percentage of persons 65 years and older living in the valley compared to Honolulu.

The resident population of the valley is comprised of a greater proportion of Whites and a lower proportion of Asians compared to Honolulu. There are no Native Hawaiians or other Pacific Islander residents in the valley surrounding the project site. The valley has a comparatively higher percentage of multiracial individuals than Honolulu.

The number of housing units in the area is roughly 2 percent (363 housing units) of Honolulu's housing stock. The number of vacant housing units in the area is slightly lower than the number of vacant units in Honolulu's housing stock. The valley has a comparatively lower percentage of non-family households relative to Honolulu and a relatively greater number of family households, which represents households with blood-related members. The area also has a slightly larger average household size than Honolulu. There is also a greater percentage of households with individuals 65 years and older at 21.9 percent compared to 11.6 percent in Honolulu.

3.10.2 Income and Employment

American Community Survey (2013) data indicates that the valley had a higher proportion of employed individuals than Honolulu. The proportion of employed individuals in the valley was 66 percent while only 58.5 percent of individuals sampled in Honolulu were employed. The valley also had a higher proportion of unemployed individuals at 4.6 percent compared to the 3.3 percent of unemployed individuals in Honolulu's labor force. The valley had a higher percentage of households in the lowest earning category (less than $10,000 yearly) than Honolulu. However, 26.4 percent of households in the valley earned over $200,000, which is significantly greater than the 5.3 percent of Honolulu's households falling within this income category. Households living in the valley had a significantly higher median income of $107,917 compared to Honolulu's median household income value of $59,359.

Of individuals employed in the valley in 2013, 28 traveled into the valley to work, 321 lived in the valley but were employed outside its boundaries, while 13 individuals lived and worked in the valley (U.S. Census Bureau 2015).

Table 3.3 Summary of American Community Survey 2013 5 Year Estimate Data

Description of Demographic Data	Urban Honolulu CDP (Honolulu)		Tract 32 (tract surrounding project site)	
	Number	Percent	Number	Percent
POPULATION	340,639		936	
AGE				
Under 5 years	17790	5.2%	11	1.2%
5 to 19 years	50828	14.9%	152	16.2%
20 to 64 years	210788	61.9%	562	60.0%
65 years and older	61233	18.0%	211	22.5%
Median age	*40.7*		*45.3*	
RACE				
White	62,027	18.2%	428	45.7%
Black or African American	5,727	1.7%	3	0.3%
American Indian and Alaska Native	516	0.2%	0	0.0%
Asian	185,666	54.5%	285	30.4%
Native Hawaiian or Other Pacific Islander	27,571	8.1%	0	0.0%
Some other race	2,282	0.7%	11	1.2%
Two or more races	56,850	16.7%	209	22.3%
HOUSEHOLDS				
Family households	74,117	58.3%	201	60.4%
Non-family households	53,103	41.7%	132	39.6%
Householders living alone	42,160	33.1%	108	32.4%
Households with individuals 65 years and over	14,760	11.6%	73	21.9%
Average household size	*2.57*		*2.81*	
Average family size	*3.37*		*3.11*	
HOUSING OCCUPANCY AND TENURE				
Total housing units	142,767		363	
Occupied housing units	127,220	89.1%	333	91.7%
Vacant housing units	15,547	10.9%	30	8.3%
Owner-occupied housing units	55,136	43.3%	259	77.8%
Renter-occupied housing units	72,084	56.7%	74	22.2%
EMPLOYMENT STATUS				
Population 16 years and older	286,878		818	
Employed in labor force	167,759	58.5%	540	66.0%
Unemployed in labor force	9,607	3.3%	38	4.6%
Not in labor force	103,061	35.9%	240	29.3%
INCOME				
Households	127,220		333	
Less than $10,000	8,968	7.0%	38	11.4%
$10,000 to $49,999	44,424	34.9%	46	13.8%
$50,000 to $99,999	40,823	32.1%	57	17.1%
$100,000 to $199,999	26,275	20.7%	104	31.2%
$200,000 or more	6,730	5.3%	88	26.4%
Median household income	*59,359*		*107,917*	

Source: U.S. Census Bureau, American Community Survey 2013 5 - Year Estimates

3.10.3 Character of Makiki Valley

Makiki Valley is located in the Makiki-Tantalus region, which varies in character throughout its subareas. This region encompasses the subareas of Lower Makiki, Makiki, Lower Punchbowl, and Makiki Heights. Lower Makiki and Lower Punchbowl are densely developed with many high- and low-rise apartment buildings. Many of Makiki's businesses and neighborhood amenities are located in portions of the Makiki-Tantalus area closer to the H-1 freeway. Neighborhood amenities include the Makiki Community Library and The Honolulu Museum of Art. These portions of the Makiki-Tantalus region are highly developed with little greenspace and a dense housing stock. The majority of greenspace in these portions of the region are concentrated at the Makiki District Park.

The density of the housing stock decreases as one heads upslope toward Mount Tantalus, with a greater concentration of single-family homes located on the ridges flanking Makiki Valley. Upper areas of Mount Tantalus are comparatively undeveloped with development consisting of single-family homes. Upslope areas of Makiki and Makiki Heights have more greenspace with two City-owned parks and a State-managed recreation area.

The project site is located *makai* of the Honolulu Watershed Forest Reserve and upslope of the Hawaiʻi Nature Center. Makiki Valley remains undeveloped compared to other areas of the Makiki-Tantalus region. The Hālau Kū Māna public charter school is located further south of the baseyard. There are no housing developments near the baseyard, with homes concentrated along the roads ringing the surrounding ridges.

3.11 Infrastructure Facilities

3.11.1 Water Facilities

The City BWS provides potable water to the project site and surrounding uses via a network of water transmission mains. Domestic water is provided to the baseyard via a 1.5-inch City Board of Water Supply (BWS) water meter located near the project site entrance. Existing 8-inch and 4-inch water mains from BWS spring sources are located on the project site. An active 8-inch water main follows the existing roadway alignment, terminating in front of an inactive City BWS chlorinator station located at the mauka end of the project site. An existing fire hydrant is located near the entrance of the project site.

Existing water demand has been estimated for the purposes of this study using average daily demand factors from the City BWS's 2002 Domestic Consumption Guidelines. Average daily demand factors calculate water usage on a square foot (SF) basis with factors differentiated by zoning designation. Factors listed for the Commercial/ Industrial Mix zoning designation for the Island of Oʻahu were utilized. The State Conservation District and the City P-1 Restricted Preservation Zoning District zoning designations are not listed in these guidelines. Therefore, a zoning designation based on facility activities and uses was selected.

The Commercial/Industrial Mix zoning designation was most applicable for this project since office oriented uses similar to commercial facilities are present along with a small number of outdoor industrial uses for DOFAW field personnel. Average water demand for this zoning designation is 100 gallons per day (gpd) per 1,000 square feet (SF). Based on a facility area of 12,200 SF, existing operations at the project site consume an estimated 1,220 gpd of water. Project estimates assume a slightly larger facility area, resulting in a more conservative estimate for this study. Table 3.4 illustrates project water consumption calculations.

Table 3.4 Water Demand

	Facilities, total SF	Average Daily Water Demand (per 1000 SF)*	Estimated water demand
Existing facilities	12,200.00	100.00	1,220.00

**Average daily water demand factor for Commercial/ Industrial Mix zoning designation utilized. Average daily demand factor information from Domestic Consumption Guidelines, City and County of Honolulu BWS Water Requirements (2002)*

3.11.2 Wastewater Facilities

The project site is not serviced by the City Department of Environmental Service's (ENV) wastewater system. The nearest City mainline sewer connection is located 4,000 feet from the project site near the intersection of Makiki Street and Nehoa Street. A Green Machine wastewater treatment system is utilized on-site to treat wastewater output from DOFAW and HNC facilities. Wastewater from these facilities are generated by domestic activity with no contributing industrial or commercial activities.

A wastewater facility study was developed for this project that calculated existing and future wastewater flows to evaluate the utility of proposed wastewater system design alternatives (HDR 2015). Study design flow calculations assume DOFAW baseyard wastewater flow is generated by a total of 17 (full- and part-time) staff members. On days of peak wastewater generation, the calculated flow for the baseyard is 205 gpd. Peak flows are incorporated in this EA to provide a conservative baseline for existing wastewater generation.

Wastewater flows for the HNC were also calculated, since the green machine system services this facility. Study calculations assume HNC wastewater flows are generated by 17 (full- and part-time) employees along with 135 visitors during the HNC's peak season. Peak season visitor estimates are also incorporated for this facility to establish a conservative wastewater generation baseline. Wastewater generation calculations for the HNC yield an estimated total flow of 840 gpd. When the 80 percent design flow factor is incorporated, a final design flow total of 643 gpd results. Total peak day flows generated by both facilities incorporating the 80 percent design flow factor are 808 gpd. Table 3.5 illustrates wastewater usage estimates in detail.

Table 3.5 Wastewater Usage			
	DOFAW Baseyard	Hawai‘i Nature Center (HNC)*	TOTAL FLOWS (gpd)
Personnel			
FTEs	10	5	-
PTEs	7	12	-
Visitors at HNC (peak day)	-	134	-
Flows (gpd)			
FTEs	150*	75*	-
PTEs	55*	90*	-
Visitors at HNC (peak day)	-	670	-
Flow (gpd) (peak day)	205**	835**	1,040
Design Flow (80%) (gpd)(peak day)	165**	670**	835

**. Flows based on: 15 gpd per FTE; 7.5 gpd per PTE; 5 gpd per NHC visitor, and; 70 gpd per residential dweller (Ranger Cottage).*
***. Design average and peak flows are assumed to be 80 percent of the flows due to reduced loads on weekends.*
1. Study (HDR 2015) calculations rounded up to nearest whole number.

The Green Machine wastewater system is not regulated by the State DOH as a “wastewater treatment works” under Chapter 11-62 HAR. Therefore, testing results are not required to be submitted to the State DOH and testing is not performed on a daily basis. Treated wastewater from this system is discharged to a series of onsite leach fields located on the makai end of the project site. Additionally, wastewater from a DOFAW and HNC field services building (Ranger Cottage) is diverted to an onsite cesspool. This field services building is located outside the project site.

The project site is located in a State critical wastewater disposal area (CWDA) which is a designation applying to areas where the disposal of wastewater may have an adverse effect on human health or the environment due to hydrogeological characteristics of the area (Department of Health 2008). The State DOH may impose stringent wastewater disposal standards for lands receiving this designation. The project site is also located in the City’s “No Pass Zones”, which was created by the City BWS to protect inland water resources. The project site is located inland (mauka) of the No Pass Zone line requiring State DOH and City BWS approval for installation of the project’s proposed wastewater treatment and subsurface disposal system.

Properties near the project site are serviced by the City Department of Environmental Services (ENV) wastewater collection and treatment system. Alternatively, properties may have their waste treated by individual on-site wastewater facilities. Area wastewater is collected and treated at the Sand Island wastewater treatment plant (WWTP). This WWTP services communities from Kuliouou to Salt Lake, and has an existing capacity of 200 million gallons per day (mgd).

3.11.3 Drainage Facilities

The baseyard presently generates an estimated 3.56 cubic feet per second (CFS) of runoff based on City and County of Honolulu Storm Drainage standards pertaining to the 10-year, 1 hour storm event (Sam O. Hirota, Inc. 2015). Stormwater generally flows downslope within the project site in a north to south direction before entering into Makiki Stream.

Site drainage is managed through a limited number of drainage facilities. A series of grass swales throughout the site direct water away from baseyard facilities toward Makiki Stream. A concrete swale and concrete rubble masonry (CRM) wall system captures a portion of site runoff. This concrete swale and CRM wall system is located in the northwest corner of the baseyard.

3.11.4 Solid Waste Facilities

The project site is located within the City Department of Environmental Service's Refuse Division Honolulu collection district. There is presently no commercial waste generated within the project site collected by the City. Private waste disposal services collect solid waste generated on-site. Recyclable waste is collected by a private recycling service. There is little green waste generated on-site. Any green waste produced is composted or removed by a private hauler.

The Waimanalo Gulch Landfill located in Kapolei is owned by the City and is the only permitted landfill accepting solid waste on Oʻahu. This landfill accepts non-combustible municipal solid waste along with 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 are 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. Ash and residue from H-POWER are delivered to the Waimanalo Gulch Landfill (R.W. Beck, Inc., October 2008).

3.11.5 Transportation Facilities

Austin Tsutsumi and Associates, Inc. conducted a traffic impact analysis study for this project (see Appendix E). Traffic counts were taken at selected study intersections to determine existing traffic operations during the weekday morning and afternoon peak hours of traffic. Future traffic projects with and without the project were generated for the study year 2026 which included analysis of traffic conditions. Study intersections include the following:

- DOFAW Access Road/Makiki Heights Drive
- Makiki Heights Drive/Makiki Street
- Makiki Street/Nehoa Street

The methods for calculating traffic volume to capacity ratios and delays are prescribed in The *2010 Highway Capacity Manual* (HCM 2010). The analysis methodology also used Level-of-Service (LOS) designations as a qualitative metric to describe traffic flow conditions at the intersections examined. LOS values range from free-flow conditions (LOS A) to congested conditions (LOS F).

3.11.5.1 Existing Roadway System

The existing roadway system in the project area consists of the DOFAW Access Road, Makiki Heights Drive, Makiki Street, and Nehoa Street. Figure 3.11 illustrates roadways and intersections utilized in the project's traffic impact analysis.

The DOFAW Access Road provides DOFAW staff access to the baseyard from Makiki Heights Drive. This north-south, two-way, undivided access road is owned and maintained by the State. It is roughly 1,450 feet long and 12 feet wide with gravel shoulders and no sidewalk. The roadway provides access to the Hālau Kū Māna Charter School, the Hawaiʻi Nature Center, Makiki Valley State Recreation Area, and DOFAW Makiki Baseyard. The access road is gated to restrict access to Makiki Valley State Recreation Area when the area is closed.

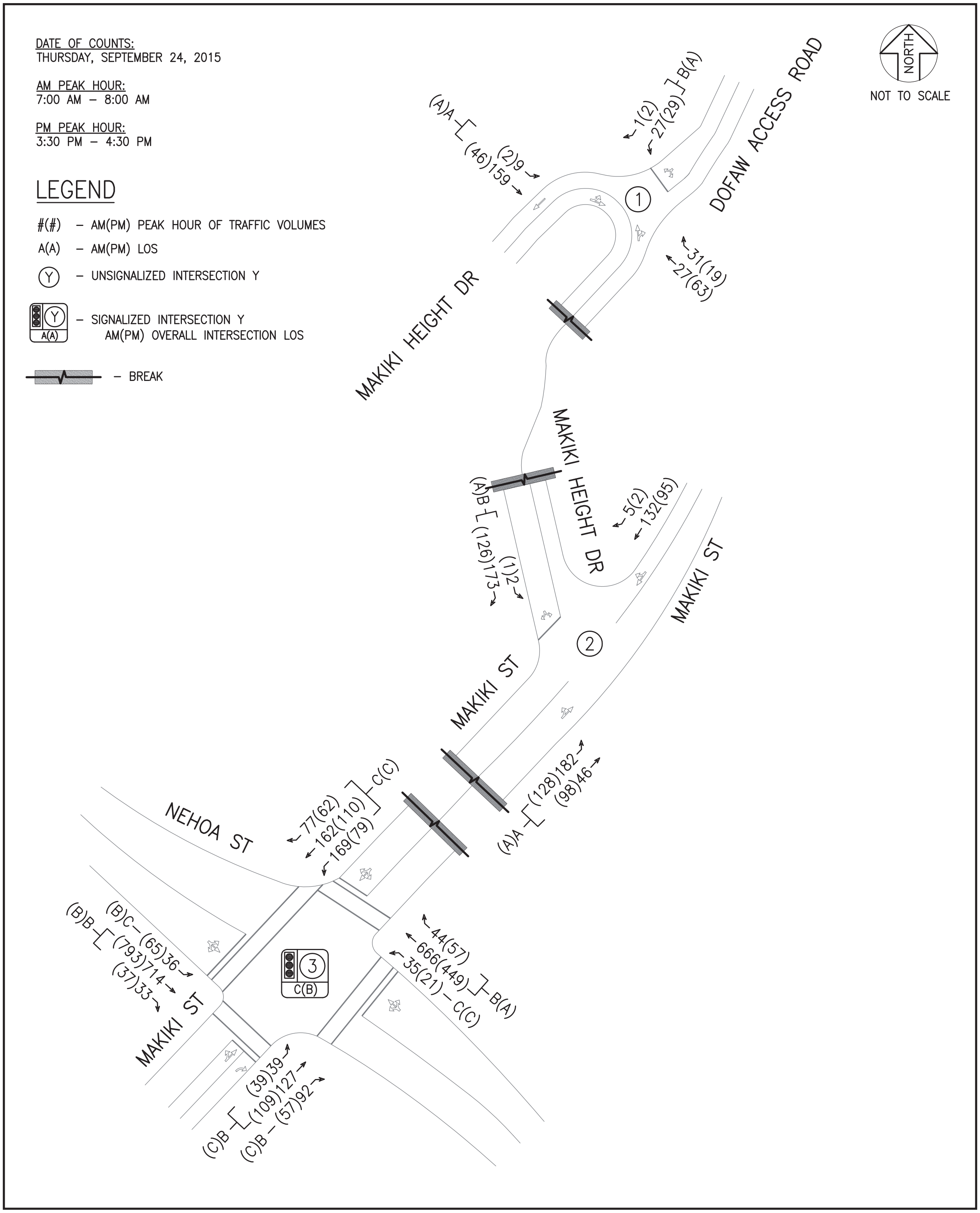
Makiki Heights Drive is a two-lane, undivided local roadway with a posted speed limit of 25 miles per hour. Makiki Heights Drive begins south of the project at its intersection with Makiki Street and winds uphill on the western side of Makiki Valley until its terminus at Tantalus Drive. Makiki Heights Drive travels southeast connecting with Makiki Street.

Makiki Street is a two-lane, undivided local roadway running north to south with a general posted speed limit of 25 miles an hour. This street begins north at its intersection with Makiki Place and terminates as a dead end street, south of Wilder Avenue. Makiki Street travels further south and intersects with Nehoa Street.

Nehoa Street is a two-way, undivided collector roadway running primarily east to west with a posted speed limit of 25 miles per hour. This street links the study area with Mānoa and Punchbowl. Nehoa Street provides access to residential areas between Punahou School and Roosevelt High School.

3.11.5.2 Existing Traffic Conditions

Weekday morning (7:00 AM to 8:00 AM) and afternoon (3:30 PM to 4:30 PM) peak hour traffic flow data was collected on Thursday, September 24, 2015. Figure 3.11 highlights the level-of-service relative to study area roadways.



Source: Austin, Tsutsumi, and Associates, Inc.

DOFAW Makiki Baseyard Improvements Project

Figure 3.11 – Study Roadways, Intersections, and Related Levels of Service

Honolulu, Hawaiʻi

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Analysis of study intersections yielded information on existing project area traffic conditions. Table 3.6 highlights these results and a summary is provided below.

- ***DOFAW Access Road/ Makiki Heights Drive.*** This unsignalized two-way stop-controlled (TWSC) T-intersection operates at a LOS B or better with no significant queueing observed during the AM and PM peak traffic hours.
- ***Makiki Heights Drive/Makiki Street.*** This unsignalized TWSC T-intersection currently operates at LOS B or better. Significant queueing is not observed during AM or PM peak hours with momentary queuing observed from 3:00 pm to 3:15 pm at the entrance to Hanahauʻoli School, which is located near the intersection of Makiki Heights Drive and Makiki Street. These queues were not observed during morning and afternoon peak hours.
- ***Makiki Street/ Nehoa Street.*** Vehicular flow at this signalized intersection was determined to operate at LOS D with no significant queuing observed during the AM and PM peak traffic hours. The intersection is comprised of the Nehoa Street eastbound and westbound approaches and the Makiki Street north and southbound approaches.

Table 3.6
Existing 2015 Levels-of-Service Analysis Results

Study Intersection	Existing 2015 Conditions					
	AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1. DOFAW Access Road/ Makiki Heights Drive						
Eastbound Left Turn/ Through	7.4	0.01	A	7.4	0.00	A
Westbound Through/ Right Turn	0.0	0.00	A	0.0	0.00	A
Southbound Left Turn/ Right Turn	10.0	0.04	B	9.3	0.04	A
2. Makiki Heights Drive/ Makiki Street						
Eastbound Left Turn/ Right Turn	10.2	0.21	B	7.7	0.09	A
Northbound Left Turn/ Through	7.9	0.14	A	0.0	0.00	A
Southbound Through/ Right Turn	0.0	0.00	A	9.5	0.15	A
3. Makiki Street/ Nehoa Street						
Eastbound Left-Turn	22.7	0.15	C	12.7	0.15	B
Eastbound Through/ Right-Turn	18.4	0.79	B	16.7	0.80	B
Westbound Left-Turn	24.5	0.15	C	22.2	0.09	C
Westbound Through/ Right-Turn	16.9	0.75	B	9.3	0.50	A
Northbound Left-Turn/ Through	20.5	0.32	C	22.3	0.31	C
Northbound Right-Turn	19.2	0.21	B	20.5	0.15	C
Southbound Left-Turn/ Through/ Right-Turn	35.7	0.81	D	26.8	0.55	C
Overall	21.5	--	C	16.5	--	B

3.12 Public Facilities and Utilities

3.12.1 Educational Facilities

The project site is within the State Department of Education's (DOE) Kaimuki-McKinley-Roosevelt Complex area. Elementary school students within the complex are served by Lincoln Elementary School, Stevenson Middle School, and the Hālau Kū Māna public charter school. Hanahau'oli School provides private educational opportunities to elementary school-aged students. High school students are served by Roosevelt and Hālau Kū Māna Schools. The official enrollment for complex area schools for the 2014-2015 school year is 2,373 students for non-charter schools and 134 for charter schools.

Hālau Kū Māna public charter school is the closest educational facility to the project site and is located about 0.25 miles away from the project site on Makiki Heights Drive. Roosevelt High School is located roughly 0.7 miles away while, Lincoln Elementary and Stevenson Middle School are located 0.8 and 0.9 miles away respectively. Figure 3.12 shows the location of these schools in relation to the project site.

3.12.2 Medical Facilities

Kapiolani Medical Center for Women and Children is the closest emergency room and hospital facility to the project site. The medical center is located about one mile away from the site situated at the intersection Punahou Street and Bingham Street. The facility is a full-service medical center offering a wide range of medical services. The medical center has 207-beds and 66 bassinets. Queens Medical Center (QMC) is located further from the project site. QMC has 505 acute care beds and 28 sub-acute beds, and is the largest private hospital in Hawai'i.

3.12.3 Recreational Facilities

The project site is located in the Makiki Valley State Recreational Area, which provides public access to the valley for the recreational enjoyment of O'ahu residents. Relevant details pertaining to these facilities are discussed below.

1. Hawai'i Nature Center. The Hawai'i Nature center provides educational opportunities to students and community members. Visitors to the center have guided access to natural resources in the recreational area.
2. Na Ala Hele Hiking Trails. Na Ala Hele is the organization overseeing the State of Hawai'i's Trail and Access program. Ten of 40 trails under Na Ala Hele oversight are located within or near the Makiki Valley State Recreational Area. Of nearby trails, Kanealole and Maunalaha trails are the closest to the project site and begin at the Makiki Forrest Recreation Area. Other trails near the project site are 'Ualaka'a trail and Makiki Valley trail.

DOFAW Makiki Baseyard Improvements Project

Figure 3.12 – Existing Public Facilities

Honolulu, Hawai'i

3. Archie Baker Mini Park. This city park site is located roughly 0.5 miles from the project site, and has a grassy area without recreational facilities.
4. Makiki District Park. This City park site is located about one mile away from the project site. The park has a swimming pool, ball fields, and a playground.

3.12.4 Police and Fire Protection

Police Protection

The Honolulu Police Department provides police protection services to the project area through their District 1 patrol. The district encompasses the Upper Makiki, Lower Punchbowl, and Tantalus region and had a population of 83,700 individuals in 2014 (Honolulu Police Department 2014). The nearest substation to the project site is the Alapai Police Headquarters. HPD criminal, narcotics, traffic, and scientific investigation units compliment the policing efforts of their patrol districts. The Department also has an array of community policing initiatives that include neighborhood security watches and the Community Policing/Weed and Seed program.

Fire Protection

The Honolulu Fire Department (HFD) is divided into three platoons that are subdivided into battalions that are further comprised of companies. Fire Company 3 services the Makiki area and is located about one miles from the project site. The fire station is located at the intersection of Pi‘ikoi Street and Wilder Avenue. Fire service access to the project area is provided through the DOFAW Access Road.

3.12.5 Electrical and Communication Facilities

The Hawaiian Electric Company’s (HECO) billing invoices indicate that energy consumption for the project site is currently minimal. Electrical services are provided to the project site from HECO distribution lines. An electrical easement located on the DOFAW Access Road provides project site facilities access to these services. This utility easement runs along the center of the baseyard and terminates by the BWS chlorinator facility. Electrical service is provided to baseyard facilities through HECO poles 11, 12, 13, and 14/15.

Existing energy demand for project site facilities is 3,452 kwh/month (DOFAW Makiki Baseyard – Electrical Conditions Report 2015). Energy usage figures are based on electrical usage profiles listed in HECO billing for these facilities. Energy demand for the BWS chlorinator facility was unable to be determined because the facility is currently inactive. Energy used at the chlorinator facility is paid for by the City BWS.

Phone service is provided by Hawaiian Telcom. Oceanic Time Warner Cable provides CATV services to two existing facilities from baseyard pole number 12.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES

This chapter discusses probable environmental consequences associated with implementing the Makiki Baseyard Improvements Project. Discussion of probable impacts addresses the No Action Alternative and the Proposed Action. The No Action Alternative represents a future scenario "without the project" and provides a baseline of environmental conditions so probable impacts or changes resulting from the proposed restoration project may be evaluated.

4.1 Topography and Soils

4.1.1 Topography

No Action Alternative

Major changes to existing project site topographic conditions would not occur under this alternative. However, topographic conditions within this site and surrounding area would eventually change from erosion caused by stormwater runoff. Management of stormwater runoff is currently minimal because of the limited number of drainage facilities on site.

Proposed Action

The layout of proposed improvements was developed with consideration of DOFAW goals to minimize the need for major site work. This would be accomplished by remaining sensitive to the site's existing topography. Given these goals, only minor grading and filling activities are required for project site improvements under this plan. No major cut or fill activities would occur that significantly alter existing site topography. Retaining walls are proposed for the *mauka* portions of the project site abutting the western flank of Makiki Valley. These retaining walls are only required for a small portion of the project site.

The project will also result in positive impacts to site topographic conditions due to proposed drainage improvements. The proposed system of 18- and 24-inch drains will manage the rate and flow pattern of site runoff, reducing rates of erosion. The proposed rainwater catchment system will detain site rainwaters that would ordinarily sheet flow across the baseyard, and effect existing site topographic conditions.

4.1.2 Soils

No Action Alternative

Major changes to existing site soil characteristics would not occur under this alternative. Onsite soils would continue to experience movement and erosion from natural processes.

Proposed Action

Construction of road and parking improvements would require temporary land-disturbing activities leading to short-term disturbance of site soils. These effects may be amplified by heavy rainfall or high winds leading to increased erosion. Soils types within the project site are Kaena Stony Clay 12 to 20 percent slope (KaeD) and Rock land (rRK) soils. Tantalus Silt Loam 40 to 70 percent slope (TAF) soils comprise a comparatively smaller portion of the project site on the *mauka* end of the site. Kaena Stony Clay soils are characterized by their slow permeability, medium runoff rate, and low erosion risk.

Construction activities should not result in higher than average disturbance to this soil type. Rock land soils may become unstable when they are saturated, leading to increased risk for facilities constructed on this soil type. Facilities will not be built on project site lands comprised of this soil type. Potential runoff from Rock land soils during rainy periods and runoff from project site work can be mitigated through applicable best management practices (BMPs). BMPs that can mitigate the impact of runoff on downstream water resources might involve usage of controlled watering to allay dust during grading work. Additional strategies may involve use of barriers to ensure travel of silt laden runoff into nearby water sources is minimized.

Mitigation measures used will be determined during the project's design phase, and would incorporate applicable City erosion and sedimentation control guidelines. The majority of plan review will occur with State agencies because the project site is a State-owned property. A State Department of Health (DOH) National Pollutant Discharge Elimination System (NPDES) permit for construction activities would be obtained. Design plans will be submitted to pertinent State and City agencies for ministerial review and approval.

4.2 Natural Hazards

The Proposed Action will not significantly increase natural hazard exposure for baseyard personnel or property. Proposed improvements consist of replacement of temporary facilities with structurally sound buildings. Replacement of temporary facilities can decrease risk of structural or human damage from natural disasters.

4.2.1 Earthquakes

No Action Alternative

The project area is susceptible to earthquake damage under the No Action Alternative. Risk of injury from significant earthquakes may be higher at the baseyard compared to other urbanized areas on O‘ahu since many baseyard facilities are temporary structures (i.e. modified storage containers and parking sheds).

Proposed Action

Significant earthquakes on O‘ahu are unlikely with most of the State of Hawai‘i’s earthquakes resulting from volcanic activity on neighbor islands. The majority of these earthquakes have caused little or no damage to Hawai‘i’s buildings or households. Permanent structures constructed as part of the Proposed Action would be less susceptible to earthquake damage than existing temporary structures. Although difficult to forecast, a significant earthquake could damage existing temporary facilities since these structures may be less likely to withstand significant seismic impacts. Replacing these facilities with well designed permanent structures would better safeguard DOFAW personnel and associated resources.

These structures would be designed and built in compliance with the provisions of the International Building Code (IBC) 2006 that the City has adopted with amendments to specific sections (Article 1, Chapter 16, Revised Ordinances of Honolulu). The project will be compliant with Chapter 16, Section 1613 earthquake load requirements of the IBC 2006 and related City amendments to the code.

4.2.2 Hurricanes

Strong winds, storm surges, and heavy rainfall accompanying hurricanes are hazardous to humans and can damage buildings (FEMA 1993). These accompanying effects can be dangerous even if associated hurricanes do not make landfall. The greatest threat related to hurricanes result from water-level rise from wave forces rather than wind forces. All coastal areas of the state are equally vulnerable to hurricane impacts. The only mitigating variables are local in nature (e.g. slope, elevation, geology, offshore barriers).

No Action Alternative

A hurricane of significant strength passing over or close to the Island of O‘ahu could damage trees and vegetation within the project site. Permanent and temporary project site facilities could also be damaged by significant hurricanes along with DOFAW staff. The project site would not be susceptible to wave induced hurricane damage since the project site is located far away and upslope from Oahu’s coastal regions.

Proposed Action

Hurricane induced storm surge and water level rise are some of the most damaging effects related to this natural hazard. The project site is located inland of the coastline and would not be affected by hurricane storm surge. The baseyard is most susceptible to strong winds and heavy rainfall that hurricanes may bring. Heavy rainfall and strong winds could damage existing temporary facilities since these structures may be unable to withstand these impacts. Project site facilities under the Proposed Action would be better constructed than existing temporary facilities and would be better suited to handle severe winds and rainfall. Proposed facilities will be consistent with the provisions of the International Building Code (IBC) 2006, which the City and County of Honolulu has adopted (Article 1, Chapter 16, Revised Ordinances of Honolulu). The project will be compliant with Chapter 16, Section 1609 wind load requirements of the IBC 2006 and related City and County of Honolulu amendments to the code. Therefore, damage risk for facility improvements should be equal to risks for other residential and educational facilities in the surrounding area.

4.2.3 Flooding

No Action Alternative

Flooding risk would continue to be low under the No Action Alternative. The project site is located in the Zone X, non-special flood hazard area, indicating that the project has a low to moderate flood risk.

Proposed Action

Flood risk may rise under the Proposed Action given increases in impervious surfaces due to construction of new buildings and other facility improvements. Increasing the area of site impervious surfaces will result in increased runoff into nearby streams. Increased runoff can cause these streams to swell over the top of streambanks, flooding nearby areas.

Increased flood risk under the Proposed Action will be mitigated through proposed drainage improvements. Improvements include the development of a system of pipes that will channel stormwater and manage the rate and location that it is released. Stormwater retention tanks will also be implemented which will also manage the rate that stormwater is discharged. These improvements will mitigate increases to flood risk that the project may result in.

4.3 Hazardous Materials

No Action Alternative

Existing hazardous material exposure risk would be maintained under the No Action Alternative. Hazardous material sources are located within a mile of the project site and downslope relative to the area.

Proposed Action

Existing hazardous material sites identified will remain in their current locations under the Proposed Action and should not pose additional risk to the project site or its inhabitants. Facility and infrastructure improvements should not result in increased exposure to hazardous materials. However, contractors will implement BMPs in accordance with regulatory requirements to reduce hazardous material exposure risk during construction. Anticipated BMPs include storage of hazardous materials in secure areas on-site that are located away from natural resources.

Hazardous material exposure could result from the removal of the BWS Chlorination Station and installation of the permanent wastewater system. DOFAW will coordinate with the City BWS to determine the appropriate method of removing the Chlorination Station so hazardous material exposure risk does not increase. Future growth in DOFAW programmatic capacity after project implementation may also increase exposure to hazardous materials from DOFAW operations. This risk can be mitigated through BMPs such as responding immediately to on-site hazardous fluid spills and proper disposal of hazardous waste through a licensed transporter.

4.4 Hydrology

4.4.1 Hydrogeological Resources

No Action Alternative

The existing characteristics of hydrogeological resources in the project site would be maintained under the No Action Alternative. The basal aquifer located under the project site would still have potential for drinking usage and will continue to be vulnerable to pollution.

Proposed Action

Project implementation will increase baseyard programmatic capacity allowing more DOFAW staff members to operate out of the baseyard. However, this may effect groundwater resources if preparation for conservation efforts produces contaminated runoff. For example, runoff from the cleaning of baseyard vehicles can percolate into baseyard soils.

To mitigate these impacts, low impact development (LID) strategies such as bioretention areas are proposed. Bioretention areas can absorb pollutants carried in runoff before they percolate into groundwater resources. The project is located *mauka* of the City's No Pass Zone and the State's Underground Injection Control line. This signifies that water resources below the project site are valuable resources that must be stringently regulated.

Construction of proposed leach field upgrades may result in negative impacts to the aquifer under the project site. To mitigate this risk, leach field upgrades will be designed in compliance with State DOH wastewater design standards. Once implemented, BMPs will be utilized as needed to mitigate aquifer contamination risk. Anticipated BMPs include maintaining yearly maintenance inspections of the leach field system and ensuring difficult to decompose organic and inorganic substances do not enter the system.

4.4.2 Surface Waters and Streams

<u>No Action Alternative</u>

The Makiki Watershed area will continue to be a region with valuable aquatic resources under the No Action Alternative. Baseyard stormwater runoff would continue to flow with little flow management into Makiki Stream under this alternative.

<u>Proposed Action</u>

Project facility and infrastructure improvements will increase the amount of impervious surfaces in the project site, leading to increased runoff rates. Drainage improvements proposed as part of the Proposed Action would mitigate this increase by detaining runoff onsite, resulting in a net positive impact to nearby water resources. Proposed improvements include an underground system of stormwater retention basins and rainwater catchment improvements. These improvements will ensure increased runoff does not flow at an excessive volume that can leading to sediment and debris transport into nearby streams.

Runoff will be further controlled through a system of 18 to 24 inch drains that will route water away from the buildings toward the streamside of the property. Bioswales will be utilized between the project site and Makiki Stream as a means of filtering contaminants from baseyard runoff so runoff is cleansed before it enters Makiki Stream. Proposed improvements can mitigate impacts increase in project site impervious surfaces may have on nearby surface water resources, resulting in an overall net benefit for the watershed area.

4.4.3 Water Quality

<u>No Action Alternative</u>

Makiki Stream, which is located downslope of the project site currently, exceeds State water quality standards and is considered an impaired water body. The poor water quality of this stream would remain the same or worsen under the No Action Alternative, which is not consistent with the State Department of Health's antidegredation policy (HAR Section 11-54-1.1) which calls for maintenance and protection of State water bodies. Runoff from the project site would continue to flow with limited regulation into Makiki Stream, which would continue to contribute to the impaired character of the water body.

<u>Proposed Action</u>

Proposed stormwater and rainwater retention improvements that will be constructed can result in better management of runoff. For example, bioswales and riparian buffers are proposed, which can trap water borne contaminants before they reach nearby water bodies. These improvements will prevent increased runoff from project related impervious surfaces from negatively affecting the quality of Makiki Stream. These improvements also have the potential to enhance stream water quality and can contribute to a potential improvement in classification for Makiki Stream under State Water Quality Standards.

Implementation of the Proposed Action would improve the water quality of Makiki Stream and downstream water resources. This aligns with State Department of Health's antidegredation policy (HAR 11-54-1.1). The project is also compliant with the State Department of Health's Designated Uses requirements (HAR 11-54-3) for Class 2 inland waters that are applicable to water bodies associated with this project. In particular, an NPDES permit will be obtained in compliance with Class 2 designated use regulations should project construction result in discharge into waters near the project site. It is anticipated that the project will be compliant with basic water quality criteria (HAR 11-54-4) and water quality criteria for inland water bodies (HAR 11-54-5.1 and HAR 11-54-5.2).

Contractors will minimize pollutant and sediment runoff into nearby water bodies during construction by implementing BMPs. These BMPs might involve usage of silt fencing to filter sediments from stormwater and proper storage of potential pollutants like fuel, which may travel into nearby waterways. Plans and associated BMPs would be reviewed and approved by pertinent agencies prior to construction activities. Anticipated water quality impacts should be minimal since approved measures will be employed to minimize negative water quality impacts.

4.5 Botanical and Faunal Resources

4.5.1 Botanical Resources

No Action Alternative

The botanical characteristics of the project site would remain unchanged under the No Action Alternative. Although the presence of native plants is comparatively higher in the project site than other lowland O'ahu areas, native plants identified in the project's biological survey are primarily planted specimens. The two endangered plant species observed (*Hibiscus clayi* and *Pritchardia (loulu)*) would most likely remain in their current locations under the No Action Alternative. The endangered plant species observed are a *Hibiscus clayi* specimen near the administration building and a *Pritchardia (loulu)* specimen located downslope of the project site (see Exhibit 3.5). The *loulu* specimen on the baseyard was not identified as being endangered but is noteworthy given the number of species in the *loulu* genus that may be endangered. DOFAW's continued presence and stewardship of the project site would result in the maintenance of the baseyard's existing biological characteristics.

Proposed Action

The Proposed Action would result in the planting of additional native species in the project site as shown in the conceptual landscape plan. This action aligns with DOFAW's goals to manage and steward native ecosystems. This will be a positive addition to the project site and will align with HRS 343 Environmental Policy goals to safeguard the State's unique natural resources. Two species of project site trees are noted on the U.S. FWS list of endangered plant species. These species are *Hibiscus clayi* and *Pritchardia (loulu)*. The Hibiscus clayi specimen identified near the administration building will not be adversely impacted since improvements are not proposed for the area it is located in. Although it is unknown whether the *Pritchardia (loulu)* specimen observed is endangered, it is important to understand whether the project impacts this specimen. This specimen is located downslope of baseyard Building 13 and will not be impacted by the project since improvements are not proposed for this area.

Proposed improvements do not call for the removal or relocation of these specimens. Therefore, the project should not have an adverse effect on threatened or endangered, or candidate threatened or endangered botanical species.

4.5.2 Avifaunal and Faunal Resources

Avifaunal Resources

No Action Alternative

The characteristics of avifaunal biota in the project site would be unchanged under the No Action Alternative. There will likely be no avian species listed or proposed for listing under Federal or State endangered species statutes found in the project site under this alternative. One endemic seabird species (White-tailed Tropicbird) was sighted in the project site, though the project's biological survey noted there were no seabird habitats found on-site. These seabirds are often injured or killed when they become disoriented by bright lights and collide into buildings. Mortality risk for endemic avian species would continue to be low since additional lighting infrastructure will not be added to the project site.

Proposed Action

It is likely that endangered avian species will not inhabit the project site under the Proposed Action. Risk of injury to endemic or endangered avian species should be low to non-existent. However, construction and operation of project site facilities may present risk to endemic seabirds that may be sighted in the area. These birds may become disoriented if lighting is used during night construction or if streetlights and exterior lighting are installed. BMPs will be implemented to reduce seabird injury risk during these periods. Nighttime construction activity will not occur for this project. However, should nighttime construction occur, lights will be shielded. Floodlights used during construction will be placed on poles so they can be pointed at the ground and away from seabirds. Once facilities have been developed, exterior lighting will be shielded to reduce risk of seabird disorientation. Mortality risk for project site avian life will be minimal if these BMPs are implemented.

4.6 Air Quality

No Action Alternative

There would be no long- or short-term impacts on air quality under the No Action Alternative because air quality in the project area would remain similar to present conditions

Proposed Action

Minor short-term construction related impacts on air quality would be associated with fugitive dust emissions. Fugitive dust emissions would likely arise from dirt moving activities associated with site clearing and grading. These emissions are expected to be limited because proposed improvements were designed to require minimal grading activities. Residential developments that may be affected by adverse air quality conditions are located upslope from the project area and are not in the immediate vicinity of the site. The Hawaiʻi Nature Center and Hālau Kū Māna Charter School are located downslope and downwind of the project area and may be impacted by fugitive dust emissions.

State air pollution controls prescribed under the State 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 will be prepared and implemented by the contractor in compliance with these regulations. Dust control measures may involve implementation of a watering program or usage of windscreens. Other measures include sound construction management practices at the job site (i.e. road cleaning or tire washing programs), and use of temporary rock pavers for heavily traveled areas with exposed soils. Exhaust emissions from construction vehicles can be minimized through the proper operation and maintenance of all equipment.

Anticipated increases in vehicular emissions from operation of construction equipment should not result in significant impacts to air quality because these vehicles will only be utilized during the work hours. Additionally, the maximum distance these vehicles will travel will be the project area. As a result, emissions from vehicle operation will be minimal and will not result in significant impacts on air quality.

Once construction is finished, vehicular emissions from future DOFAW staff members driving to the site may have minor effects on air quality. Anticipated emission increases from the relatively small number of additional staff should not result in significant air quality impacts. This is anticipated because future staff members are not expected to congest nearby roads, resulting in concentrated vehicular emissions. Additionally, Federal air pollution control regulations require new motor vehicles to be equipped with emission control devices that reduce emissions significantly. Amendments to the Clean Air Act require further emission reductions that 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. This will not result in carbon monoxide concentrations exceeding State standards.

4.7 Noise

Noise from construction activities is regulated under Title 11, Chapter 46 (Community Noise Control) of the State DOH's Administrative Rules (Department of Health, 1996). The zoning district classification and maximum permissible sound levels are summarized in Table 4.1 below. The project falls under the Class A category applying to properties zoned for preservation and conservation 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.

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

<u>No Action Alternative</u>

There would be no long- or short-term changes to noise levels in the project area under the No Action Alternative. Significant changes would not occur because sources of noise near or far from the project area would remain similar to present conditions

<u>Proposed Action</u>

The project may result in temporary short-term increases in noise from construction activities occurring during daytime hours. These activities will temporarily increase ambient noise levels for areas near the project area. Noise would come from equipment used for construction activities that may be audible at the property line. Actual noise levels produced would depend on construction methods employed, along with ambient conditions including wind speed and direction. Earthmoving equipment such as bulldozers and diesel-powered trucks may contribute the greatest increases to ambient noise levels. The typical range of construction equipment noise varies between 70 and 95 dBA.

Construction activities should not result in a significant noise impact on surrounding uses because these activities are expected to be limited to regular workday hours (7:30 a.m. to 4:30 p.m., Monday through Friday). The closest noise sensitive receptor to the project area is the Hālau Kū Māna Charter School, which is located roughly 1,100 feet *makai* of the project area. Noise impacts are anticipated to be minimal given the distance between the project area and charter school, which will allow construction noise to dissipate. Additionally, the school's administrative activities and many educational activities are conducted in on-site trailers. These trailers will also mitigate ambient noise impacts that may occur from construction activities. Measures to control construction noise include the use of mufflers on power equipment and construction vehicles. 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.

The project is not anticipated to generate significant long-term impacts on noise levels after buildout. This is anticipated because baseyard activities are primarily indoor and administrative or involve preparation for conservation activities carried out offsite. Noise from human voices, activities, and vehicles should be minimal with little impact to ambient noise levels.

4.8 Visual Resources

<u>No Action Alternative</u>

There would be no changes to scenic views of important visual resources under the No Action Alternative. This area is currently not visible from coastal areas and would not impact views of nearby visual resources like Round Top (*Pu'u 'Ualaka'a*) and the Ko'olau Coastal Land Form. The Sand Island Significant Stationary View will not be impacted under the No Action Alternative. Intermittent and Continuous Coastal Views in the South Shore viewshed will not be impacted because these views face toward the ocean and away from the project area

<u>Proposed Action</u>

Visual quality characteristics from the City's Coastal View Study (Chu 1987) are used to assess the impact this project may have on nearby visual resources. The visual impact of the project is evaluated by the degree that it may alter nearby views or scenic resources. These characteristics are: 1) visual vividness, 2) visual unity, and 3) visual 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 described below:

1. <u>Visual Vividness.</u> 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 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.

The visual vividness, unity, and intactness of the Koʻolau Coastal Land Form will not be impacted under the Proposed Action. Although baseyard facilities will increase, these facilities would be similar in size to existing buildings. The site plan also respects the existing natural character of the project site and calls for minimal clearance of vegetation. All site design elements are intended to be visually pleasing and consistent with the surrounding area, respecting the visual unity of the surrounding area. As a result, proposed improvements will not alter the character and memorability of the landform that surrounds it.

The visual vividness of views from the Sand Island Significant Stationary View will not be impacted under the Proposed Action because the project site is not visible from this location. The vividness of these views would not be disrupted because the proposed improvements are intended to blend seamlessly with the natural character of the surrounding area, preserving the area's visual unity. Views from this Significant Stationary View would remain intact and free from encroaching features since project improvements are located deep within a highly vegetated area.

Intermittent and Continuous Coastal Views will not be impacted under the Proposed Action because these views are all oriented toward the ocean and away from the project area.

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 improvements proposed, and includes the area within which the project may directly or indirectly cause alterations to the use of a historic property. Based on facility and infrastructure improvements planned, the project will not have visual, auditory, or other environmental impacts to any known archaeological historic properties located outside the project site. Therefore, the area of potential effect, or APE, is the same as the project site of 3.05 acres.

No Action Alternative

Under this alternative, facility and infrastructural improvements would not be implemented in the project site. Potential subsurface historic resources would not be affected since ground disturbing activities associated with this project would not occur. Existing permanent and temporary project site facilities would not be demolished or renovated. As a result, Buildings 2 and 4 which potentially but likely will not qualify as historic properties will not be replaced. Cultural resources are not located within the project site nor are cultural practices occurring in the project site. Cultural resources would not be impacted under the No Action Alternative.

Proposed Action

It was determined that there are no known native Hawaiian or traditional archaeological resources in the project site, based on results of the literature review and field inspection for this project. Existing retaining walls identified on the site were determined to not be historic properties. Existing Buildings 2 and 4 should also not be considered historically significant and should not be adversely impacted by its demolition associated with this project.

There are no known native Hawaiian cultural practices occurring in the project site. Although some plants found in the project site are known to have cultural uses, there are no known cultural gathering practices associated with or located in the project site. There are no known burials located within the project site. Therefore, the Proposed Action should not significantly affect traditional native Hawaiian cultural practices or resources.

The Proposed Action will not restrict existing access to trails. There are no areas outside the project site that may potentially be used for traditional native Hawaiian cultural practices. In the unlikely event that project improvements impede access to nearby trails, DOFAW will work with concerned parties to restore access to these resources.

Surface level historic properties are not located in the project site. However, the project site is located within portions of four LCAs which indicates the potential for per- and/or early post-Contact land uses being uncovered due to ground disturbing activities. Therefore, an archaeological monitoring program should be developed to address impacts that ground disturbing activities can have on subsurface historic resources that may be present given the project sites location within portions of four LCAs.

The monitoring plan should 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 subsurface historic resources 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 DOFAW baseyard historic site should be included in the data recovery report.

4.10 Social and Economic Factors

4.10.1 Population and Housing

No Action Alternative

No changes to population and housing characteristics would occur under the No Action Alternative. The number of housing and visitor units in Makiki valley and the surrounding areas would not be affected because such units would not be developed on the project site. There would be no change to the existing resident population or the existing population characteristics of the surrounding area as well.

Proposed Action

Improvements proposed in the Proposed Action will not increase or decrease the number of housing units in the valley because residential development is not proposed. There are no new visitor units included with this project. New employment positions resulting from project improvements will most likely be filled by O‘ahu residents. In-migration of individuals to O‘ahu to fill new jobs created by project improvements is not expected. Therefore, this project will not affect existing population characteristics of the valley.

4.10.2 Income and Employment

No Action Alternative

Income and employment characteristics for individuals in Makiki Valley would not change under the No Action Alternative. There would be no effect on the City and State of Hawai‘i’s finances in terms of tax revenue. This alternative would not result in changes to worker travel patterns to or from the valley.

Proposed Action

Significant changes to income and employment characteristics in the valley surrounding the project site are unlikely to occur as a result of the Proposed Action. However, project implementation may result in minor positive impacts to islandwide employment and income characteristics. Temporary construction jobs would be generated by the Proposed Action. Given the phased structure of project implementation, the number of construction jobs created would be spread over the anticipated 10-year implementation period. These short-term construction jobs would stimulate creation of indirect jobs servicing the needs of the construction industry. Expansion of DOFAW facilities will also create multiple long-term direct jobs. Project implementation is anticipated to create an additional 24 jobs. Both short-term construction related and permanent jobs are anticipated to be filled by O‘ahu residents.

The potential short-term jobs created from construction activities and long-term jobs created from the expansion of DOFAW facilities would provide additional personal income to individuals. This additional income would have an overall small, positive impact to residents on Oʻahu. This income 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. 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.

4.10.3 Character of Makiki Valley

No Action Alternative

The character of Makiki Valley would remain essentially the same under this alternative. The project site and the valley surrounding it comprise a small, remote portion of the region that is less developed compared to the region as a whole. The character of both areas would remain the same under the No Action Alternative. The number of housing and visitor units in Makiki Valley and surrounding areas would not be affected because such units would not be developed in the project site. There would be no resulting change to the existing resident population or the existing population characteristics of Makiki Valley or the surrounding area. The character of businesses in the surrounding area also would not be affected since consumer demographics of the surrounding area would not change. The character of Makiki Valley and the surrounding area would be remain similar to current conditions in the No Action alternative.

Proposed Action

The valley surrounding the project site will remain relatively undeveloped since proposed facilities do not require expansion of existing baseyard boundaries. Proposed facilities will be similar in scale to existing facilities and are designed with respect to surrounding natural conditions. The Proposed Action is limited to the region the project site is located in and will not impact the character of the surrounding area. Improvements planned under the Proposed Action will not impact the number of housing units in Makiki Valley and the surrounding area because no housing units are included in 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 Makiki Valley or the surrounding area. The character of businesses surrounding the project site will not be impacted by the proposed project since the population that supports these businesses will not change.

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 in the project site would essentially remain the same under this alternative.

Proposed Action

Construction of proposed facilities will result in increased water demand. It is estimated that water demand will increase from 1,220 gpd to 2,850 gpd. Table 4.2 compares water demand estimates between the No Action Alternative and the Proposed Action. Although the additional amount of water demanded is estimated to increase, additional demand in this scenario should not significantly impact the City BWS's water system or its ability to service water needs in Makiki Valley.

Table 4.2 Water Demand

	Facilities, total square footage	Average Daily Water Demand (per 1000 sq.ft)*	Estimated water demand
No Action Alternative	12,200.00	100.00	1,220.00
Proposed Action	28,500.00	100.00	2,850.00

**Average daily water demand factor for Commercial/ Industrial Mix zoning designation utilized. Average daily demand factor information from Domestic Consumption Guidelines, City and County of Honolulu BWS Water Requirements (2002)*

A 1-1/2" City Board of Water Supply (BWS) water meter located near the project entrance will continue to provide water service to the project site, and a new 8-inch waterline will be constructed to service baseyard water needs. All new buildings connecting to this 8-inch water main shall have an appropriately sized BWS water meter.

The Honolulu Fire Department (HFD) requires construction of a new onsite fire hydrant so access can be provided 150-feet from the fire access road to the furthest exterior wall. HFD hydrant flow requirements are currently unattainable given existing BWS water system infrastructure. An interior sprinkler systems will be utilized to address this issue and meet HFD requirements. Design plans will be coordinated with the BWS, as appropriate, during the design phase and necessary ministerial permits will be obtained. DOFAW must pay for water use along with any applicable water system facilities charges when water is made available for project improvements.

4.11.2 Wastewater Facilities

No Action Alternative

There would be no long- or short-term impacts on municipal wastewater facilities or the Green Machine because conditions in the baseyard and the HNC would remain the same as present. DOFAW and the HNC will employ the same number of individuals at the baseyard under this alternative and the number of HNC visitors would remain unchanged. Therefore, wastewater flows to the Green Machine would not change under the No Action Alternative.

Proposed Action

The existing wastewater system will be upgraded in the Proposed Action to accommodate future increases in baseyard personnel. It is estimated that total peak design flows will increase from 835 gpd to 1,400 gpd. Peak design flows for the baseyard alone will increase from 165 gpd to 480 gpd with project improvements. Table 4.3 compares water demand estimates between the No Action Alternative and the Proposed Action.

Table 4.3 Wastewater Usage

	DOFAW Baseyard		Hawai'i Nature Center (HNC)*		Ranger Cottage		*TOTAL FLOWS (gpd)*	
	No Action	Proposed Action	No Action	Proposed Action	No Action	Proposed Action	*No Action*	*Proposed Action*
Personnel								
FTEs	10	34	5	7	-	3		-
PTEs	7	12	12	15	-	-		-
Visitors at HNC (peak day)		-	134	134	-	-		-
Flows (gpd)								
FTEs	150*	510*	75*	105*	-	210	-	
PTEs	55*	90*	90*	115*	-	-	-	
Visitors at HNC (peak day)		-	670	670	-	-	-	
Flow (gpd) (peak day)	205**	600**	835**	890**	-	210	*1,040*	*1,700*
Design Flow (80%) (gpd)(peak day)	165**	480**	670**	710**	-	210	*835*	*1,400*

**. Flows based on: 15 gpd per FTE; 7.5 gpd per PTE; 5 gpd per NHC visitor, and; 70 gpd per residential dweller (Ranger Cottage).*
***. Design average and peak flows are assumed to be 80 percent of the flows due to reduced loads on weekends.*
1. Study (HDR 2015) calculations rounded up to nearest whole number.

Although wastewater usage is estimated to rise, increased demand is not expected to adversely impact City wastewater infrastructure since the proposed system would function independently of the City system. Anticipated upgrades include construction of a subsurface constructed wetland system. This system will serve as secondary treatment of DOFAW, HNC, and Ranger Cottage wastewaters. Effluent will pass through a layer of subsurface organic material that will compost suspended organic solids. Treated effluent will discharge to an onsite disposal field. A small portion of treated effluent will be chlorinated to irrigate an education demonstration area to illustrate how wastewater can be reused. In this manner, the new system will support organization educational goals, accommodate future organizational needs, and respect the sensitive nature of the site. Upgrades proposed will comply with existing State regulations and are not anticipated to result in significant adverse impacts to natural resources in the project site.

4.11.3 Drainage Facilities

No Action Alternative

Under this alternative, stormwater runoff would continue to flow downslope and into Makiki Stream. The existing concrete swale and concrete rubble masonry (CRM) wall system will capture a portion of this runoff. Sediment and debris that are not captured will continue to flow into the stream, traveling to lower portions of the watershed.

Proposed Action

The project would provide additional drainage facilities to the baseyard under the Proposed Action that would better manage increased runoff volumes resulting from the addition of impervious surfaces to the project site. The proposed development will generate an estimated 11.95 cfs of runoff, which is four percent lower than runoff estimates if the project was implemented without these improvements. Drainage improvements can mitigate potential negative impacts of proposed new facilities while providing additional means to manage stormwater runoff.

Proposed drainage improvements include a stormwater retention system comprised of onsite subsurface retention tanks. Runoff from the parking lot between the Forestry/NARS and Na Ala Hele buildings will be retained in a 3,000 gallon underground retention tank located. The location of this tank is shown in Figure 4.1 Drainage Map. Runoff from the area fronting the Na Ala Hele building and parking area on the eastside of the property will be detained in a 5,000 gallon underground retention tank. These systems will store runoff, releasing detained water slowly so receiving waters are not adversely impacted from project site runoff.

An onsite rainwater catchment system comprised of five 4,000 gallon catchment tanks is proposed for location near the administration building and the proposed Forestry/NARS building. This catchment system will also reduce site runoff and provides opportunities to capture, store, and retain rainwater for human usage. This system has potential to mitigate potential increased water consumption related to baseyard expansion by allowing baseyard staff to use this underutilized freshwater resource.

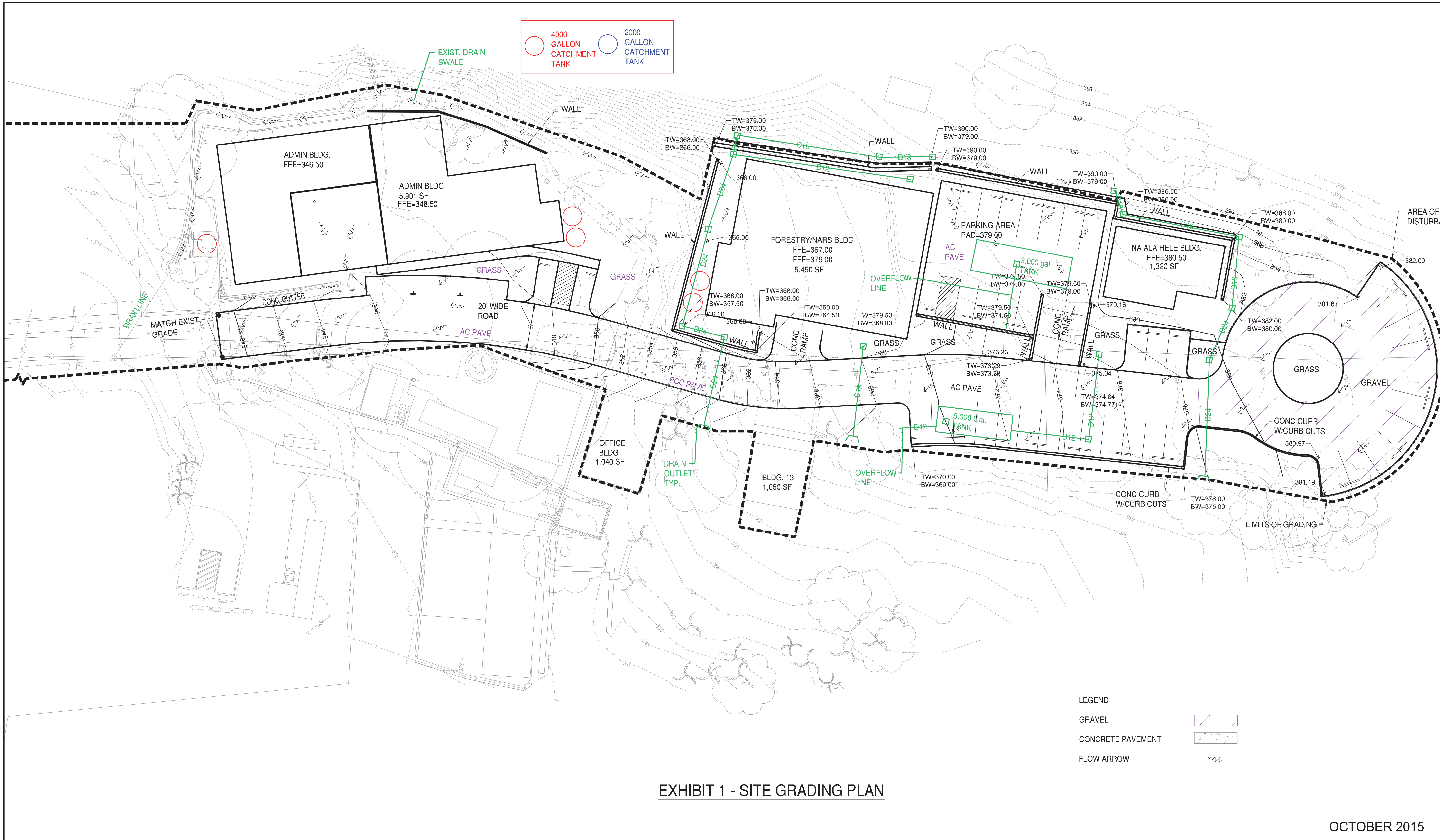

EXHIBIT 1 - SITE GRADING PLAN

OCTOBER 2015

DOFAW Makiki Baseyard Improvements Project

Figure 4.1 – Drainage Map

Honolulu, Hawai'i

0 40 Feet

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On-site stormflow will be further controlled through a system of 18 to 24 inch drains that are proposed for location around the proposed Forestry/NARS and Na Ala Hele buildings. This system that will route water away from the buildings toward the streamside of the property. This system will mitigate adverse impacts to nearby groundwater resources, which are at risk of contamination by baseyard sheet flow which may carry contaminants. This drainage system will mitigate these risks by regulating the flow of stormwater so contaminants are not transported by strong flows.

Bioswales are also proposed as a means of slowing stormwater sheet flow and retaining contaminants that may be transported. A new constructed bioswale is proposed for the makai end of the project site near Makiki Stream. Existing natural swales at the mauka end of the project site will be reinforced with boulders.

These measures will have a positive impact to water quality conditions in the nearby Makiki Stream by regulating baseyard stormwater flows. Managing the volume of stormwater discharge can decrease the quantity of sediment and other materials that may be picked up by stormflows and travel into downstream portions of the watershed. The Preliminary Engineering Report provides additional details on drainage improvements proposed and is included in Appendix F-1 of this document.

4.11.4 Solid Waste Facilities

No Action Alternative

There would be no long- or short-term impacts on the City's solid waste facilities because conditions at the project site would essentially remain the same as present under this alternative.

Proposed Action

Construction of proposed facilities will generate solid waste typical of construction-related activities. Short-term construction waste generated will not affect City solid waste facilities, operations, or landfills. A private contractor would dispose of construction waste in conformance with agency regulations at the privately owned PVT Nānākuli Construction and Demolition Material Landfill if not permitted at the H-POWER facility or the Waimanalo Gulch Sanitary Landfill.

Baseyard expansion under the Proposed Action should have minimal impacts on the City's solid waste facilities, operations, and landfill since waste collection will likely continue to be collected by private contractors. Baseyard utilization of private waste collection services will not put undue strain on municipal waste collection infrastructure. Typical municipal solid waste generated, such as residential waste consisting of organics, paper, and plastics will increase as DOFAW staffing capacity expands. Baseyard solid waste will also continue to be collected by a private disposal service. Recyclable waste will continue to be collected by a private recycling service. It is anticipated that any green waste produced onsite will be composted on the baseyard or disposed of by a private green waste collection service.

4.11.5 Transportation Facilities

The year 2026 was used as the study year reflecting the projected completion of the project, which includes full buildout of proposed facilities and improvements. Future conditions without the project were projected. Changes with the project could then be assessed to determine project related impacts.

No Action Alternative

Traffic conditions in the study area would remain largely similar to present conditions under the No Action Alternative. The project traffic study incorporates a growth rate of 1 percent per year based on the Oʻahu Regional Traffic Demand Model (ORTDM). This growth rate was applied to existing traffic volumes observed to anticipate traffic conditions under the No Action Alternative.

The Hālau Kū Māna Charter School Improvements Project is anticipated to be completed by year 2026. However, the project does not anticipate an increase in traffic volume. As a result, there are no increases in traffic as a result of other known developments near the project. Proposed traffic volumes under the No Action Alternative are summarized below.

- ***DOFAW Access Road/ Makiki Heights Drive.*** This unsignalized TWSC T-intersection operates at a LOS B or better with no significant queueing observed during the AM and PM peak traffic hours.
- ***Makiki Heights Drive/Makiki Street.*** This unsignalized TWSC T-intersection currently operates at LOS B or better.
- ***Makiki Street/ Nehoa Street.*** Vehicular flow at this signalized intersection was determined to operate at LOS E or better. The LOS E designation implies that traffic flow patterns are unstable and operating at capacity. Restriping the Makiki Street/Nehoa Street southbound approach is proposed in the traffic impact assessment report as a means of mitigating forecasted traffic flow issues. Traffic movements are forecasted to operate at LOS D or better if this improvement is implemented.

Proposed Action

Vehicular trips generated by the proposed project were estimated using the Institute of Transportation Engineers *Trip Generation Manual, 9th Edition*. This publication provides trip rates and/or formulae based on graphs that correlate vehicular trips with independent variables. These trip rates were used to forecast the number of vehicular trips the project will generate. Additional trips were added to Base Year 2026 traffic volumes to determine the Future Year 2026 traffic conditions for the project. Trips generated by the project were distributed throughout the study area based on existing travel patterns.

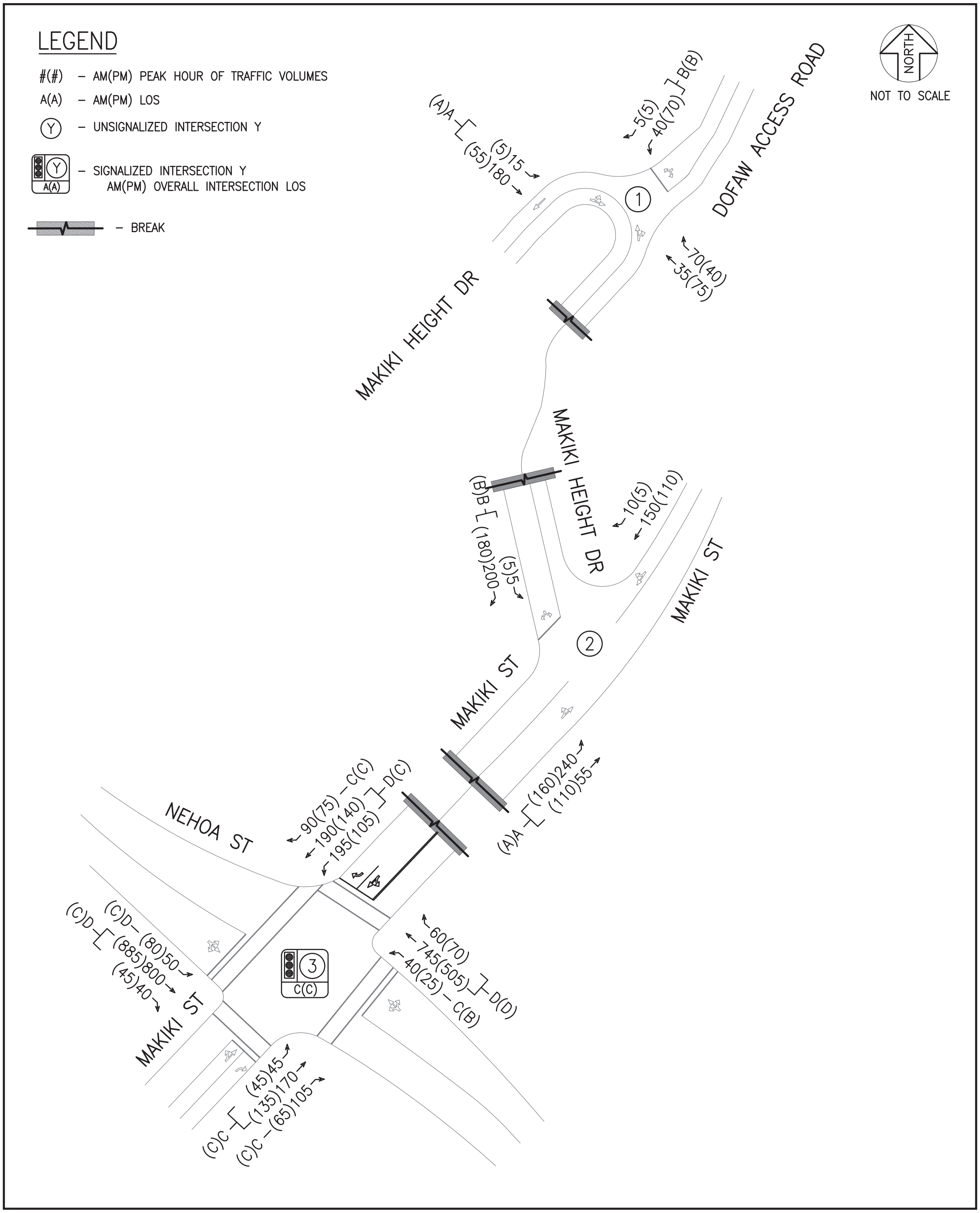
Forecasted traffic volumes under the Proposed Action are provided in Table 4.5 and are summarized below. Figure 4.2 highlights the spatial distribution of LOS metrics throughout study roadways.

- ***DOFAW Access Road/ Makiki Heights Drive.*** This unsignalized TWSC T-intersection operates at a LOS B or better in morning and afternoon peak periods.
- ***Makiki Heights Drive/Makiki Street.*** This unsignalized TWSC T-intersection currently operates at LOS B or better in morning and afternoon peak periods.
- ***Makiki Street/ Nehoa Street.*** Vehicular flow at this signalized intersection was determined to operate at LOS D or better if prescribed restriping improvements occur.

Table 4.5
Future Year 2026 Levels-of-Service Analysis Results

Study Intersection	Future 2026 Conditions					
	AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
1. DOFAW Access Road/ Makiki Heights Drive						
Eastbound Left Turn/ Through	7.4	0.01	A	7.4	0.00	A
Westbound Through/ Right Turn	0.0	0.00	A	0.0	0.00	A
Southbound Left Turn/ Right Turn	10.4	0.07	B	9.6	0.07	B
2. Makiki Heights Drive/ Makiki Street						
Eastbound left Turn/ Right Turn	10.8	0.26	B	10.0	0.19	B
Northbound Left Turn/ Through	8.1	0.17	A	7.8	0.11	A
Southbound Through/ Right Turn	0.0	0.00	A	0.0	0.00	A
3. Makiki Street/ Nehoa Street	50.8	0.40	D	22.8	0.24	C
Eastbound Left-Turn	38.5	0.94	D	34.0	0.94	C
Eastbound Through/ Right-Turn	54.0	0.38	D	46.4	0.22	D
Westbound Left-Turn	33.7	0.90	C	14.9	0.59	B
Westbound Through/ Right-Turn	23.2	0.36	C	26.0	0.32	C
Northbound Left-Turn/ Through	21.2	0.20	C	23.5	0.14	C
Northbound Right-Turn	36.2	0.74	D	29.0	0.43	C
Southbound Left-Turn/ Through/ Right-Turn	20.8	0.17	C	23.8	0.16	C
Overall	24.5		C	26.8		C

Forecasts indicate that upon project completion and prescribed restriping improvements, all study intersection movements are forecasted to operate with LOS similar to conditions in the No Action Alternative. Indeed, overall peak morning hour traffic improves from an LOS D in the No Action Alternative to an LOS C rating with the Proposed Action. As a result, the TIAR prepared for this project recommends that no roadway improvements are needed to mitigate adverse traffic impacts.



Source: Austin, Tsutsumi, and Associates, Inc.

DOFAW Makiki Baseyard Improvements Project

Figure 4.2 – Traffic Conditions, Proposed Action (Future Year 2026)

Honolulu, Hawai'i

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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 project site conditions would essentially remain the same.

Proposed Action

Facility improvements are not anticipated to result in long-term negative impacts on educational facilities servicing the Makiki-Tantalus region. Project implementation will not result in construction of new housing units, leading to additional students attending area schools. The project will not increase student enrollment or place additional demands on related educational facilities.

4.12.2 Medical Facilities

No Action Alternative

There would be no long- or short-term impacts on existing medical facilities (Kapiolani Medical Center and Queens Medical Center) servicing the project site under this alternative. Long or short-term impacts will not result because project site conditions would essentially remain the same.

Proposed Action

The Proposed Action will not result in adverse impacts to existing medical facilities. The project does not involve creation of new housing units that would add new residents to the area who may require medical services. As a result, the project will not place undue strain on medical facilities servicing the region surrounding the project site.

4.12.3 Recreational Facilities

No Action Alternative

There would be no long- or short-term impacts on existing recreational facilities near the project site under this alternative because site conditions would essentially remain the same. People hike on a system of trails that surround the project site. These trails are accessed from a trailhead located outside the boundaries of the project site. As a result, visitors to the Hawai‘i Nature Center and trail system entrance near the project site generally do not interact with baseyard staff or facilities because the baseyard is a distinct area upslope from these facilities. Existing baseyard operations do not impact other recreational facilities in the surrounding area because these facilities are located a considerable distance away.

Proposed Action

Users of nearby recreational facilities such as the Honolulu Mauka Trail System and the Hawai‘i Nature Center walk near the project site to access these facilities and hike near the project site. As a result, facility users may be impacted by short-term construction related activity noise caused by the Proposed Action. BMPs will be utilized to decrease construction noise, so visitors are not impacted. These practices would include the use of mufflers on power equipment and construction vehicles. If necessary, a community noise permit would be obtained from the State DOH to allow construction activities to occur. This permit includes restrictions to mitigate potential noise impacts. Short-term fugitive dust emissions from construction activities may also impact nature center and trail visitors. However, a dust control plan will be prepared to mitigate short-term construction related impacts on air quality for surrounding uses, such as the recreational facilities discussed. Mitigation measures prescribed in the plan may include a watering program or implementation of windscreens to control airborne transmission of dust. DOFAW will also coordinate with the DSP to inform visitors of construction vehicles and workers that may travel on the access road below the baseyard. This access road is shared by baseyard users and recreational facility users. This coordination between DOFAW and the DSP will minimize construction related impacts to parking areas for recreational facilities below the baseyard.

Long-term impacts resulting from project site facility improvements are not expected to impact nearby recreational facilities. The baseyard is a distinct area upslope from these recreational facilities. Visitors to these facilities should not come into contact with baseyard facilities. Future increases to baseyard activities will not impede visitor access to the Nature Center or area trails.

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 operations under this alternative because site conditions would likely remain the same.

Proposed Action

This project should have minimal impact on police department operations and the department’s ability to provide adequate protection services to the Makiki-Tantalus area during construction or upon completion of facility improvements. The hiring of off-duty police officers to direct traffic during construction activities should not be required since the majority of construction activities will occur within the baseyard area. However, police services will be retained if transportation of construction equipment upslope to the baseyard impedes motorists on Makiki Heights Drive. If required, the contractor overseeing project improvements will prepare and implement a traffic management plan for construction activities that 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 in the project area or Honolulu Fire Department operations under this alternative because site conditions would likely remain the same.

Proposed Action

This project should have minimal impacts to Honolulu Fire Department operations and the department's ability to provide fire protection to the Makiki-Tantalus area. Project facility improvements will require fire protection. However, fire risk for baseyard facilities is anticipated to be lower than existing hazard risk. This is anticipated because proposed facilities will be constructed in compliance with relevant building and safety codes and will be structurally sound. Additionally, an interior sprinkler system will be utilized to protect facilities from fire risk. Plan implementation will not negatively influence Honolulu Fire Department service to the Makiki-Tantalus area.

4.12.5 Electrical and Communication Facilities

No Action Alternative

There would be no long- or short-term impacts on existing project site electrical or communications facilities under this alternative because site conditions would likely remain the same.

Proposed Action

The location of onsite electrical facilities would be impacted by the Proposed Action. The boundary of an existing electrical easement must be adjusted to accommodate the new building layout. Specifically, poles 13 and 14/15 will need to be relocated because their existing locations will become part of a proposed roadway and parking lot. As a result, the Fire Cache Building and Building 13 will need to be reconnected to pole 13. Service at the interim storage shed for the Na Ala Hele Trails and Access Program and the City BWS chlorinator facility must be removed since these buildings will be demolished. The City BWS will initiate removal of chlorinator facility electrical service. Electrical service requirements for proposed and existing facilities will change after plan implementation. Future electrical demand is estimated to be 10 to 12 times higher than existing load based on the square footage of proposed facility improvements (DOFAW Makiki

Baseyard – Electrical Conditions Report 2015). Anticipated electrical load values do not incorporate future building occupancy numbers and should only be considered estimates. Anticipated increases in electrical capacity will be offset through implementation of a photovoltaic system. Hawaiian Telcom and Oceanic Time Warner Cable facilities will not be impacted by proposed improvements nor will communication services to surrounding areas be impacted.

4.13 Secondary and Cumulative Impacts

4.13.1 Secondary and Cumulative Effects Under The No Action Alternative

The project would not contribute to secondary or cumulative effects on the surrounding environment under the No Action Alternative. Therefore, any secondary or cumulative impacts would be associated with 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 occurring 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 enrollment. 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 facility improvement 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 facility improvements within DOFAW's Makiki Baseyard.

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 or parks due to new residents in a community. Infrastructure improvements proposed for the project will not adversely impact municipal facilities serving the area surrounding the project site. Drainage facility improvements will better manage onsite stormflows that will have a secondary benefit for downstream water resources. Off-site improvements to increase the capacity or expand existing infrastructure systems are not required to implement this project.

The project would not influence changes to existing land use patterns in the immediate area. Much of the area *mauka* of the project site is designated as "Conservation District" which restricts development. Future changes to residential, commercial, and visitor-oriented areas *makai* of the baseyard would be due to economic reasons and not due to facility improvements.

Construction of this project will generate limited short-term construction jobs that are not expected to result in any permanent in-migration of workers to the Island of O‘ahu to fill these jobs. It is anticipated that qualified O‘ahu contractors 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. Buildout of the project facilities will create long-term employment opportunities with DOFAW. It is anticipated that qualified O‘ahu residents would fill these positions. This will not result in significant secondary impacts due to in-migration of workers.

4.13.3 Cumulative Impacts with Proposed Action

Cumulative impacts are typically defined as environmental effects resulting 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 likely to occur 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 have provided information to assist in addressing the applicable cumulative effects associated with the project and other reasonably foreseeable future actions being implemented. The Makiki Baseyard Improvements Project should not have significant cumulative impacts on the surrounding environment. Most effects are confined to the baseyard area. The project would not require off-site infrastructure improvements and any adverse impacts resulting from facility construction will be short-term.

The only other known development in the area anticipated to begin construction within the 2017 study year is the Hālau Kū Māna Charter School Improvements Project. Information on the charter school project was obtained from the 2014 Draft Environmental Assessment for the project (Mana Maoli 2014). The charter school project is proposed by Mana Maoli, a Hawai‘i based non-profit that runs the charter school. The project proposes improvements within a 5.2-acre project area. Mana Maoli’s project site is located on DLNR land and is situated roughly 1,100 feet from the baseyard and is upslope from Makiki Stream. Mana Maoli’s project is occurring because existing educational facilities cannot adequately meet the needs of the charter school’s student body.

Proposed improvements include renovation of existing structures, installation of a permanent wastewater system, and the addition of new facilities. The charter school project proposes sustainable planning and design principles. It is likely that construction for both projects will occur simultaneously. However, this period will likely to be short since the anticipated date of completion for the charter school project of 2020 is prior to the proposed 2027 date of completion for baseyard improvements. Additionally, the phasing structure of baseyard improvements may be staggered across the 10 year window for project build out. This may decrease the period when the construction of both projects overlap. Although the period when simultaneous construction of both projects may be short, analysis of their cumulative impact is needed given their close proximity and capacity to affect a similar environment.

Short-Term Construction Related Effects

A number of cumulative impacts would be associated with temporary construction activities because the construction of the DOFAW baseyard and Mana Maoli improvements may occur concurrently. Should this occur, the cumulative effect would contribute to increased short-term nuisance effects such as increased noise from construction activities, and fugitive dust emissions. Increased disruptions to roadways may also occur from construction worker traffic along Makiki Heights Drive and heading into the DOFAW baseyard access road.

Nuisance effects from implementation of both projects would be temporary and should not lead to significant environmental impacts.

Although the Mana Maoli and DOFAW projects occur within a similar area, construction of DOFAW's project would occur in phases. The structure of this phasing is unknown. Therefore, periods when DOFAW's project is being constructed may overlap infrequently with Halau Ku Mana's project. For example, periods of increased ambient noise when construction for both projects is occurring would be infrequent and intermittent. To mitigate this cumulative impact, both projects will comply with relevant State noise regulations if noise levels exceed allowable limits. Surrounding residential uses are primarily located upslope at a considerable distance from both project sites and should not be impacted by short-term increased noise levels. Additionally, construction would occur during daytime work hours limiting the times cumulative construction noise related impacts would occur.

Construction for both projects may result in fugitive dust emissions impacting surrounding air quality. Carbon emissions may also be emitted from construction equipment used for site work in the DOFAW project. In recognition of these impacts, BMPs will be implemented in both projects to mitigate foreseeable impacts to air quality. Best management that might be implemented to address these adverse impacts include usage of dust screens and ensuring construction related equipment does not remain idling to lower overall emissions.

Increased construction related traffic may occur since both projects will utilize Makiki Heights Drive for access. In particular, movement of construction machinery may contribute to increases in traffic. Impacts to traffic flow should be minimal since construction will occur in phases for both projects, preventing continuous overuse of Makiki Heights Drive. If heavy construction traffic is anticipated, Mana Maoli affiliates will mitigate these impacts by restricting construction delivery during off-peak hours and by communicating construction schedules with surrounding neighbors. Additionally, DOFAW will hire an off-duty police officer to direct area traffic if construction related impacts are anticipated. Traffic impacts can be mitigated if these strategies are used.

Land-disturbing activities associated with both projects may result in soil erosion during periods of heavy rainfall or high winds. Various mitigation measures in the form of site-specific BMPs will be incorporated into design plans prepared for both projects to minimize short-term erosion impacts during construction. Contractors would comply with other regulatory and agency requirements. In particular, the DOFAW project will require issuance of an NPDES permit from the State DOH for construction related activities. An NPDES permit must also be issued for Mana Maoli's project if soil disturbance exceeds one acre. Conformance with relevant regulations and usage of BMPs will ensure the cumulative effect of these activities on area soils is not significant. BMPs that might be implemented to mitigate these impacts include placement of fiber rolls downslope from construction areas to ensure the erosive effects of construction related runoff are mitigated.

Effects on Physical and Natural Environment

Both projects would result in some changes to the physical environment of the Makiki Valley area. However, these improvement projects should not have a cumulatively adverse impact. Mana Maoli's and DOFAW's project both propose site-specific green infrastructure improvements that will mitigate the impact improvements will have on nearby natural resources. These changes would cumulatively improve the natural environment in the surrounding area.

Botanical resources would be improved in both project sites through landscaping improvements. Existing landscaping in Mana Maoli's project site incorporates native vegetation with future landscaping improvements proposed. Similarly, DOFAW's project site is landscaped with planted native specimens with additional landscaping with native plants proposed. Improvements would not adversely impact either project sites or soil conditions. In particular, site work for the DOFAW project was designed to be minimal and reduce impacts to area topography.

Both projects propose installation of an individual wastewater system for project sites within O'ahu's Critical Wastewater Disposal Area (CWDA) and No Pass Zone which contribute additional regulations to improvements impacting water resources. Both systems will be developed in compliance with requirements of both regulations. Therefore, ground and surface water flows should not be significantly impacted by these projects. Mitigative measures will be implemented to minimize potential effects on archaeological resources that may be present in the both project sites. These measures consist of archaeological monitoring for the DOFAW project. The archaeological inventory survey for Mana Maoli's project site concluded that no further site work was needed on the site. Mana Maoli's contractors will comply with all State and County laws regulating the preservation of archaeological sites if they are uncovered during construction. Consideration of project impacts on the physical and natural environment will mitigate negative cumulative impacts from DOFAW and Mana Maoli's projects on physical and environment resources in both areas.

Effects on Social and Economic Factors

Both projects would contribute to the local economy by creating temporary construction jobs and wages that will have a small but positive impact on Hawaiʻi's economy and businesses related to the construction industry. A small number of full and part time jobs would be created as DOFAW project facility improvements are implemented. Although only a small number of jobs will be created, these jobs should result in a small but positive impact on Hawaiʻi's economy and employment sector. 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 undeveloped land designated as "Conservation Districts."

These projects would have minimal, if any, cumulative effects on the resident or visitor population because they do not add new housing or visitor units. They would not induce changes to the surrounding land use patterns, the character of the Makiki-Tantalus area, or cause significant social impacts as discussed in this document. Therefore, improvements proposed in both projects should not result in cumulative impacts to social factors.

Effects on Infrastructure and Public Facilities

The Makiki Baseyard Improvement Project will have minimal cumulative impacts on infrastructure facilities serving the Makiki-Tantalus Area as discussed in this document and Mana Maoli's environmental document. Although additional facilities are proposed for both areas, improvements are anticipated to generate minimal impacts on the potable water system. The BWS water system servicing both sites will not require significant upgrades. The City's wastewater system does not service either project site and will not be taxed as a result of proposed improvements. Both projects will be serviced by an individual wastewater system that will be compliant with State regulations. These projects are not expected to create additional cumulative impacts on the City's downstream drainage system and will implement drainage improvements that will better manage stormflow in both areas.

No significant cumulative impacts are expected on existing school facilities, medical facilities, recreational facilities, or police and fire protection services. These improvements would not result in additional residents migrating to Oʻahu and thus will not create additional demands on these facilities, activities, or services. Therefore, the Makiki Baseyard Improvements project should not have significant cumulative impacts on public facilities or existing infrastructure serving the Makiki-Tantalus area.

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

This chapter discusses the project's conformance with the State Plan, State Land Use District regulations, State Environmental Policy (Chapter 344, HRS), the State Coastal Zone Management Program (Chapter 205A, HRS), the City Primary Urban Center Development Plan, the City Land Use Ordinance, and the City Special Management Area (Chapter 25, Revised Ordinances of Honolulu).

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 districts referred to as State Land Use Districts. These districts are the Urban, Rural, Agricultural, and Conservation Districts. Permitted uses within 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.

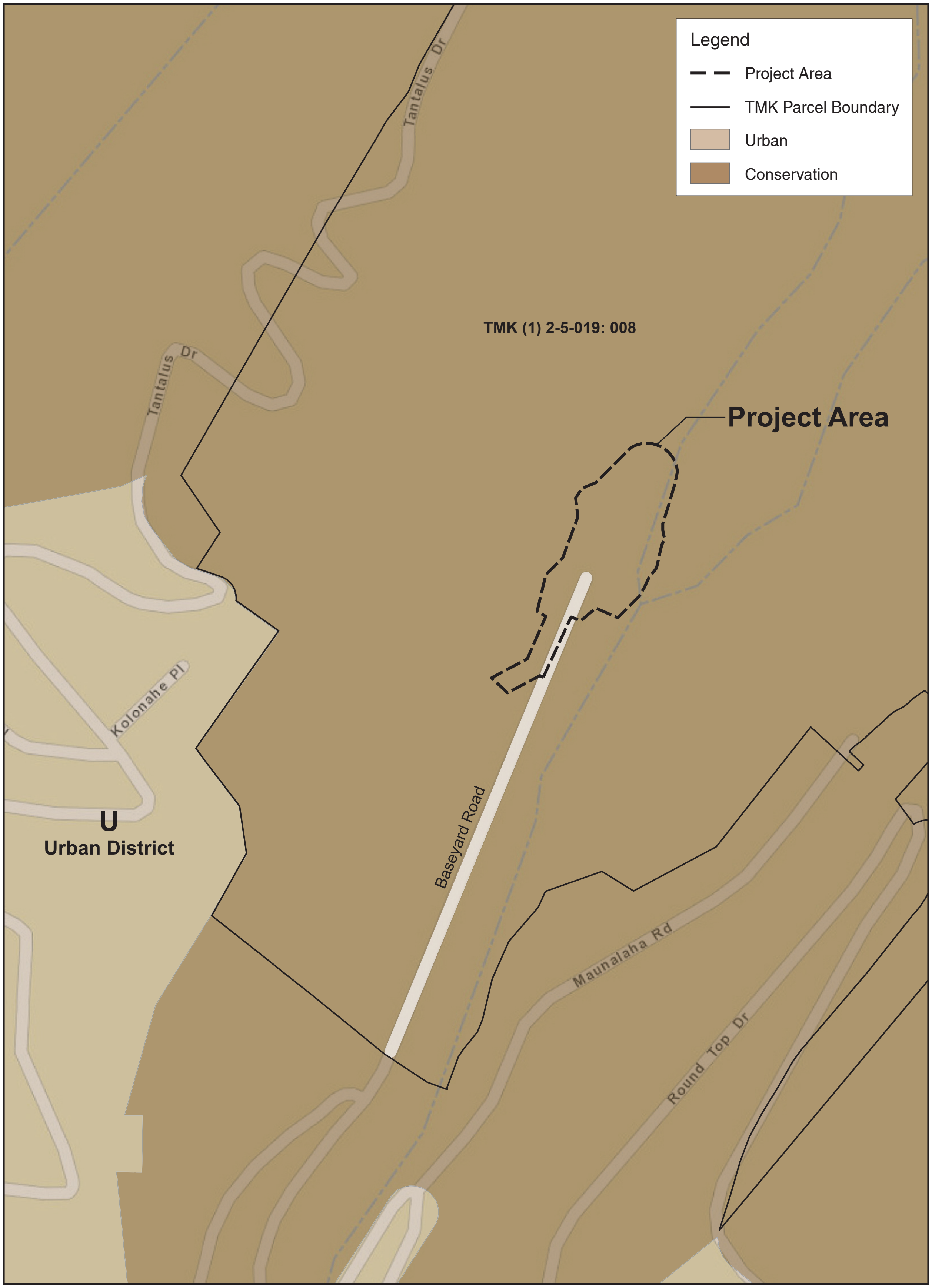
The State LUC's Land Use District Boundary Map indicates that the project site and surrounding areas are located within the State's Conservation District. Figure 5.1 highlights the location of the project site within the State's Land Use Districts.

5.1.1 State Conservation District

Conservation District 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 Districts. Permitted uses within subzones are delineated in the BLNR's Administrative Rules, Section 13-5-23 of Title 13, Chapter 5, HAR.

The Conservation District area of the project is classified as the "Resource Subzone." Figure 5.2 highlights the Conservation District subzone designation for the project site. The Resource Subzone encompasses lands suitable for parks, forestry, and outdoor recreation. The objective of the "Resource" subzone is to ensure the sustainable use of natural resources in the subzone, assuming proper management occurs. Permitted uses in this subzone relevant to this project include public purpose land uses, alteration of existing structures, and landscaping and removal of noxious plants. These uses are discussed in greater detail below. Other permitted uses applicable to this project and activities at the baseyard include private parks, natural centers, land and resource management, data collection, signs, and the construction of accessory structures.

1. Public Purpose Uses. This use include land uses undertaken by the State of Hawaiʻi 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 uses may include transportation systems, water systems,



DOFAW Makiki Baseyard Improvements Project

Figure 5.1 – State Land Use District Map

Honolulu, Hawaiʻi

0 400 Feet

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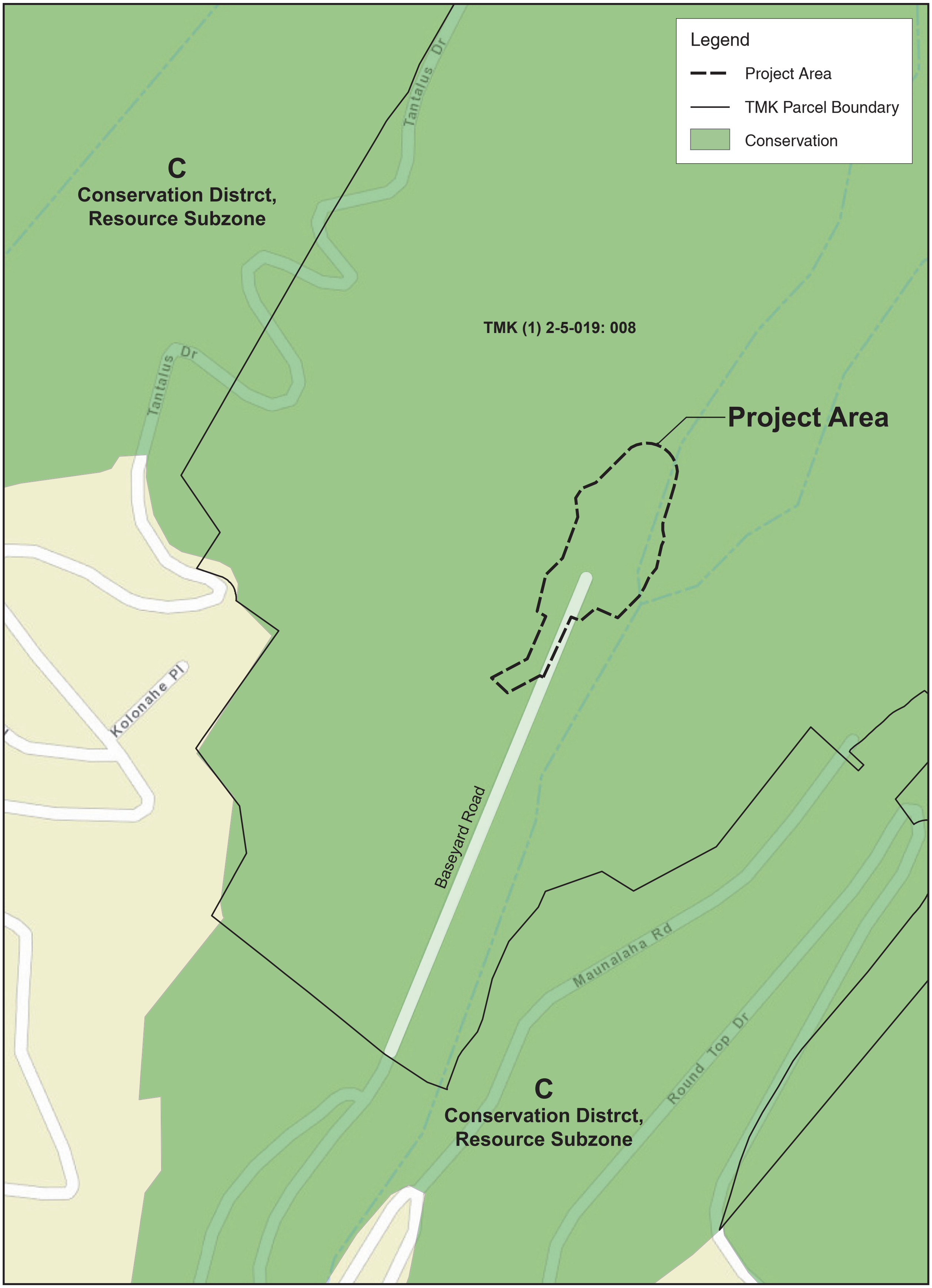

DOFAW Makiki Baseyard Improvements Project

Figure 5.2 – Conservation District Subzones Map

Honolulu, Hawaiʻi

0 400 Feet

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communications systems, and recreational facilities. DLNR's activities that protect and manage Hawai'i's natural resources align with the goals of the Conservation District Resource Subzone. Improvements proposed will support DLNR conservation activities while fulfilling Conservation District, Resource Subzone objectives to ensure the sustainable use of area resources.

2. Structures and Land Uses, Existing. These uses include major alteration of existing structures, facilities, uses, and equipment or topographical features that differ from the original use or differ from what was allowed under the original permit. Board approval is required when a County permit is required for the associated plan. The project proposes major alteration of existing structures and facilities requiring compliance with this requirement.
3. Landscaping, removal of noxious plants. Landscaping is defined as alternation (including clearing) of plant cover. Such alteration shall be limited to plant materials that are endemic or indigenous and similar in character and appearance to existing vegetation in the surrounding area. Project improvements include selective habitat restoration through the use of native flora and fauna which complies with this use.

A Conservation District Use Permit is required to implement the proposed project. This permit will be obtained in compliance with State Conservation District regulations.

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 Hawai'i.

Discussion: The project will be consistent with this policy as discussed throughout the EA. Proposed facility improvements will help DOFAW implement its initiatives to safeguard the State's natural resources. The project proposes implementation of alternative energy solutions and facility improvements that limit the baseyard's impact on the surrounding environment. Project activities are therefore expected to have significant positive impacts on natural resources in the project site. Restoration efforts and recreational improvements planned will be designed and constructed to minimize impacts and control pollutants during construction. This will be accomplished by implementing BMPs, which 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 SHPD.

Section 344(4)

(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 proposed project will be consistent with these guidelines. Project improvements include installation of photovoltaic arrays and usage of alternative water sources that will allow full utilization of natural resources. Additionally, proposed rain gardens can help the facility fully utilize water sources, decreasing its reliance on municipal water sources. The plan proposes improvements which will conserve and protect surrounding watersheds. The project itself will help to maintain natural area preserves around the project site by effectively managing stormwater runoff and decreasing reliance on ground water and electrical resources. DOFAW's mission is to responsibly manage and protect Hawai'i's natural resources. The organization will explore methods of promoting environmentally sound strategies to reduce or dispose of solid waste created through plan implementation.

(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: Proposed improvements include onsite selective habitat restoration using native flora and fauna, aligning with goals to support the presence of indigenous flora. These efforts will also require planting of native flora, aligning with these policy goals. Facility improvements will increase DOFAW capacity to implement their activities to protect native flora and fauna on O'ahu.

(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: Drainage and wastewater improvements will enhance the natural qualities of Makiki Valley State Recreation area which surrounds the site. Wastewater and drainage improvements will have an overall positive impact on downstream and shoreline areas. The project will indirectly support larger islandwide efforts to preserve and maintain these resources. Improved baseyard facilities will support DOFAW's work to establish, preserve, and maintain these areas. Similarly, project improvements will support DLNR efforts to create and enhance open space areas under oversight of this organization. Historic or cultural resources are not anticipated to be adversely impacted by restoration activities because mitigative measures will be developed through an archaeological monitoring plan.

(7) Energy.

(A) Encourage the efficient use of energy resources.

Discussion: Proposed improvements include implementation of photovoltaic arrays on new structures and over covered parking areas. These improvements will offset electrical demand and align with the goals of this guideline.

5.3 Hawai‘i State Plan, Chapter 266, HRS

The Hawai‘i State Plan, Chapter 226, HRS, serves as a guide for goals, priorities, and policies for the State. The Hawai‘i State Plan provides a basis for determining priorities, allocating limited resources, and improving coordination of State and County plans, policies, programs, projects, and regulatory activities. It establishes a set of themes, goals, and policies that are meant to guide the State's long-range growth and development. The project is consistent with the following relevant State Plan objectives:

Section 226(11) Objective and policies for the physical environment –- land-based, shoreline, and marine resources

(1) Prudent use of Hawai‘i's land-based, shoreline, and marine resources.

(2) Effective protection of Hawai‘i's unique and fragile environmental resources.

2(b)(1) Exercise an overall conservation ethic in the use of Hawai‘i's natural resources.

2(b)(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.

2(b)(3) Take into account the physical attributes of areas when planning and designing activities and facilities.

2(b)(4) Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.
2(b)(5) Consider multiple uses in watershed areas, provided such uses do not detrimentally affect water quality and recharge functions.
2(b)(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.
2(b)(8) Pursue compatible relationships among activities, facilities, and natural resources.

Discussion: The project proposes improvements that incorporate low impact design and sustainability measures that allow for prudent usage of Hawai‘i's valuable natural resources. Site planning and design of facilities ensure proposed facilities and future activities are compatible with the physical attributes and resources of the property. In particular, the location of nearby surface and groundwater resources were considered so proposed improvements do not impact water quality and overtax limited water resources. Facility improvements will support DOFAW's goals and operations that protect Hawai‘i's valuable plant, animal, and habitat resources. The deliberate consideration of natural resources nearby and surrounding the project will ensure that proposed facilities are compatible with and do not adversely impact Hawai‘i‘s natural resources.

Section 226(13) Objective and policies for the physical environment – land, air, and water quality
(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.
(2)(b)(2) Promote the proper management of Hawai‘i's land and water resources
(2)(b)(3) Promote effective measures to achieve desired quality in Hawai‘i's surface, ground, and coastal waters.
(2)(b)(8) Foster recognition of the importance and value of the land, air, and water resources to Hawaii's people, their cultures and visitors.

Discussion: Project improvements are guided by goals to maintain the quality of Hawai‘i's land and water resources. Low impact design elements have potential to improve the quality of downstream water resources relative to current conditions given proposed bioswale and bioretention improvements. These improvements can cleanse runoff from baseyard activities before runoff reaches nearby water resources. The project will promote proper management of Hawai‘i's natural resources in this manner. The project will improve baseyard operational efficiency so DOFAW programs can better encourage recognition of Hawai‘i's natural resources to the state's community and visitors.

Section 226(104) Population growth and land resource priority guidelines

(12) Utilize Hawai'i's limited land resources wisely, providing adequate land to accommodate projected population and economic growth needs while ensuring the protection of the environment and the availability of the shoreline, conservation lands, and other limited resources for future generations.

(13) Protect and enhance Hawai'i's shoreline, open spaces, and scenic resources.

Discussion: Project improvements will enhance baseyard operational efficiency. As a result, DOFAW's programs can better protect and enhance Hawai'i's open spaces, scenic resources, and related shoreline areas. In this manner, the project will help ensure the protection of Hawai'i's environment, conservation lands, and other limited resources for future generations.

Section 226(108) Sustainability

(2) Encouraging planning that respects and promotes living within the natural resources and limits of the State;

Discussion: Project improvements incorporate low impact design elements that will ensure prudent use of Hawai'i's limited natural resources. Proposed raingarden improvements will allow use of an underutilized resource, ensuring water resources that are already in use are not overtaxed beyond their limits. The master plan for project site facilities is an example of planning that protects, respects, and promotes living within Hawai'i's natural resource limits.

5.4 State Coastal Zone Management Program (Chapter 205A, HRS)

All lands in the State of Hawai'i are defined as being within the Coastal Zone Management Area (HRS 205A). The CZM area encompasses: "all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the United States territorial sea" (State of Hawai'i, 2001).

Discussion of the pertinent objectives and policies of the CZM program and analysis of how the project conforms to these objectives and policies is discussed below.

(1) Recreational resources;

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

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

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

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

iii.Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;

iv.Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;

v.Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;

vi.Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters

vii.Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and

viii.Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission, board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.

Discussion: The State of Hawai‘i has adopted water quality standards to safeguard coastal recreational areas from point and nonpoint sources of pollution, and if possible, restore the recreational value of coastal waters. Plan improvements were proposed with consideration of the impact that may occur on natural resources throughout the watershed. Proposed infrastructure improvements will support smart stormwater management, improved flood mitigation, and enhanced ground water recharge which have potential to create a larger positive impact for resources across the watershed. The project site is located inland and does not have direct positive or negative impacts on coastal recreational resources. Therefore, elements of this policy goal which call for direct efforts to protect, management, or ensure access to coastal resources are not applicable to this plan.

(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: Proposed project improvements considered historic resources that are present in the project site. The project’s literature review and field inspection recommends that appropriate mitigation of adverse historic impacts from this project would involve submission of an archaeological monitoring plan that would be submitted to SHPD for review and approval. This monitoring plan will be compliant with HAR 13-279-4, discussing the location of existing historic properties, anticipated properties that may be found, and project compliance with on-site archaeological monitoring requirements. Adherence to monitoring plan requirements will allow the project to be compliant with CZM historic resource policies.

(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; and

(D) Encourage those developments that are not coastal dependent to locate in inland areas.

Discussion: Proposed improvements are compatible with the visual environment of the project site. Improvements are located inland, away from the shoreline and will not adversely impact inland or coastal public views. Policy goals to preserve shoreline scenic and open space resources and encourage shoreline developments to locate to inland areas are not applicable.

(4) Coastal ecosystems;

(A) Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;

(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; and

(D) Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and

(E) Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.

Discussion: Project improvements are intended to minimize degradation of freshwater and downstream marine ecosystems through improved on-site stormwater management infrastructure. These improvements may serve as water pollution control measures, minimizing disruption of freshwater stream ecosystems and downstream marine ecosystems. The project is guided by an overall conservation ethic which values stewardship of inland aquatic resources which determine the biotic health of marine resources. The project is proposed for an inland area that is away from the coast. Therefore, policy goals to ensure that new coastal developments are compatible with their visual environments and goals to directly preserve or improve shoreline areas are not applicable to this project.

(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

(C) Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:

- *i. Use of presently designated locations is not feasible;*
- *ii. Adverse environmental effects are minimized; and*
- *iii. The development is important to the State's economy.*

Discussion: The project is located inland, away from the ocean. Therefore, policy goals to ensure that coastal economic uses do not cause direct economic impacts to coastal areas do not apply to this project.

(6) Coastal hazards;

(A) Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;

(B) Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;

(C) Ensure that developments comply with requirements of the Federal Flood Insurance Program; and

(D) Prevent coastal flooding from inland projects.

Discussion: The project will be developed in compliance with the Federal Flood Insurance program, satisfying components of this project goal. The project is located inland, away from the ocean. Therefore, policy goals to prevent coastal flooding, control development in areas subject to direct coastal hazards like tsunamis, and communicate information about direct coastal hazards are not applicable. This project plans for facility improvements for an inland region that align with DLNR’s sustainability goals. Goals to develop information about coastal hazards of control development in coastal areas are not applicable given the facility oriented nature of this project and its geographic location.

(7) Managing development;

(A) Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;
(B) Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and
(C) Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.

Discussion: This project is located inland, away from the ocean. Therefore, policy goals to manage development in along coastal regions are not applicable to this project.

(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
(C) Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.

Discussion: This project was developed with consultation from State agencies, City agencies, and neighborhood stakeholders. Public involvement was provided in the process of developing this facility plan. Efforts to disseminate information on CZM issues or provide opportunities to discuss coastal issues were not undertaken given the facility oriented nature of this project.

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

Discussion: This project is located inland, away from the ocean. Therefore, policy goals to provide direct protection to beach areas are not applicable to this project.

(10) Marine resources;

(A) Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;

(B) Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;

(C) Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;

(D) Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and

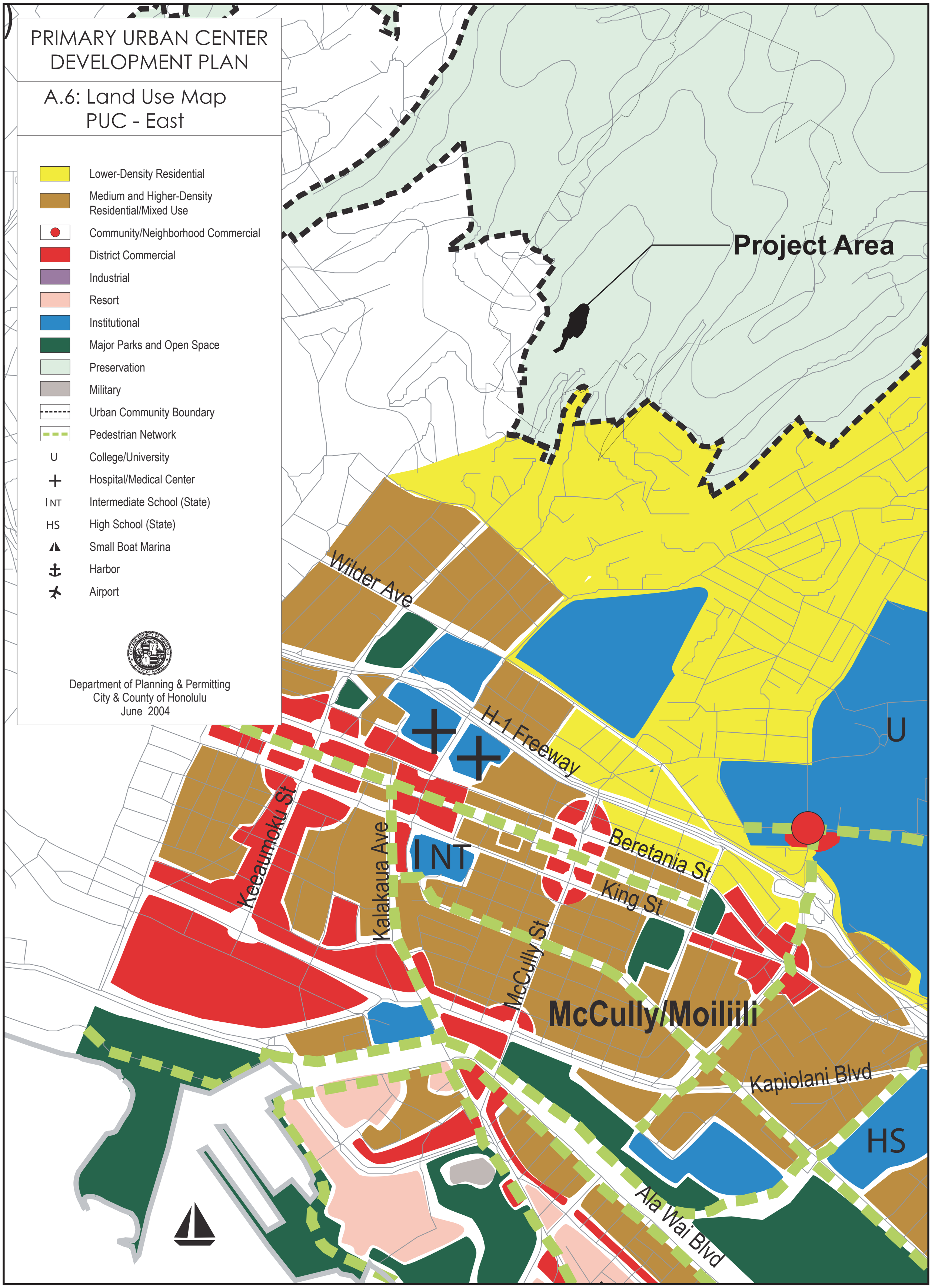
(E) Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources. [L 1977, c 188, pt of §3; am L 1993, c 258, §1; am L 1994, c 3, §1; am L 1995, c 104, §5; am L 2001, c 169, §3]

Discussion: The project is located inland, away from the ocean. Therefore, policy goals to sustainably manage or promote research of marine resources are not applicable to this plan.

5.5 County Primary Urban Center Development Plan

The City's Primary Urban Center Development Plan (DP) provides a framework for implementing the City's General Plan objectives and policies for the growth, development, and sustainability of O'ahu at a regional level (City and County of Honolulu 2004). The development plan program established eight geographical areas on O'ahu, one of which is the Primary Urban Center region, the location of the proposed project. The DP (DPP, August 2000) is designed to provide a guide for balanced growth in public and private sectors consistent with the General Plan that accommodates the projected increases in employment and population in the Primary Urban Center (PUC). The PUC stretches from Honolulu and Pearl City in the west to Wai'alae- Kāhala in the east. The Ko'olau Mountain range comprises the northern border of the PUC while Mamala Bay and Pearl Harbor comprise the southern border. This community plan was adopted in June 2004 as Ordinance No. 04-14, Revised Ordinances of Honolulu.

This section discusses the project's conformance and consistency with the pertinent policies and guidelines of the City's Primary Urban Center Development Plan. The Land Use Map for this community plan designates the project site as a Preservation area. Preservation areas include lands valued for their natural, cultural, or scenic resource value. Project improvements would be consistent with the community plan's land use designation for the site. Figure 5.3 illustrates the project site's land use designation under the Primary Urban Center Development Plan.



DOFAW Makiki Baseyard Improvements Project

Figure 5.3 – County Primary Urban Center Development Plan

Honolulu, Hawai'i

0 2000 Feet

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Section 3.1 Protecting and Enhancing Natural, Cultural, and Scenic Resources
Section 3.1.2 Policies

- *Preserve historic and cultural sites. Preserve and protect sites that have high preservation value because of their good condition or unique features. Protection includes planning and design of adjacent uses to avoid conflicts or abrupt contrasts that detract from or destroy the physical integrity and historic or cultural value of the site. Retain, whenever possible, significant vistas associated with historic, natural and man-made features. Allow adaptive reuse of historic buildings to serve a new function and/or enhance interpretive value without destroying the historic value of a site.*

Discussion: The project's literature review and field inspection study recommends implementing an archaeological monitoring program to mitigate adverse impacts of construction on potential subsurface historic resources. This monitoring plan has been developed by the project's cultural survey consultants. The monitoring plan is compliant with HAR 13-279-4 and discusses the location of existing historic properties, anticipated historic properties that may be found, and the project's compliance with on-site archaeological monitoring requirements. Adherence to the monitoring plan will allow the project to align with the Primary Urban Center Development Plan's policies that call for consideration of valuable onsite historic properties in planning initiatives.

Section 3.1.3 Guidelines:

- *In developing drainage and flood control, seek to limit stormwater velocity and reduce the transport of sediment and pollutants to coastal waters.*

Discussion: This plan proposes installation of stormwater management infrastructure to control drainage and reduce the transport of sediment and pollutants to coastal waters. Proposed improvements include bioswales, riparian buffers, and protection of open space and sensitive areas.

Section 4.1 Water Allocation and System Development
Section 4.1.2 Policies

- *Integrate resource management of all potable and nonpotable water sources, including groundwater, stream water, stormwater, and wastewater effluent.*
- *Adapt water conservation practices in the design of new developments and modification of existing uses, including landscaped areas.*
- *Protect and maintain watersheds to ensure an adequate supply of high quality water with sufficient infiltration recharge into groundwater aquifers.*

Discussion: The project proposes incorporating infrastructure to capture and utilize alternative water sources on-site that can decrease reliance on potable water. Proposed improvements incorporate water conservation principles including the utilization of rain gardens to harvest rainwater for onsite usage. Project improvements also acknowledge the importance of protecting and maintaining watersheds by implementing buffers in riparian zones.

Section 4.3 Electrical Power
Section 4.3.3 Guidelines:

- *Promote and implement energy conservation measures and integrated resource planning.*

Discussion: The plan proposes installation of photovoltaic arrays, which will offset electrical demand and reduce energy consumption.

Section 4.6 Stormwater Systems
Section 4.6.2 Policies

- *Manage stormwater flows through BMPs to minimize stormwater runoff and peak discharge rates.*

Discussion: Smart stormwater management infrastructure will be implemented to control runoff and peak discharge rates. Relevant improvements include bioswales and rain gardens, which will better channel and absorb stormwater runoff.

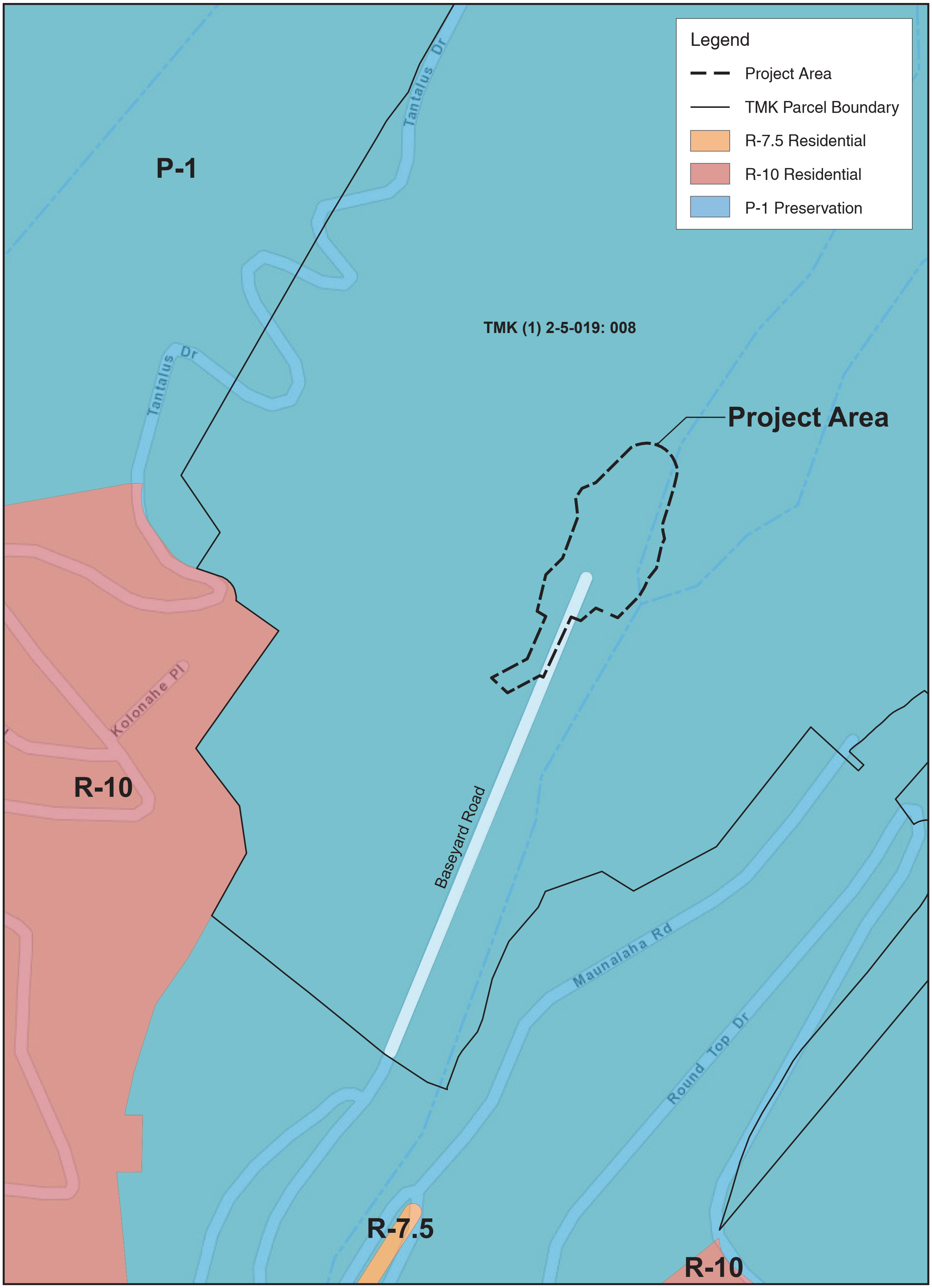
5.6 County Zoning Regulations

Permitted land uses and activities under the City's jurisdiction are prescribed under Chapter 21 of the City's Revised Ordinances of Honolulu Land Use Ordinance (LUO) (City,1990). Figure 5.4 shows the City zoning established for the project site. As shown on Figure 5.4, the project site is on lands designated P-1, Restricted Preservation District.

The purpose of the P-1 Preservation District is to preserve and manage major open space, recreation lands, and lands of scenic and other natural resource value. Land uses within the P-1 zoning district are governed by the DLNR Office of Conservation & Coastal Lands. For this project, DLNR is the appropriate State governing agency since the project site is on Conservation District land. Conservation lands within the project site are further classified within the Resource Subzone Therefore, land uses in the project site must adhere to permitted uses regulations under Chapter 5 Title 13, HAR. Project compliance with land use regulations governing Conservation, Resource subzone lands are discussed in Section 5.1.1.

5.7 County Special Management Area

The project site is outside the City's Special Management Area (SMA). SMA regulations do not apply to the project. Figure 5.5 illustrates the location of the project in relation to the SMA.



DOFAW Makiki Baseyard Improvements Project

Figure 5.4 – City Land Use Regulations Map

Honolulu, Hawaiʻi

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DOFAW Makiki Baseyard Improvements Project

Figure 5.5 – County Special Management Area

Honolulu, Hawai'i

0 4000 Feet

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5.8 County Board of Water Supply No Pass Zone

The project site is located inland (*mauka*) of the County No Pass Zone. The No Pass Zone was created by the Honolulu Board of Water Supply to protect inland water resources. As a result, installation of the project's proposed wastewater treatment and subsurface disposal system requires State DOH and BWS approval. These approvals will be pursued during project implementation. The system's relatively low flow and design which is oriented toward removal of pathogens and excessive nitrates will reduce risk associated with leaching into the potable aquifer.

CHAPTER 6
CONSULTED AGENCIES AND ORGANIZATIONS

6.1 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
U.S. Department of the Interior, Fish & Wildlife Services, Pacific Islands Administrator
U.S. Department of Agriculture, Natural Resources Conservation Service, Pacific Islands State Office

State of Hawai'i

Department of Business, Economic Development & Tourism
- Director
- Land Use Commission
- » Office of Planning

Department of Land and Natural Resources
- Director
- » Division of Aquatic Resources
- » Office of Conservation and Coastal Lands
- » Division of State Parks
- » Land Division
- Historic Preservation Division
- » Office of Conservation & Coastal Lands
- Commission on Water Resource Management
- Engineering Division

Department of Health
- Director
- » Clean Air Branch
- » Clean Water Branch
- » Environmental Planning Office

» Department of Accounting and General Services
» Department of Defense
» Department of Education
» Department of Transportation
» Office of Hawaiian Affairs

City and County of Honolulu

Department of Emergency Management
Department of Environmental Services
» Department of Design and Construction
» Department of Facility Maintenance
» Department of Planning & Permitting
» Department of Parks and Recreation
» Department of Transportation Services
» Board of Water Supply
» Honolulu Fire Department
» Honolulu Police Department

Utilities, Elected Officials, and Organizations

» Hawaiian Telcom
Hawaiian Electric Company, Inc.
» Time Warner Oceanic Cable

Senator Brian T. Taniguchi, 11th Senate District
Representative Della Au Belatti, 24th Representative District
Councilmember Carol Fukunaga
Makiki/ Lower Punchbowl/ Tantalus Neighborhood Board No. 10

Hawaiʻi Nature Center

6.2 Presentations to Community Organizations

Consultation efforts also included presentations to relevant stakeholder organizations. A description of presentations conducted is provided below.

6.2.1 Makiki/Punchbowl/Tantalus Neighborhood Board No. 10

The project site is located within the jurisdiction of the City's Makiki/Punchbowl/Tantalus Neighborhood Board No. 10. A presentation was given by members of the project team at the July 16th, 2015 neighborhood board meeting. The presentation was given to 1) inform board members of the project; 2) respond to questions raised; and 3) solicit comments on proposed plans. It should be noted that discussion of the project between board members and the project team was constrained by the meeting time limit.

CHAPTER 7
FINDINGS AND ANTICIPATED DETERMINATION

To determine whether a proposed action may have a significant effect on the environment, the Approving Agency must 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 Approving Agency. A Finding of No Significant Impact determination is presently anticipated for this project.

7.1 Findings Under Chapter 343, HRS

7.1.1 Anticipated Determination

A FONSI determination should be warranted for the Makiki Baseyard Improvements Project based upon assessment 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.

7.1.2 Findings

1. Involve an irrevocable commitment to loss or destruction of any natural or cultural resource;

The project consists of facility and infrastructure improvements within DOFAW's Makiki Baseyard Area that are needed to accommodate growth in future organization operations. These improvements would not result in irrevocable commitment to loss or destruction of natural or cultural resources. Project impacts are primarily related to short-term construction related impacts and various BMPs will be taken to ensure adverse impacts are mitigated. The project will not lead to adverse impacts for the resources discussed if mitigative strategies are taken.

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

The project would not curtail the range of beneficial uses associated with this property. The location of proposed improvements aligns with the existing topography of the site in an area already disturbed, minimizing the amount of grading needed which may transport soil to adjacent conservation areas. Air quality impacts from proposed construction are recognized and will be addressed through mitigation measures prescribed in a dust control plan created during plan implementation. Proposed improvements can decrease the impact of project stormwater runoff on nearby water resources. This can result in a net positive impact for the entire watershed, maintaining or increasing the range of beneficial uses for associated environmental resources.

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 facilities in the project site thereby increasing DOFAW operational capacity. Wastewater improvements will allow the baseyard to accommodate personnel increases associated with growth in operational capacity. The project will also provide green infrastructure improvements which will mitigate the environmental impact of the baseyard. These changes would have a beneficial impact within the project site 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 Native Hawaiian or other traditional cultural practices occurring on-site or in Makiki Valley. There are no know Native Hawaiian or traditional cultural practices currently occurring on-site. Areas where Native Hawaiian or traditional cultural practices may occur in Makiki Valley are still accessible via the trail system that surrounds the project site.

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 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. BMPs will also be implemented as part of construction activities to mitigate public health impacts.

6. Involves substantial secondary impacts, such as population changes or effects on public facilities;

The project should not have any substantial secondary impacts on area demographic characteristics, 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 improvements would support improved stormwater control, flood mitigation, and usage of alternative and water and energy sources. These changes would result in a beneficial effect on the environmental quality of the Makiki watershed and the Makiki-Tantalus area. Appropriate mitigative measures will be implemented to address construction related impacts on the environment in coordination with appropriate government agencies. This includes implementing BMPs 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 facility improvements proposed for the Hālau Kū Māna Charter School. In evaluating environmental impacts, it was determined that the project should not contribute to significant cumulative effects 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. The biological survey conducted for this study determined there were two threatened or endangered trees planted on-site. Appropriate measures will be taken if these trees must be relocated or removed. No rare, threatened, or endangered mammalian species or endangered birds were found on-site.

10. Detrimentally affect air or water quality or ambient noise levels;

The project will not have detrimental, 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. Although impacts are expected to be minor, they will be monitored by DOFAW to minimize nuisance effects (e.g. fugitive dust), and will be mitigated by applicable BMPs. 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;

Project facilities will not be constructed within the flood plain. These facilities are not located within a tsunami evacuation zone, near the shoreline, or in a geologically hazardous area. The project is not located in an erosion-prone area. The project site is not located near or within coastal waters or an estuary. The project is located upslope from freshwater stream resources and unforeseen stormwater impacts will be mitigated through proposed drainage improvements.

12. Substantially affect scenic vistas and view planes identified in county or state plans or studies;

The project site occupies a small, secluded area within a City designated *mauka-makai* view corridor. The project site is currently not visible in this view corridor given its secluded location. The project site is not anticipated to substantially impact this view corridor at buildout.

13. Require substantial energy consumption

The project will not require substantial energy consumption or result in increased demands on the capacity of supporting electrical facilities. Energy demand is predicted to increase due to facility construction but will not require upgrading of onsite or nearby electrical infrastructure. The project proposes implementation of a photovoltaic system that will offset a portion of anticipated increases in energy demand.

CHAPTER 8
REFERENCES

Austin, Tsutsumi & Associates, Inc. 2015. *Traffic Impact Analysis Report Division of Forestry & Wildlife Makiki Baseyard.* Prepared for HHF Planners.

Board of Water Supply. 2002. *Water System Standards*. City and County of Honolulu. Honolulu, Hawai‘i.

Chu, Michael S., Robert B. Jones. 1987. *Coastal View Study*. Prepared for Department of Land Utilization, City and County of Honolulu. Honolulu, Hawai‘i.

City and County of Honolulu (City). 2004. *Primary Urban Center Development Plan*. Honolulu, Hawai‘i.

City and County of Honolulu (City). 1990. *Revised Ordinances of Honolulu, as amended*. Honolulu, Hawai‘i.

Commission on Water Resource Management (CWRM). 2008. *Water Resources Protection Plan, Hawai‘i Water Plan*. Department of Land and Natural Resources, State of Hawai‘i. Prepared by Wilson Okamoto Corporation. Honolulu, Hawai‘i.

Cultural Surveys Hawai‘i, Inc. 2014. *Archaeological Literature Review and Field Inspection for the DOFAW Makiki Base Yard Makiki Ahupua‘a, Honolulu (Kona) District, O‘ahu Island TMK: (1) 2-5-019:008 por.* Prepared for HHF Planners.

Cultural Surveys Hawai‘I, Inc. January 2016. Archaeological Monitoring Plan for the DOFAW Makiki Base Yard, Makiki

Department of Health (DOH). 1996. *Title 11-Chapter 46, Hawaii Administrative Rules, Community Noise Control.* Department of Health, State of Hawai‘i.

Department of Health (DOH). 2004. *Title 11-Chapter 62 Wastewater Systems*. Department of Health, State of Hawai‘i.

Department of Health (DOH). 2008. *Onsite Wastewater Treatment Survey and Assessment.* Prepared by the Water Resources Research Center and Engineering Solutions, Inc. Honolulu, Hawai‘i.

Department of Health (DOH). 2014. *2014 State of Hawaii Water Quality Monitoring and Assessment Report: Integrated Report To The U.S. Environmental Protection Agency and The U.S. Congress Pursuant To Sections §303(D) and §305(B), Clean Water Act (P.L. 97-117)*. State of Hawai‘i. Honolulu, Hawai‘i.

Department of Health (DOH). 2015. *State of Hawai'i Annual Summary 2014 Air Quality Data*. Clean Air Branch, State of Hawai'i. Honolulu, Hawai'i.
Department of Health (DOH). Original maps prepared by John F. Mink and L. Stephen Lau (Water Resources Research Center) for the Department of Health's Groundwater Protection Program. "DOH Aquifers". [ESRI shapefile]. Digitized by DOH – Environmental Planning Office from original mylars. Digitized in 1992, updated in June, 2011.

Department of Land and Natural Resources (DLNR). 2009. *State Comprehensive Outdoor Recreation Plan (SCORP) 2008 Updated*. State of Hawai'i. Honolulu, Hawai'i.

Department of Planning and Permitting (DPP). 2004. *Primary Urban Center Development Plan*. City and County of Honolulu. Honolulu, Hawai'i.

Douglas Engineering Pacific, Inc. 2015. *DOFAW Makiki Baseyard – Electrical Conditions Report*. DRAFT. Prepared For Mason Architects, Inc.

Federal Emergency Management Agency (FEMA). 1993. *Hazard Mitigation Report, Hurricane Iniki. In Response to the September 12, 1992 Federal Disaster Declaration*. FEMA-961-DR-HI. San Francisco, California.

Federal Emergency Management Agency (FEMA). September 2014. *Hawai'i – Tropical Storm Iselle.* FEMA-4194-DR.

Fletcher, Charles H., Grossman, Eric E., Richmond, Bruce M., and Gibbs, Ann E. in cooperation with University of Hawai'i, State Office of Planning, and National Oceanic and Atmospheric Administration. Geologic Investigations, Series I-2761. U.S. Government Printing Office.
Hawaii Statewide GIS Program. U.S. Geological Survey Digital Elevation Model data. "Watershed Unit Boundary Polygons and Attributes". [ESRI shapefile]. Created by the Hawaii Statewide GIS Program, using Arc/Info and GRID watershed commands. Arcs that could not be automatically created were manually digitized on screen. 1995

Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte, 2013: Online Rainfall Atlas of Hawai'i. Bull. Amer. Meteor. Soc. 94, 313-316, doi: 10.1175/BAMS-D-11-00228.1.

Hawaii Department of Land and Natural Resources. 1998. *Ala Wai Canal Dredging, Final Environmental Assessment, Federal Aid Project No. STP-0300(038).* Prepared by Belt Collins Hawai'i. Honolulu, Hawai'i.

HDR, Inc. October 2015. *Makiki Baseyard Wastewater Treatment Facility Evaluation Study.* Prepared for Mason Architects, Inc. Honolulu, Hawai'i.

Helber, Hastert, & Fee Planners. 2012. *Master Plan DOFAW Makiki Base Yard*. Prepared for State of Hawaii, Dept. Of Land and Natural Resources, Division of Forestry and Wildlife.

Honolulu Police Department (HPD). 2014. *Honolulu Police Department Annual Report 2014.* City and County of Honolulu. [http://www.honolulupd.org].

Macdonald, Gordon A., Abbott, Agatin T., and Peterson, Frank L. 1983. *Volcanoes in the Sea, The Geology of Hawaii*. Second Edition. University of Hawaiʻi Press. Honolulu, Hawaiʻi.

Mana Maoli. *Halau Ku Mana Public Charter School Improvements Draft Environmental Assessment*. March 2014. Prepared by PBR Hawaiʻi & Associates, Inc. Honolulu, Hawaiʻi.

Masa Fujioka & Associates. 2015. *Report of Findings, Hazardous Materials Testing Services, State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW), Makiki Baseyard Improvements*. Prepared for Mason Architects, Inc.

Oki, D.S., Gingerich, S.B., and Whitehead, R.L. 1999. *Ground Water Atlas of the United States, Segment 13, Alaska, Hawaii, Puerto Rico, and the U.S. Virgin Islands: U.S. Geological Survey.* Retrieved from http://pubs.usgs.gov/ha/ha730/gwa.html

Rana Biological Consulting, Inc. 2015. *Biological Surveys Conducted for the DOFAW Makiki Base Yard Master Plan, Honolulu District, Island of Oʻahu*. DRAFT. Prepared for HHF Planners. Honolulu, Hawaiʻi.

R.M. Towill Corporation. 2011. *Master Plan For The Division of Forestry and Wildlife Makiki Baseyard. Prepared for the Department of Land and Natural Resources, Division of Forestry and Wildlife*. Honolulu, Hawaiʻi.

R.W. Beck, Inc. 2008. *Integrated Solid Waste Management Plan Update*. Prepared for City and County of Honolulu. Honolulu, Hawaiʻi.

Sam O. Hirota, Inc. November 2015. *Preliminary Engineering report (PER) – Assessment of Civil Infrastructure for Department of Forestry and Wildlife Makiki Baseyard*. DRAFT. Prepared for Mason Architects, Inc.

State of Hawaii. 1998 (as amended). *Hawaii Revised Statutes. Chapter 343, Environmental Impact Statements.*

State of Hawaii. 2001. *Hawaii Revised Statutes. Chapter 205A, Coastal Zone Management.*

State of Hawaii. 2011 (as amended). *Hawaii Administrative Rules. Title 13, Department of Land and Natural Resources, Subtitle 1, Administration; Chapter 5, Conservation District.*

State of Hawaii. 2008 (as amended). *Hawaii Administrative Rules. Title 11, Department of Health; Chapter 200, Environmental Impact Statement Rules.*

State of Hawaii. 2014 (as amended). *Hawaii Administrative Rules. Title 11, Department of Health, Chapter 54, Water Quality Standards.*

PBR Hawaiʻi & Associates, Inc. 2014. Hālau Kū Māna Public Charter School Improvements Draft Environmental Assessment. Prepared for Mana Maoli.

Post, Buckley, Schuch, & Jernigan, Inc. September 1993. *Hurricane Iniki Assessment Review of Hurricane Evacuation Studies Utilization and Information Dissemination.* Prepared for U.S. Army Corps of Engineers, Federal Emergency Management Agency, and the State of Hawaiʻi, Department of Defense.

U.S. Census Bureau; "American Fact Finder"; generated by Matt Hom; using American Factfinder; http://factfinder2.census.gov; (30 September 2015).

U.S. Census Bureau. 2015. On The Map Application. Longitudinal-Employer Household Dynamics Program. http://onthemap.ces.census.gov/

U.S. Department of Agriculture, Soil Conservation Service (SCS). August 1972. *The Soil Survey of the Islands of Kauaʻi, Oʻahu, Maui, Molokaʻi and Lānaʻi, State of Hawaii*. In cooperation with the University of Hawaii, Agricultural Experiment Station. Washington, D.C.

U.S. Department of the Interior, Geological Survey (USGS). 2002. *Atlas of Natural Hazards in the Hawaiian Coastal Zone*.

U.S. Fish and Wildlife Service (FWS). 1978. *Stream Channel Modification in Hawaii*. Honolulu, HI.

U.S. Geological Survey (USGS) [cartographer]. 2013. Honolulu, HI 2013 [map]. 1:24,000. Retrieved from http://nationalmap.gov/ustopo/

U.S. Geological Survey (USGS), 2015, National Water Information System data available on the World Wide Web (Water Data for the Nation), accessed [September 20,2015], at URL [http://waterdata.usgs.gov/nwis/uv/?site_no=16238000&PARAmeter_cd=00065,00060,00062,72020]

Western Regional Climate Center (WRCC). 2015. *National Oceanic and Atmospheric Administration, U.S. Department of Commerce. Historical Climate Information. Climate Data Summary.* [http://www.wrcc.dri.edu/index.html] (accessed September 2015).

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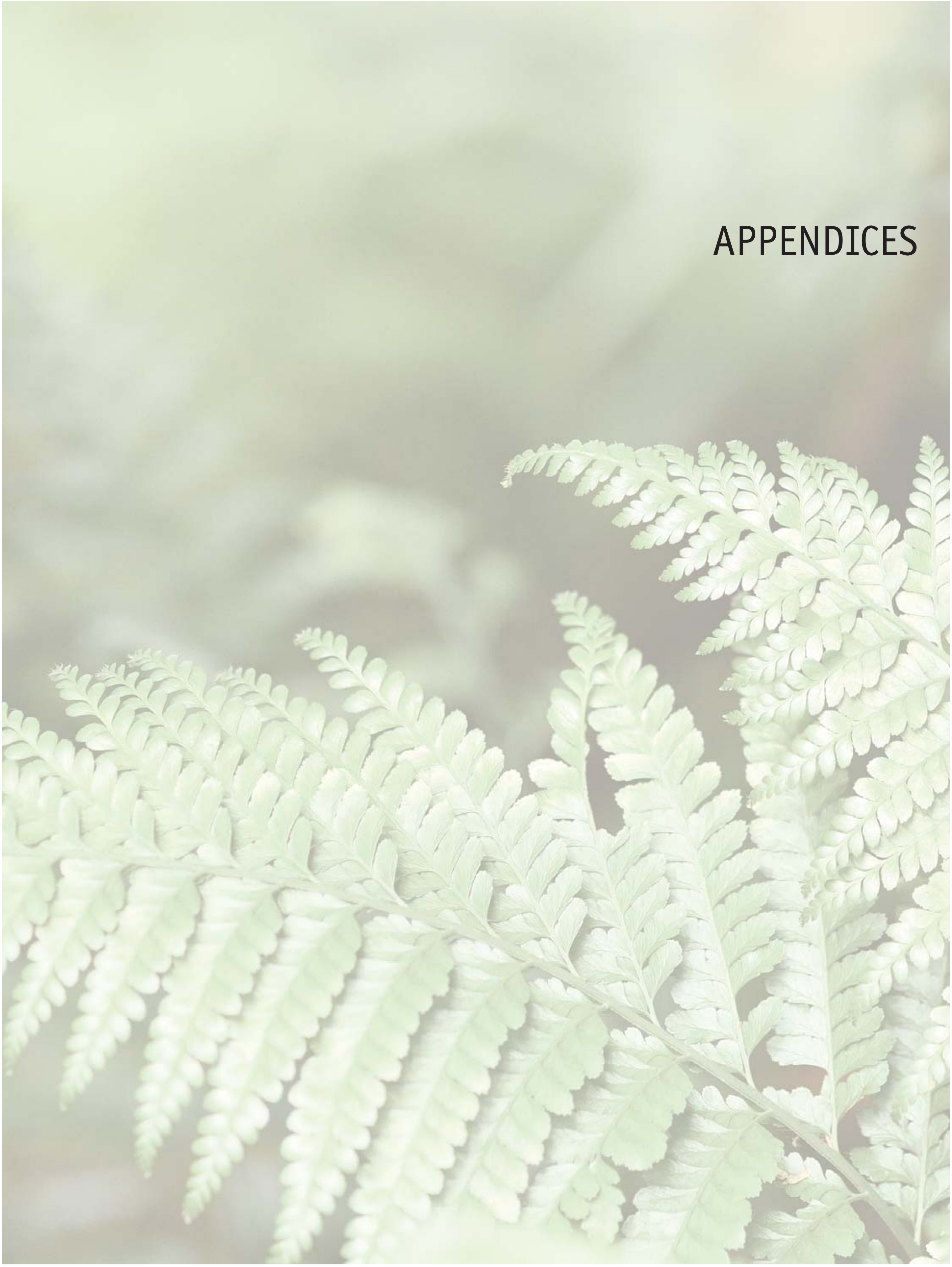
APPENDICES



APPENDIX A

Pre-Assessment Consultation Comments and Responses

DAVID Y. IGE
GOVERNOR

DOUGLAS MURDOCK
Comptroller

AUDREY HIDANO
Deputy Comptroller

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P.O. BOX 119, HONOLULU, HAWAII 96810-0119

(P)1153.5

JUN 22 2015

Mr. Ronald A. Sato, AICP
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, HI 96813

Dear Mr. Sato:

Subject: Draft Environmental Assessment Pre-Assessment Consultation
State DLNR DOFAW Makiki Baseyard Improvements Project
Makiki, Honolulu, Hawaii
TMK: (1) 2-5-019: portion of 008

This is in response to your letter dated June 12, 2015 regarding the subject project. The proposed project does not impact any of the Department of Accounting and General Services' projects or existing facilities, and we have no comments to offer at this time.

The forthcoming Draft Environmental Assessment may be transmitted to our office as a pdf file format on a CD.

If there are any questions, your staff may call Mr. David DePonte of the Public Works Division at 586-0492.

Sincerely,

for DOUGLAS MURDOCK
Comptroller

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March 4, 2016

Mr. Douglas Murdock, Comptroller
Department of Accounting and General Services
State of Hawai‘i
P.O. Box 119
Honolulu, Hawai‘i 96810

Dear Mr. Murdock:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated June 22, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We confirm that the project does not impact any of your department’s projects or existing facilities, and you have no other comments at this time. We will provide you with a copy of the Draft EA on a CD when it is published.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
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

July 15, 2015

Helber Hastert & Fee, Planners, Inc.
Attention: Mr. Ronald A. Sato, AICP
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

via email: rsato@hhf.com

Dear Mr. Sato,

SUBJECT: State DLNR DOFAW Makiki Baseyard Improvements Project, Draft Environmental Assessment Pre-Assessment Consultation

Thank you for the opportunity to review and comment on the subject matter. In addition to the comments sent to you dated July 14, 2015, enclosed are additional comments from the Division of Aquatic Resources on the subject matter. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)

DAVID Y. IGE
GOVERNOR OF HAWAII

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LAND DIVISION
2015 JUL 14 AM 11:25
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

SUZANNE D. CASE
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

RECEIVED
JUN 19 2015
AQUATIC RESOURCES

June 18, 2015

DAR #5131

MEMORANDUM

TO: **DLNR Agencies:**
X Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X 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
X Historic Preservation

JK ✓
GH ✓
BK ✓

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: State DLNR DOFAW Makiki Baseyard Improvements Project, Draft Environmental Assessment Pre-Assessment Consultation
LOCATION: Makiki, Honolulu, Hawaii; TMK (1) 2-5-019: portion of 008
APPLICANT: State of Hawaii, Department of Land and Natural Resources, Division of Forestry and Wildlife, by its consultant Helber Hastert & Fee, Planners, Inc.

Transmitted for your review and comment on the above-referenced document. We would appreciate your comments on this document.

Please submit any comments by July 13, 2015. 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 Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached. GRH

Signed: Alton Miyasaka
Print Name: Alton Miyasaka
Date: 7-13-15

DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF AQUATIC RESOURCES
1151 PUNCHBOWL STREET, ROOM 330
HONOLULU, HAWAII 96813

July 13, 2015

7-13-15

Date: 7/13/15
DAR # 5131

MEMORANDUM

TO: Alton Miyasaka, Acting Administrator

DATE:

FROM: Glenn Higashi, Aquatic Biologist GRH

SUBJECT: Request for Comments: Draft Environmental Assessment Pre-Assessment Consultation: State DLNR DOFAW Makiki Baseyard Improvements Project, Honolulu, Oahu

Comment	Date Request	Receipt	Referral	Due Date
	6/18/15	6/19/15	6/19/15	7/13/15

Requested by: Russell Y. Tsuji, Land Administrator

Summary of Proposed Project

Title: Request for Comments: Draft Environmental Assessment Pre-Assessment Consultation: State DLNR DOFAW Makiki Baseyard Improvements Project, Tax Map Key No. (1) 2-5-019; portion of 008, Honolulu, Oahu

Project by: State of Hawaii, DLNR, DOFAW by its consultant Helber Hastert & Fee, Planners, Inc.

Location: Makiki, Honolulu, Oahu

Brief Description:

The State of Hawai'i (State), Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) is proposing to improve its existing Makiki Baseyard facility located in the Makiki district of the Island of O'ahu. Proposed improvements include additional buildings and improvements to existing facilities to support DOFAW's ability to manage their islandwide operations and more effectively implement program activities.

This baseyard lies within a larger 346-acre property owned by the State. This project site is identified as Tax Map Key (1) 2-5-019: portion of 008. The property is within the Makiki Ahupua'a, and is part of the Honolulu Watershed Forest Reserve.

Vehicular access to the project site is via a driveway routed through the State property situated at a bend off of Makiki Heights Drive. The DOFAW Makiki Baseyard is situated about 1,400 feet (0.27 miles) further inland from the driveway entrance at Makiki Heights Drive. The lower area of this State property from Makiki Heights Drive up to the DOFAW base yard is under the jurisdiction of the State DLNR, Division of State Parks, and is used for their Makiki Valley State Recreational Area. The Hawaii Nature Center is also located within this recreational area below (makai) the baseyard along with a few residences. Upslope (mauka) of the Makiki Baseyard is the Honolulu Watershed Forest Reserve. The west side boundary of the Makiki Baseyard runs along the Makiki Stream.

The proposed structures and infrastructure improvements would include the following:

- Expansion of the current Administration Building.
- Renovation of an existing building to an office environment, and replacement of an existing building with a new office building.
- Construction of a new fire cache and fuel storage building.
- Removal of temporary and dilapidated structures and construction of two new buildings to support operations.
- Permeable surfaced parking areas to meet a parking demand of 66 stalls. At a minimum, 50 percent of the stalls will be covered.
- Realignment of an existing Hawaiian Electric Company easement.
- Removal of the BWS Chlorination Station that is not being used.
- Installation of a 24-foot-wide roadway with a vehicle turnaround to meet current fire code.
- Installation of another fire hydrant to meet code requirements.
- Installation of a vehicle wash off area.
- Installation of a permanent wastewater system (subsurface constructed wetlands) to serve DOFAW and the Hawaii Nature Center. Based upon coordination between DOFAW and DSP, the constructed wetlands and drain field would be located in an open grass area by the existing cottage south of the DOFAW site in an area currently used as a leach field for the current wastewater system.
- Installation of photovoltaic arrays to offset annual electrical demand. Panels will be placed on new structures and over parking areas.
- Installation of infrastructure to support smart storm water management, flood mitigation, enhanced groundwater recharge, and mitigation of urban heat islands. This infrastructure could include rainwater harvesting, rain gardens, bio swales, permeable surfaces, riparian buffers, and protection of open and sensitive land areas.
- Use of alternate water sources (rainwater and greywater) on-site
- Installation of native vegetation in new landscaped areas were possible.

Comments:

The proposed project is not expected to have any significant impact on the aquatic resource values in this area. Best Management Practices (BMPs) should be incorporated in the DEA, such as a sediment catchment basin for the vehicle wash down area and drainage system to accommodate the runoff from the 24-foot wide roadway, to minimize stream impacts due to siltation and pollution.

Thank you for providing DAR the opportunity to review and comment on the proposed project. Should there be any changes to the project plans, DAR requests the opportunity to review and comment on those changes.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
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

July 20, 2015

Helber Hastert & Fee, Planners, Inc.
Attention: Mr. Ronald A. Sato, AICP
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

via email: rsato@hhf.com

Dear Mr. Sato,

SUBJECT: State DLNR DOFAW Makiki Baseyard Improvements Project, Draft Environmental Assessment Pre-Assessment Consultation

Thank you for the opportunity to review and comment on the subject matter. In addition to the comments sent to you dated July 14 and 15, 2015, enclosed are additional comments from the Office of Conservation and Coastal Lands on the subject matter. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)

DAVID Y. IGE
GOVERNOR OF HAWAI'I

RECEIVED
LAND DIVISION
2015 JUL 13 PM 2:21
DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII

STATE OF HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAI'I 96809

Ref: OCCL:LY

CORR: OA 15-194

JUL 13 2015

MEMORANDUM

TO: Russell Tsuji, Administrator
Land Division

FROM: Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

SUBJECT: Pre-Assessment Consultation for the State DLNR DOFAW Makiki Baseyard Improvements Project

TMK: (1) 2-5-019: Portion of 008

LOCATION: Makiki, O'ahu, Hawai'i

Based on the information provided, the Division of Forestry and Wildlife (DOFAW) is proposing to improve its existing Makiki Baseyard Facility. Proposed improvements include additional buildings and improvements to existing facilities to support DOAFW's ability to manage their islandwide operations and more effectively implement program activities. The proposed structures and infrastructure improvements would include the following:

- Expansion of the current Administration Building;
- Renovation of an existing building to an office environment, and replacement of an existing building with a new office building;
- Construction of a new fire cache and fuel storage building;
- Removal of temporary and dilapidated structures and construction of two new buildings to support operations;
- Construction of permeable surfaced parking areas to meet a parking demand of 66 stalls, of which at least 50 percent will be covered;
- Realignment of an existing Hawaiian Electric Company easement;
- Removal of the Board of Water Supply chlorination station that is not being used;
- Installation of a 24-foot wide roadway with a vehicle turnaround to meet current fire code;
- Installation of another fire hydrant to meet code requirements;
- Installation of a vehicle wash off area;

- Installation of a permanent wastewater system (subsurface constructed wetlands) to serve DOFAW and the Hawai'i nature center;
- Installation of photovoltaic arrays placed on new structures and over parking areas;
- Installation of infrastructure to support smart storm water management, flood mitigation, enhance ground water recharge, and mitigation of urban heat islands. This infrastructure could include rainwater harvesting, rain gardens, bioswales, permeable surfaces, riparian buffers, and protection of open and sensitive land areas;
- Use of alternate water sources (rain and greywater) on-site; and
- Installation of native vegetation in new landscaped areas where possible.

The OCCL notes that the project area is located within the Resource Subzone of the State Land Use Conservation District. In addition, based on our records, there are no existing Conservation District use Permits (CDUPs) for the overall baseyard site. However, we do recognize that Makiki Valley was designated as a Forest Reserve in 1904 and is under the management of DOFAW. As the area has been under management of DOFAW prior to the advent of the Conservation Land Use District, the baseyard could be considered a non-conforming use. Therefore, based on the preliminary list of proposed projects outlined in the project summary, we anticipate that the project will require a Conservation District Use Board Permit pursuant to Hawai'i Administrative Rules (HAR) § 13-5-22 P-8 STRUCTURES AND LAND USES, EXISTING (D-1) *Major alteration of existing structures, facilities, uses, and equipment, or topographical features which are different from the original use or different from what was allowed under the original permit*

Please note that this letter does not constitute the Department's final decision regarding the level of permitting required for the subject project. We reserve the right to change our decision dependent on the final project description presented to us by DOFAW and/or their consultant when they have submitted their Conservation District Use Application for our review and processing. Should you have any questions regarding this correspondence, please contact Lauren Yasaka of our Office at (808) 587-0386.

cc: Chairperson

HHF PLANNERS
places for people

March 4, 2016

Mr. Russell Y. Tsuji, Land Administrator
Land Division
Department of Land and Natural Resources
State of Hawai‘i
P.O. Box 621
Honolulu, Hawai‘i 96809

Dear Mr. Tsuji:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letters dated July 15th and 20th, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project. We have the following responses to the comments organized by divisions.

Division of Aquatic Resources

We confirm that the project is not expected to have any significant impact on aquatic resources in the area. The implementation of best management practices (BMPs) to minimize drainage impacts on surrounding areas and the nearby stream will be addressed in the Draft EA. Design plans developed for this project will include specific measures to be implemented by the contractor.

Office of Conservation and Coastal Lands

We confirm the project site is situated within the Resource Subzone of the State's Conservation District. A Conservation District Use Permit application will be submitted for this project after completion of the environmental review process, and we will coordinate with your department's staff on the application's preparation and processing.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF STATE PARKS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 21, 2015

HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawai‘i 96813
Attn: Ronald A. Sato, AICP
Email: rsato@hhf.com

Dear Mr. Sato:

Subject: Pre-Assessment Consultation for a Draft EA on DOFAW's Proposed Makiki Baseyard Improvements Project; TMK: (1) 2-5-019: 008 (portion), Makiki, O‘ahu

We have reviewed the request for a Pre-Assessment consultation regarding the subject project and have the following comments:

1. The Division of State Parks (State Parks) supports the overall vision of the project and notes that DOFAW and State Parks have a history of working together as the Makiki State Recreation Area abuts the DOFAW Baseyard and Forest Reserve.

2. The construction of the permanent wastewater system as a subsurface constructed wetland is located on land under the jurisdiction of State Parks, which is further under General Lease No. S-97-01 dated August 27, 1997, a long term lease to the Hawai‘i Nature Center, Inc. The system is designed to treat wastewater currently treated by an above ground device identified as the "Living Machine" or "Green Machine", from the DOFAW baseyard and the Hawai‘i Nature Center leased area. The Division of State Parks does not have adequate funds for the construction or maintenance of a constructed wetland and notes that the responsibility of maintenance of structures on the leased area is the responsibility of the lessee.

3. The proposed constructed wetland may require the construction of a fence around its perimeter, that may impact the potential educational value of such a feature. Further, construction of the wetland may limit further development of the site.

4. State Parks conducted archaeological surveys in Makiki Valley in 1980 and 1994. The 1980 survey was along Kanealole and Moleka Streams and did not include the DOFAW Baseyard. However, agricultural terraces were noted along the streams in the vicinity of the baseyard. The 1994 survey encompassed the area from the park entry and included the baseyard. The agricultural terraces and ‘auwai recorded during this survey are located makai of the baseyard but their location should be assessed relative to the wastewater system. Copies of these 2 surveys will be provided to you through an email.

5. The 20th Century history of this section of Makiki Valley should also be addressed:
   a. Territorial Forestry acquired Makiki Valley in 1904 and initiated forest restoration projects. It would be valuable to research the history of the baseyard as some of the buildings may be more than 50 years old. The Architecture Branch of the State Historic Preservation Division (SHPD) would be able to make a better assessment of the architectural value and historical significance of these buildings.
   b. The complex of rock and mortar walls in the area proposed for the wastewater system are historic properties as they were built in the 1930s as a public work project.
   c. There is a dam and reservoir along Kanealole Stream with a large water pipe running along the Kanealole Trail and is in the vicinity of the baseyard. These features are believed to be part of the Board of Water Supply system in Makiki Valley and may have some historic significance.
   d. These historic properties will require compliance with HRS Chapter 6E-8.

Upon notification of the date the DEA will be published in *The Environmental Notice*, we will access the document via OEQC's website. We appreciate the opportunity to provide input on this project and the extension of the comment deadline.

Very truly yours,

Daniel S. Quinn
State Parks Administrator

March 4, 2016

Mr. Daniel S. Quinn, Administrator
Division of State Parks
Department of Land and Natural Resources
State of Hawaiʻi
P.O. Box 621
Honolulu, Hawaiʻi 96809

Dear Mr. Quinn:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawaiʻi
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 21, 2015 responding to our 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. Your department's support of the overall vision for this project is appreciated, and DOFAW will continue to work together with your department in this area.
2. Thank you for the comments and information on the "green machine" wastewater system serving this area. Coordination has been, and will continue to be, conducted with your department to address future wastewater system improvements to serve this project.
3. This project is now planned to utilize a septic tank with leach field system to treat wastewater. Information on this proposed system will be included in the Draft EA.
4. We appreciate the information provided on prior archaeological surveys conducted in the area. An archaeological literature review and field inspection (LRFI) study was conducted for this project which incorporated information from the prior studies noted. The location of agricultural terraces and ʻauwai recorded in the prior surveys are not situated near the currently planned wastewater system.
5. The 20th Century history of the project area will be addressed in the LRFI conducted and incorporated into the Draft EA.
    a. Mason Architects, Inc. has been coordinating with the State Historic Preservation Division (SHPD) to address the historical significance of buildings older than 50 years.

b. Discussion of the historical significance of rock and mortar walls in the area near the proposed wastewater system will be included in the Draft EA.
c. The dam and reservoir should not be affected because they are not located in the project area where improvements will occur.
d. The LRFI will be submitted to SHPD for review under Chapter 6E-8, HRS, and the published Draft EA will also be submitted to that division for review and comments.

We note that your department plans to access (download) the electronic pdf file of the published Draft EA when it is published in *The Environmental* Notice.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

DAVID Y. IGE
GOVERNOR

ARTHUR J. LOGAN
MAJOR GENERAL
ADJUTANT GENERAL

KENNETH S. HARA
COLONEL
DEPUTY ADJUTANT GENERAL

STATE OF HAWAII
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 DIAMOND HEAD ROAD
HONOLULU, HAWAII 96816-4495

July 8, 2015

HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawai'i 96813

Attn.: Mr. Ronald A. Sato, AICP

Subject: State DLNR DOFAW Makiki Baseyard Improvements Project Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawaii
TMK: (1) 2-5-019: portion of 008.

Dear Mr. Sato,

Thank you for the opportunity to comment on the above project. The State of Hawaii Department of Defense has no comments to offer relative to the project.

If you have any questions or concerns, please have your staff contact Mr. Lloyd Maki, Assistant Chief Engineering Officer at (808) 733-4250.

Sincerely,

ARTHUR J. LOGAN
Major General
Hawaii National Guard
Adjutant General

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March 4, 2016

Mr. Arthur J. Logan, Adjutant General
Major General. Hawaii National Guard
Office of the Adjutant General
Department of Defense
State of Hawai'i
3949 Diamond Head Road
Honolulu, HI 96816

Dear Mr. Logan:

Subject: **DLNR DOFAW Makiki Baseyard Improvements Project**
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai'i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 8, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We confirm 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 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

DAVID Y. IGE
GOVERNOR

KATHRYN S. MATAYOSHI
SUPERINTENDENT

STATE OF HAWAI`I
DEPARTMENT OF EDUCATION
P.O. BOX 2360
HONOLULU, HAWAI`I 96804

OFFICE OF SCHOOL FACILITIES AND SUPPORT SERVICES

June 25, 2015

Mr. Ronald A. Sato, AICP
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Re: State DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment (DEA) Pre-Assessment Consultation
Makiki, Honolulu, Hawaii, TMK (1)2-5-019: portion of 008

Dear Mr. Sato:

The Department of Education (DOE) has reviewed the Draft Environmental Assessment Pre-Assessment Consultation for the State Department of Land and Natural Resources, Division of Forestry and Wildlife Makiki Baseyard improvements project.

The DOE has no comment to offer regarding this project.

We appreciate the opportunity to provide comments. If you have any questions, please call Heidi Meeker, Land Use Planner of the Planning Section, Facilities Development Branch at 377-8301 or via email at heidi_meeker@notes.k12.hi.us.

Respectfully,

Kenneth G. Masden II
Public Works Manager
Planning Section

KGM:jmb

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March 4, 2016

Mr. Kenneth G. Masden II, Public Works Manager
Planning Section
Department of Education
State of Hawai‘i
P.O. Box 2360,
Honolulu, Hawai‘i 96804

Dear Mr. Masden:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated June 25, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We confirm 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 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P.O. Box 3378
HONOLULU, HAWAII 96801-3378

In reply, please refer to:
File:

15-447A CAB

July 8, 2015

Mr. Ronald A. Sato, AICP
Senior Associate
Helbert, Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

SUBJECT: Draft Environmental Assessment Pre-Assessment Consultation State DLNR DOFAW Makiki Baseyard Improvements Project Makiki, Honolulu, Hawaii

Construction/Demolition that May Involve Asbestos
If the proposed project includes renovation/demolition activities which may involve asbestos, the applicant should contact the Asbestos Abatement Office in the Indoor and Radiological Health Branch at 586-5800.

Control of Fugitive Dust
A significant potential for fugitive dust emissions exists during all phases of construction. The activities must comply with the provisions of Hawaii Administrative Rules, §11-60.1-33 on Fugitive Dust. We encourage the contractor to implement a dust control plan, which does not require approval by the Department of Health, to comply with the fugitive dust regulations.

Dust control measures may include, but are not limited to, the following:

a) Planning the different phases of construction, focusing on minimizing the amount of dust-generating materials and activities, centralizing on-site vehicular traffic routes, and locating potential dust-generating equipment in areas of the least impact;
b) Providing an adequate water source at the site prior to start-up of construction activities;
c) Landscaping and providing rapid covering of bare areas, including slopes, starting from the initial grading phase;
d) Minimizing dust from shoulders and access roads;
e) Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
f) Controlling dust from debris being hauled away from the project site. Also, controlling dust from daily operations of material being processed, stockpiled, and hauled to and from the facility.

In support of your efforts to move to a paperless environment, please send the Draft Environmental Assessment in electronic format to: CAB@doh.hawaii.gov

If you have any questions, please contact Mr. Barry Ching of the Clean Air Branch at 586-4200.

Sincerely,

NOLAN S. HIRAI, P.E.
Manager, Clean Air Branch

BC:rg

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March 4, 2016

Mr. Nolan S. Hirai, P.E., Manager
Clean Air Branch
Department of Health
State of Hawaiʻi
P.O. Box 3378,
Honolulu, Hawaiʻi 96801-3378

Dear Mr. Hirai:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawaiʻi
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 8, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

The Asbestos Abatement Office will be contacted if asbestos is present in structures slated for renovation or demolition. This will be better determined during project design.

Construction activities will comply with the provisions of the Hawaii Administrative Rules Section 11-60.1-33 on Fugitive Dust. The contractor will also implement a dust control plan that may include the various measures identified in your letter.

We will provide an electronic file of the published Draft EA via the email address provided.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
EMD/CWB

07038PJF.15

July 28, 2015

Mr. Ronald A. Sato, AICP
Senior Associate
HHF Planners Pacific
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

SUBJECT: Draft Environmental Assessment (DEA) Pre- Assessment Consultation for State DLNR DOFAW Makiki Baseyard Improvements Project Makiki, Island of Oahu, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated June 12, 2015, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/05/Clean-Water-Branch-Std-Comments.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. You may be required to obtain National Pollutant Discharge Elimination System (NPDES) permit coverage for discharges of wastewater, including storm water runoff, into State surface waters (HAR, Chapter 11-55).

For NPDES general permit coverage, a Notice of Intent (NOI) form must be submitted at least 30 calendar days before the commencement of the discharge. An application for an NPDES individual permit must be submitted at least 180 calendar days before the commencement of the discharge. To request NPDES permit coverage, you must submit the applicable form ("CWB Individual NPDES Form" or "CWB NOI Form") through the e-Permitting Portal and the hard copy certification statement with the respective filing fee ($1,000 for an individual NPDES permit or $500 for a Notice of General Permit Coverage). Please open the e-Permitting Portal website located at: https://eha-cloud.doh.hawaii.gov/epermit/. You will be asked to do a one-time registration to obtain your login and password. After you register, click on the Application Finder tool and locate the appropriate form. Follow the instructions to complete and submit the form.

3. If your project involves work in, over, or under waters of the United States, it is highly recommended that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 835-4303) regarding their permitting requirements.

   Pursuant to Federal Water Pollution Control Act [commonly known as the "Clean Water Act" (CWA)], Paragraph 401(a)(1), a Section 401 Water Quality Certification (WQC) is required for "[a]ny applicant for Federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may **result** in any discharge into the navigable waters..." (emphasis added). The term "discharge" is defined in CWA, Subsections 502(16), 502(12), and 502(6); Title 40 of the Code of Federal Regulations, Section 122.2; and HAR, Chapter 11-54.

4. Please note that all discharges related to the project construction or operation activities, whether or not NPDES permit coverage and/or Section 401 WQC are required, must comply with the State's Water Quality Standards. Noncompliance with water quality requirements contained in HAR, Chapter 11-54, and/or permitting requirements, specified in HAR, Chapter 11-55, may be subject to penalties of $25,000 per day per violation.

5. It is the State's position that all projects must reduce, reuse, and recycle to protect, restore, and sustain water quality and beneficial uses of State waters. Project planning should:

   a. Treat storm water as a resource to be protected by integrating it into project planning and permitting. Storm water has long been recognized as a source of irrigation that will not deplete potable water resources. What is often overlooked is that storm water recharges ground water supplies and feeds streams and estuaries; to ensure that these water cycles are not disrupted, storm water cannot be relegated as a waste product of impervious surfaces. Any project planning must recognize storm water as an asset that sustains and protects natural ecosystems and traditional beneficial uses of State waters, like community beautification, beach going, swimming, and fishing. The approaches necessary to do so, including low impact development methods or ecological bio-engineering of drainage ways must be identified in the planning stages to allow designers opportunity to include those approaches up front, prior to seeking zoning, construction, or building permits.

b. Clearly articulate the State's position on water quality and the beneficial uses of State waters. The plan should include statements regarding the implementation of methods to conserve natural resources (e.g., minimizing potable water for irrigation, gray water re-use options, energy conservation through smart design) and improve water quality.

c. Consider storm water Best Management Practice (BMP) approaches that minimize the use of potable water for irrigation through storm water storage and reuse, percolate storm water to recharge groundwater to revitalize natural hydrology, and treat storm water which is to be discharged.

d. Consider the use of green building practices, such as pervious pavement and landscaping with native vegetation, to improve water quality by reducing excessive runoff and the need for excessive fertilization, respectively.

e. Identify opportunities for retrofitting or bio-engineering existing storm water infrastructure to restore ecological function while maintaining, or even enhancing, hydraulic capacity. Particular consideration should be given to areas prone to flooding, or where the infrastructure is aged and will need to be rehabilitated.

If you have any questions, please visit our website at: http://health.hawaii.gov/cwb/, or contact the Engineering Section, CWB, at (808) 586-4309.

Sincerely,

Alec Wong

ALEC WONG, P.E., CHIEF
Clean Water Branch

JF:ay

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March 4, 2016

Mr. Alec Wong, P.E., Chief
Clean Water Branch
Department of Health
State of Hawai‘i
P.O. Box 3378
Honolulu, Hawaii 96801-3378

Dear Mr. Wong:

Subject: **DLNR DOFAW Makiki Baseyard Improvements Project**
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 28, 2015 responding to our 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 would be compliant with the anti-degradation policy (Section 11-54-1.1 HAR), designated uses based upon receiving waters classification, and water quality criteria.
2. National Pollutant Discharge Elimination System (NPDES) general permit coverage will be obtained for the project’s construction activities (storm water runoff) and discharge of wastewater.
3. This project will not involve work in, over, or under the waters of the United States.
4. It is anticipated that all discharges related to construction activities or operations will comply with State Water Quality Standards. The project’s design will include measures addressing storm water runoff, and will be coordinated with pertinent agencies for ministerial review and permits.
5. Proposed green infrastructure improvements associated with the project recognize storm water as a resource, and design plans being prepared will incorporate pertinent measures. In particular, storm water best management practices, like the usage of permeable pavers, are proposed to allow stormwater to recharge groundwater aquifers. Additionally, pervious pavement and bioswale improvements are proposed as methods to reduce excessive site runoff and improve water quality. Use of alternative water sources including rainwater and greywater are also proposed, which can minimize the use of potable water for irrigation.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

STATE OF HAWAII
DEPARTMENT OF HEALTH
P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

EPO 15-144

July 10, 2015

Mr. Ronald A. Sato, AICP
Senior Associate
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Via email/hardcopy: rsato@hhf.com

Dear Mr. Sato:

SUBJECT: Draft Environmental Assessment (DEA) Pre-Assessment Consultation State DLNR DOFAW Makiki Baseyard Improvements Project

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your DEA to our office on June 17, 2015. Thank you for allowing us to review and comment on the proposed project. The DEA was routed to the Clean Water branch. They will provide specific comments to you if necessary. EPO recommends that you review the standard comments and available strategies to support sustainable and healthy design provided at: http://health.hawaii.gov/epo/home/landuse-planning-review-program. Projects are required to adhere to all applicable standard comments.

We encourage you to examine and utilize the Hawaii Environmental Health Portal. The portal provides links to our e-Permitting Portal, Environmental Health Warehouse, Groundwater Contamination Viewer, Hawaii Emergency Response Exchange, Hawaii State and Local Emission Inventory System, Water Pollution Control Viewer, Water Quality Data, Warnings, Advisories and Postings. The Portal is continually updated. Please visit it regularly at: https://eha-cloud.doh.hawaii.gov

You may also wish to review the revised Water Quality Standards Maps that have been updated for all islands. The Water Quality Standards Maps can be found at: http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/water-quality-standards

We request that you utilize all of this information on your proposed project to increase sustainable, innovative, inspirational, transparent and healthy design.

Mahalo nui loa,

Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office

c: DLNR, Division of Forestry & Wildlife, CWB {via email only}

HHF PLANNERS
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March 4, 2016

Ms. Laura Leialoha Phillips McIntyre, AICP, Program Manager
Environmental Planning Office
Department of Health
State of Hawaiʻi
P.O. Box 3378
Honolulu, Hawaiʻi 96801-3378

Dear Ms. Phillips McIntyre:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawaiʻi
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 10, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We will review the branch's standard comments mentioned which generally pertain to items that will be more appropriately addressed as part of the project's design phase. Thank you for the link to the Department of Health's resource website and water quality standard maps.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

DAVID Y. IGE
GOVERNOR

STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
869 PUNCHBOWL STREET
HONOLULU, HAWAII 96813-5097

FORD N. FUCHIGAMI
DIRECTOR

DEPUTY DIRECTORS
JADE T. BUTAY
ROSS M. HIGASHI
EDWIN H. SNIFFEN
DARRELL T. YOUNG

IN REPLY REFER TO:
DIR 0750
HWY-PS 2.0207

July 20, 2015

Mr. Ronald A. Sato
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Early Consultation for Draft Environmental Assessment
DOFAW Makiki Baseyard Improvement Project
Makiki Heights – Maikiki Valley, Oahu
TMK: (1) 2-5-019:008 (POR.)

We received your letter dated June 12, 2015, requesting a pre-assessment on the preparation of a draft environmental assessment (EA) required by Chapter 343, Hawaii Revised Statutes on the subject project. The project site is part of a 346-acre State-owned property for the Department of Land and Natural Resources (DLNR). The property is located within the Honolulu Watershed Forest Reserve and adjoins the Makiki Valley State Recreational Area at the southwestern boundary of the baseyard.

The proposed improvements involve the expansion and renovation to the existing baseyard facilities. The property will provide 60 parking stalls with the main access via Makiki Heights Drive, a county roadway. The site serves as the headquarters for the DLNR Division of Forestry and Wildlife on Oahu and the proposed improvements are part of a preliminary conceptual master plan for the existing baseyard.

The State Department of Transportation (DOT) has the following comments:

1. A Traffic Assessment should be prepared and included in the draft EA.

2. A permit is required from the DOT Highways Division to transport oversized/overweight equipment/loads within State highways. The draft EA should provide a description of the types of construction and heavy equipment vehicles to be used during construction and construction hours and activities.

If you have any questions, please contact Nami Wong, Systems Planning Engineer, Highways Division, Planning Branch, at (808) 587-6336. Please reference file review number PS 2015-121 in all contacts and correspondence regarding these comments.

Sincerely,

For FORD N. FUCHIGAMI
Director of Transportation

March 4, 2016

Mr. Ford N. Fuchigami, Director
Department of Transportation
State of Hawai‘i
869 Punchbowl Street
Honolulu, Hawai‘i 96813

Dear Mr. Fuchigami:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 20, 2015 responding to our 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 Draft EA will include the results of a traffic impact study prepared for this project.
2. If required, the contractor will obtain a permit for the transportation of oversized/overweight equipment or loads being transported on State highways. Efforts will be taken to ensure the contractor's transport of construction materials and equipment to the project site occurs during off-peak hours (8:30 a.m. to 3:30 p.m.) to minimize disruption on roadways. General information on construction-related activities will be discussed in the Draft EA. However, more specific information on construction activities would be developed 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 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

PHONE (808) 594-1888

FAX (808) 594-1938

STATE OF HAWAI'I
OFFICE OF HAWAIIAN AFFAIRS
560 N. NIMITZ HWY., SUITE 200
HONOLULU, HAWAI'I 96817

HRD 15-7519

July 20, 2015

Ronald A. Sato, Senior Associate, AICP
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawai'i 96813

Re: State DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki Ahupua'a, Honolulu Moku, O'ahu Mokupuni
TMK: (1) 2-5-019: portion of 008

Aloha Mr. Sato:

The Office of Hawaiian Affairs received your letter dated June 12, 2015 requesting comments on a pre-assessment consultation for a draft environmental assessment for the Makiki Baseyard Improvements Project. Our agency has no comments at this time. For the future, we would prefer to receive a copy of the draft EA as a pdf file format on a CD. Should you have any questions, please contact Everett Ohta at 594-0231 or everetto@oha.org.

'O wau iho nō me ka 'oia 'i'o,

for Kamana'opono M. Crabbe, Ph.D.
Ka Pouhana, Chief Executive Officer

KC: kkk

**Please address replies and similar, future correspondence to our agency:*
Dr. Kamana'opono Crabbe
Attn: OHA Compliance Enforcement
560 N. Nimitz Hwy., Ste. 200
Honolulu, Hawai'i 96817

HHF PLANNERS
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March 4, 2016

Dr. Kamana‘opono M. Crabbe, Chief Executive Officer
Attention: OHA Compliance Enforcement
Office of Hawaiian Affairs
State of Hawai‘i
560 North Nimitz Highway, Suite 200
Honolulu, Hawai‘i 96817

Dear Dr. Crabbe:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 20, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We acknowledged that your department has no comments at this time. We will provide the published Draft EA in pdf electronic file format on a CD.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

OFFICE OF PLANNING
STATE OF HAWAII

DAVID Y. IGE
GOVERNOR

LEO R. ASUNCION
ACTING DIRECTOR
OFFICE OF PLANNING

235 South Beretania Street, 6th Floor, Honolulu, Hawaii 96813
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Telephone: (808) 587-2846
Fax: (808) 587-2824
Web: http://planning.hawaii.gov/

Ref. No. P-14818

July 10, 2015

Mr. Ronald A. Sato, AICP
Senior Associate
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Pre-Assessment Consultation for the State DLNR DOFAW Makiki Baseyard Improvement Project, Makiki, Honolulu, Hawaii; TMK: (1) 2-5-019:008 (por)

Thank you for the opportunity to provide comments on the pre-consultation request for a Draft Environmental Assessment (Draft EA) for the Makiki baseyard improvement project being proposed by the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW). The pre-consultation review material was transmitted to our office by letter, dated June 12, 2015.

It is our understanding that this project proposes to redevelop this baseyard site to meet the current and projected needs of DOFAW in a manner sensitive to the surrounding area and the mission of this agency. The development of the baseyard will be conducted in phases to allow portions of this project to be constructed as State funding is allocated to this project. A Master Plan was created for this project to serve as the framework for the development process.

The proposed structures and infrastructure improvements include the expansion of the current administration building; renovation of an existing building; replacement of an existing building with a new office building; construction of a fuel storage building; removal of dilapidated structures; permeable surfaces for the parking area; removal of an obsolete Board of Water Supply chlorination station; installation of an additional emergency fire hydrant, a vehicle wash off area; a permanent wastewater system; photovoltaic arrays; new infrastructure to support smart stormwater management; the use of an on-site alternative water sources; and the use of native vegetation for landscaping.

The Office of Planning (OP) has reviewed the transmitted material and has the following comments to offer:

1. OP provides technical assistance to state and county agencies in administering the statewide planning system in Hawaii Revised Statutes (HRS) Chapter 226, the Hawaii

State Plan. The Hawaii State Plan provides goals, objectives, policies, and priority guidelines for growth, development, and the allocation of resources throughout the State. The Hawaii State Plan includes diverse objectives and policies of state interest including but not limited to the economy, agriculture, the visitor industry, federal expenditure, the physical environment, facility systems, socio-cultural advancement, climate change adaptation, and sustainability.

The Draft EA should include an analysis that addresses whether the proposed project conforms or is in conflict with the goals, objectives, policies, and priority guidelines listed in the Hawaii State Plan. OP acknowledges that this project proposes to include water and energy resource efficiency design principles, permeable surfaces for the parking area, solar energy, rain catchment devices, and will use natural light for building interiors. These practices are consistent with the priority guideline on sustainability, HRS § 226-108(2).

2. The coastal zone management area is defined as "all lands of the State and the area extending seaward from the shoreline to the limit of the State's police power and management authority, including the U.S. territorial sea" see HRS § 205A-1 (definition of "coastal zone management area").

   HRS Chapter 205A requires all State and county agencies to enforce the coastal zone management (CZM) objectives and policies. The Draft EA should include an assessment as to how the proposed project conforms to the CZM objectives and its supporting policies set forth in HRS § 205A-2. The assessment on compliance with HRS Chapter 205A is an important component for satisfying the requirements of HRS Chapter 343. These objectives and policies include: recreational resources, historic resources, scenic and open space resources, coastal ecosystems, economic uses, coastal hazards, managing development, public participation, beach protection, and marine resources.

3. OP acknowledges that this project proposes to incorporate smart stormwater management and Low-Impact development strategies to reduce the potential damage that storm runoff may have on nearshore waters of Oahu. The Makiki project site is considerable distance from the coastline, however the project is within the Conservation district and adjacent to environmentally sensitive land and water resources (forest wetlands and perennial streams) that ultimately connect to nearshore waters. In order to ensure that these valuable natural resources remain protected, the negative effects of natural processes, stormwater runoff, and a wide range of human activities should be considered and mitigated. The Draft EA should summarize the area's classification in the State Land Use Districts, its relation to wetlands and

perennial streams, the tsunami evacuation zone, and flood zone. These items, as well as the nearshore water quality classification, should be considered when developing mitigation measures to protect the coastal ecosystem.

OP has a number of resources available to assist in the development of projects which ensure sediment and stormwater control on land, thus protecting the nearshore environment. OP recommends consulting these guidance documents and stormwater evaluative tools when developing strategies to address polluted runoff. They offer useful techniques to keep soil and sediment in place and prevent contaminating nearshore waters, while considering the practices best suited for each project. These three evaluative tools that should be used during the design process include:

- Hawaii Watershed Guidance provides direction on site-appropriate methods to safeguard Hawaii's watersheds and implement watershed plans http://files.hawaii.gov/dbedt/op/czm/initiative/nonpoint/HI Watershed Guidance Final.pdf

- Stormwater Impact Assessments can be used to identify and evaluate information on hydrology, stressors, sensitivity of aquatic and riparian resources, and management measures to control runoff, as well as consider secondary and cumulative impacts to the area http://files.hawaii.gov/dbedt/op/czm/initiative/stomwater_imapct/final_storm water_impact_assessments_guidance.pdf

- Low Impact Development (LID), A Practitioners Guide covers a range of structural best management practices (BMP's) for stormwater control management, roadway development, and urban layout that minimizes negative environmental impacts http://files.hawaii.gov/dbedt/op/czm/initiative/lid/lid_guide_2006.pdf

If you have any questions regarding this comment letter, please contact Josh Hekekia of our office at (808) 587-2845.

Sincerely,

Leo R. Asuncion
Acting Director

HHF PLANNERS
places for people

March 4, 2016

Mr. Leo R. Asuncion, Acting Director
Office of Planning
State of Hawai‘i
P.O. Box 2359
Honolulu, Hawai‘i 96804

Dear Mr. Asuncion:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 10, 2015 responding to our 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 Draft EA will include discussion of the project’s conformance with pertinent goals, objectives, policies, and priorities of the Hawaii State Plan.
2. The Draft EA will include discussion of the project’s conformance with pertinent goals, objectives, policies, and priorities of the Hawaii State Coastal Zone Management program (Chapter 205A, HRS).
3. The relationship between the proposed project and environmentally sensitive lands and water resources has been considered in the conceptual plans. The Draft EA will summarize the area’s classification within the State Land Use District system, and address project effects on wetlands, perennial streams, the tsunami evacuation zone, and the flood zone. The resources listed in the comment letter were considered in the development of best management practices to mitigate impacts the project may have on related water resources.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

July 16, 2015

Mr. Ronald A. Sato, AICP
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Your Letter of June 12, 2015 Regarding the Draft Environmental Assessment Pre-Consultation for the State Department of Land and Natural Resources Division of Forestry and Wildlife Makiki Baseyard Improvements Project, Makiki, Oahu, Hawaii, TMK: 2-5-019: Portion of 008

Thank you for the opportunity to review the subject document for the proposed baseyard project.

We have the following comments to offer:

1. We have no objection to the removal of our existing Makiki Chlorinator Station. However, we require an equivalent area of land or more adjacent to the master planned area near the proposed turn around for a replacement chlorinator facility should we reactivate our spring sources.

2. We also have no objections to the removal of any abandoned 8, 6, and 4-inch water mains in the project vicinity.

3. The existing 8-inch and 4-inch water mains from our spring sources are to be retained but cut and plugged in accordance with our Standards and to meet State Department of Health (DOH) sanitary survey requirements, including but not limited to pictorial documentation and as-built records.

4. The active 8-inch water main in the access road should also be cut and plugged at the mauka end of the site and include a clean-out for flushing according to our Standards. The clean-out should be located such that it will be accessible for Board of Water Supply (BWS) crews and the discharge will not cause damage, flooding or permitting issues. In addition, an easement is required for this water main.

5. The existing water system cannot provide adequate fire protection to the proposed development in accordance with our Standards. The nearest fire hydrant is located approximately 1,600 linear feet away. Therefore, the developer will be required to install a fire hydrant, within 125 linear feet of the parcel, providing a flow of 2,000 gallons per minute. The proposed fire hydrant shown in the document does not qualify as the off-site fire protection as it can only provide a flow of approximately 1,500 gallons per minute. However, please be advised that this information is based upon current data, and therefore, the BWS reserves the right to change any position or information stated herein up until the final approval of the building permit application. The final decision on the availability of water will be confirmed when the building permit application is submitted for approval.

6. The construction drawings addressing the previous comments should be submitted for our review and approval.

7. When water is made available, the applicant will be required to pay our Water System Facilities Charges for resources development, transmission and daily storage.

8. The on-site fire protection requirements should be coordinated with the Fire Prevention Bureau of the Honolulu Fire Department.

9. The project will be subject to our cross-connection and backflow prevention requirements due to the on-site auxiliary water system and type of facility.

10. The wastewater system and any ground disposal of wastewater should be coordinated with the State DOH.

If you have any questions, please contact Iris Oda, Long Range Planning Branch of our Water Resources Division at 748-5946 or by e-mail at ioda@hbws.org. We also prefer receiving the Draft Environmental Assessment on a CD.

Very truly yours,

FOR ERNEST Y. W. LAU, P.E.
Manager and Chief Engineer

cc: DLNR-DOFAW

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March 4, 2016

Mr. Ernest Y.W. Lau, P.E., Manager and Chief Engineer
Board of Water Supply
City and County of Honolulu
630 South Beretania Street
Honolulu, Hawai'i 96843

Dear Mr. Lau:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai'i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 16, 2015 providing comments to our 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. We confirm that the City Board of Water Supply (BWS) has no objections to the removal of the existing Makiki Chlorinator Station. An area of land located just *mauka* (north) of the planned turnaround area with vehicular parking bays has been identified for a replacement chlorinator facility should the City BWS decide to reactivate its spring sources.
2. We confirm there is no objection to removal of any abandoned 4-, 6-, and 8-inch water mains in the project vicinity.
3. The existing 8-inch and 4-inch water mains from the spring sources will be retained, cut, and plugged in accordance with City BWS standards, which includes pictorial documentation and as-built records.
4. The existing 8-inch water main in the access road will be cut and plugged at its *mauka* and *makai* ends according to BWS standards. The project's design phase will determine an appropriate and accessible location for the clean-out. An easement will be created for the water main.
5. Thank you for information on the existing water system relative to fire protection adequacy. To meet fire protection requirements, an indoor sprinkler system will be provided to address existing on-site fire system inadequacies.
6. The project's architect will coordinate with your department to address water system-related fire protection improvements, as appropriate.

7. Water System Facilities Charges will be paid when water is made available.
8. The project's design will be coordinated with the Honolulu Fire Department's Fire Prevention Bureau.
9. The design team will coordinate with your agency to address cross-connection and backflow prevention requirements.
10. Coordination of the project wastewater system and ground disposal of wastewater will be coordinated with the State Department of Health.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

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

KIRK CALDWELL
MAYOR

ROBERT J. KRONING, P.E.
DIRECTOR

MARK YONAMINE, P.E.
DEPUTY DIRECTOR

July 6, 2015

HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Attn: Ronald A. Sato, AICP

Dear Mr. Sato:

Subject: State DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawaii
TMK (1) 2-5-019: portion of 008

The Department of Design and Construction does not have comments to offer on the draft environmental assessment.

Thank you for the opportunity to review and comment. Should there be any questions, please contact me at 768-8480.

Sincerely,

fr M. Yonamine

Robert J. Kroning, P.E.
Director

RJK: cf (613645)

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March 4, 2016

Mr. Robert J. Kroning, 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. Kroning:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai'i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 6, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We confirm that the City Department of Design and Construction 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 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

Ronald Sato

From: Hirai, Peter J.S. <PHirai@honolulu.gov>
Sent: Friday, June 26, 2015 3:18 PM
To: Ronald Sato
Subject: Draft Environmental Assessment Pre-Assessment Consultation

Follow Up Flag: Follow up
Flag Status: Completed

Categories: Priority

Dear Mr. Sato:

In reply to your letter of June 12, 2015, requesting comments for the Makiki Baseyard Improvements Project, the City Department of Emergency Management has no comments to provide at this time.

We prefer to receive the Draft Environmental Assessment on CD to conserve paper.

Thank you for the opportunity to comment.

Sincerely,

Peter J.S. Hirai, MSS, CEM®
Deputy Director
Department of Emergency Management
650 South King Street
Honolulu, Hawaii 96813-3078
Voice: (808) 723-8960 Fax: (808) 768-1458

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March 4, 2016

Mr. Peter J.S. Hirai, MSS, CEM, Deputy Director
Department of Emergency Management
City and County of Honolulu
650 South King Street,
Honolulu, Hawai‘i 96813

Dear Mr. Hirai:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your email dated June 26, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We note that the City Department of Emergency Management has no comments at this time. We will provide you with a copy of the Draft EA on a CD when it is published.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

DEPARTMENT OF FACILITY MAINTENANCE

CITY AND COUNTY OF HONOLULU

1000 Ulu`ohia Street, Suite 215, Kapolei, Hawaii 96707
Phone: (808) 768-3343 • Fax: (808) 768-3381
Website: www.honolulu.gov

KIRK CALDWELL
MAYOR

ROSS S. SASAMURA, P.E.
DIRECTOR AND CHIEF ENGINEER

EDUARDO P. MANGLALLAN
DEPUTY DIRECTOR

IN REPLY REFER TO:
DRM 15-482

July 13, 2015

Mr. Ronald A. Sato, AICP
Senior Associate
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813-3484

Dear Mr. Sato:

SUBJECT: State DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawaii
TMK: (1) 2-5-019: portion of 008

Thank you for the opportunity to review and comment on your letter dated June 12, 2015, on the above-subject project.

We have no objections, as we do not have any facilities or easements on the subject property.

If you have any questions, please contact Mr. Kyle Oyasato of the Division of Road Maintenance at 768-3697.

Sincerely,

Ross S. Sasamura, P.E.
Director and Chief Engineer

HHF PLANNERS
places for people

March 4, 2016

Mr. Ross S. Sasamura, P.E., Director and Chief Engineer
Department Facility Maintenance
City and County of Honolulu
1000 Ulu‘ohia Street, Suite 215,
Kapolei, Hawai‘i 96707

Dear Mr. Sasamura:

Subject: **DLNR DOFAW Makiki Baseyard Improvements Project**
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 13, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We confirm that the City Department of Facility Maintenance has no objections to the project since there are no agency facilities or easements within the project site.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

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

KIRK CALDWELL
MAYOR

GEORGE I. ATTA, FAICP
DIRECTOR

ARTHUR D. CHALLACOMBE
DEPUTY DIRECTOR

2015/ELOG-1215 (tb)

July 31, 2015

Mr. Ronald A. Sato, AICP
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Thank you for your letter dated June 12, 2015, regarding pre-assessment consultation in preparation of a Draft Environmental Assessment (EA) for Division of Forestry and Wildlife's Makiki Baseyard.

Due to the proximity of Makiki Stream and its tributaries, the applicant must submit a flood assessment report to determine if the project site is subject to flooding.

Should you have any questions, please contact Thomas Blair at 768-8030.

Very truly yours,

for George I. Atta, FAICP
Director

GIA:js

HHF PLANNERS
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March 4, 2016

Mr. George I. Atta, FAICP, Director
Department of Planning and Permitting
City and County of Honolulu
650 South King Street, 7th Floor
Honolulu, HI 96813

Dear Mr. Atta:

Subject: **DLNR DOFAW Makiki Baseyard Improvements Project**
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 31, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

Preliminary engineering work conducted for this project determined that the project site should not be subject to flooding from the nearby Makiki Stream. The stream is about 15 to 20 feet lower in elevation than building areas used for operations. The Draft EA will address flooding effects on the project.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

Pacific Guardian Center • 733 Bishop Street, Suite 2590 • Honolulu, Hawaii 96813
Tel. 808.545.2055 • Fax 808.545.2050 • www.hhf.com • e-mail: info@hhf.com

DEPARTMENT OF PARKS & RECREATION

CITY AND COUNTY OF HONOLULU

1000 Uluohia Street, Suite 309, Kapolei, Hawaii 96707
Phone: (808) 768-3003 • Fax: (808) 768-3053
Website: www.honolulu.gov

KIRK CALDWELL
MAYOR

MICHELE K. NEKOTA
DIRECTOR

JEANNE C. ISHIKAWA
DEPUTY DIRECTOR

July 2, 2015

Mr. Ronald A. Sato, AICP
Senior Associate
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato,

SUBJECT: Draft Environmental Assessment
State DLNR DOFAW Makiki Baseyard Improvement Project
Makiki, Honolulu, Hawaii
TMK (1) 2-5-019: portion of 008

Thank you for the opportunity to review and comment on the subject Draft Environmental Assessment of the subject stated above.

The Department of Parks and Recreation has no comment. As the proposed project will have no impact on any program or facility, 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,

Michele K. Nekota
Director

MKN:jr
(613745)

HHF PLANNERS
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March 4, 2016

Ms. Michele K. Nekota, Director
Department of Parks & Recreation
City and County of Honolulu
1000 Uluoahi Street, Suite 309
Kapolei, Hawai'i 96707

Dear Ms. Nekota:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai'i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 2, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We confirm that the City Department of Parks and Recreation has no comment since the proposed project will have no impact on any City DPR programs or facilities. We will remove your agency as a consulted party in the environmental review process for this project.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

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

KIRK CALDWELL
MAYOR

MICHAEL D. FORMBY
DIRECTOR

MARK N. GARRITY, AICP
DEPUTY DIRECTOR

TP6/15-613925R

July 13, 2015

Mr. Ronald A. Sato, AICP
Senior Associate
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

SUBJECT: State Department of Land and Natural Resources, Division of Forestry and Wildlife Makiki Baseyard Improvements Project, Draft Environmental Assessment (DEA) Pre-Assessment Consultation; Makiki, Honolulu, Hawaii; Tax Map Key: (1) 2-5-019: portion of 008

In response to your letter dated June 12, 2015, we have the following comments:

1. The DEA should analyze and mitigate any traffic and safety impacts on Makiki Heights Drive as a result of the project including the short-term impacts during construction.

2. The Makiki/Lower Punchbowl/Tantalus Neighborhood Board No. 10, as well as the area residents, businesses, etc., particularly Halau Ku Mana Public Charter School, should be kept apprised of the details of the proposed project and the impacts, particularly during construction, the project may have on the adjoining local street area network.

3. A street usage permit from the City's Department of Transportation Services shall be obtained for any construction-related work that may require the temporary closure of any traffic lane on a City street.

4. Any construction materials and equipment should be transferred to and from the project site during off-peak traffic hours (8:30 a.m. to 3:30 p.m.) to minimize any possible disruption to pedestrians and traffic on the local sidewalks and streets.

We reserve further comment pending submission of the DEA. We would prefer to receive the DEA as a PDF file on a CD-ROM disk.

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,

Michael D. Formby
Director

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March 4, 2016

Mr. Michael D. Formby, Director
Department of Transportation Services
City and County of Honolulu
650 South King Street, 3rd Floor
Honolulu, Hawai'i 96813

Dear Mr. Formby:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai'i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 13, 2015 responding to our 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 Draft EA will include the results of a traffic impact study that examined project impacts to traffic along Makiki Heights Drive, and identify if any mitigative measures attributable to the project are required.
2. A presentation on the project was already given to the Makiki/Lower Punchbowl/Tantalus Neighborhood Board No. 10. DOFAW will keep the neighborhood board, Hālau Kū Māna Public Charter School, area residents and businesses informed about project construction work at the appropriate time.
3. A street usage permit will be obtained if project construction-related work requires the temporary closure of any traffic lane on a City street.
4. Efforts will be taken to ensure the contractor's transport of construction materials and equipment to the project site occurs during off-peak hours (8:30 a.m. to 3:30 p.m.) to minimize disruption on local sidewalks and streets.

We will provide your agency with the Draft EA in an electronic format on a CD. Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

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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

KIRK CALDWELL
MAYOR

MANUEL P. NEVES
FIRE CHIEF

LIONEL CAMARA JR.
DEPUTY FIRE CHIEF

July 7, 2015

Mr. Ronald Sato, AICP
Senior Associate
Helber Hastert & Fee Planners, Inc.
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Sato:

Subject: Draft Environmental Assessment (DEA) Preassessment Consultation
State of Hawaii Department of Land and Natural Resources
Division of Forestry and Wildlife
Makiki Baseyard Improvements Project
Tax Map Key: 2-5-019: portion of 008

In response to your letter dated June 12, 2015, regarding the above-mentioned subject, the Honolulu Fire Department (HFD) requires that the following be complied with:

1. Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 feet from fire department access roads as measured by an approved route around the exterior of the building or facility. (National Fire Protection Association [NFPA] 1, Uniform Fire Code [UFC]™, 2006 Edition, Section 18.2.3.2.2.)

   A fire department access road shall extend to within 50 feet of at least one exterior door that can be opened from the outside and provides access to the interior of the building. (NFPA 1, UFC™, 2006 Edition, Section 18.2.3.2.1.)

2. A water supply approved by the county, capable of supplying the required fire flow for fire protection, shall be provided to all premises upon which facilities or buildings, or portions thereof, are hereafter

constructed, or moved into or within the county. When any portion of the facility or building is in excess of 150 feet from a water supply on a fire apparatus access road, as measured by an approved route around the exterior of the facility or building, on-site fire hydrants and mains capable of supplying the required fire flow shall be provided when required by the AHJ [Authority Having Jurisdiction]. (NFPA 1, UFC™, 2006 Edition, Section 18.3.1, as amended.)

3. The unobstructed width and unobstructed vertical clearance of a fire apparatus access road shall meet county requirements. (NFPA 1, UFC™, 2006 Edition, Section 18.2.3.4.1.1, as amended.)

4. Submit civil drawings to the HFD for review and approval.

The HFD requests a copy of the DEA as a portable document format file on a compact disc.

Should you have questions, please contact Battalion Chief Terry Seelig of our Fire Prevention Bureau at 723-7151 or tseelig@honolulu.gov.

Sincerely,

Socrates D Bratakos

SOCRATES D. BRATAKOS
Assistant Chief

SDB/SY:jl

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March 4, 2016

Mr. Socrates D. Bratakos, Assistant Chief
Honolulu Fire Department
City and County of Honolulu
636 South Street,
Honolulu, Hawai'i 96813

Dear Mr. Bratakos:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai'i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 7, 2015 responding to our 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 Fire department access roads have been incorporated into the project's conceptual plans. Design plans developed will address uniform fire code requirements.
2. To meet fire protection requirements, an indoor sprinkler system will be provided to address existing on-site fire system conditions.
3. The unobstructed width and vertical clearance requirements for the fire access road will comply with City requirements.
4. Design plans developed will be coordinated with your department, as appropriate.

We will provide your agency with the Draft EA in an electronic format on a CD. Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

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POLICE DEPARTMENT

CITY AND COUNTY OF HONOLULU

801 SOUTH BERETANIA STREET · HONOLULU, HAWAII 96813
TELEPHONE: (808) 529-3111 · INTERNET: www.honolulupd.org

KIRK CALDWELL
MAYOR

LOUIS M. KEALOHA
CHIEF

DAVE M. KAJIHIRO
MARIE A. McCAULEY
DEPUTY CHIEFS

OUR REFERENCE MT-DK

June 29, 2015

Mr. Ronald A. Saito, AICP
Senior Associate
HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Dear Mr. Saito:

This is in response to your letter dated June 12, 2015, requesting comments on a Pre-Assessment Consultation, Draft Environmental Assessment, for the Makiki Baseyard Improvements Project

The Honolulu Police Department has reviewed the information provided and has concerns regarding the safe flow of vehicular traffic during the construction phase of this project.

The Makiki Heights Road is a two-way (one lane each way) road with narrow widths. The limited width of Makiki Heights Road would require "warning" escorts or special duty police officers to provide traffic safety controls for the conveyance of construction vehicles and tractor trailers that span onto or over the center line of the road, especially in areas encompassing hairpin or tight turns.

If there are any questions, please call Major Roy Sugimoto of District 1 (Central Honolulu) at 723-3327.

Thank you for the opportunity to review this project.

Sincerely,

LOUIS M. KEALOHA
Chief of Police

By Mark Tsuyemura

MARK TSUYEMURA
Management Analyst VI
Office of the Chief

Serving and Protecting With Aloha

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March 4, 2016

Mr. Louis M Kealoha, Chief of Police
Police Department
City and County of Honolulu
801 South Beretania Street,
Honolulu, Hawai‘i 96813

Dear Chief Kealoha:

Subject: **DLNR DOFAW Makiki Baseyard Improvements Project**
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai‘i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated June 29, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

The services of a special duty police officer or a “warning” escort will be retained by the contractor if it is anticipated that vehicles used to transport construction equipment and materials will span onto or over the center line of Makiki Heights Road. Efforts will also be taken to ensure the contractor’s transport of construction materials and equipment to the project site occurs during off-peak hours (8:30 a.m. to 3:30 p.m.) to minimize disruption on and streets.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

Pacific Guardian Center • 733 Bishop Street, Suite 2590 • Honolulu, Hawaii 96813
Tel. 808.545.2055 • Fax 808.545.2050 • www.hhf.com • e-mail: info@hhf.com

Hawaiian Telcom

July 9, 2015

HHF Planners
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813
Attention: Mr. Ronald A. Sato, AICP

Dear Mr. Sato:

Subject: **State DLNR DOFAW Makiki Baseyard Improvements Project**
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawaii
TMK (1) 2-5-019: portion of 008

Thank you for the opportunity to review and comment on the early consultation phase for the subject project.

Hawaiian Telcom does not have any comments to offer at this time.

Please submit a copy of the Draft EA as a pdf file format on a CD.

If you have any questions or require assistance in the future on this project, please call me at 546-7761.

Sincerely,

Les Loo
Network Engineer – OSP Engineering
Network Engineering & Planning

cc: File [Punahou]

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March 4, 2016

Mr. Les Loo, Network Engineer
OSP Engineering
Network Engineering & Planning
Hawaiian Telcom
P.O. Box 2200
Honolulu, Hawai'i 96841

Dear Mr. Loo:

Subject: **DLNR DOFAW Makiki Baseyard Improvements Project**
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai'i
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 9, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We acknowledged that your company has no comments at this time. We will provide the published Draft EA in pdf electronic file format on a CD.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

Ronald Sato

From:	Kuwaye, Kristen <kristen.kuwaye@hawaiianelectric.com>
Sent:	Monday, July 13, 2015 1:08 PM
To:	Ronald Sato
Cc:	Liu, Rouen; '1.11.160038@ecollab.heco.com'
Subject:	State DLNR DOFAW Makiki Baseyard Improvements Project
Categories:	Priority

Kristen Kuwaye on behalf of Rouen Liu

Dear Mr. Ronald Sato,

Thank you for the opportunity to comment on the subject project. Hawaiian Electric Company has no objection to the project. Should HECO have existing easements and facilities on the subject property, we will need continued access for maintenance of our facilities.

We appreciate your efforts to keep us apprised of the subject project in the planning process. As the proposed State DLNR DOFAW Makiki Baseyard Improvements Project comes to fruition, please continue to keep us informed. Further along in the design, we will be better able to evaluate the effects on our system facilities.
If you have any questions, please call me at 543-7245.

Sincerely,
Rouen Q. W. Liu
Permits Engineer
Tel: (808) 543-7245
Email: Rouen.liu@hawaiianelectric.com

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March 4, 2016

Mr. Rouen Q.W. Liu
Permits Engineer
Hawaiian Electric Company
Email: Rouen.liu@hawaiianelectric.com

Dear Mr. Liu:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawai'i
TMK (1) 2-5-019: portions of 008

Thank you for your email dated July 13, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

We acknowledge that the Hawaiian Electric Company (HECO) has no objection to this project. The project's design team and DOFAW will coordinate with HECO to address continued access to HECO facilities and easements within the project site. Design plans will also be coordinated with your division for review.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

Oceanic
Time Warner Cable®

June 26, 2015

Helber, Hastert & Fee
733 Bishop Street, Suite 2590
Honolulu, Hawaii 96813

Attention: Mr. Ronald A. Sato

Project: DLNR DOFAW Makiki Base Yard Improvements

Subject: CATV Review

Dear Mr. Sato,

Oceanic Time Warner Cable has facilities on the pole line leading up to the base yard pole# 12. We provide service to two buildings from pole# 12. WE do not have any facilities past pole# 12. Unless this pole line is going to be removed or relocated I see not conflict with the work to be done. A pdf file on CD for a copy of the Draft EA is fine. If you have any questions, contact me at #625-8576.

Sincerely,

Lionel Aguiar
OSP Engineer
Oceanic Time Warner Cable

200 Akamainui Street
Mililani, Hawaii 96789-3999
Tel (808) 625-2100
Fax (808) 625-5888

HHF PLANNERS
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March 4, 2016

Mr. Lionel Agular, OSP Engineer
Oceanic Time Warner Cable
200 Akamainui Street
Mililani, Hawaiʻi 96789-3999

Dear Mr. Agular:

Subject: DLNR DOFAW Makiki Baseyard Improvements Project
Draft Environmental Assessment Pre-Assessment Consultation
Makiki, Honolulu, Hawaiʻi
TMK (1) 2-5-019: portions of 008

Thank you for your letter dated July 9, 2015 responding to our pre-assessment consultation efforts for the preparation of the Draft Environmental Assessment (Draft EA) for the subject project.

Thank you for information on your pole line leading to the project site, and services being provided to two buildings within the project site from that pole. Pole No. 12 is not planned to be removed or relocated under this project. We will provide the published Draft EA in pdf electronic file format on a CD.

Thank you for your participation in this process. If you need additional information, please contact me by phone at 457-3172, or by email at rsato@hhf.com.

Sincerely,

Ronald A. Sato, AICP
Senior Associate

APPENDIX B

Photos of Existing Project Site

Photo: 01

South view of gated entrance above recreational park parking lot separating entrance into DSP and DOFAW area.

Photo: 02

View of existing DOFAW Administration Building.

Photo: 03

Photo of office building next (mauka) to main Administration Building.

Photo: 04

Photo of storage buildings. Building on left converted from storage container.

Photo: 05

North view of access driveway leading to mauka areas of existing baseyard.

Photo: 06

Photo of storage building converted out of two storage containers.

Photo: 07

Photo of another storage building.

Photo: 08

Storage container being used for office space.

Photo: 09

Photo of fire cache building.

Photo: 10

Area being used for greenhouse.

Photo: 11

Photo of vehicle storage sheds.

Photo: 12

Photo of storage sheds used for equipment.

Photo: 13

Existing Board of Water Supply Chlorinator Building (Inactive).

Photo: 14

Storage building located mauka of chlorinator building.

Photo: 15

Open gravel area used for vehicle parking.

Photo: 16

Open grassed area used for vehicle parking.

Photo: 17

South view of access road below gate to DSP/DOFAW area.

Photo: 18

Parking area used for recreational park.

Photo: 19

View of Nature Center building.

Photo: 20

View of DSP house and grassed area in front of it planned for septic tank and leach field use.

Photo: 21

Grassed area in front of house planned for septic tank and leach field use.

Photo: 22

View of Makiki Stream located makai of project site below greenhouse.

Photo: 23

View of Makiki Stream located below DOFAW baseyard.

Photo: 24

Another photo of Makiki Stream located below DOFAW baseyard site.

APPENDIX C

Archaeological Literature Review and Field Inspection for the DOFAW Makiki Base Yard Makiki Ahupua'a, Honolulu (Kona) District, O'ahu Island TMK (1) 2-5-019:008 por. (March 2016)

Prepared by: Cultural Surveys Hawai'i, Inc.

Draft

Archaeological Literature Review and Field Inspection for the DOFAW Makiki Base Yard Makiki Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK: [1] 2-5-019:008 por.

Prepared for
Helber Hastert & Fee, Planners

Prepared by

Leandra W. Medina, B.A.,
Tara Seaver, B.A.,
and
Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.
Kailua, Hawai‘i

(Job Code: MAKIKI 5)

March 2016

O‘ahu Office		**Maui Office**
P.O. Box 1114		**1860 Main St.**
Kailua, Hawai‘i 96734	www.culturalsurveys.com	**Wailuku, Hawai‘i 96793**
Ph.: (808) 262-9972		**Ph.: (808) 242-9882**
Fax: (808) 262-4950		**Fax: (808) 244-1994**

Management Summary

Reference	Archaeological Literature Review and Field Inspection for the DOFAW Makiki Base Yard Makiki Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK: [1] 2-5-019:008 por. (Medina et al. 2016)
Date	March 2016
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: MAKIKI 5
Investigation Permit Number	CSH conducted the archaeological field inspection for this investigation under Hawai‘i State Historic Preservation Division (SHPD) permit number 14-06, issued per Hawai‘i Administrative Rules (HAR) §13-13-282.
Agencies	SHPD; State of Hawai‘i Department of Land and Natural Resources / Division of Forestry and Wildlife (DLNR/DOFAW)
Land Jurisdiction	State of Hawai‘i and the State of Hawai‘i Department of Land and Natural Resources/Division of Forestry and Wildlife
Project Funding	State of Hawai‘i
Project Location	The project area is located in Kānealole Valley, approximately 0.45 km (0.28 mi) north of Makiki Heights Drive and 0.27 km (0.17 mi) southeast of Tantalus Drive, Makiki Ahupua‘a, Honolulu (Kona) District, O‘ahu TMK: [1] 2-5-019:008 por. The project area is depicted on the 1998 Honolulu U.S. Geological Survey (USGS) 7.5-minute series quadrangle map.
Project Description	Mason Architects, Inc. is proposing improvements and new construction to the Hawai‘i Division of Forestry and Wildlife Makiki Base Yard. Proposed improvements will include extension of administration buildings, and additional buildings for Forestry, Wildlife, and Nā Ala Hele programs. Additional construction will include a new fuel storage building, a general storage building, dumpster locations, and covered parking.
Project Acreage	1.1 ha (2.9 acres)
Document Purpose	This archaeological literature review and field inspection study was completed for use as a planning document. The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation (Hawai‘i Revised Statutes [HRS] §343 and HRS §6E-8/Hawai‘i Administrative Rules [HAR] §13-275, respectively). While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR §13-276), it serves as a document to facilitate the proposed project’s planning and supports historic preservation review compliance by assessing if there are major archaeological concerns within the project area and to develop data on the general nature, density, and distribution of archaeological resources.

Fieldwork Effort	Fieldwork was completed on 7 August 2014 by Leandra Medina B.A. and Tara Seaver B.A. under the general supervision of Hallett H. Hammatt, Ph.D. This work required approximately 2 person-days to complete.
Historic Properties Potentially Affected	Four previously documented historic properties are located immediately adjacent to the project area boundaries, but do not extend within the project area: ▪ SIHP # 50-80-14-3985 (Yent and Ota 1980), a series of 28 pre-Contact traditional agricultural features and post-Contact historic features located to the north, south, and southeast; ▪ SIHP # 50-80-14-2297 (McCoy 1971) a rock shelter burial discovery to the north; ▪ SIHP # 50-80-14-5759 (Nagata 1999), post-Contact cart road and associated features to the north and east; and ▪ SIHP # 50-80-14-4866 (Carpenter and Yent 1994), a traditional terrace complex and rock shelter to the south.
Recommendations	No surface historic properties are located within the project area. The project area is, however, located within portions of four LCAs indicating the potential for pre- and/or early post-Contact land use. The documentation of LCAs within the project area suggests the potential for subsurface historic properties that may include culturally enriched strata, cultural deposits, artifacts, and/or human burials. Thus, an archeological monitoring program is recommended for all ground disturbance activities associated with this project. The archaeological monitoring program should begin with the preparation of an archaeological monitoring plan to be submitted for SHPD review and acceptance.

Table of Contents

List of Figures

List of Tables

Section 1 Introduction

1.1 Project Background

At the request of Helber Hastert and Fee, Planners, Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this archaeological literature review and field inspection (LRFI) for the Department of Forestry and Wildlife (DOFAW) Makiki Base Yard within Makiki Ahupua‘a, Honolulu (Kona) District, O‘ahu Island. TMK: (1) 2-5-019:008 por. The project area is depicted on a portion of the 1998 Honolulu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1) a tax map plat (Figure 2), and a 2013 aerial photograph (Figure 3).

The approximately 1.1 ha (2.9 acres) project area is owned by the State of Hawai‘i and is proposed for redevelopment to include demolition and/or renovation of the existing structures and the construction of new buildings and utilities. Project plans also include construction of bridges, covered sidewalks, parking spaces, landscaping, and additional utilities to accommodate green and sustainable energy (Figure 4 and Figure 5).

1.2 Historic Preservation Regulatory Context and Document Purpose

This archaeological literature review and field inspection study was completed for use as a planning document. The proposed project is subject to Hawai‘i State environmental and historic preservation review legislation (Hawai‘i Revised Statutes [HRS] §343 and HRS §6E-8/Hawai‘i Administrative Rules [HAR] §13-275, respectively). While this investigation does not fulfill the requirements of an archaeological inventory survey investigation (per HAR §13-276), it serves as a document to facilitate the proposed project’s planning and supports historic preservation review compliance by assessing if there are major archaeological concerns within the project area and to develop data on the general nature, density, and distribution of archaeological resources.

1.3 Scope of Work

The scope of work for this project includes the following:

1. Historical research to include study of archival sources, historic maps, Land Commission Awards (LCAs), and previous reports to construct a history of the project area and vicinity and to determine if there are any historic properties;
2. Limited field inspection of the project area; this assessment will identify any sensitive areas that may require further investigation for this report; and,
3. Preparation of a report to include the results of the historical research and limited fieldwork assessment with recommendations for further work, if appropriate. It will also provide a mitigation recommendation, if appropriate.

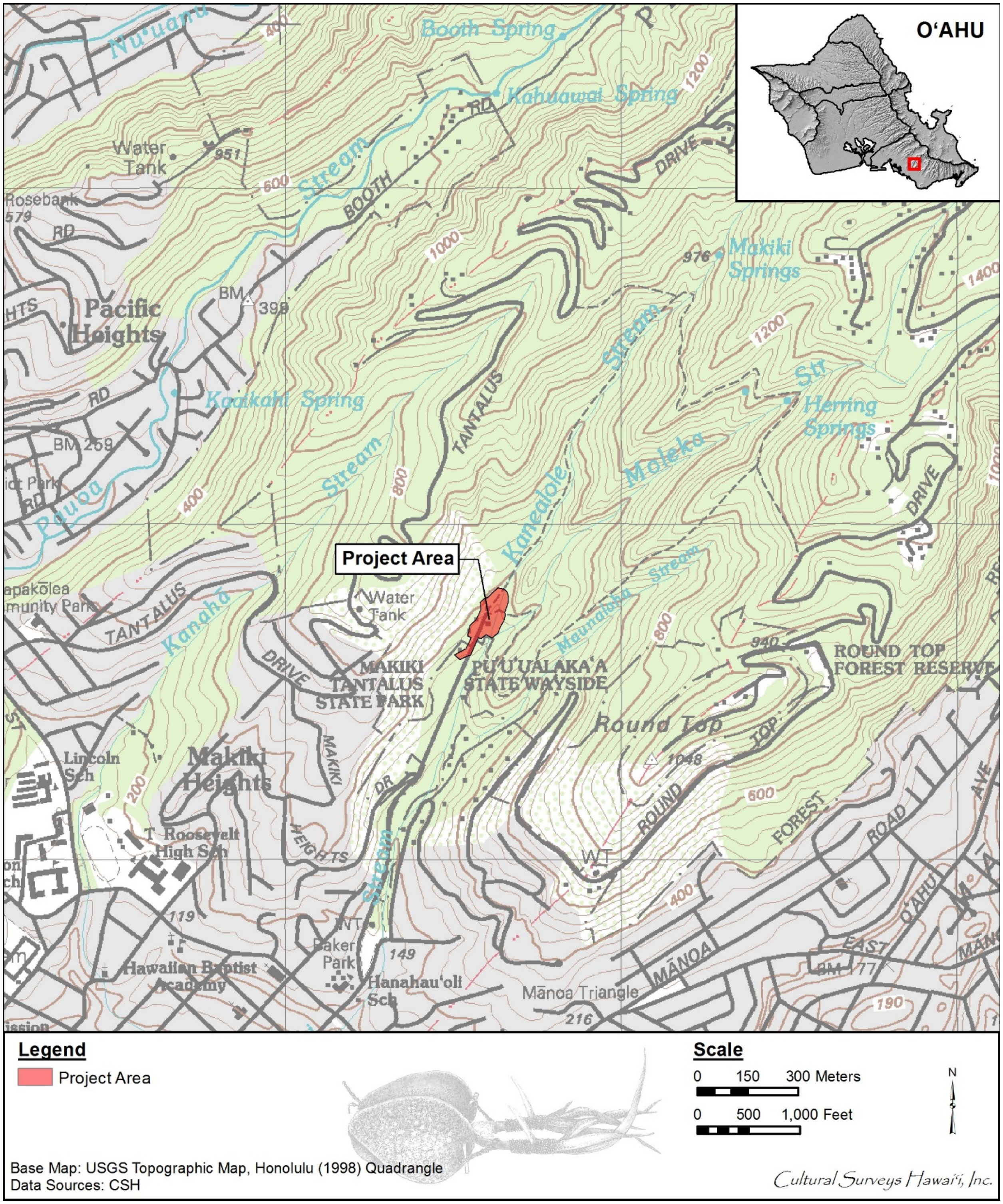


Figure 1. Portion of 1998 Honolulu USGS 7.5-Minute Series Topographic Quadrangle, showing project area.

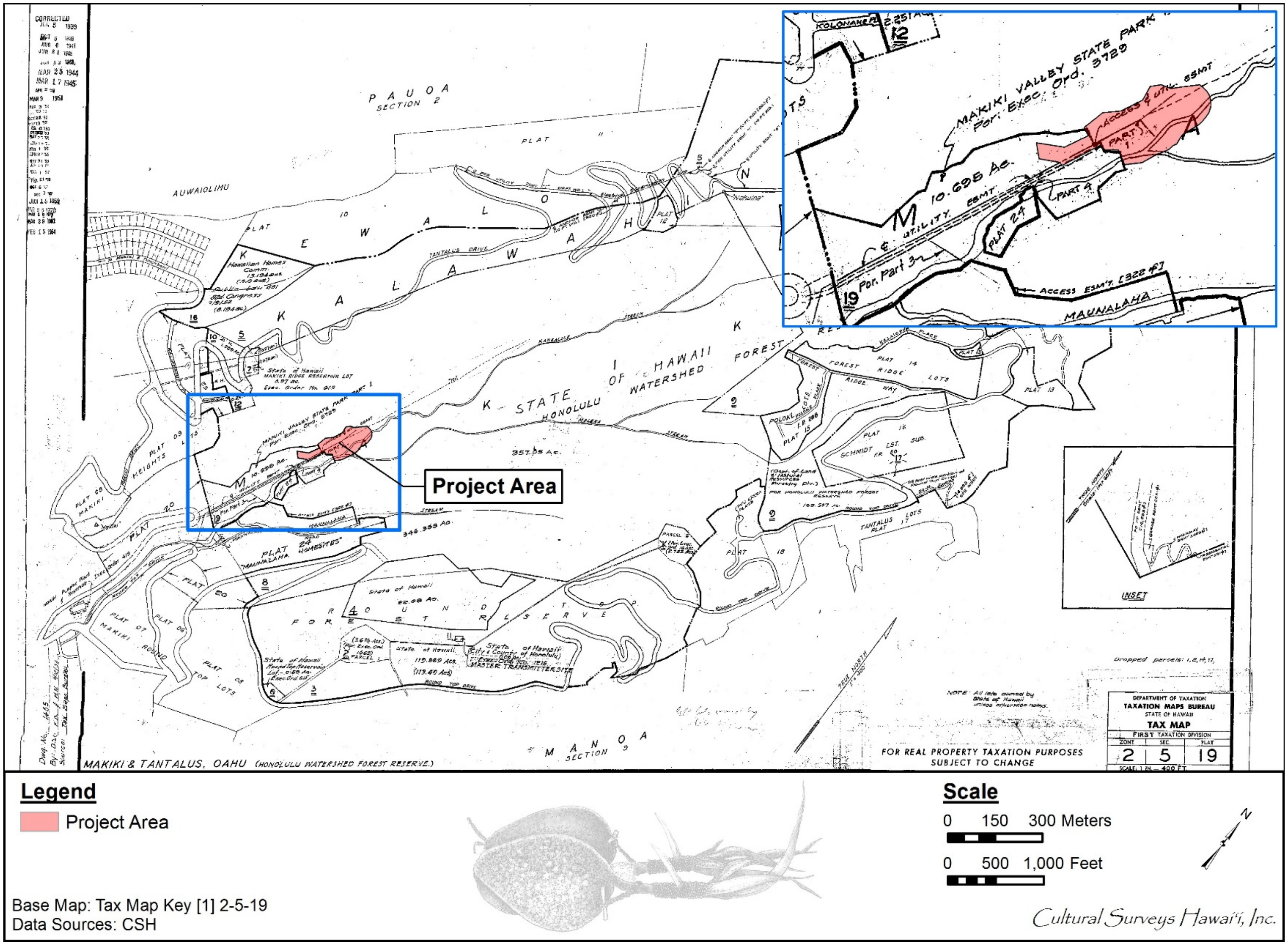


Figure 2. Tax Map Key (TMK) 2-5-019 map showing project area (Hawai‘i TMK Service)

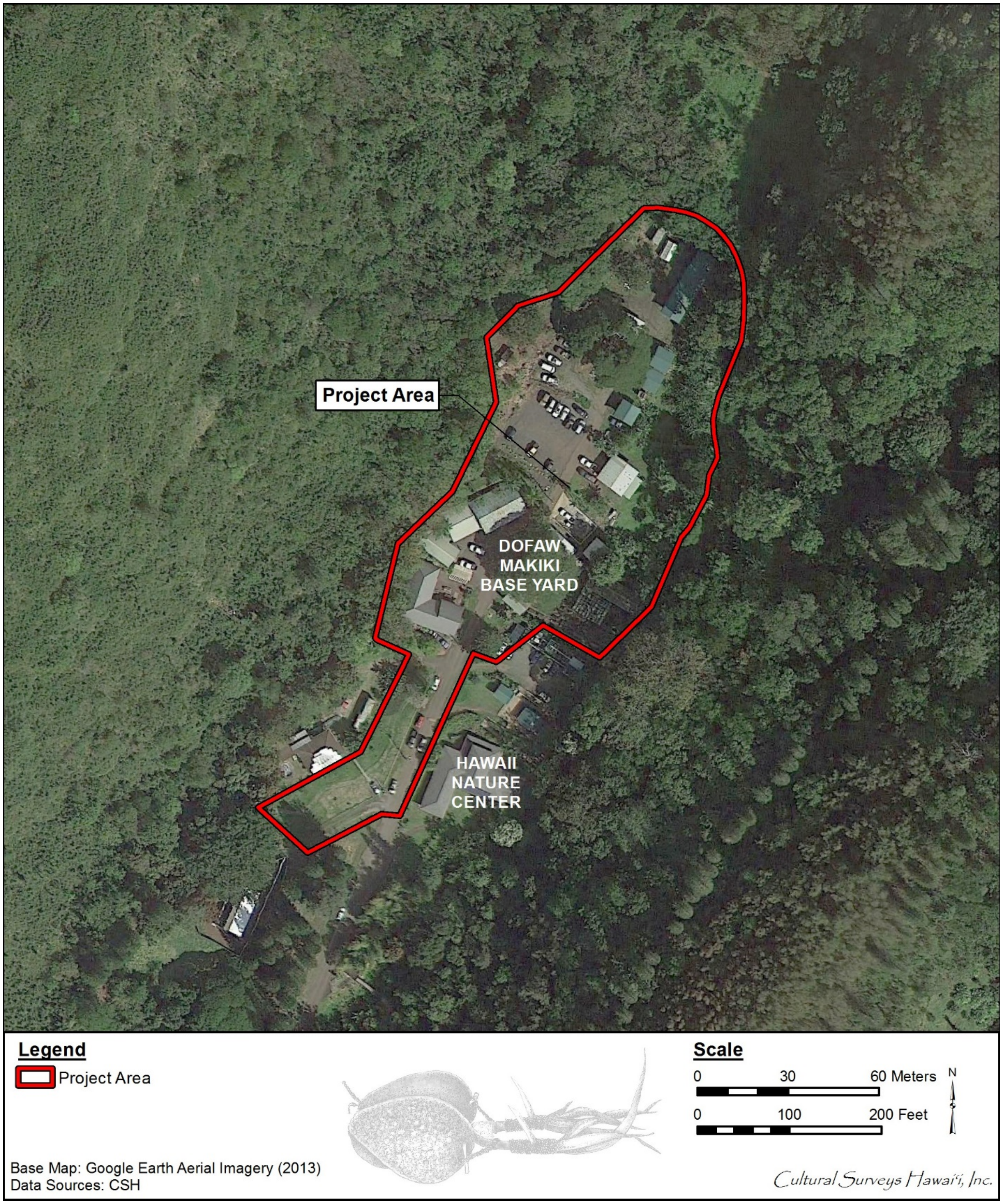


Figure 3. Aerial photograph showing the location of the project area (Google Earth 2013)

Figure 4. DOFAW Makiki Base Yard Conceptual Master Plan (HHF Planners. 1/20/2016)

Figure 5. DOFAW Makiki Base Yard Site Elevations (Mason Architects, Inc. 9/21/2015)

1.4 Environmental Setting

1.4.1 Natural Environment

The project area is located in the Makiki Ahupuaʻa (land division) within the Honolulu (Kona) district on the island of Oʻahu. Makiki is bounded by the Koʻolau Mountain Range summit on the *mauka* (inland) side, the Kahauiki Ahupuaʻa on the northwest, the Kapālama Ahupuaʻa on the southeast, and the ocean on the *makai* (seaward) side. The project area is located approximately 104 m (343 ft) above mean sea level (AMSL). Upper Makiki Valley is near the wet, Koʻolau Mountain Range and receives an average annual rainfall of 254 cm (100 inches) in the upper valley near Puʻu ʻŌhiʻa (Tantalus) and 63.5 cm (25 inches) in the lower plain (Giambellua et al. 1986). The valley is watered mainly by the Kānealole and Moleka streams, which come together just east of the project area to form Makiki Stream, which flows *makai*, terminating *makai* of Interstate H-1.

According to the U.S. Department of Agriculture (USDA) soil survey data the sediments within the project area consist of Kaena stony clay, 12–20% (KaeD) and Rock land (rRK) (Foote et al. 1972) (Figure 6). Kaena series soils are classified as deep, poorly drained soils that formed in alluvium and colluvium. They are mostly formed on steep colluvial slopes with slow to rapid runoff, and slow permeability (Foote et al. 1972:49). Geologically, the land where the project area is located is underlain by fractured, highly weather igneous rock, mostly basalt.

1.4.2 Built Environment

The land within the project area is currently being used as a base yard for the State of Hawaiʻi Department of Land and Natural Resources/Division of Forestry and Wildlife (DLNR/DOFAW). The natural topography has been subject to extensive land altering for the modern development of the DOFAW Makiki base yard. Twenty-one structures related to the daily operations and infrastructure are present within the project area.

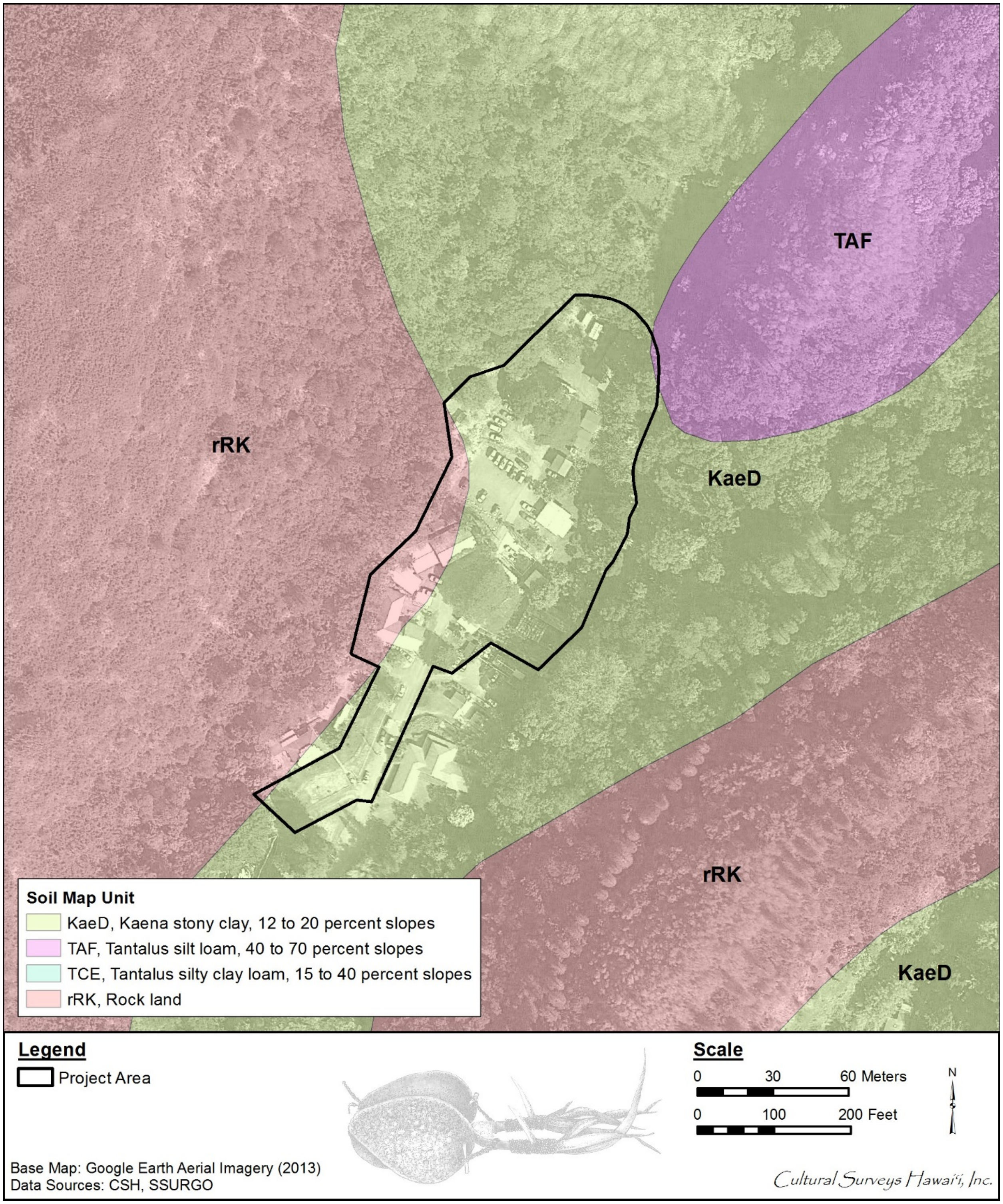


Figure 6. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), indicating sediment types within and surrounding the project area (source: Google Earth 2013, USDA Soils Survey Geographic Database [SSURGO] 2001)

Section 2 Traditional and Historical Background

2.1 Makiki Place Names and Legendary Sites

2.1.1 Makiki Valley

Makiki Valley is bounded by Pauoa Valley to the west, following the borders of the *ʻili* (land division smaller than *ahupuaʻa*) called Kalāwahine, Kewalo, and Kaiwiokaihu. Mānoa Valley is to the east; the two *ahupuaʻa* are separated by a ridge which extends from the base of Puʻu ʻŌhiʻa (Tantalus) to the top of Puʻu Kākea (Sugarloaf) and then to the top of Puʻu ʻUalakaʻa (Round Top**)** (Figure 7).

Makiki Stream is fed by four tributary streams, Kanahā (*lit*. shattered), Kānealole, Moleka, and Maunalaha (*lit*. flat mountain), from west to east (Pukui et al. 1974:142, 149). The name of the valley, *makiki,* is a type of stone used as weights for octopus lures (Malo 1976:19) and for adzes (Pukui and Elbert 1986:229).

2.1.2 Legendary *Pōhaku* of Makiki

In the legends of Makiki, a place—and sometimes a *pōhaku* (stone)—called Anianikū is often mentioned. According to *Place Names of Hawaii*, the name Anianikū literally means "stand beckoning," from the legend of a Papa-kolea girl who stood at this place beckoning to a girl in Mānoa who was chanting (Pukui et al. 1974:12). In the Makiki land records there is a small land unit in Makiki Valley called Keaniani or Kaniani, which may be related to the legend of Anianikū (Fitzpatrick 1989:16). Anianikū also seems to have been used as a marker for the post-Contact boundary of Makiki Ahupuaʻa. This marker acted as the dividing point between Makiki and Pauoa, and also as the dividing line between the larger land units of Honolulu and Waikīkī.

Pukui recounts the legend of Anianikū thus:

> A girl lived near there and would go up onto this place from where you can look into Manoa. In Manoa lived a girl who chanted beautifully. This girl was entranced by it and would go up there and wave. The girl in Manoa said, 'If that is a girl waving she will be my friend; if it is a man, he shall be my husband.' She found out it was a girl. The place where she used to stand is called Aniani-ku, meaning 'Beckoning.' [Mrs. M.K. Pukui 16 March 1954 in Sterling and Summers 1978:290]

The name Anianikū is associated with a famous *pōhaku*. In one legend, the stone is called Pohaku-o-Papakolea.

> *Huli aku au nana ia Pauoa e kilohi i ka nani o ka aina ike aku la au i ka waiho kahelahela mai a ka Pohaku o Papakolea ma ke kae maluna o ka owawa o Pauoa me ka aina Leialii ma ka aoao mauka aku o Puowaina a oia pohaku kaʻu i makemake ai no ka mea he moolelo maikai a kaulana ko keia Pōhaku o* Papakolea. [Makanikeoe 1908]
>
> Translation:
>
> Turn to look at Pauoa. Gaze on the beauty of the land and you will see laying in full view Pohaku-o-Papakolea on the edge of Pauoa and the crown land back of

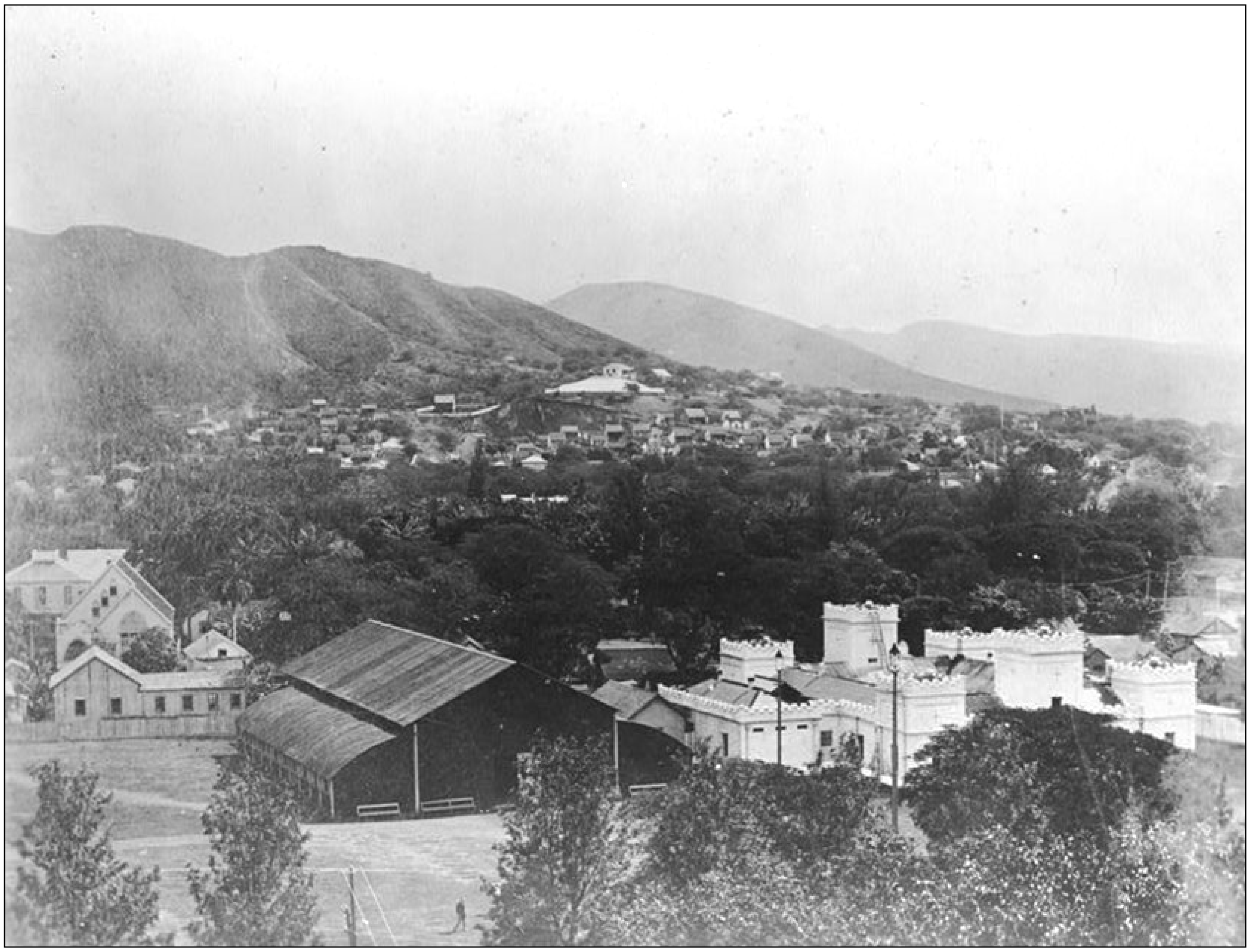


Figure 7. 1899 photograph of Makiki Valley taken from the top of ʻIolani Palace, showing, from left to right, Pūowaina (Punchbowl), Puʻu ʻUalakaʻa (Round Top), and Puʻu ʻŌhiʻa (Tantalus) (original photograph at the Library of Congress; reprinted in Scott 1968:569)

> Punchbowl. That is the stone that I like for it has a fine and famous legend. [translation from Sterling and Summers 1978:290]

Another legend ties the Anianikū p*ōhaku* to the tales of the Hawaiian pig-god, Kamapuaʻa.

Above Makiki is Mauna-laha. There is a stone there called Aniani-ku (Stand-beckoning) where Kamapuaʻa was tied (Pukui 15 Septebmer 1953 in Sterling and Summers 1978:290). Anianikū was located by Mary Kawena Pukui as the place now called Papakōlea. Papakōlea or *kapapakōlea*, meaning "the plover flats" (Pukui et al. 1974:180) is associated with a saying concerning the planting of sweet potatoes.

Ua ka ua i Papakōlea, ihea ʻoe	When it rained in Papakōlea, where were you?

> The reply of a sweet-potato grower on Papakōlea to one who asks for some of his crop. If one answered that he had been there when the rain fell to soak the earth for planting, and had not planted, then he was lazy and would be given no potatoes. [Pukui 1983:308]

Anianikū is also the name of one of the ancestors of the Hawaiian race.

> According to the legend of Hawaii-loa, the first man was Kumu-honua (k) and the first woman was Lalo-honua. . . . the so-called genealogy from the first man Kumu-honua (k) down, proceeded with 12 generations as the measure of time between each name. . . . At this time Aniani-ku (k) was born in a chieftain family and became the ruler of the people. Whether the whole or only part of the Polynesian race was under his rule is not clear. . . . The race under Aniani-ku (k) was known as Lahuia-kua, while those who worshipped images were called Lahui-laa-luau. Aniani-ku (k) and Ke-kai-lani (k) and Ka-mee-nui-hikina (w) had Hawaii-loa (k) also known as Ke-kowa-i-Hawaii. Aniani-ka-lani (k) . . . 'is quoted by both Tahitian and Hawaiian legends as the progenitor kupuna of their nations.' [Cartwright 1929:106-107]

2.1.3 Legends Concerning Cinder Cones

The eastern boundary of Makiki Ahupuaʻa is defined by a line of three cinder cones: Puʻu ʻŌhiʻa (Tantalus); Puʻu Kākea (Sugarloaf); and, Puʻu ʻUalakaʻa (Round Top).

2.1.3.1 Puʻu ʻŌhiʻa (Tantalus)

The literal meaning of Puʻu ʻŌhiʻa (Figure 8) is "the *ʻōhiʻa* tree hill" (Pukui et al. 1974:203). On the top of Puʻu ʻŌhiʻa was a *heiau* called Pepeiaoohikiau or Pepeiao o Hikiea, one of the *heiau* associated with human sacrifices at Pūowaina (Boundary Commissioners' Record Book, Makiki Boundary Certificate, p. 60-62 in Fitzpatrick 1989:22, 46).

2.1.3.2 Puʻu Kākea (Sugarloaf)

Puʻu Kākea is named for a storm wind associated with Mānoa (Pukui et al. 1974:197). It is also associated with the saying "*He Kākea ka makani kulakulaʻi kauhale o Mānoa,*" which means "the Kākea wind that pushes over the houses of Mānoa," said of one who is excessively aggressive (Pukui and Elbert 1986:119).

Figure 8. 1889 photograph of carriage road summit on Pu'u 'Ō'hia (Mount Tantalus) made by member of excursion party and cameraman Joaquin Augusto Gonsalves (original photograph in Hawai'i State Archives; reprinted in Scott 1968:580)

2.1.3.1 Pu'u 'Ualaka'a (Round Top)

The literal meaning of Pu'u 'Ualaka'a (Figure 9) is "rolling sweet potato hill," and it is named for the story of a rat that bit a sweet potato, causing it to roll downhill and sprout. The name may also have originated when Kamehameha I planted many sweet potatoes in this area (Fornander 1919:5:692), which on being dug, rolled downhill (Pukui et al. 1974:214).

> *Ma hope iho o ka pau ana o ka mai ahulau. (Okuu) o ka mahi ai ka hana nui loa. Mahi ai o ia ma Waikiki, Honolulu, Kapalama a me na wahi ae o Kona, a nui ka ai, a laila, haawi i ka ai i na alii a me na kanaka. Hele no o Kamehameha i ka lawaia, a nui ka ia, haawi no i na alii a me na kanaka, no laila, ua maopopo loa kona malama i na alii a me na kanaka.*
>
> *I ka wa o Kamehameha e noho ana ma Oahu, he nui loa na moku haole i ku mai ma ke awa o Honolulu; o na moku kalepa, na moku imi 'āina a me na moku manua. O ka pu ka mea i makemake nui ia e na alii a me na kanaka, no laila, ua kuai nui aku na alii i ka pu a me ka pauda. O na hale waiho pu o Kamehameha, aole o kana mai a ka nui launa ole.Ua lako loa o Kamehameha i na mea kaua haole, a pela no hoi i na alii a pau. Aohe makemake nui ia o ke dala a me ka lole. A ike o Kamehameha, o ka uala ka ai i makemake nui ia e ka haole, a o ka uhi kahi, no laila, mahi ihola o Kamehameha i ka uala a nui, o ia hoi o Ualakaaa ma Manoa a ma Makiki. A mahi ihola i ka uhi ma Kaakopua, a ma Honolulu, o ia hoi o Kapauhi, a kuai akula me na haole.* [Kamakau, *Ka Nūpepa Kū'oka'*a, 27 July 1867]
>
> Translation:
>
> After the pestilence had subsided the chiefs again took up farming, and Kamehameha cultivated land at Waikiki, Honolulu, and Kapālama, and fed the people. He fished, made huge hauls, and gave food to the chiefs and people. Thus

> he cared for both chiefs and commoners. In those days ships were coming into the harbor at Honolulu—merchant vessels, war ships and ships out to discover new lands. Of these the chiefs and people bought arms and gunpowder. Kamehameha had several storehouses well stocked with foreign arms, but nobody wanted money or clothing. On the part of the foreigners potatoes and yams were in great demand. The chief accordingly went into the cultivation of these foods, and grew potatoes on the hill of ‘Ualaka‘a between Manoa and Makiki, and yams at Ka‘akopua, and sold them to the foreigners. [Kamakau 1992:190]

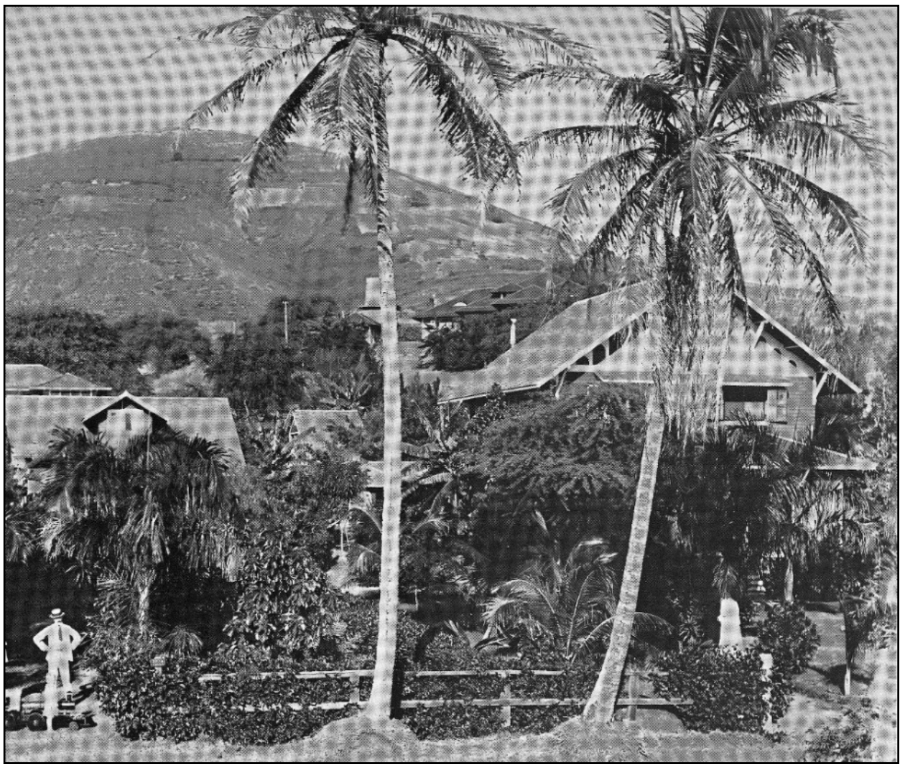


Figure 9. 1920s photograph of Pu‘u ‘Ualaka‘a (Round Top), showing farmlands growing sweet potatoes, melons, bananas, and breadfruit on the slopes (photograph reprinted in Scott 1968:584)

There are several alternate legends of the origin of the place name Pu‘u ‘Ualaka‘a. In “A Story of Ualakaa” (Fornander 1919), there were two potato fields planted on the slope of ‘Ualaka‘a in Mānoa.

> *Ua kanu ia keia uala ma Manoa, Oahu, aia ma ka pali komohana akau e pili la ia Manoa. He elua nae mala uala, na Kupihe kekahi, a na Kapanaia kekahi. O ka Kupihe mala uala, ua kanu ia maluna o ka pali, o ka Kapanaia hoi, ua kanu ia maluna o kahi honua palahalaha, i ko laua wa i mahiai ai, hookahi no uala i loaa i ka Kapanaia mala, ua hoomaka oia e puepue a hoomaka nohoi ua uala nei e nui a ahuwale aku mawahoo ka pue i kanu ia ai, o ka mala hoi a kela kanaka, aohe uala iki iloko o kana mala.*

<u>Translation:</u>

This potato was planted at Manoa, Oahu, on the northwestern slope of Manoa. There were two potato fields, one for Kupihe and the other for Kapanaia. Kupihe planted his potato on the side hill while Kapanaia planted his on the flat. When they were cultivating only one potato was found in Kapanaia's field, so he hilled it up. But the potato grew large and became exposed from the hill in which it was planted; the field of the other man, however did not contain any potato.

One day Kapanaia went to check on his potato, but it was gone. He went up to Kupihe's field and noticed a potato causing a lump in his field. He asked 'Whose potato is this?' The other answered: 'It is mine, for it is growing in my potato-hill.' The two quarreled, and then returned to their home. That night the potato rolled down hill and made a deep hole where it struck; it then bounced and reattached itself to its parent vine. [Fornander 1919:5:532-533]

Fornander (1919) also records two other versions of this story:

Ua olelo ia ma keia moolelo a'u i lohe ai, ua oki maoli ia no ke anakiu o ua uala nei e ka iole, a hoomaka mai ua uala nei e kaa a paa i ka mala a Kapanaia, a malaila kahi i waiho ai a ulu haupuupu, oai ka mea e ulu haupuupu nei ka uala a kakou e ike nei. Oia ka mea i kapa ia ai kela puu mauka o Makiki o Ualakaa, no ka kaa ana o ua uala la. A kekahi inoa a'u i lohe ai o Iolekaa. O kekahi hoi, na Kaauhelemoa i kiko ke anakiu o ua uala la, a haule i ka mala a Kapanaia, no ke alualu ia ana mai e Pupuulima.

<u>Translation:</u>

That is one version of the story. But in the story which I heard, it is stated that the stem of this potato was bitten by a rat and the potato rolled down until it landed in Kapanaia's field, and it was left there until new sprouts commenced to grow from it. That is why new sprouts come from potatoes as we see them now. That was why this potato at Makiki was called Ualakaa, because it rolled [down hill]. Another name which I heard [applied to it] was Iolekaa (rolling rat). Another has it that Kaauhelemoa pecked at the stem of this potato and it rolled to Kapanaia's field, because Pupuulima chased after it. [Fornander 1919:5:532–533]

A fourth explanation for the name of this hill was given by George P. Mossman (1934) in an article in the *Honolulu Star-Bulletin*.

In the district of Ualakaa were grown some of the finest sweet potatoes in the islands. One day a famous bow and arrow expert, resting on Punchbowl, a mile or so away from the potato field, looked over that way and spied a mouse eating one of the potatoes. He shot his arrow, and the mouse fell dead. But the potato which it had been eating rolled down the hill. In commemoration of the feat, the Hawaiians gave the name of 'rolling potato' to the district. [Mossman 1934:10]

These legends led to the origin of the saying *Aia i luna o 'Ualaka'a*, meaning "He is up on 'Ualaka'a," said of one who, like a rolling potato, has nothing to hold fast to (Pukui 1983:8).

A *hōlua* slide may also have once been located on ʻUalakaʻa. According to an 1869 Makiki Boundary Certificate, the Makiki/Mānoa boundary began at King Street, went past Punahou School, then past John Īʻī's land called Anapuni, which was the beginning of the *hōlua* slide on the slopes of ʻUalakaʻa. Fitzpatrick (1989:45) believes this slide must have been on the side of the hill above Punahou School.

2.2 Makiki Background History

2.2.1 Early Visitor's Description of Makiki Valley

The earliest description of Makiki was made by a visitor to the Islands in the early nineteenth century. In 1831, the Prussian explorer vessel *Prinzess Louis* anchored in Honolulu harbor. On board was Dr. Franz Julius Ferdinand Meyen, a 27 year old botanist, who during the next six days toured the southern coast of Oʻahu from Diamond Head to Pearl Harbor, collecting plant and animal species and making notes on the scenes of Hawaiian life that he observed.

After making a successful trek up Nuʻuanu Valley, Meyer next planned an expedition to Puʻu Kākea (Sugarloaf). Meyen observed the following:

> The excursion which we had planned for today, July 27th, took us by the foot of the extinct volcano which lies on the eastern end of the city and is called Puwaina [Pūowaina]. This old cone rises to a height of 400 feet and is completely round. . . . Since the mountain has at present been converted into a fortification, not everyone has access to it but it is not supposed to be difficult to obtain permission. . . . The fortifications consist almost solely of ten or twelve cannons of high but unequal caliber which range over the harbor but cannot be aimed. Every time the current ruler leaves the island of Oahu and again when he returns, he is saluted with these cannons. [Pultz 1981:39]

Meyen observed the barren and arid nature of the area along the plain and lower slopes of Punchbowl:

> The flat valley of Honolulu through which we hiked on the excursion as well as the entire slope of Puowaina and the ridge which we had just climbed were completely barren up to an elevation of 600 to 700 feet—covered only by low herbage scorched by the sun. . . .
>
> On our way we also saw a little piece of land which was covered with dry taro. It was a damp place. Nearby we came across a spring. They had formed the earth around the root of each plant into a little hollow so that moisture could collect there.
>
> . . . The top of Mount Kakea, [now known as Sugarloaf], which we reached right after noon time, is bare of all arboraceous vegetation. Bushes six to seven feet in height and connected by an extremely dense crown of *Dracaen*a and *Convolvulus* cover the whole area. The last stretch of the way to the summit was so densely covered with plants that we first had to cut a path through them. [Pultz 1981:39-43]

After resting and breaking for lunch, the excursion party decided to return to Honolulu by a different route, traveling on the west side of the ridge that they had followed to Puʻu Kākea. The slopes of this ridge were thickly forested, as described by Meyen:

> Nowhere again, neither on Oahu nor in Brazil nor in Manila, did we see such a charming picture of nature. We saw here the greatest profusion of the gayest tropical vegetation complemented by the picturesque forms of the mountains. Numerous *Musaceae*, some casually planted, other wild, covered the slope of the mountain. Among them were the fragrant and aromatic *Scitamineae* which were already mentioned above, and also the short, shrub-like ferns intertwined and covered with vines which had blossoms of the most wonderful colors. Beneath that were the various greens of the *Cyperaceae*, which cover the lowest parts of the transversal valley, as well as the loveliest arrangement of the individual clusters of shrub-like and arboraceous vegetation on the slope of the mountain ridge and on the top of the mountain close by. All this taken together made such a glorious and friendly impression that we were often not capable of going on. Had it only been possible to have a view of this region—even if only a small portion of it—copied by a talented artist! [Pultz 1981:44]

Meyen also observed the natives gathering the stone called *makiki*, used to make the stone portion of an octopus lure. The name of the *ahupua‘a* comes from this special type of stone.

> As soon as the valley became wider the beautiful vegetation disappeared. The slopes of the mountains were covered only with low grasses, the huts of the Indians became more numerous and here and there large boulders appeared again. The end of a low ridge which runs through the center of this transversal valley had been artificially cleared of vegetation and of the cover of humus. The rock which came to light here is a very attractively colored basalt conglomerate. The Indians were just then busy chipping flat pieces from this rock which they wanted to use to hunt octopus. The rock on the sides of the valley, however, is the usually porous basalt which is found all around Honolulu. Here and there one can find caves in this rock, some of which are inhabited. [Pultz 1981:46]

Meyen also noted that many formerly forested areas were being turned into pastures, either intentionally cleared by man or eaten away by the roaming cattle. Meyen reported the following:

> In the course of our excursion we saw the mountains everywhere covered with grazing horses and horned cattle. . . . The island of Oahu has more than 2000 head of horned cattle of which 1000 head belong to the Spaniard Don Francisco Marin. There is also a great number of horses on these islands and already every reasonably well-to-do person, man or woman, keeps a riding horse. Yet, as welcome as the increase in this most useful domestic animal is, the joy in it will soon disappear when it is realized that this increase, as well as the expanded cultivation of meadows, is in exact proportion to the decrease in true agriculture.
>
> Everywhere one hears the complaint that in former times a far greater quantity of field-produce was cultivated than now. . . . Many and very extensive fields through which we have just wandered and which are presently being used as pasture land were formerly covered with sweet potatoes. Today one can still see the remaining traces of their cultivation. They say that in the days of Kamehameha a great part of the Honolulu Valley was used for the cultivation of field-produce. Now there are meadows there and the valley is far less productive that in former times. [Pultz 1981:46-47]

2.2.2 Agriculture in Makiki Valley

In 1940, E. Craighill Handy noted that taro cultivation was practiced in the swampy lands of Makiki south of King Street (now within the modern boundary of Makiki Ahupuaʻa), but the inland areas were known for the growing of sweet potatoes.

> Makiki. Between Kalakaua Avenue and Kakaako there were extensive terrace areas in the swampy land. A few terraces are now planted in rice, and others are filled in and used as house sites, right of way for streets, etc.
>
> Punchbowl Crater (Puowaina), on both the inner and outer slopes, was also famous in ancient times as a sweet potato locality. The planting was especially good on the inland side near the present Hawaiian homestead of Papakolea. [Handy 1940:156]
>
> The cinder slopes of what are now called Round Top and Makiki Heights did not support taro, but have always been famous for sweet potatoes. [Handy 1940:78]
>
> The region around Makiki and Round Top, between Makiki and Manoa Valley, is perhaps the most favorable locality on Oahu for sweet potato cultivation; here Hawaiians still have many small plantations, mostly for domestic use, though occasionally they market their products. The volcanic cinder mixed with humus in this locality seems to be ideal for sweet potato cultivation and normally the amount of rainfall is about right. [Handy 1940:156]
>
> Kamehameha revived the use of this locality for sweet-potato cultivation. The place is ideal, because all the year round there is enough rain for *ʻuala*, and even in rainy winter months the drainage on the cinder slopes is complete. Sweet potatoes flourish in volcanic cinders, with a little infiltration of humus, and in crumbling lava. Kamehameha is said to have had the whole hillside planted . . . [Handy and Handy 1972:478]

2.2.3 Mid-1800s and the Māhele

In 1845, the Board of Commissioners to Quiet Land Titles, also called the Land Commission, was established "for the investigation and final ascertainment or rejection of all claims of private individuals, whether natives or foreigners, to any landed property" (Chinen 1958:8). This led to the Māhele, the division of lands between the king of Hawaiʻi, the *aliʻi*, and the common people, which introduced the concept of private property into Hawaiian society. In 1848, Kamehameha III divided the land into four divisions: certain lands to be reserved for himself and the royal house were known as Crown Lands; lands set aside to generate revenue for the government were known as Government Lands; lands claimed by *aliʻi* and their *konohiki* (supervisors) were called Konohiki Lands; and habitation and agricultural plots claimed by the common people were called *kuleana* (Chinen 1958:8-15).

About 1830, Queen Kaʻahumanu ordered that a wall should be built in the Makiki area to keep cattle from the inland residential areas. The stone wall also marked a path across Makiki which was first called Stonewall Street; presently this former path is covered by Wilder Avenue. The Queen wished to form a gateway at Punahou through this wall, and wanted two large stones on each side of the gate. The workers tried to move a large rock called Pōhakuloa, which was either on Rocky Hill in Mānoa or on the side of Round Top (ʻUalakaʻa) at the boundary of Makiki and

Mānoa Ahupuaʻa. The stone would not move at first, so a *kahuna* was consulted. The *kahuna* suggested that a *luau*, or feast, be prepared with certain foods. After the *luau*, the stone was moved easily to its new spot. This stone was worshipped "in the old days by Hawaiian women, who prayed for the endowment of their children with wisdom and strength" (Sterling and Summers 1978:283). It was shaped like a "mammoth taro leaf" and was used to bless pregnant women and their unborn children (Alexander and Dodge 1941:45). This rock was broken up later, sometime between 1854 and 1859, when the road to Mānoa was widened. The wall along Wilder Avenue still remains (Fitzpatrick 1989:316).

Land Commission Award documentation for Makiki Valley (north of King Street) indicates a concentration of awards in the lower valley areas primarily along Kānealole and Moleka streams, with most of the land in the Makiki Valley owned by the government (Figure 10 and Table 1). In terms of land use, the two dominant dry and wet agriculture crops in Makiki seem to have been taro and sweet potato. The land in and around the project area (LCA MA 11) was noted as *kula* (pasture, wasteland) and *kalo* (taro production) (Fitzpatrick 1989:379) (see Appendix A). Dr. F.J.F. Meyen, a German botanist, visited the Makiki Valley area in 1831 and described habitation and agricultural features in the valleys along streams. The largest awards in Makiki were for the *ʻili ʻāina* of Opu in Pawaʻa, which was part of the large approximately 253-acre Pawaʻa award (LCA 8241) to John Papa ʻĪʻī, the approximately 120-acre *ʻili* of Poloke ("fresh poi") to Keawehano (LCA MA 11), and the approximately 74-acre award to Kaihiwa in the *ʻili* of Kauhikio (meaning perhaps "the cistern cover"). Other *ʻili ʻāina* and *ʻili kū* of Makiki were Anapuni ("boundary"), Kaʻaiʻamaʻama ("the mullet food"), Kaʻaiheʻe ("the octopus food"), Kulaokahuʻa, Kanahā, Kaneahaka, Kanealole, Kumuʻulu ("breadfruit tree"), Kūpahu (to brace oneself"), Loko ("pond"), Manu ("bird"), Maunalaha, Miki ("active"), Moho, Palai (native fern, *Microlepia setosa*), and Pohukini.

2.2.4 Late Nineteenth Century to Present

During the late nineteenth century several large grants were awarded to foreigners (Table 2), especially lands south of King Street. One large land grant was awarded in the back of Makiki Valley to H.W. Schmidt, who attempted to grow coffee trees, but was unsuccessful (Carpenter and Yent 1994:17). Another attempt at coffee cultivation was made by J.M. Herring, who purchased several acres (portions of Royal Patents 3216, 3830, 3863, 4519, and 7410) along Kānealole and Moleka Streams between 1864 and 1876. Mr. Herring built a house in the lower valley on the Maunalaha side of Moleka Stream and a carriage road to his house, and modified some of the original Hawaiian agricultural terraces for his planting areas. Remnants of this operation were recorded as SIHP # 50-80-14-3985, located directly adjacent and slightly overlapping the project area. Another land grant (Grant 2788) including the southern portion of the project area was awarded to Lot Kamehameha V (Figure 11 and Figure 12). No land use is indicated.

On an 1887 map of Honolulu by W.A. Wall (Figure 13) and an 1897 map by Monsarrat (Figure 14), houses are still widely scattered over the few lower streets from Beretania to Wilder. The only prominent structures Wall noted were the Makiki Reservoir, the Makiki Church, the C. Judd home, Oahu College, the Makiki Cemetery, the Lunalio Asylum, and Thomas Square. The C. Judd on the 1887 map (Figure 13) refers to Charles Sheldon Judd, grandson of Gerrit P. Judd. C.S. Judd was the commissioner of public lands and president of the Board of Agriculture and Forestry for the Territory of Hawaiʻi from 1911 to 1915.

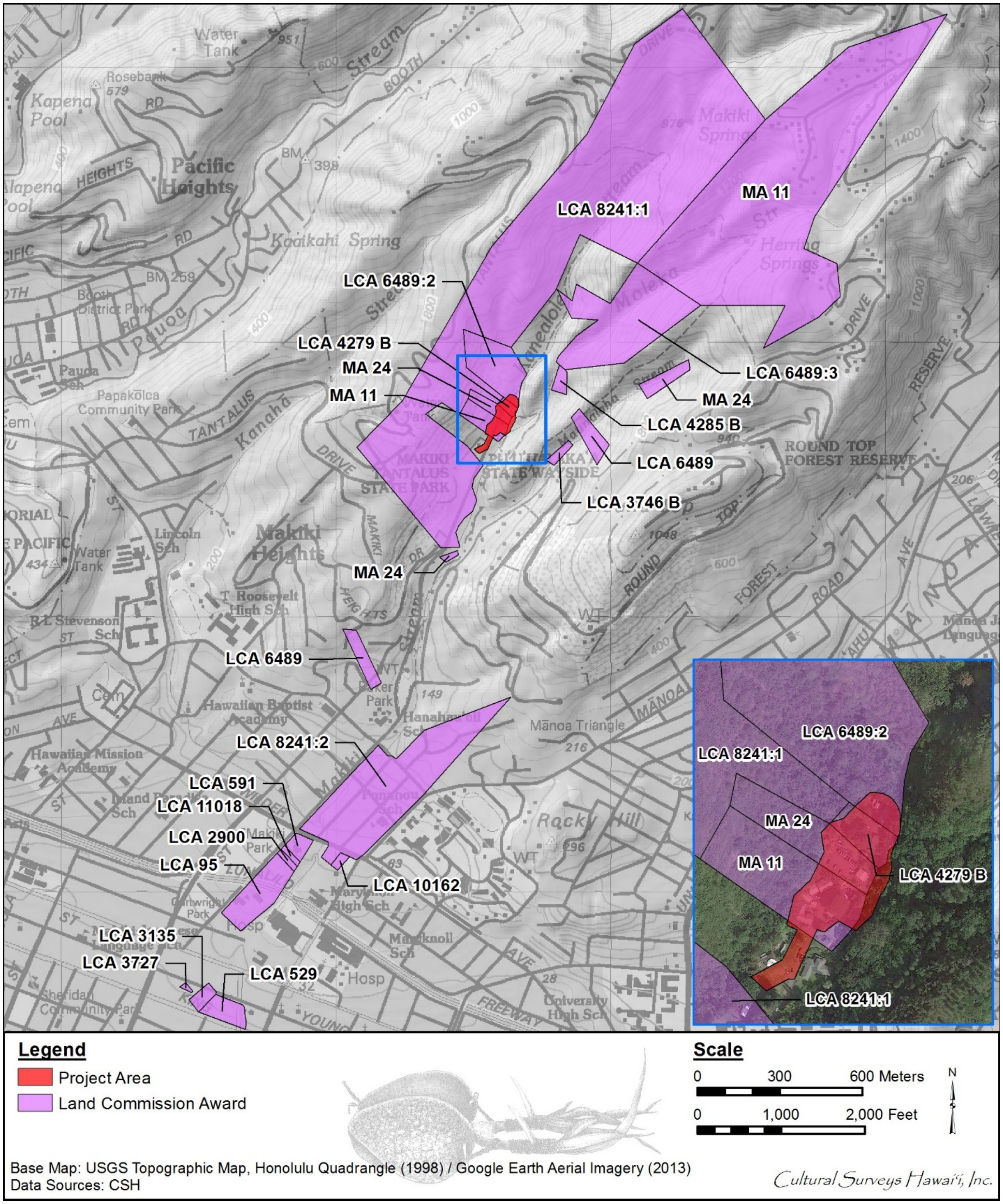


Figure 10. Land Commission Award (LCA) overlay map (from information on Registered Map 1071, Hawai‘i Land Survey Division) of Makiki over modern 1998 Honolulu USGS topographic quadrangle

Table 1. Land Commission Awards and Royal Patents for Makiki Ahupua‘a

LCA #	Royal Patent #	Claimant	Land came from:	Land Name	Land Claimed	Acres
MA 11	6715	Keawehano	[No data]	*‘Ili* of Polokē	2 *‘āpana*; an *‘ili‘āina*	119.99
MA 19	5584	Kanehiwa	[No data]	Half of Kahaumaka‘awe *‘Ili*	1 *‘āpana*	3.25
MA 24		Kauliokamoa	[No data]	Kaiwiokaihu; one along upper Maunalaha Stream, one along Makiki Stream	2 *‘āpana*	
95	6305	Hannah A. Holmes Jones	From husband J.C. Jones, who received it in 1825 from Kalaimoku	Makiki	1 *kula*	8.02
591	2387	John Meek	Houselot from Boki in 1817; From Kamehameha III in 1840	Makiki	Cattle Pen; *kula*; area enclosed by a wall; inside were two houses built in 1826	1.73
1423		Z. Kaauwai	From Kamehameha III	Kauhikio	*‘Ili kūpono*, *mo‘o āina*; *kalo*, fishpond	5.72
1447	4432	Kahue	From Kane in 1843	Hamohamo	2 *‘āpana*; houselot and 1 *lo‘i*	0.39
2900	4310	T. Kaoi	[No data]	Pāwa‘a	Houselot	0.42
3135	6924	James Walker	From Nauia, in 1829	Pāwa‘a	1 *‘āpana*, three houses on *kula* land	1.15

LCA #	Royal Patent #	Claimant	Land Originated From:	Land Name	Land Claimed	Acres
3746B	3863	Nahina	From Laʻau, got from ʻĪʻī in time of Kaʻahumanu	Kupaheʻe (Maunalaha Stream)	One *ʻāpana; moʻoʻ āina; kalo*	0.66
4263B		Kaaiahua (or Kaahanahua)	From ʻĪʻī during the time of Kīnaʻu	Kānealole	Entire valley, *kalo*	0.61
4279B	5463	Ia	[No data]	Pāwaʻa (along Kānealole Stream)	One *ʻāpana*	0.40
4283C	7410	Moo	Got land from ʻĪʻī	Poʻohukini	*ʻIliʻāina, moʻoʻāina; kalo*	0.56
4285B	3830	Mokuhanui	Land from father; land from ʻĪʻī in time of Kīnaʻu	Manu, Makiki (lower Moleka Stream)	House lot and taro land; *ʻiliʻāina, moʻoʻāina; kalo*	0.67
6486		Keohoaeae	Given to Maalo by Kīnaʻu in time of Kaomi	Pāwaʻa-kai	*Loʻi, kula*	0.77
6489	4519	M. Kaihiwa	Land received from the king	Kauhikio	Four *ʻāpana; kalo, kula; ʻili kūpono*	73.80
8241		John ʻĪʻī	[No data]	Pāwaʻa	One *ʻāpana*	2.59
8241	5704	John ʻĪʻī	From Kamehameha after battle of Nuʻuanu	*ʻIli* of Pāwaʻa	Five *ʻāpana*	250.80
10162	2270	Moku	Wife's first husband who got it from his parent	Makiki	House lot (*kula*) and *kalo*	0.56
11018	3690	Wahine	From M. Kekuanaoa in the time of Kaoma's disturbance	Pāwaʻa	House lot with two houses	0.42

Table 2. Original Government Land Owners in Makiki Ahupuaʻa

Grant #	Grantee	Locality	Date
153	E.W. Clark	Pāwaʻa, west of Punahou	1849
177	P.J. Gulick	Pāwaʻa, King and Beretania streets	1849
387	John Cummins	Pāwaʻa, King St	1850
500	H.M. Whitney	Kulaokauʻa, Beretania St	1851
1290	W. Miller	Maloʻokohana and Paʻaweuweu	1854
1676	C.R. Bishop	Kaʻaiheʻe	1855
2011	R Kelly	Pāwaʻa	1856
2057	R. Keanui	Kaiwiokaihu, Pāwaʻa, King St	1856
2341	W. Miller	Maloʻokohana, King St	1857
2364	John ʻĪʻī	Pāwaʻa (same as LCA #8441), Waikīkī St	1857
2365	G.P. Judd	Pāwaʻa (same as LCA #8534), King St	1857
2609	Kahula	Pāwaʻa o Maʻalo, King St	1859
2616	John ʻĪʻī	Pāwaʻa o Maʻalo, Waikīkī St.	1859
2745	Thomas Cummins	Pāwaʻa o Maʻalo, King St	1861
2788	L. Kamehameha	Kaihuokapuʻa (the snout of the pig) (31 acres), Makiki Valley	1861
2790	L. Kamehameha	Kālia (seashore)	1961
2870	L. McCully	Pāwaʻa, King St	1862
3106	W.R. Seal	Kīnaʻu St	1872

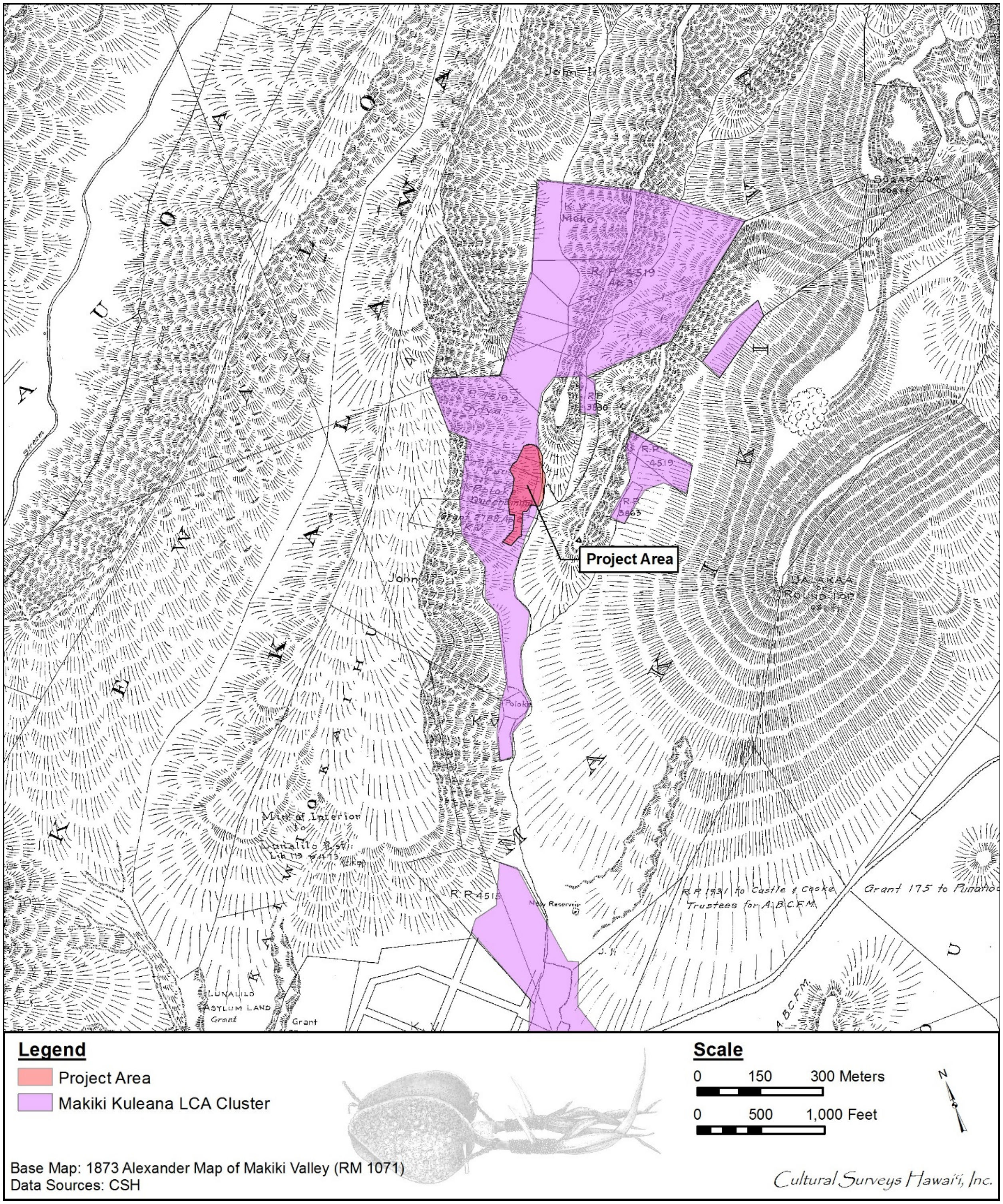


Figure 11. 1873 Alexander Map of Makiki Valley (RM 1071) showing project area

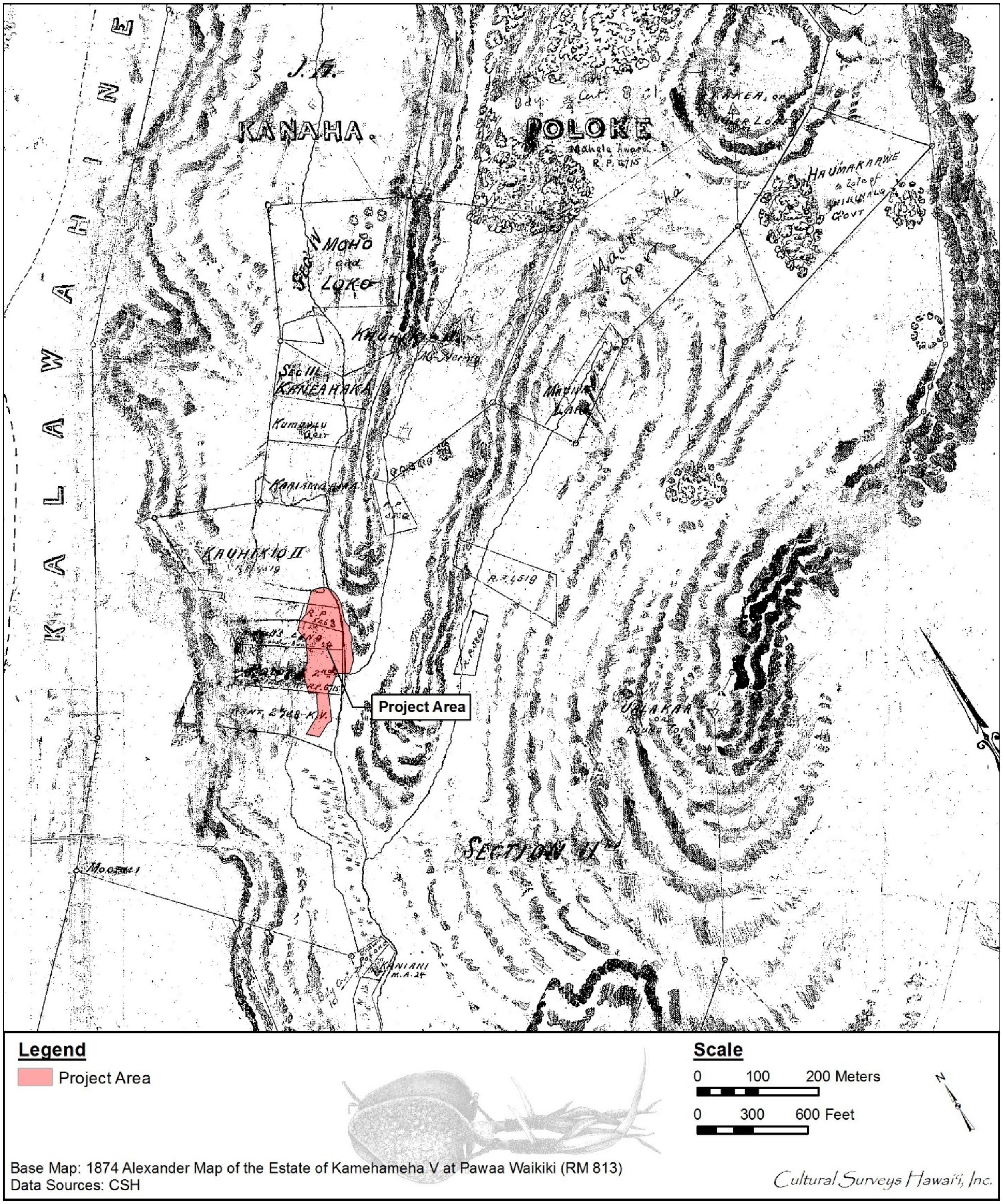


Figure 12. 1874 Alexander Map of the Estate of Kamehameha V at Pawaa Waikiki (RM 813) showing project area

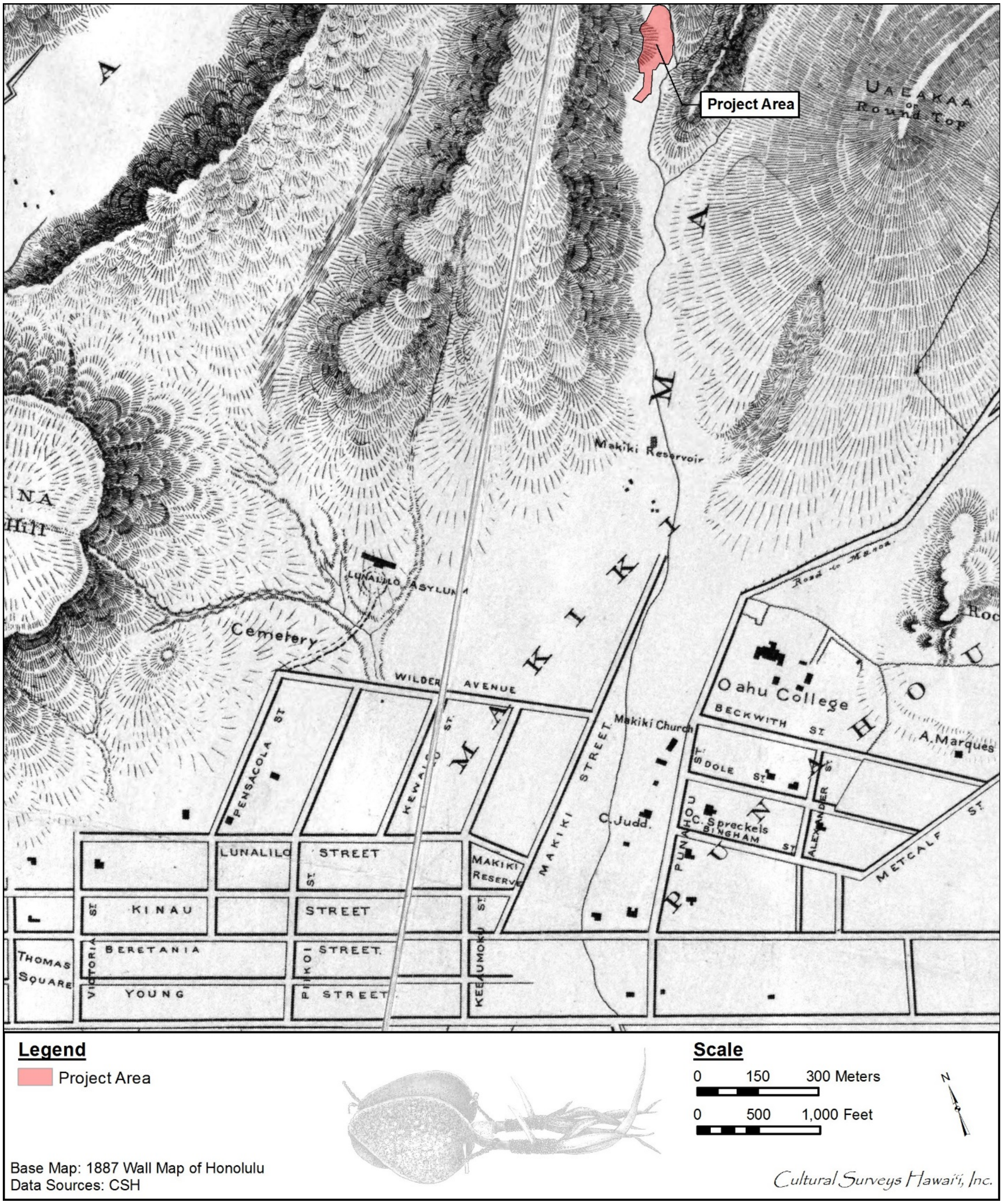


Figure 13. 1887 map of Honolulu and vicinity, by W.A Wall, showing residential areas of the late nineteenth century

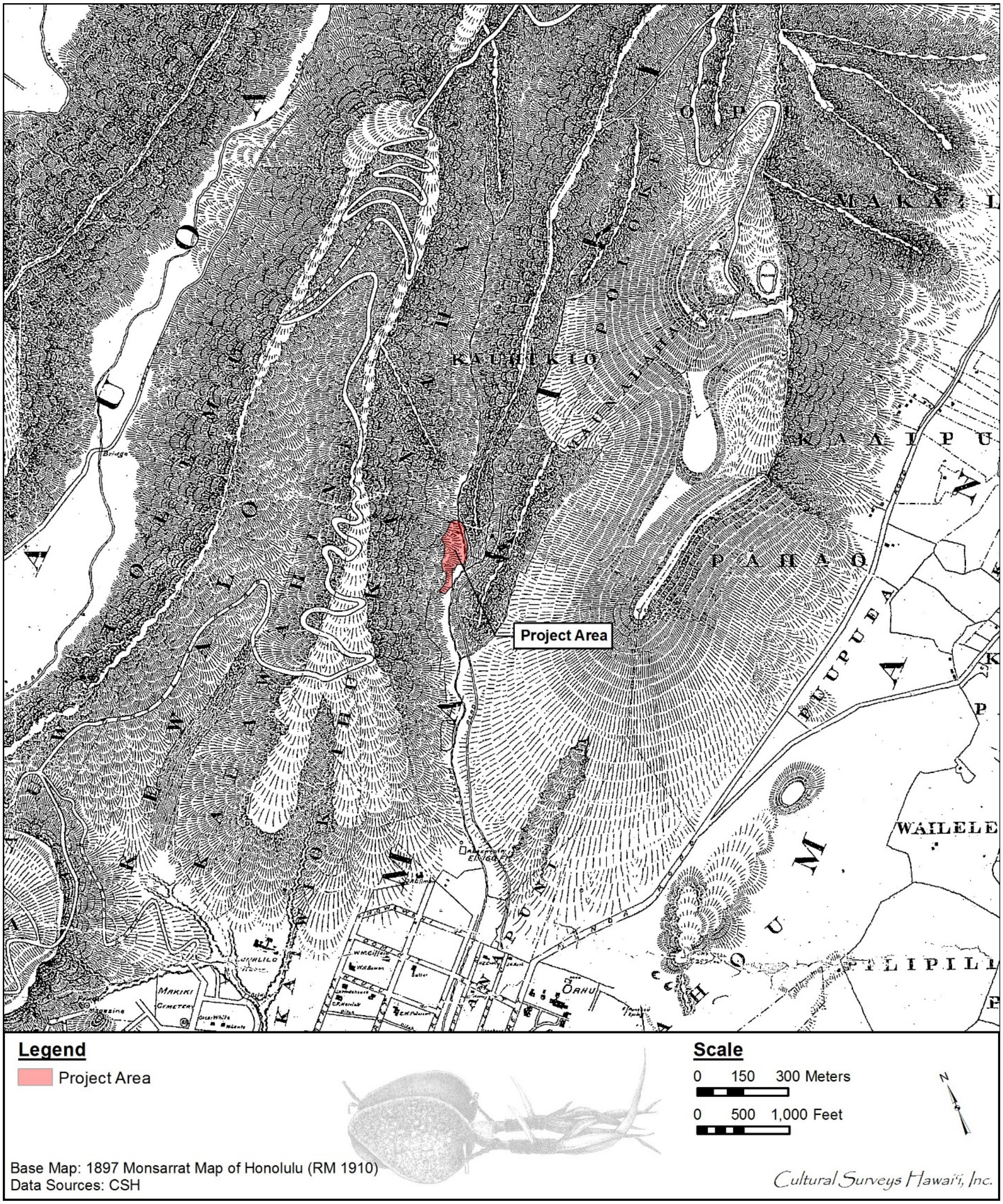


Figure 14. 1897 Monsarrat map of Honolulu (RM 1910) showing portion of residential area of the late nineteenth century

The Makiki Church was an *‘āpana* (branch) of the Kawaiaha‘o Church, established by the first missionaries who came to the Islands in 1920. In the early years, travelling was difficult, and ten branch churches were established from Kalihi to Waikiki, usually managed by Hawaiian converts, with occasional visits from one of the missionaries assigned to the O‘ahu section of the American Board of Foreign Missions. In the late nineteenth and early twentieth century, roads were improved and the missionaries began to close the branch churches and encourage the church members to travel to the main church in Honolulu for services (Damon 1945:123). This church does not appear on subsequent maps, so it was most likely closed sometime between 1887 and 1919.

In 1874, Lunalilo, the sixth Hawaiian monarch, died and bequeathed his lands, approximately 70,000 acres, for a trust to fund a care home for aged Hawaiians. Called the Lunalilo Asylum or the Lunalilo Home for the Aged (Figure 15), the home was established in 1883 on a 21-acre land section in Kewalo, Makiki, an area now occupied by Roosevelt High School. This facility closed in 1927 due to the increasing urbanization of the area, and the home was reopened in the Hawai‘i Kai area (Smith 1905:12).

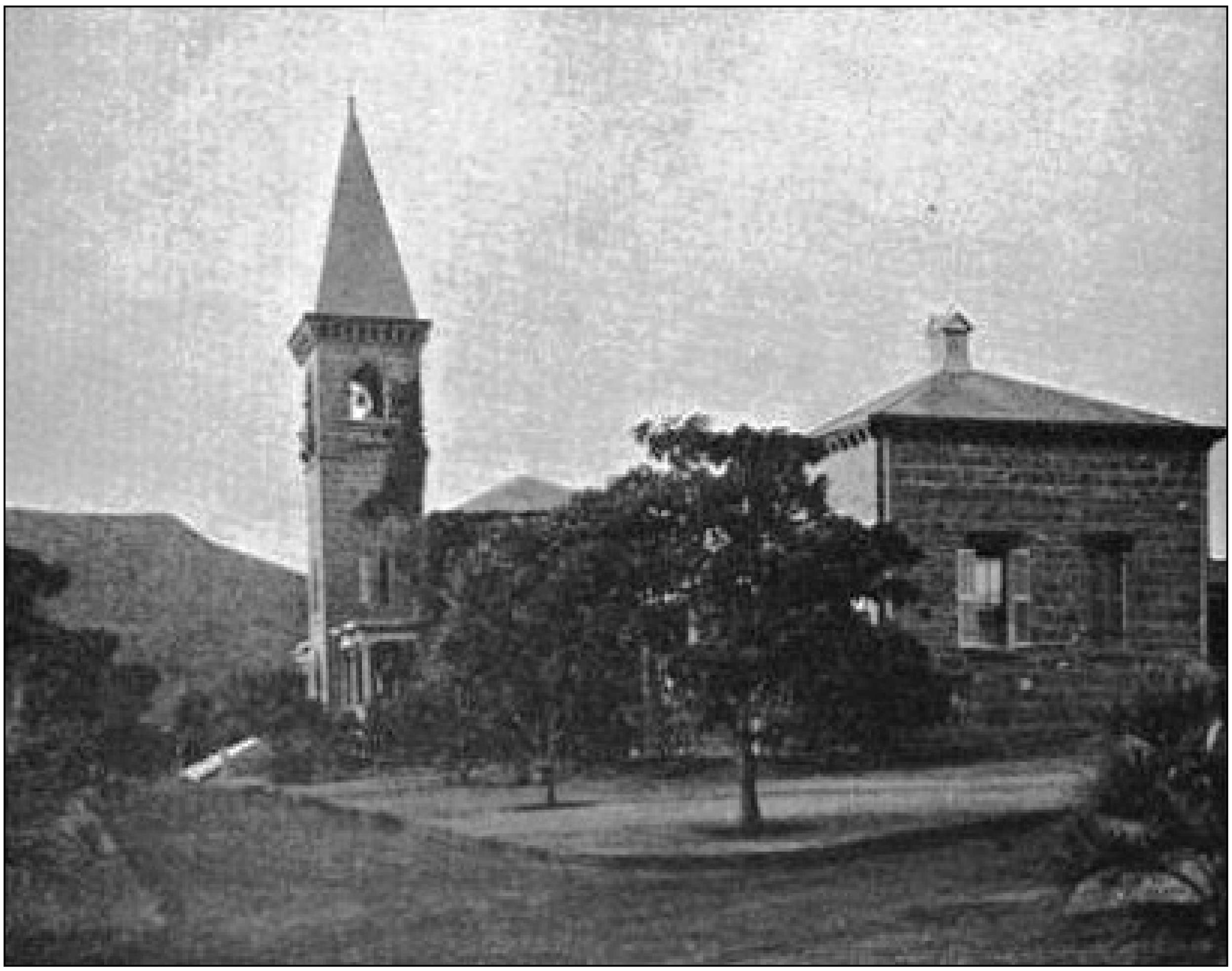


Figure 15. Lunalilo Home, or Lunalilo Asylum, ca. 1900 (photograph printed in Twombley 1900:291)

In 1901, the U.S. Congress passed an appropriation to establish an agricultural station on Oʻahu for the study of agricultural produce (excluding sugar cane). A plot in the tract called Kewalo uka was originally chosen, but was later used instead for a Marine Hospital. The next tract chosen was 154 acres from the eastern slope of Punchbowl to the southern slopes of Tantalus. Sixty-two acres were reserved for a stone quarry and a public park. This park later became Makiki Cemetery. In 1904, upper Makiki Valley was acquired by the Division of Forestry for their reforestation program. They built a concrete dam midway along Kānealole Stream that created a small reservoir, and constructed a plant nursery at the *mauka* end of the access road.

The Makiki State Recreation Area was established in 1957 as part of the Makiki-Tantalus State Park. This recreation area includes a wayside park along Makiki Street and the upper valley area from the wayside park on the *makai* end to Puʻu ʻŌhiʻa (Tantalus) on the *mauka* border. ʻUalakaʻa State Park, located on the Maunalaha side of Makiki Valley, is also part of the Makiki-Tantalus State Park. Oahu College, now called Punahou School, was established in 1841 as a school for the children of missionaries living on Oʻahu. Daniel Dole was the first principal of the school which operated as Oahu College from 1853 to 1934. During World War II, the campus was taken by the Army Corps of Engineers to use a command center, parking lots, sleeping quarters, and officer's mess (Punahou School 2013).

The city of Honolulu's water supply in the late nineteenth century was still primitive. In 1875, there was a brick reservoir at the corner of Nuʻuanu and Judd, fed by streams and spring water. Fortunately, during the reign of King Kalākaua, artesian water was discovered, and small wells were drilled to supply local needs.

An improvement of city water was possible when five new masonry reservoirs were built, one in Makiki in 1880 and four in Nuʻuanu Valley. Kuykendall (1967:3:95) notes that "Twice, in periods of drought during the years 1888-91, water was pumped by a fire engine from an artesian well in Thomas Square into the Makiki reservoir, this being the first use of artesian water in the city water system."

A review of historic maps indicates minimal development and change within the project area through the twentieth century. The 1919 U.S. Army War Department map depicts an unimproved roadway and two structures within the project area (Figure 16). The same is shown on the 1933 U.S. Army War Department Fire Control map (Figure 17) and the 1943 U.S. Army War Department terrain map (Figure 18). Additional structures are depicted in the 1953 and 1969 USGS topographic quadrangles (Figure 19 and Figure 20). The 1978 USGS orthophotoquad aerial photograph depicts additional urban development in the vicinity of the project area (Figure 21).

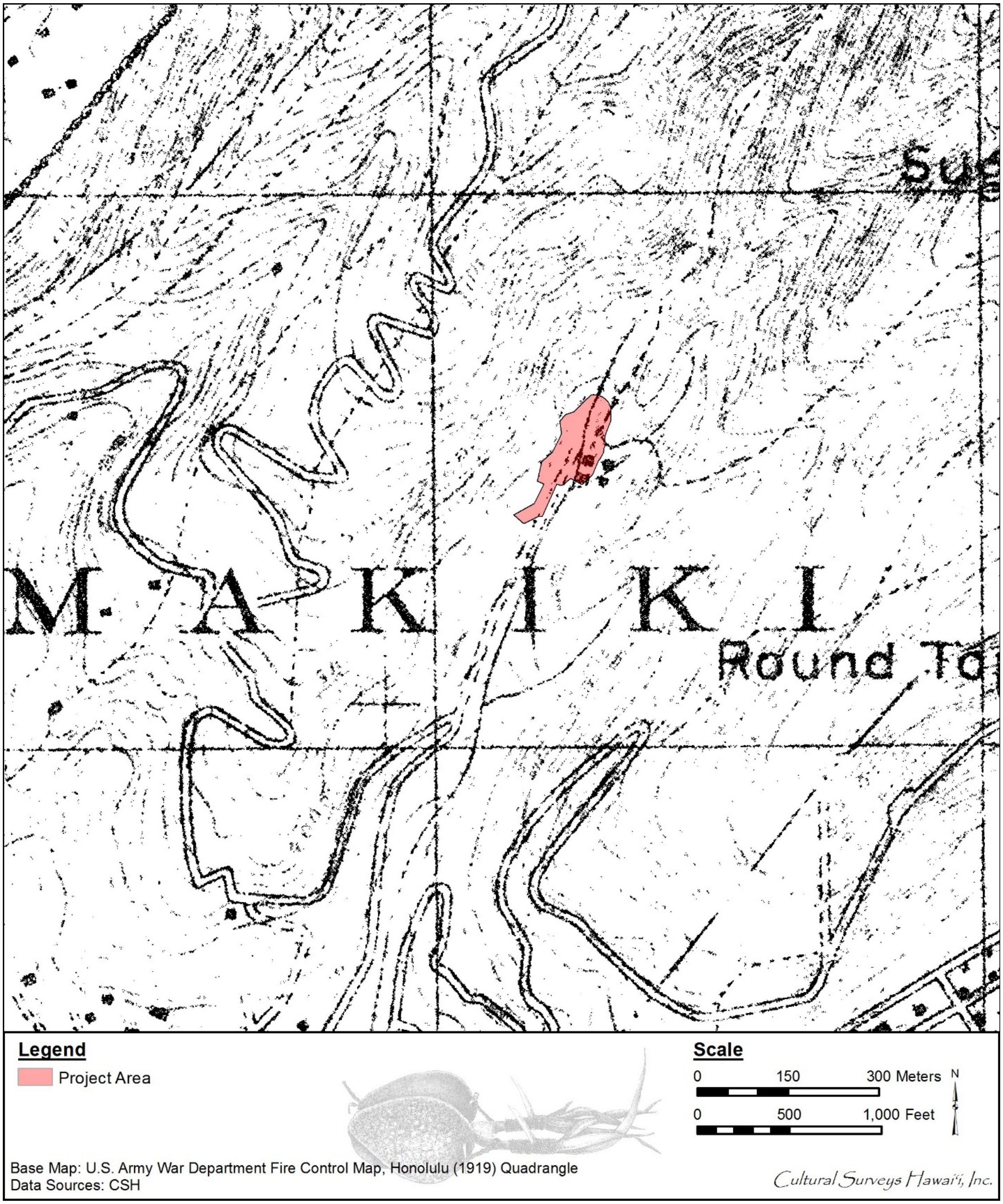


Figure 16. Portion of the 1919 U.S. Army War Department Fire Control Map Honolulu Quadrangle showing the location of the project area

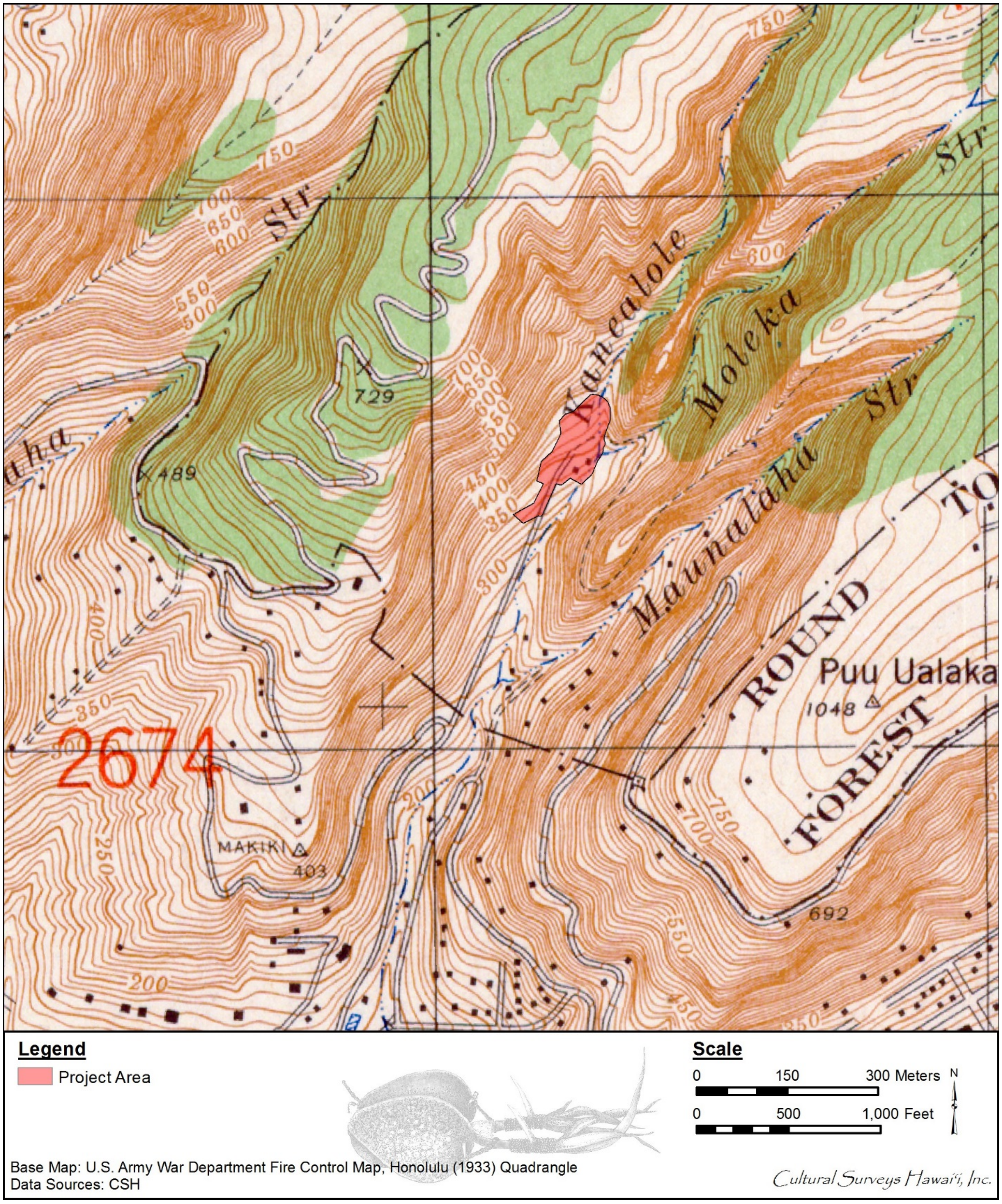


Figure 17. Portion of the 1933 U.S. Army War Department Fire Control Map Honolulu Quadrangle showing the location of the project area

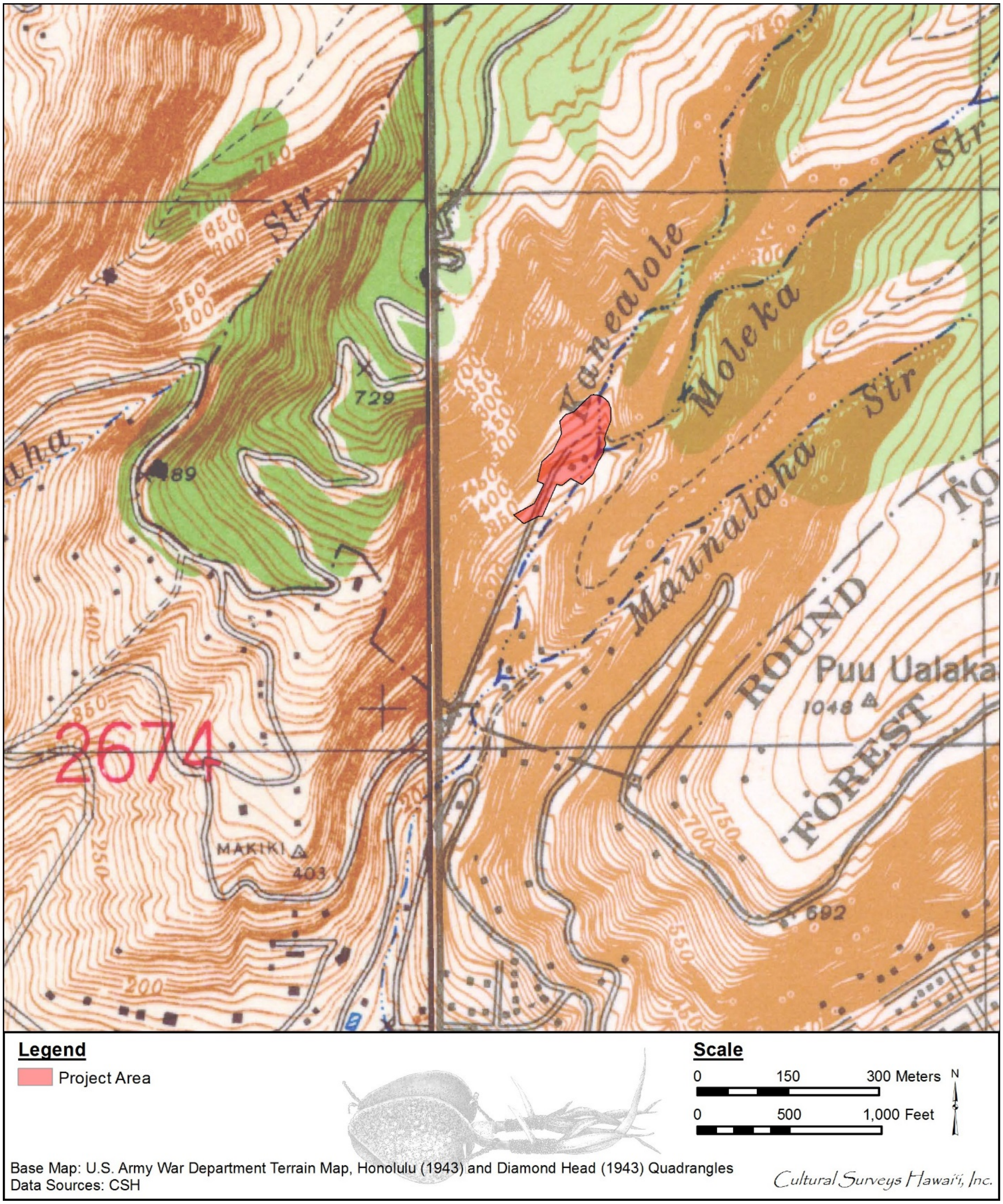


Figure 18. U.S. Army War Department Terrain Map, Honolulu (1943) and Diamond Head (1943) Quadrangles showing project area

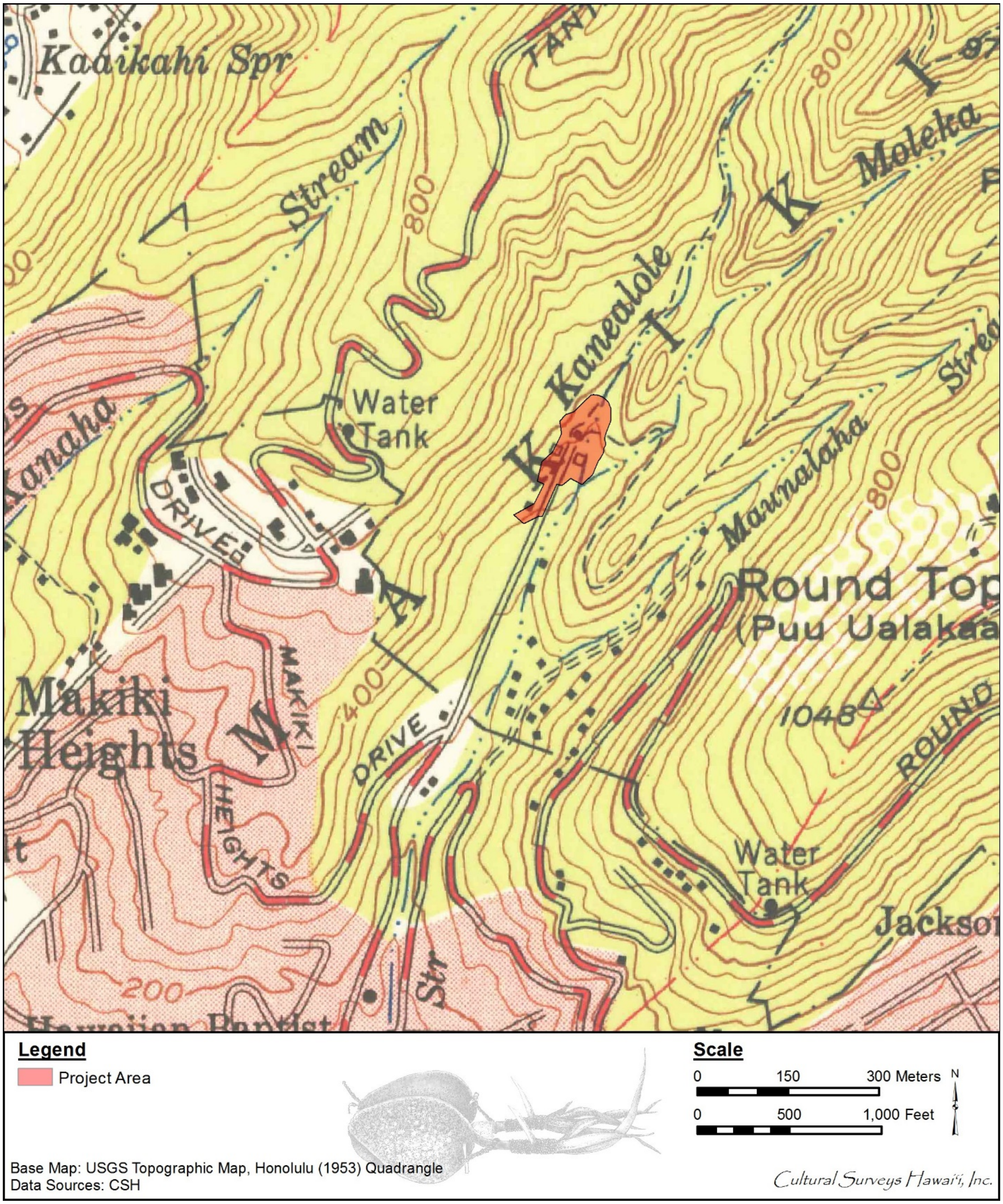


Figure 19. Portion of the 1953 Honolulu USGS Topographic Quadrangle showing the location of the project area

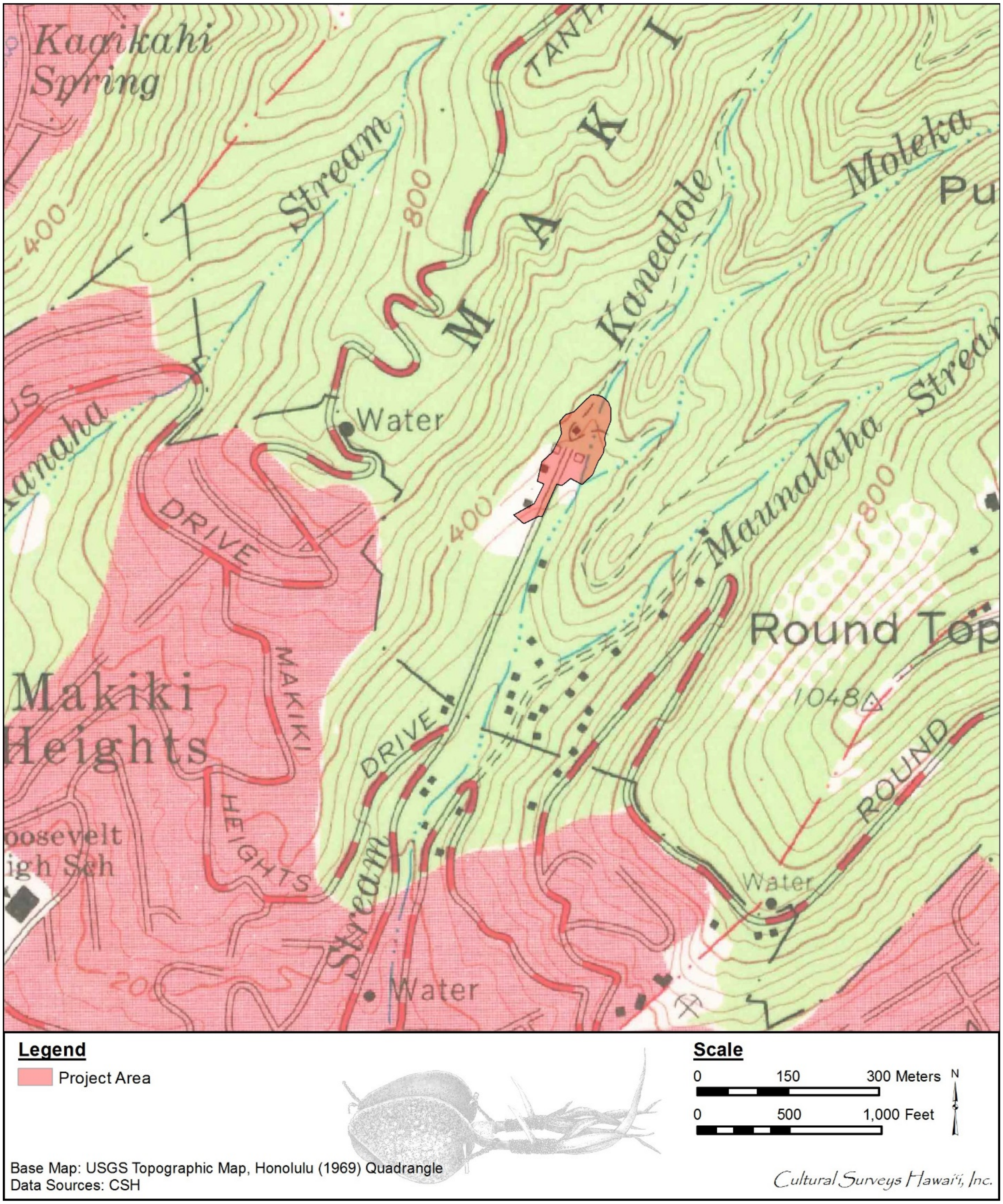


Figure 20. Portion of the 1969 Honolulu USGS Topographic Quadrangle showing the location of the project area

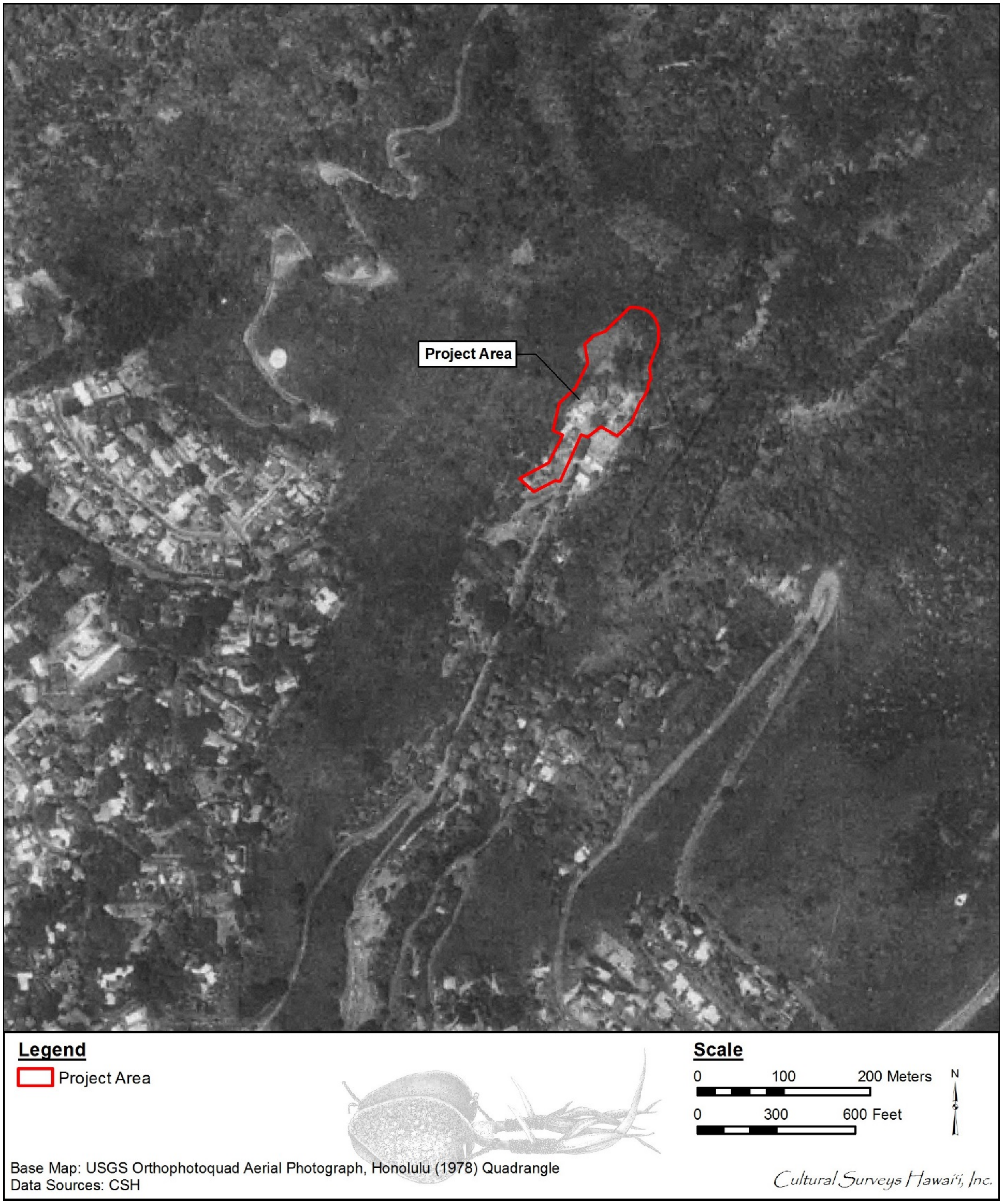


Figure 21. 1978 USGS Orthophotoquad aerial photograph, Honolulu Quadrangle showing the location of the project area

Section 3 Previous Archaeological Research

3.1 Previous Archaeological Research

Previous archaeological research in the Makiki Valley-Tantalus area has been concentrated in the valley areas along Kānealole and Moleka Streams. A number of burials have also been inadvertently found within Makiki Valley, including skeletons in burial caves (McCoy 1971) and at least eight burials found under roads and houses on the west side of Round Top (Bath 1989; Bath and Smith 1988; Kawachi 1991a, b; Kawachi 1992 a,b; Pietrusewsky 1992a, b). Pre-Contact sites indicating traditional agricultural land use and historic sites have also been recorded within the vicinity of the current project area. Archaeological research in Makiki Valley and vicinity is depicted on Figure 22 and is summarized in Table 3 with historic property locations depicted on Figure 23 and summarized in Table 4.

3.2 Previous Archaeological Studies in the Immediate Vicinity of the Current Project Area

Four historic properties previously identified within a 300-m radius of the project area boundaries, but which do not extend within the project area include SIHP #s 50-80-14-2297 (McCoy 1971), -3985 (Yent and Ota 1980), -4866 (Carpenter and Yent 1994), and -5759 (Nagata 1999).

In 1971, a single burial located within a rock shelter was reported to the Bishop Museum 100 m north of the current project area. However, by the time Bishop Museum archaeologist Patrick McCoy was able to make a site visit, the burial was destroyed. All bones were removed without proper documentation, but were left within the rock shelter. Although McCoy's informant described the burial as being in a flexed position, two historic period artifacts were found in association with the burial: a cane knife handle and a portion of a small, round wooden box. Both artifacts were brought back to the Bishop Museum and given accession numbers. A second mound was observed underneath a cairn adjacent to the disturbed burial and was suspected to also be of historic age, but was not further investigated. This site was designated SIHP # -2297 (McCoy 1971).

The first systematic archaeological survey in the Makiki Valley area was conducted by Martha Yent and Jason Ota (1980). Five areas along Kānealole and Moleka streams were surveyed, identifying a variety of pre-Contact and historic sites including agricultural terraces, rock walls, rock shelters, a walled enclosure, a historic house site and carriage road, and retaining walls. Twenty-eight features were identified during this survey, including 22 pre-Contact agricultural terraces and related features (i.e., rock walls and enclosures) and six post-Contact features (i.e., dump site, carriage road) were recorded and all designated components of SIHP # -3985 (Figure 23 and Table 4).

In 1994, the DLNR Division of State Parks carried out an archaeological survey of approximately 90 acres of Puʻu ʻUalakaʻa State Wayside and a discrete 3,000-ft long strip of Makiki Valley State Recreation Area (Carpenter and Yent 1994). A rock shelter (SIHP # -4668) above an agricultural field system near Moleka Stream, and a series of at least nine terraces (SIHP

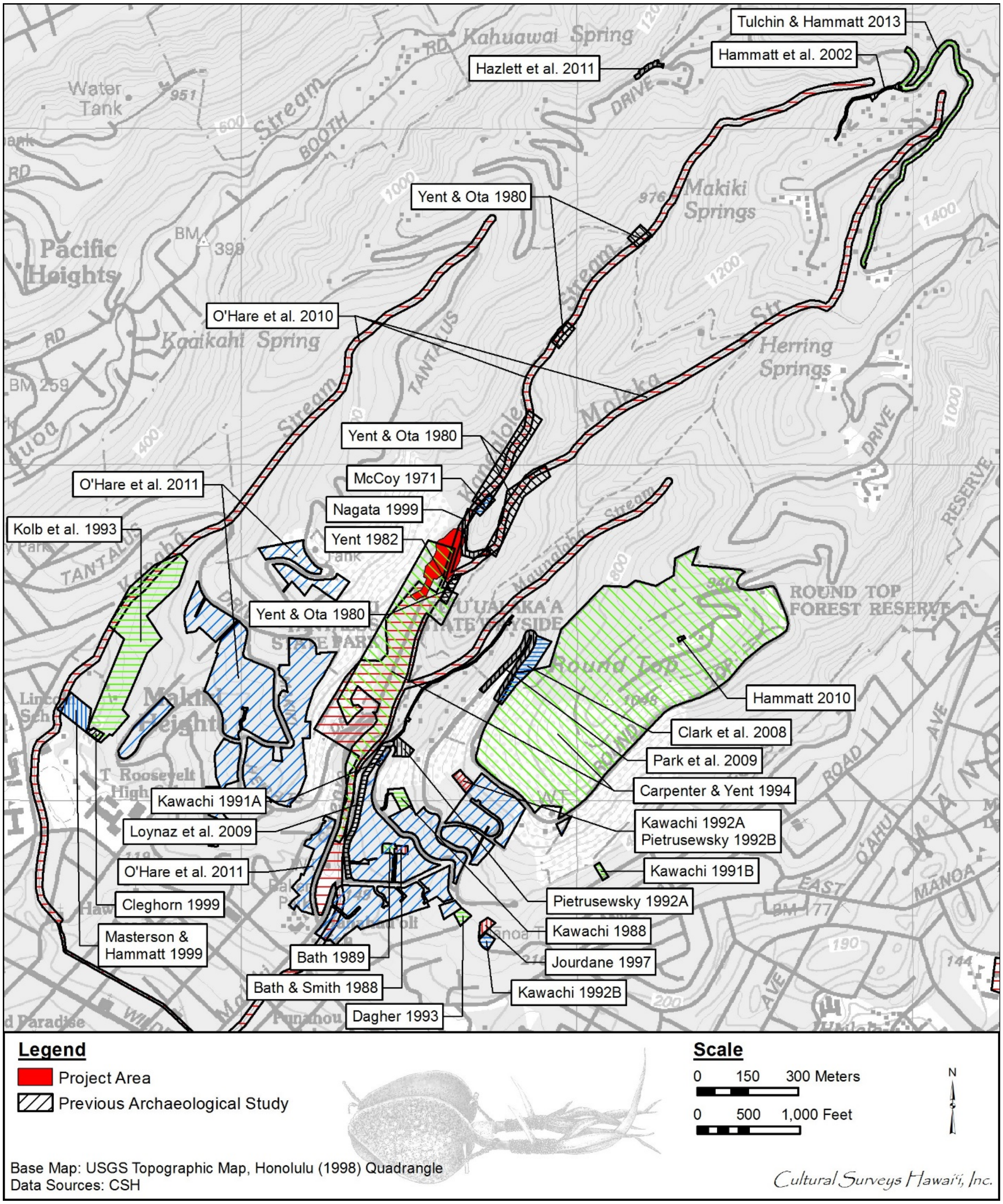


Figure 22. Portion of 1998 Honolulu USGS topographic quadrangle, showing previous archaeological studies within the vicinity of the project area

Table 3. Previous Archaeological Studies Conducted in the Vicinity of the Project Area

Reference	Type of Investigation	General Location	SIHP # 50-80-14	Results
McCoy 1971	Memo: burial report	Makiki Valley burial shelter	2297	Letter report on field inspection of Makiki Valley burial shelter
Yent and Ota 1980	Archaeological field survey	Makiki Valley, Kānealole Stream and Moleka Stream systems	3985	Sites reflect traditional settlement/subsistence pattern; agricultural fields along streams; rock shelter habitation; further testing and mapping recommended for features associated with 1800s Herring occupation on Moleka Stream; 37 features recorded at one site (SIHP # -3985)
Yent 1982	Archaeological inspection	Makiki-Tantalus State Park	--	No findings during inspection of short nature trail for the Makiki Environmental Education Center
Bath and Smith 1988	Burial removal	2034 Round Top Terrace	3743	Inadvertent discovery of human remains
Kawachi 1988	Field check	2182 Round Top Dr		No sites found
Bath 1989	Burial call	2030A Makiki St	4134	Inadvertent discovery of at least three individual burials
Kawachi 1991a	Unmarked burial under house	2123 Round Top Dr	1603	Unmarked burial found under house; skeletal remains left in place (June 1991)
Kawachi 1991b	Burial recovery	2414 Sonoma St	4273	A single individual with the bones in poor condition is reported.
Kawachi 1992a	Burial recovery	‘Āina Lani Pl, Round Top	4530	Human skeletal remains found
Kawachi 1992b	Burial recovery	1908 Judd Hillside Rd	4529	Human skeletal remains found
Pietrusewsky 1992a	Burial recovery	2316 Maunalaha Rd	4648	A human skeleton found; no archaeology report found (4 November 1993)
Pietrusewsky 1992b	Osteology report	2399 Āina Lani Pl	4648	Human skeletal remains found

Reference	Type of Investigation	General Location	SIHP # 50-80-14	Results
Dagher 1993	Burial report	2048B Ualaka‘a St	4666	Human skeletal remains found
Kolb et al. 1993	Archaeological inventory survey	Kalāwahine ‘Ili	4434–4446	Very limited or no habitation prior to AD 1900 within project area; total of five sites and 38 features, mainly agricultural, recorded
Carpenter and Yent 1994	Archaeological survey	Proposed state park areas in Makiki Valley and Pu‘u ‘Ualaka‘a	4688, 4866	Remnant agricultural terraces (SIHP # -4866) should be preserved, two test trenches dug, no pond soils in Makiki State Rec. Area, no sites in Pu‘u ‘Ualaka‘a area; C14 dates; rock shelter (SIHP # -4688) tested
Jordane 1997	Burial recovery	W.O. Sullivan house	5697	Human skeletal remains found
Cleghorn 1999	Archaeological inventory survey	Kalāwahine Stream	-	Newly discovered cave at the Kalāwahine Stream; contained recent historic material; possibility of buried cultural deposits; cave sealed; no SIHP number assigned
Masterson and Hammatt 1999	Archaeological inventory survey	Kalāwahine Reservoir site	5732	One retaining wall, twentieth century, of large boulders in SE corner of project area; no longer significant
Nagata 1999	Evaluation, mapping and site description	Carriage road within Honolulu Watershed Forest Reserve	5759	Recommend Na Ala Hele’s proposal approved to utilize existing historic carriage road, constructed ca. 1870, for trail use
Hammatt et al. 2002	Archaeological assessment	Tantalus: Kala‘i‘ōpua Pl	-	Concluded no permanent habitation in traditional Hawaiian period
Clark et al. 2008	Archaeological monitoring	Round Top Dr	6864, 6865	Two human burials inadvertently discovered; documented in separate report
Loynaz et al. 2009	Archaeological monitoring	Makiki Heights and Maunalaha home sites	-	Two possible sites found, a small pit containing a dog burial and a historic rubbish pit; neither given SIHP numbers
Park et al. 2009	Archaeological monitoring	Round Top Dr	-	No historic properties affected

Reference	Type of Investigation	General Location	SIHP # 50-80-14	Results
Hammatt 2010	Literature review and field inspection	Round Top radio facility	-	No historic properties affected
O’Hare et al. 2010	Cultural impact assessment	Ala Wai watershed	-	Forty sites recorded in Makiki, Manoa, and Palolo watershed streams; all determined significant under criterion “d,” one significant under criterion “e”
O’Hare et al. 2011	Literature review and field inspection	Makiki Heights and Pūowaina Dr	-	No sites documented, but on-site monitoring recommended for Pūowaina-Punchbowl project area
Hazlett et al. 2011	Literature review and field inspection	3798 Tantalus Dr	9019	No historic properties affected
Tulchin and Hammatt 2013	Archaeological inventory survey	Round Top Dr around Forest Ridge Way	9019	Tantalus-Round Top Rd (SIHP # -9019) within the project area; on State and National Registers; recommended SHPD architecture branch be consulted prior to construction

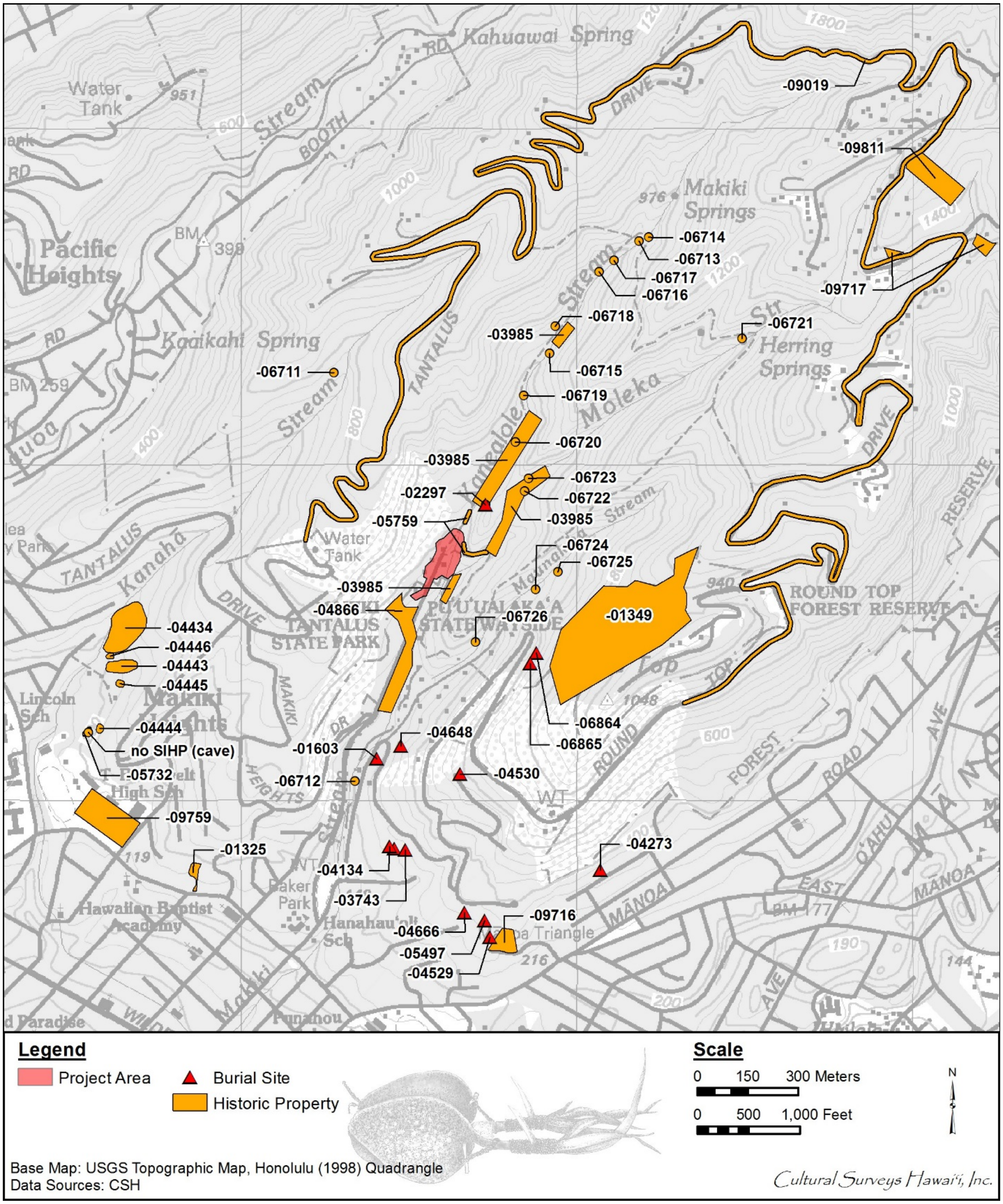


Figure 23. Portion of 1998 Honolulu USGS topographic quadrangle, showing previously identified sites in Makiki Ahupua'a

Table 4. Features of SIHP # 50-80-14-3985 Identified by Yent and Ota (1980)

Feature	Brief Description
1A	T-shaped retaining wall, 50 m long
1B	Agricultural complex of at least three low terraces
1C	A complex of at least seven terraces 70-80 cm high and an associated semi-circular walled feature
1D	Wooden water tank
1E	Complex of at least four terraces and a rock shelter
1F	Historic retaining wall
1G	Agricultural complex of terraces and ditches
2A	Two terraces
2B	Two parallel rock walls
2C	Rock shelter
3A	Two low retaining walls
3B	Two rock-lined planting holes
5A	Complex of three terraces
5B	Old carriage road
5C	Old carriage road continued
5D	Two parallel terraces
5E	Rock-lined pit
5F	Taro *lo‘i* (terrace)
5G	Coffee grove
5H	Series of at least five stairs, or very steep terraces
5I	Circular platform
5J	Four terraces
5K	Walled enclosure
5L	Two walled depressions
5M	Dump site
5N	Proposed Herring residence
5O	Complex of terraces

-4866) were recorded in Makiki Valley. A portion of this survey included the current project area, where it was indicated that the area has been in use since the early 1900s as part of the first tree nursery in the Territory of Hawaii, established by Ralph S. Hosmer. Rows of concrete slabs used as potting benches during this period may still exist beneath and *makai* of DOFAW's present Makiki nursery. All retaining walls were recorded and it was concluded that these walls were constructed and maintained as part of the modern DOFAW base yard development and thus were not considered to be significant historic properties.

Ralston Nagata (1999) conducted a field investigation of a cart road remnant in the Forest Reserve near the Makiki Valley State Recreation Area down near Kānealole Stream. The cart road and associated features were related to J. M. Herring, who purchased several parcels in the vicinity between 1864 and 1876 and established a coffee plantation.

Section 4 Results of Field Inspection

A field inspection of the project area was conducted on 7 August 2014 by CSH archaeologists Leandra W. Medina B.A. and Tara Seaver B.A., under the general supervision of Hallett H. Hammatt, Ph.D., principal investigator. A total of 2 person-days were required for the survey of the project area. CSH conducted the fieldwork component of this study under state archaeological fieldwork permit number 14-06 issued by the State Historic Preservation Division (SHPD), per HAR §13-282. The fieldwork consisted of a pedestrian field inspection to identify any surface archaeological features and assess any potential impact to historic properties. Representative photographs of the project area were taken for inclusion in this report.

The DOFAW Makiki Base yard is located at 2135 Makiki Heights Drive, northeast beyond the Makiki Valley State Recreation Area and the Hawaiʻi Nature Center. Pedestrian inspection of the project area determined that the entire area has been subject to previous disturbance during modern construction phases of the DOFAW base yard. Observed disturbance includes the leveling of the natural topography, which consists of two leveled out portions that make up the current base yard complex of structures and designated areas for parking.

The field inspection documented 21 structures within the project area associated with DOFAW operations including many retaining walls (Figure 24 and Figure 25). These structures include the DOFAW main office located west of the entrance (Figure 26 and Figure 27), the DOFAW Makiki nursery and greenhouse (Figure 28), a multi-tier parking lot (Figure 29 and Figure 30), and other structures used for DOFAW daily operations and storage (Figure 31 through Figure 35).

In addition to the 21 modern DOFAW structures, three basalt and mortar retaining walls were observed primarily at the southern and central portions of the project area. For the purposes of discussion, the retaining walls were designated by temporary number (CSH 1, CSH 2, and CSH 3a–c) and are depicted on the Makiki Baseyard Master Plan existing conditions map (Figure 24) and an aerial photograph (Figure 25). CSH 1 is a 36.5 m retaining wall to the south and west of the DOFAW main office (Figure 36). CSH 2 is a 36.5 m retaining wall surrounding an existing storage building and nursery area (Figure 37 and Figure 38). CSH 3a is a 25.0 m retaining wall located to the south of the lower tier parking area (Figure 39). CSH 3b is a 27.0 m retaining wall that separates the upper and lower tier parking areas (Figure 40). CSH 3c is an 18.0 m retaining wall located west of the upper tier parking area and abutting CSH 3b (Figure 41). Yent and Carpenter (1994) also identified and recorded these retaining walls and concluded these walls were constructed and maintained as part of the modern DOFAW base yard development and thus were not considered to be significant historic properties.

The results of the current field inspection were consistent with the documentation presented by Yent and Carpenter (1994). No significant historic properties were identified within the project area during the field inspection.

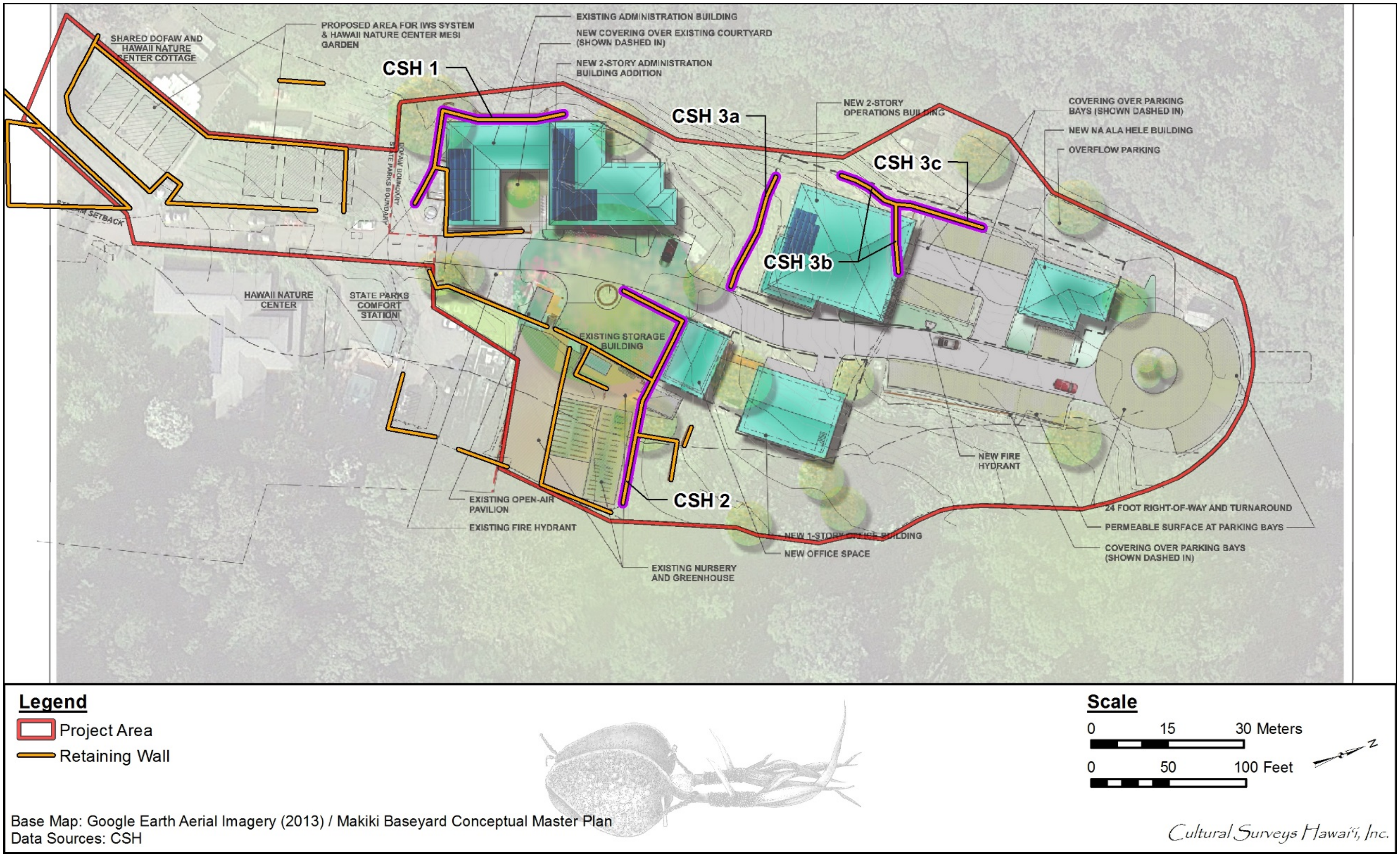


Figure 24. Existing condition plan map showing retaining walls of the DOFAW Makiki Base Yard (DOFAW Makiki Base Yard Conceptual Master Plan, HHF Planners. 1/20/2016)

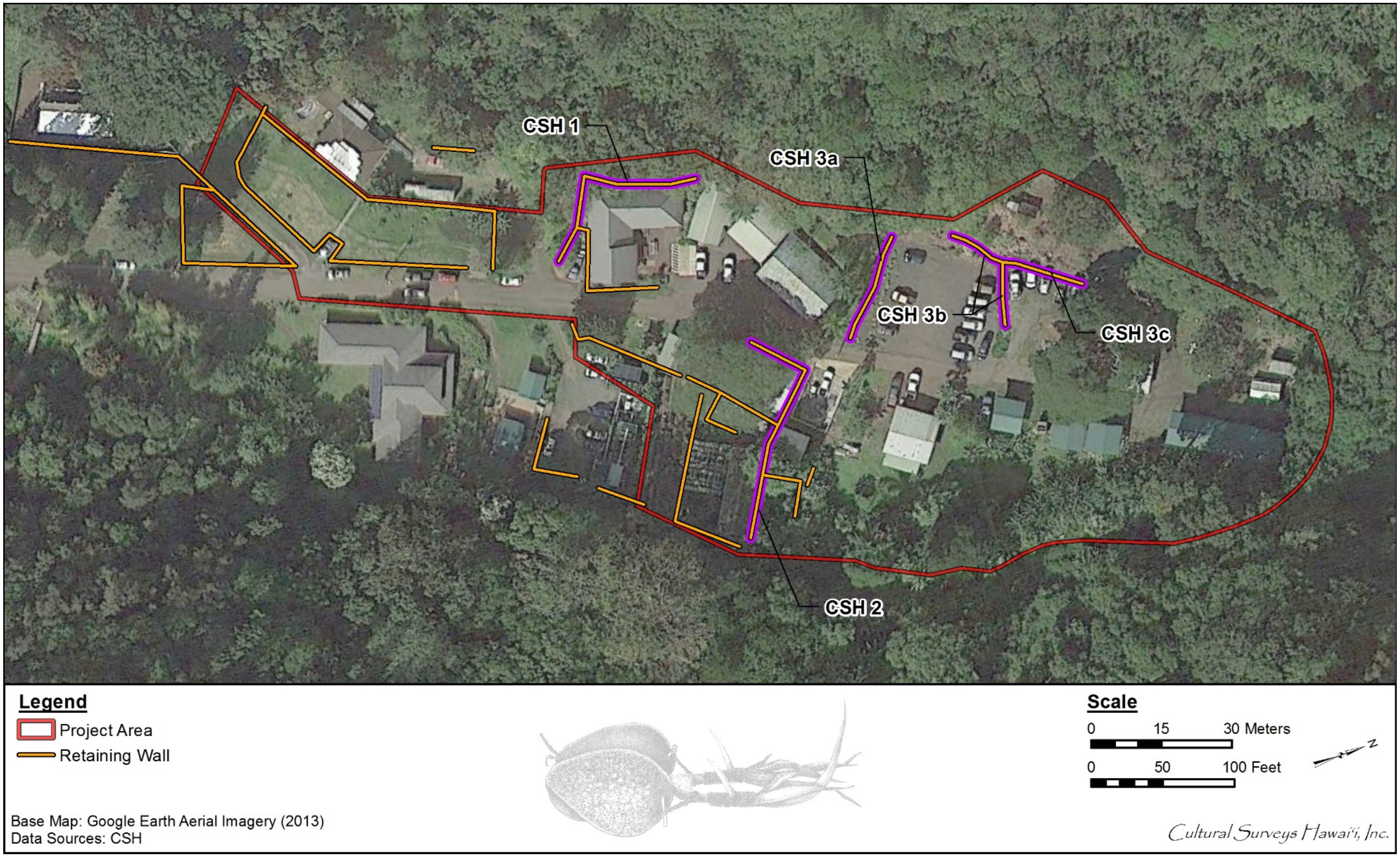


Figure 25. Aerial photograph (Google Earth Aerial Imagery 2013) showing retaining walls (base map Google Earth aerial imagery 2013)

Figure 26. Entrance to DOFAW Makiki Base Yard from Makiki Heights Drive, view to northeast

Figure 27. Overview of main office and adjacent equipment storage buildings, view to southwest

Figure 28. Overview of the DOFAW Makiki nursery and greenhouse, view to east

Figure 29. Overview of the upper tier parking area, view to southwest

Figure 30. Overview of the lower teir parking area, view to southwest

Figure 31. Covered picnic area and offices fronting nursery, view to northeast

Figure 32. Overview of storage buildings and workshop/maintenance areas

Figure 33. Craftsman kit structure used as a workshop/maintenance area, view to east

Figure 34. Overview of north end of project area, including equiptment storage/maintencnce workshop structures and overflow parking area, view to northeast

Figure 35. Overview of covered parking area at north end of DOFAW base yard, view to southeast

Figure 36. Overview of retaining wall CSH 1 to the south of the DOFAW main office, view to northwest

Figure 37. Overview of retaining wall CSH 2, west of storage building, view to north

Figure 38.Overview of retaining wall CSH 2 north of nursery, view to west

Figure 39. Overview of retaining wall CSH 3a fronting lower tier parking area, view to west

Figure 40. Overview of retaining wall CSH 3b that divides the upper and lower tier parking areas, view to north

Figure 41. Overview of retaining wall CSH 3c located at the upper tier parking area, view to north

Section 5 Summary and Recommendations

5.1 Summary

Mason Architects, Inc. is proposing improvements and new construction to the Hawaiʻi Division of Forestry and Wildlife Makiki Base Yard. Proposed improvements will include extension of administration buildings, and additional buildings for Forestry, Wildlife, and Nā Ala Hele programs. Additional construction will include a new fuel storage building, a general storage building, dumpster locations, and covered parking.

Background research has indicated four previously documented historic properties are located immediately adjacent to the project area boundaries, but do not extend within the project area:

- SIHP # 50-80-14-3985 (Yent and Ota 1980), a series of 28 pre-Contact traditional agricultural features and post-Contact historic features located to the north, south, and southeast;
- SIHP # 50-80-14-2297 (McCoy 1971) a rock shelter burial discovery to the north;
- SIHP # 50-80-14-5759 (Nagata 1999), post-Contact cart road and associated features to the north and east; and
- SIHP # 50-80-14-4866 (Carpenter and Yent 1994), a traditional terrace complex and rock shelter to the south.

The DOFAW Makiki base yard was subject to the EIS (DLNR 1994) and archaeological survey (Yent and Carpenter 1994) in the early 1990s in support for the previous renovation of the DOFAW Makiki base yard. These two studies indicate the location of the current project area has been in use since the early 1900s as part of the first tree nursery in the Territory of Hawaii, established by Ralph S. Hosmer. The EIS indicated no significant archaeological resources were present within the project area (DLNR 1994). Yent and Carpenter (1994) identified and recorded the retaining walls within the project area and concluded these walls were constructed and maintained as part of the modern DOFAW base yard development and thus were not considered to be significant historic properties. However, Yent and Carpenter (1994:27) noted, "This area was likely formerly in agricultural terraces as evidenced by a preserved section of *ʻauwai* along the hillside west of the area and the remnants of terraces along the stream and lower slopes *makai* of the base yard area."

A field inspection of the project area was conducted on 7 August 2014 by CSH archaeologists Leandra W. Medina B.A. and Tara Seaver B.A. under the general supervision of Hallett H. Hammatt, Ph.D., principal investigator. The field inspection documented 21 structures within the project area associated with DOFAW operations. In addition to the 21 modern DOFAW structures, three basalt and mortar retaining walls were observed primarily at the southern and central portions of the project area. The results were consistent with the documentation presented by Yent and Carpenter (1994). No significant historic properties were identified within the project area during the field inspection.

5.2 Recommendations

No surface historic properties are located within the project area. The project area is, however, located within portions of four LCAs indicating the potential for pre- and/or early post-Contact land use. The documentation of LCAs within the project area suggests the potential for subsurface historic properties that may include culturally enriched strata, cultural deposits, artifacts, and/or human burials. Thus, an archeological monitoring program is recommended for all ground disturbance activities associated with this project. The archaeological monitoring program should begin with the preparation of an archaeological monitoring plan to be submitted for SHPD review and acceptance.

Section 6 References Cited

Alexander, Mary Charlotte and Charlotte Peabody Dodge

1941 *Punahou 1841-1941*. Berkeley and Los Angeles, California.

Bath, Joyce

1989 *Burial Call; ME #89-0776 Site #80-14-4134 2030A Makiki St. Honolulu*, Oʻahu. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Bath, Joyce and Marc Smith

1988 *Burial Removal at 2034 Round Top Terrace TMK: 2-5-07:43*. [Contains Report "A Human Skeleton from Makiki, Oʻahu, by Michael Pietrusewsky and Michele Toomay Douglas]. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Carpenter, Alan and Martha Yent

1994 *Archaeological Survey of Proposed State Park Areas in Makiki Valley and Puʻu ʻUalakaʻa, Makiki, Honolulu District, Oʻahu.* Department of Land and Natural Resources, State Parks, Honolulu.

Cartwright, Bruce

1929 The Legend of Hawaii-loa. *Journal of the Polynesian Society* 38 (2):105-119.

Chinen, Jon J.

1958 *The Great Mahele: Hawaii's Land Division of l848.* University of Hawaii Press. Honolulu.

Clark, Stephan D., Sara Collins, and Richard C. Nees

2008 *Archaeological Monitoring of Slope Stabilization Along a Portion of Round Top Drive, Makiki Ahupuaʻa, Kona District, Island of Oʻahu, State of Hawaiʻi TMKs: (1) 2-5-024: 014, 030, 031 & 032; (1) 2-5-019:008.* Pacific Consulting Services, Inc., Kailua, Hawaiʻi.

Cleghorn, Paul

1999 *Report on Newly Discovered Cave at the Kalāwahine Streamside Project.* Pacific Legacy, Honolulu.

Dagher, Cathleen

1993 *Inadvertent Discovery of Human Skeletal Remains at 2048B Ualakaʻa Street, Makiki Valley (State Site 50-80-14-4666), Waikiki, Kona, Oʻahu. TMK 2-5-03:014.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Damon, Ethel M.

1945 *The Stone Church at Kawaiahao*. Trustees of Kawaiahao Church, Honolulu.

DOFAW

2012 DOFAW Makiki Base Yard Master Plan. Helber Hastert & Fee, Honolulu.

Fitzpatrick, Stephanie Lei

1989 *Wandering Boundaries and Waning Hawaiians: Makiki's People and Land in Mid-Nineteenth Century Hawai‘i*. M.A. thesis in History, University of Hawai‘i Mānoa, Honolulu.

Foote, D.E., E.L. Hill, S. Nakamura, and F. Stephens

1972 *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii.* U.S. Department of Agriculture, Soil Conservation Service, Government Printing Office, Washington, D.C.

Fornander, Abraham

1919 *Fornander Collection of Hawaiian Antiquities and Folklore*. T.G. Thrum, editor. Memoirs of the Bernice Pauahi Bishop Museum (Vol. V, Part III), Bishop Museum Press, Honolulu.

Giambelluca, Thomas W., Michael A. Nullet, and Thomas A. Schroeder

1986 *Rainfall Atlas of Hawai‘i*. Department of Land and Natural Resources, Kapolei, Hawai‘i.

Google Earth

2013 Aerial image. Electronic document, http://www.google.com (accessed July 2013).

Handy, E.S. Craighill

1940 *The Hawaiian Planter*, Volume 1. Bishop Museum Bulletin 161. Bishop Museum Press, Honolulu.

Handy, E.S. Craighill and Elizabeth G. Handy

1972 *Native Planters in Old Hawaii: Their Life, Lore, and Environment.* Bishop Museum Bulletin 233. Bernice Pauahi Bishop Museum, Honolulu.

Hammatt, Hallett H.

2010 *Archaeological Literature Review and Field Inspection Report for the Round Top Radio Facility Building Addition and Other Improvements (DAGS JOB No. 12-10-0603), Makiki Ahupua‘a, Honolulu (Kona) District, O‘ahu Island TMK: [1] 2-5-019:003 por.* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Hammatt, Hallett H., David Shideler, and Todd Tulchin

2002 *Archaeological Assessment in Support of the Kala‘iopua Place Road Improvements Project*. Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Hazlett, Alexander, David W. Shideler, and Hallett H. Hammatt

2011 *Historic Preservation Literature Review and Field Inspection for Highway Improvements and Roadway Repair Vicinity of 3798 Tantalus Drive (Tantalus Crib Wall Repair) Project, Pauoa and Makiki Ahupua‘a, Kona District, O‘ahu Island TMK: (1) 2-5-012:014 and (1) 2-5-019:005 Draft.* Cultural Surveys Hawai‘i, Inc., Kailua, Hawai‘i.

Jourdane, Elaine Rogers

1997 *Inadvertent Discovery of Skeletal Remains at Wo/Sullivan House Construction Judd-Hillside Site 50-80-14-5497 TMK: 2-5-4:10.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawai‘i.

Kamakau, Samuel Mānaiakalani

1992 *Ruling Chiefs of Hawai'i.* Revised edition. Kamehameha Schools Press, Honolulu.

Kawachi, Carol

1988 *Field Check at 2182 Round Top Drive, Honolulu, O'ahu (TMK 2-5-06:14*). Honolulu. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawai'i.

1991a *Unmarked Burial Under House at 2123 Round Top Drive, Makiki, Kona, O'ahu. TMK: 2-5-07:39.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawai'i.

1991b *Burial at 2414 Sonoma Street, Lower Manoa, Honolulu, O'ahu (TMK: 2-9-08:42) & Report on Human Skeletal Remains Recovered from Sonoma Street, Lower Manoa, Honolulu, O'ahu.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawai'i.

1992a *'Āina Lani Place Burial, Makiki, Honolulu.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawai'i.

1992b *Judd Hillside Road Burial (State Site # 50-80-14-4529) 1908 Judd Hillside Road, Honolulu, O'ahu.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawai'i.

Kolb, Michael J., C. Mitchell, P. Conte, and M. McFadden

1993 *Archaeological Inventory Survey in Kalāwahine 'Ili Honolulu Ahupua'a, Kona District Island of O'ahu.* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawai'i.

Kuykendall, Ralph

1967 *The Hawaiian Kingdom, 1874-1893: The Kalakaua Dynasty.* University of Hawaii Press, Honolulu.

Loynaz, Lleliena, Kendy Altizer, Douglas F. Borthwick, and Hallett H. Hammatt

2009 *Archaeological Monitoring Report in Support of the Board of Water Supply Makiki Heights and Maunalaha Home Sites Water System Improvements Project, Makiki Ahupua'a, Kona District, O'ahu Island, TMK: 2-5-007, 020 and 024.* Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

McCoy, Patrick C.

1971 *Memo: Makiki Valley Burial Shelter.* Bernice Pauahi Bishop Museum, Honolulu

Makanikeoe, J.K.W.

1908 Haina Nane. *Ka Nūpepa Kū'oko'a*, 2 October.

Malo, David

1976 *Hawaiian Antiquities*. Bishop Museum Press, Honolulu.

Masterson, Ian A. and Hallett H. Hammatt

1999 *FINAL: Archaeological Inventory Survey of the Kalāwahine Reservoir Site.* Cultural Surveys Hawai'i, Inc., Kailua, Hawai'i.

Monsarrat, M.D.

1897 Map of Honolulu. Registered Map 1910. Hawaiʻi Land Survey Division, Department of Accounting and General Services, Honolulu.

Mossman, George P.

1934 Skill of Archer Gives Punahou Knoll its Name. *Honolulu Star-Bulletin*, 9 March:10.

Nagata, Ralston, H.

1999 *Evaluation of Carriage Road Remnant within Honolulu Watershed Forest Reserve, Makiki, Honolulu, Oahu*. Department of Land and Natural Resources, State Parks Division, Honolulu.

O'Hare, Constance R., Kūhiō Vogeler, Chris Monahan, David W. Shideler, and Hallett H. Hammatt

2010 *Cultural Resources and Ethnographic Study for the Ala Wai Watershed Project: Makiki, Mānoa and Pālolo Ahupuaʻa, Honolulu District, Oʻahu Island TMK: [1] 2–3, 2–4, 2–5, 2–6, 2–7, 2–8, and 2–9; [1] 3–1, 3–2, 3–3 and 3–4 Volume I: Cultural Resources of the Makiki, Manoa and Pālolo Ahupuaʻa.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

O'Hare, Constance R., David W. Shideler, and Hallett H. Hammatt

2011 *Archaeological Literature Review and Field Inspection for the Makiki Heights and Pūowaina Drive Sewers Project, Pauoa and Makiki Ahupuaʻa, Honolulu District, Oʻahu Island TMK: [1] 2-2-005, 2-4-026, 027, 034, 035, 036, 038, 2-5-001, 003, 005, 006, 007, 008, 009, 019, and 2-2-006.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Park, Valerie, Jackie Walden, and Sara L. Collins

2009 *Archaeological Monitoring Report in Support of Emergency Roadway Improvements at Round Top Drive, Makiki Ahupua'a, Honolulu District, Oʻahu Island, State of Hawaii TMKS: (1) 2-5-024: 014, 030, 031 & 032; (1) 2-5-019:008.* Pacific Consulting Services, Inc., Kailua, Hawaiʻi.

Pietrusewsky, Michael

1992a *A Human Skeleton from 2316 Maunalaha Road, Honolulu, Oʻahu (SHPD 468).* Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

1992b *Human Skeletal Remains from Round Top Ridge, Makiki, Oʻahu*. Department of Land and Natural Resources, State Historic Preservation Division, Kapolei, Hawaiʻi.

Pukui, Mary Kawena

1983 *ʻŌlelo Noʻeau. Hawaiian Proverbs & Poetical Sayings.* Bishop Museum Special Publication No. 71. Bishop Museum Press, Honolulu.

Pukui, Mary Kawena and Samuel H. Elbert

1986 *Hawaiian Dictionary.* Second edition. University of Hawaii Press, Honolulu.

Pukui, Mary K., Samuel H. Elbert, and Esther Mookini

1974 *Place Names of Hawaii.* University of Hawaii Press, Honolulu.

Pultz, Mary Anne (editor)

1981 *A Botanists Visit to Oahu in 1831: Being the Journal of Dr. F.J.F. Meyen's Travels and Observations about the Island of Oahu*. Press Pacifica, Ltd., Kailua, Hawaiʻi.

Punahou School

2013 History. Electric document, http://www.punahou.edu/about/history/index.aspx (accessed 27 June 2014).

Scott, Edward B.

1968 *The Saga of the Sandwich Islands*. Fourth edition. Sierra-Tahoe Publishing Company, Crystal Bay, Lake Tahoe, Nevada.

Smith, Mary Roberts

1905 The Bequest of a Kamehameha. The Lunalilo Home of Aged Hawaiians and Its Inmates, the Remnants of a Primitive People. In *Charities. A Weekly Review of Local and General Philanthrop*y, XIII:12-16. Charity Organization Society, New York.

Sterling, Elspeth and Catherine Summers

1978 *Sites of Oʻahu.* Bernice Pauahi Bishop Museum, Honolulu.

Tulchin, Jon and Hallett H. Hammatt

2013 *Archaeological Inventory Survey for Rock Slide Potential Inspection and Mitigative Improvements Along Round Top Drive in the Vicinity of Forest Ridge Way, Makiki Ahupuaʻa, Honolulu (Kona) District, Oʻahu Island TMKs: (1) 2-5-013:001, 002, 003, 004, and 005; (1) 2-5-016:001, 002, 004, 022, 025, 030, and 031; and (1) 2-5-019:009.* Cultural Surveys Hawaiʻi, Inc., Kailua, Hawaiʻi.

Twombly, Alexander S.

1900 *Hawaii and its People.* Silver, Burdett and Company, New York, Boston, Chicago.

U.S. Army War Department

1919 Fire Control Map, Honolulu Quadrangle. USGS Information Services, Denver, Colorado.

1933 Fire Control Map, Honolulu Quadrangle. USGS Information Services, Denver, Colorado.

U.S. Department of Agriculture

2001 Soil Survey Geographic (SSURGO) database. U.S. Department of Agriculture, Natural Resources Conservation Service. Fort Worth, Texas. http://www.ncgc.nrcs.usda.gov/products/datasets/ssurgo/.

USGS (U.S. Geological Survey)

1953 Honolulu USGS 7.5-minute topographic quadrangle. USGS Information Services, Denver, Colorado.

1969 Honolulu USGS 7.5-minute topographic quadrangle. USGS Information Services, Denver, Colorado.

1978 USGS Orthoimagery, Honolulu Quad (aerial photograph). USGS Information Services, Denver, Colorado.

1998 Honolulu USGS 7.5-minute topographic quadrangle. USGS Information Services, Denver, Colorado.

Wall, Walter E.

1887 Map of Honolulu and Vicinity, Oahu Island, Kona District. Hawai‘i Land Survey Division, Department of Accounting and General Services, Honolulu.

Yent, Martha

1982 *Memo: Archaeological Inspection of Short Nature Trail for the Makiki Environmental Education Center, Makiki-Tantalus State Park, Makiki Valley, O‘ahu.* Department of Land and Natural Resources, State Parks Division, Honolulu.

Yent, Martha and Jason Ota

1980 *Archaeological Field Survey of Makiki Valley, the Kānealole Stream and Moleka Stream Systems, Makiki, Kona, O‘ahu*. Department of Land and Natural Resources, State Parks Division, Honolulu.

Appendix A LCA Awards

No. 4279B, Ia

Royal Patent Number(RP)	**5463**	LCA Number:	**04279B**
Patentee:	**Ia**	Book::	**21**
Island	**Oahu**	Page	**581**
District:	**Kona**	TMK	
Ahupua'a	**Waikiki**	Miscellaneous	
Ili	**Pawaa**		

Helu 5463, Ia, Pawaa Ili, Waikiki Ahupuaa, District of Kona, Island of Oahu, Volume 21, pps 581-582[RP Reel 11, 01226-01227.tif]

HELU 5463
PALAPALA SILA NUI,
A KE ALII, MAMULI O KA OLELO A KA POE HOONA KULEANA.

NO KA MEA, Ua hooholo na Luna Hoona i ua kumu kuleana aina i ka olelo, he kuleana oiaio ko Ia, Kuleana Helu 4279B ma ke Ano Alodio iloko o kahi i oleloia malalo.

Nolaila, ma keia Palapala Sila Nui, ke hoike aku nei o Kamehameha ~~IV~~ V, ke Alii nui a ke Akua i kona lokomaikai i hoonoho ai maluna o ko Hawaii Pae Aina, i na kanaka a pau, i keia la nono iho a no kona mau hope alii, ua hoolilo, a ua haawi aku oia ma ke Ano Alodio ia Ia, i kela wahi a pau loa ma Pawaa – Waikiki, ma ka mokupuni o Oahu, penei na mokuna,

Mookalo ma Kumanuunuu
E hoomaka ma ke Kihi Komohana, e holo
Akau 37° Hikina 1.30 Kaulahao ma ka Koele
Hema 64° Hikina 2- Kaulahao ma ko Pohano
Hema 34 1/2° Komohana 2.25 Kaulahao ma ka Kahawai
Akau 64° Komohana 2.10 Kaulahao ma ko Kauliokamoa
4.05 Kaulahao

[Page 582]

Maloko o keia apana 4.05 Kaulahao ~~Eka~~ a oi iki aku, a emi iki mai paha. Ua koe nae i ke aupuni na mine minerela a me na metela a pau.

No Ia, ua aina la i haawiia ma ke Ano Alodio a no kona mau hooilina, a me kona waihona; ua pili nae ku auhau a ka Poe Ahaolelo e kau like ai ma na aina alodio i kela manawa i keia manawa.

A I MEA E IKEA AI, ua kau wau i ko'u inoa, a me ka Sila Nui o ko Hawaii Pae Aina ma Honolulu i keia la 21 o Aperila 1864.

By the King, Kamehameha R [Rex]
M. Kekuanaoa
C.G. Hopkins

[Royal Land Patent No. 5463, Ia, Pawaa Ili, Waikiki Ahupuaa, District of Kona, Island of Oahu, .405 Acre, 1864]

No. 8241, Ii

Claim Number:	**08241**
Claimant:	**Ii, Ioane / Ii, John**
Other claimant:	
Other name:	Ii, John
Island:	**Oahu**
District:	**Kona, Ewa**
Ahupuaa:	**Honolulu, Waikiki, Waipio**
Ili:	**Pawaa, Kalawahine**

Apana:	**8**	Awarded:	**1**
Loi:		FR:	
Plus:		NR:	**512v5**
Mala Taro:		FT:	**554v3**
Kula:		NT:	**148v10**
House lot:		RP:	**5699, 5704, ,5732**
Kihapai/Pakanu:		Number of Royal Patents:	**3**
Salt lands:		Koele/Poalima:	**No**
Wauke:		Loko:	**No**
Olona:		Lokoia:	**No**
Noni:		Fishing Rights:	**No**

Hala:		Sea/Shore/Dunes:	**No**
Sweet Potatoes:		Auwai/Ditch:	**No**
Irish Potatoes:		Other Edifice:	**No**
Bananas:		Spring/Well:	**No**
Breadfruit:		Pigpen:	**No**
Coconut:		Road/Path:	**No**
Coffee:		Burial/Graveyard:	**No**
Oranges:		Wall/Fence:	**No**
Bitter Melon/Gourd:		Stream/Muliwai/River:	**No**
Sugar Cane:		Pali:	**No**
Tobacco:		Disease:	**No**
Koa/Kou Trees:		Claimant Died:	**No**
Other Plants:		Other Trees:	
Other Mammals:	**No**	Miscellaneous:	**Lists 110 tenants living on the land**

No. 8241, Ioane Ii, Honolulu, February 1, 1848

N.R. 512-517v5

Greetings to the Land Commissioners: I hereby state my claim for land, on Oahu only. An ahupua`a, Waipio, Ewa, is from the mountain to the sea, however, there are no ku lands situated within it because of the Mo`i - that is up to the Mo`i. The ones with the right to live there are listed below.

[No.] 2. Pawaa is the second of my lands on Oahu. It is at Waikiki, next to G.L. Kapeau, at Pawaa. This `Ili was gotten after the /Battle of/ Nuuanu by my makuas, from Kamehameha I, and these lands and other lands on other islands are held. The reason they, and I, got them, was by the actions of Kamehameha I and Kamehameha II, but they have been divided at this time and separated by the Government and the Mo`i -- nine lands for them and two for me. Below are the names of the people living on this land.

[No.] 3. A small lot claim, in Honolulu, is leased to Dr. Epener and Dr. Rooke; perhaps Samisona has the occupancy at this time for the remaining years. My retainers lived there in 1837 and in 1841, perhaps, it was leased as aforesaid.

Here are the names of the people living on the land of Waipio in Ewa:

Name of the Man, Mo`o, Lo`i, House lot, House(s), Children

Ulakaipo, 1 Mo`o, 1 Lo`i, 1 House lot, 1 House(s), 3 Children

M. Luheluhe, 1 Mo`o, 4 Lo`i, 1 House lot, 1 House(s), 1 Child

Nahua, 1 Mo`o, 7 Lo`i, 1 House lot, 2 House(s), 3 Children

Luaka, 1 Mo`o, 5 Lo`i, 1 House lot, 1 House(s), 2 Children

Kalauli, 1 Mo`o, 9 Lo`i, 1 House lot, 1 House(s), 2 Children

Nahea, 1 Mo`o, 4 Lo`i, 1 House lot, 1 House(s), 2 Children

Kaakau, widow*, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 2 Children

Manoha, 1 Mo`o, 7 Lo`i, 1 House lot, 1 House(s), 3 Children

Neliikuhoe, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 3 Children

Ohilau, 1 Mo`o, 16 Lo`i, 1 House lot, 1 House(s), 1 Child

Makaloka, 1 Mo`o, 9 Lo`i, 1 House lot, 1 House(s), 1 Child

Puakea, 1 Mo`o, 6 Lo`i, 1 House lot, 1 House(s), 1 Child

Keahekahuole, 1 Mo`o, 7 Lo`i, 1 House lot, 1 House(s), 1 Child

Kaapaahili, 1 Mo`o, 10 Lo`i, 1 House lot, 1 House(s), 1 Child

Puhipaka, 1 Mo`o, 4 Lo`i, 1 House lot, 1 House(s), 1 Child

Kalili, 1 Mo`o, 4 Lo`i, 1 House lot, 1 House(s), 1 Child

Kahuainana, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 1 Child

Pi, 1 Mo`o, 7 Lo`i, 1 House lot, 1 House(s), 1 Child

Poikeo, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 1 Child

Kula, 1 Mo`o, 2 Lo`i, 1 House lot, 1 House(s), 1 Child

Paumano, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 1 Child

Kupehe, widow*, 1 Mo`o, 7 Lo`i, 1 House lot, 1 House(s), 1 Child

Pohano, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 1 Child

Hana, 1 Mo`o, 1 Lo`i, 1 House lot, 1 House(s), 1 Child

Kaiki, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 1 Child

Kamaka, 1 Mo`o, 4 Lo`i, 1 House lot, 1 House(s), 4 Children

Niau, w, 1 Mo`o, 5 Lo`i, 1 House lot, 1 House(s), 1 Child

Kupokii, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 3 Children

Nau w, 1 Mo`o, 5 Lo`i, 1 House lot, 1 House(s), 1 Child

Manuwa, 1 Mo`o, 8 Lo`i, 1 House lot, 1 House(s), 1 Child

Paakiki, 1 Mo`o, 5 Lo`i, 1 House lot, 1 House(s), 1 Child

Uma, 1 Mo`o, 8 Lo`i, 1 House lot, 1 House(s), 4 Children

Kuaana, 1 Mo`o, 7 Lo`i, 1 House lot, 1 House(s), 4 Children

Kuhanapilo, 1 Mo`o, 1 Lo`i, 1 House lot, 1 House(s), 1 Child

Kauhi, 1 Mo`o, 2 Lo`i, 1 House lot, 1 House(s), 1 Child

Kakaukola, 1 Mo`o, 2 Lo`i, 1 House lot, 2 House(s), 4 Children

Kauhiohewa, 1 Mo`o, 1 Lo`i, 1 House lot, 1 House(s), 1 Child

Luukia, wahine, 1 Mo`o, 2 Lo`i, 1 House lot, 1 House(s), 1 Child

Hanaiuka, 1 Mo`o, 3 Lo`i, 1 House lot, 1 House(s), 1 Child

Nawahinelawaia, 1 Mo`o, 1 Lo`i, 1 House lot, 1 House(s), 4 Children

Leoiki, 1 Mo`o, 10 Lo`i, 1 House lot, 1 House(s), 2 Children

Kaanaana, 1 Mo`o, 2 Lo`i, 1 House lot, 1 House(s), 4 Children

Hinaumai, 1 Mo`o, 9 Lo`i, 1 House lot, 1 House(s), 4 Children

Kaholohua, 1 Mo`o, 9 Lo`i, 1 House lot, 5 House(s), 4 Children

Homa, 1 Mo`o, 9 Lo`i, 1 House lot, 1 House(s), 4 Children

Kaheau, 1 Mo`o, 9 Lo`i, 1 House lot, 1 House(s), 4 Children

Kaluluahi, 1 Mo`o, 9 Lo`i, 1 House lot, 1 House(s), 4 Children

Paamua, 1 Mo`o, 9 Lo`i, 1 House lot, 1 House(s), 4 Children

Kamauli, 1 Mo`o, 9 Lo`i, 1 House lot, 2 House(s), 4 Children

Lio, 1 Mo`o, 1 Kula, 1 House lot, 2 House(s), 4 Children

Naokiai, 1 Mo`o, 1 Kula, 1 House lot, 2 House(s), 4 Children

Kailihao, 1 Mo`o , 1 Kula, 1 House lot, 1 House(s), 4 Children

Kaulewaiwi, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 3 Children

Kalaepoha, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 3 Children

Hepa, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 3 Children

Kamakahi, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s) Children, 3

Kaualelehuna, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 3 Children

Halelaau, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Kaneakauhi, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Opunui, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Keahale, 1 Mo`o, 1 Kula, 1 House lot, 2 House(s), 3 Children

Kahuluhulu, 1 Mo`o, 1 Kula, 1 House lot, 2 House(s), 3 Children

Kaimoleihonua, 1 Mo`o, 1 Kula, 1 House lot, 2 House(s), 3 Children

Naiapapa, 1 Mo`o, 1 Kula, 1 House lot, 2 House(s), 3 Children

Kaleiku, 1 Mo`o, 1 Kula, 1 House lot, 2 House(s), 3 Children

Kailio, 1 Mo`o, 1 Kula, 1 House lot, 2 House(s), 3 Children

Kahili, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 3 Children

Haikoi, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 3 Children

Uoo, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 3 Children

Kanealu, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 3 Children

Kaioe, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Kuhoomalana, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Uao, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Kaliiwahinui, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Poupou, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Palekaluhi, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Kahakai, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Kaopuaua, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Naniu, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Kawaihae, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Ukeke, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Kaihumua, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Mokunui, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Kauleeku, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Humehume 1 mo`o, 2 kula, 1 House lot, 1 House(s), 2 Children

Moku 1 Mo`o, 5 Kula, 1 House lot, 1 House(s), 1 Child

Kaia, 1 Mo`o, 2 Kula, 1 House lot, 2 House(s), 1 Child

Kaliikanakaole, 1 Mo`o, 5 Kula, 1 House lot, 1 House(s), 1 Child

Kapule, 1 Mo`o, 5 Kula, 1 House lot, 1 House(s), 1 Child

Kaneaumoana, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Nahokunui, 1 Mo`o, 5 Kula, 1 House lot, 1 House(s), 1 Child

Kailua, 1 Mo`o, 5 Kula, 1 House lot, 1 House(s), 1 Child

Kapela, 1 Mo`o, 5 Kula, 1 House lot, 2 House(s), 3 Children

Holomoana, 1 Mo`o, 2 Kula, 1 House lot, 2 House(s), 2 Children

Kaumiumi, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 2 Children

Nahona, 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 4 Children

Puou, 1 Mo`o, 3 Kula, 1 House lot, 1 House(s), 4 Children

Koleaka, 1 Mo`o, 3 Kula, 1 House lot, 1 House(s), 4 Children

Kaluwahinenui, 1 Mo`o, 1 Kula, 1 House lot, 1 House(s), 1 Child

Alele, 5 Mo`o, 5 Kula, 1 House lot, 1 House(s), 1 Child

Kuhiwahiwa, 1 Mo`o, 5 Kula, 1 House lot, 1 House(s), 3 Children

Ope, 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 4 Children

Keawekolohe, 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 3 Children

Makahiwahiwa 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 3 Children

Kekahili 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 2 Children

Lokai, 4 Mo`o, 4 Kula, 1 House lot, 1 House(s), 2 Children

Kaheananaui, 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 2 Children

Ainui, 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 2 Children

Uma , 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 2 Children

Kahoowaha, 1 Mo`o, 2 Kula, 1 House lot, 1 House(s), 2 Children

Land Two, Pawaa is the name, at Waikiki. Names of people living on this land:

Ia, Oopa, Kaheleloa, Mahoe, Nahuakai, Laau, Kamokuahanui, Kaolei, Napohaku, Naukana, Mu, Kua, Nakaikuaana, Kaaiahua.

These lands are my share from the Government, therefore, two thirds only remain to us and the people. The explanation is in the Mahele Book.

I am, respectfully, your obedient servant.

IOANE II

*The initials w, k, m, are shown, which I take to mean wahine, kane, make, or widow/

The fourth of the land claims is at Waiakimi, with three lo`i and a kula in Honolulu land, in Kalawahine. It was transferred to the wahine of Ioane Ii from the year 1830 until this time.

F.T. 554v3

No. 8241, Ioane Ii

Keekapu, sworn, says she knows the Kuleana of Ii in "Kalawahine." Honolulu Aina. It consists of some Kalo patches in one piece with a small piece of kula adjoining.

It is bounded:

Mauka by the land of Kaauhauhula

On Waikiki side by a stream

Makai by L. Haalilea & Kekuanaoa

On Ewa side by the land of Rosalie Marini.

Claimant received this land from his father, Kalimahauna, in the time of Kinau, and has held it ever since. There is not dispute to this claim.

Witness knows the House Lot in "Manamana" Honolulu, claim by Ii.

It is bounded:

Mauka by Ala Beretane

On Waikiki side by Kaluahinenui's lot

Makai by Kalaiheana & Pahana's lots

Ewa side by Hinau's lot.

This lot was anciently a waste place and was taken up by claimant in the time of Kinau & he has held possession of it ever since, without dispute.

K. Kapaakea, sworn, says he knows this house lot, and confirms in full the testimony given by Keekapu.

N.T. 148v10

No. 8241, Ionae Ii

Waipio ahupuaa, Ewa, Oahu

Pawaa ili, Waikiki, Kona, Oahu.

This distribution is correct and the lands are for John Ii. Permission has been granted to present this before the land officers who settle claims.

(Sign) Kamehameha

Royal Palace, 27 January 1848

[Award 8241; R.P. 5699; Kalawahine Honolulu Kona; 1 ap.; .77 Ac.; no R.P. Pawaa Kona; 1 ap.; 2.59 Acs; R.P. 5704; Pawaa Kona; 5 ap.; 250.8 Acs; R.P. 5732; Waipio Ewa; (ahupua`a);1 ap.; 20,546 Acs; See other names for other claims]

No. 6489, Kaihiwa

Acs; R.P. 2509; Mokauea Kalihi Kona; Ap. 2; 1 ap.; 216 Acs; R.P. 6846; Mokauea Kalihi Kona; ap. 3; 1 ap.; 21.81 Acs; R.P. 7168; Mokauea Kalihi Kona; Ap. 6; 1 ap.; 110 Acs; Land Patent 8466; Kalihi Kona; Kaunuohua for W.L. Moehonua (ap. 8); Land Patent 8307; Mokauea Kalihi Kona, 1 ap.; 58 Acres 6 chains; Ap. 9; 1 ap.; 95.36 Acs; Kaunuohua for Moehonua; R.P. 7263; Puulena Manoa Kona Ap. 2; ; 1 ap.; 35.4 Acs; Land Patent 8349; Kuwili Ponds, Kalia Waikiki, Ap. 1; 1 ap.; 3.62 Acs; no R.P. Kalia Waikiki Kona; 1 ap.; 13.7 Acs; Land Patent 8442; Kalihi Kona; for W.L. Moehonua (ap. 4); Land Patent 8477; Mokauea Kalihi Kona; Kaunuohua for Moehonua (ap. 1); Land Patent 8491; Mokauea Kalihi Kona; Kaunuohua for W.L. Moehonua;(Molokai) no R.P.; Kalaupapa Koolau; 1 ap. No acreage given]

Number: 06489

Claim Number:	**06489**
Claimant:	**Kaihiwa**
Other claimant:	
Other name:	
Island:	**Oahu**
District:	**Kona**
Ahupuaa:	**Makiki, Honolulu**
Ili:	**Kauhikio, Honuakaha**

Apana:	**3**	Awarded:	**1**
Loi:	**0**	FR:	
Plus:		NR:	**375v5**
Mala Taro:	0	FT:	
Kula:	0	NT:	**734v3,324v10**
House lot:	**1**	RP:	**3472, 4519**
Kihapai/Pakanu:	0	Number of Royal Patents:	**2**
Salt lands:	0	Koele/Poalima:	**No**
Wauke:	**0**	Loko:	**No**
Olona:	0	Lokoia:	**No**
Noni:	**0**	Fishing Rights:	**No**
Hala:	0	Sea/Shore/Dunes:	**No**
Sweet Potatoes:	0	Auwai/Ditch:	**No**
Irish Potatoes:	0	Other Edifice:	**No**
Bananas:	**0**	Spring/Well:	**No**
Breadfruit:	**0**	Pigpen:	**No**
Coconut:	0	Road/Path:	**No**
Coffee:	0	Burial/Graveyard:	**No**
Oranges:	0	Wall/Fence:	**No**
Bitter Melon/Gourd:	0	Stream/Muliwai/River:	**No**
Sugar Cane:	0	Pali:	**No**
Tobacco:	0	Disease:	**No**
Koa/Kou Trees:	0	Claimant Died:	**No**
Other Plants:	0	Other Trees:	0
Other Mammals:	**No**	Miscellaneous:	

No. 6489, Kahiwa
N.R. 375-376v5

Greetings to the Land Commissioners: I hereby state my claim for land and house lot also.

The land claim is Kauhikio, an `ili kupono, at Waikiki on Oahu. This land is mine forever, from the Mo`i. The nature of this land is that it jumps. It does not lie all together but is scattered.

The second is a house `lot at Kawaiahao in Honolulu on Oahu. The boundaries are explained as follows: on the north is the highway going to Waikiki, on the east is the house Lot of Kekualoa, on the south is the lot of Kaahumanu, on the west is the lot of Kekuhaupio.

The dimensions of this house lot are: on the north, two chains, twenty-eiqht feet, and the length on the south is the same The length on the other two sides is one chain, forty feet. Below is the diagram which explains it::

[DIAGRAM]

That is the diagram which explains this house lot.
With aloha,
KAIHIWA
Honolulu, 7 February,1848

N.T. 734-735v3
No. 6489, Kaihiwa, February 11, 1851

Moa, sworn, I have seen his house lot at Kawaiahao. The boundaries are:

Mauka, Queen Street
Waikiki, Kekuanui
Makai, Kaahumanu and Kekuhaupio
Ewa, Kekuhaupio.

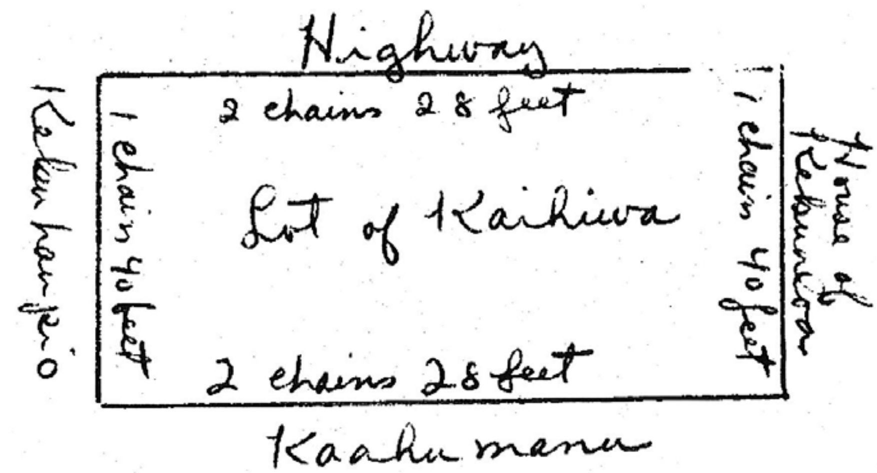
Kaihiwa received this house lot from Kamehameha III before the death of Kinau in 1839 and he has lived there to the present time. No one has objected.

Kalawaia, sworn, We both have known just as Moa has related here.

N.T. 324v10
No. 6489, Kaihiwa, 4 November 1853

Kaihiwa's land distribution.
Kauhikio ili for Waikiki, Kona, Oahu.
True Copy
Interior Department, 4 November 1853
A.G. Thruston, Clerk

[Award 6489; R.P. 4519; Honuakaha Honolulu Kona; 1 ap.; .307 Ac.; R.P. Kauhikio Makiki Kona; 4 ap.; 73.8 Acs; R.P. 3472; Kauhikio Makiki Kona; 1 ap.; 5.27 Acs (Kaihiwa for Z. Kaauwai); Waikiki Kona; 1 ap.; 1.91 Acs]



Number:

06716*O

Claim Number:	**06716*O**
Claimant:	**Haumea**
Other claimant:	
Other name:	
Island:	**Oahu**
District:	**Kona**
Ahupuaa:	**Waikiki**
Ili:	**Keauhou**

Apana:	**4**	Awarded:	**1**
Loi:	**8**	FR:	
Plus:		NR:	**392v5**
Mala Taro:		FT:	**492v14**
Kula:	1	NT:	**200v10**
House lot:		RP:	**5698**
Kihapai/Pakanu:		Number of Royal Patents:	**1**
Salt lands:		Koele/Poalima:	**No**
Wauke:		Loko:	**No**
Olona:		Lokoia:	**No**
Noni:		Fishing Rights:	**No**
Hala:		Sea/Shore/Dunes:	**Yes**
Sweet Potatoes:		Auwai/Ditch:	**No**
Irish Potatoes:		Other Edifice:	**No**
Bananas:		Spring/Well:	**No**
Breadfruit:		Pigpen:	**No**
Coconut:		Road/Path:	**No**
Coffee:		Burial/Graveyard:	**No**
Oranges:		Wall/Fence:	**No**

Section 7 Photograph Addendum Addressing Two Additional Possible Project Areas

Figure 42. General view of wall along the west side of the northeast additional project area

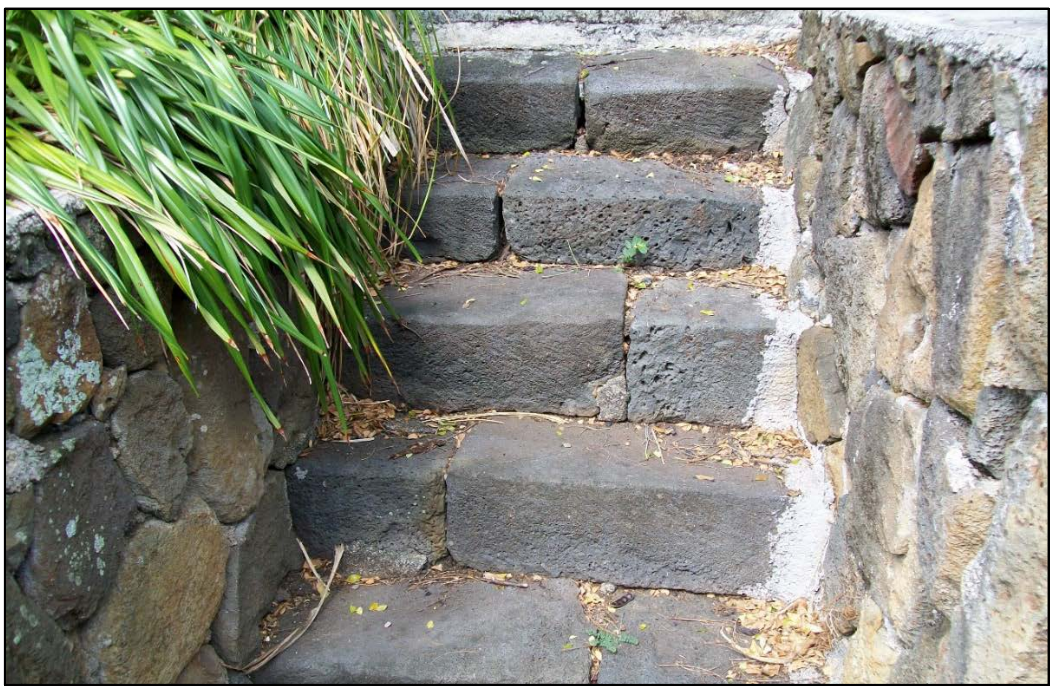


Figure 43. General view of steps traversing wall along the west side of the northeast additional project area

Figure 44View of cement slabs understood as just north (outside of) the project area

Figure 45. General view of retaining wall along west side of Stream (along east side of the northeast additional project area

Figure 46. General view of retaining wall at northeast corner of the southwest additional project area

Figure 47 Terrace walls on either side of a driveway in the southwest additional project area

Figure 48. Terrace walls on either side of a driveway in the southwest additional project area

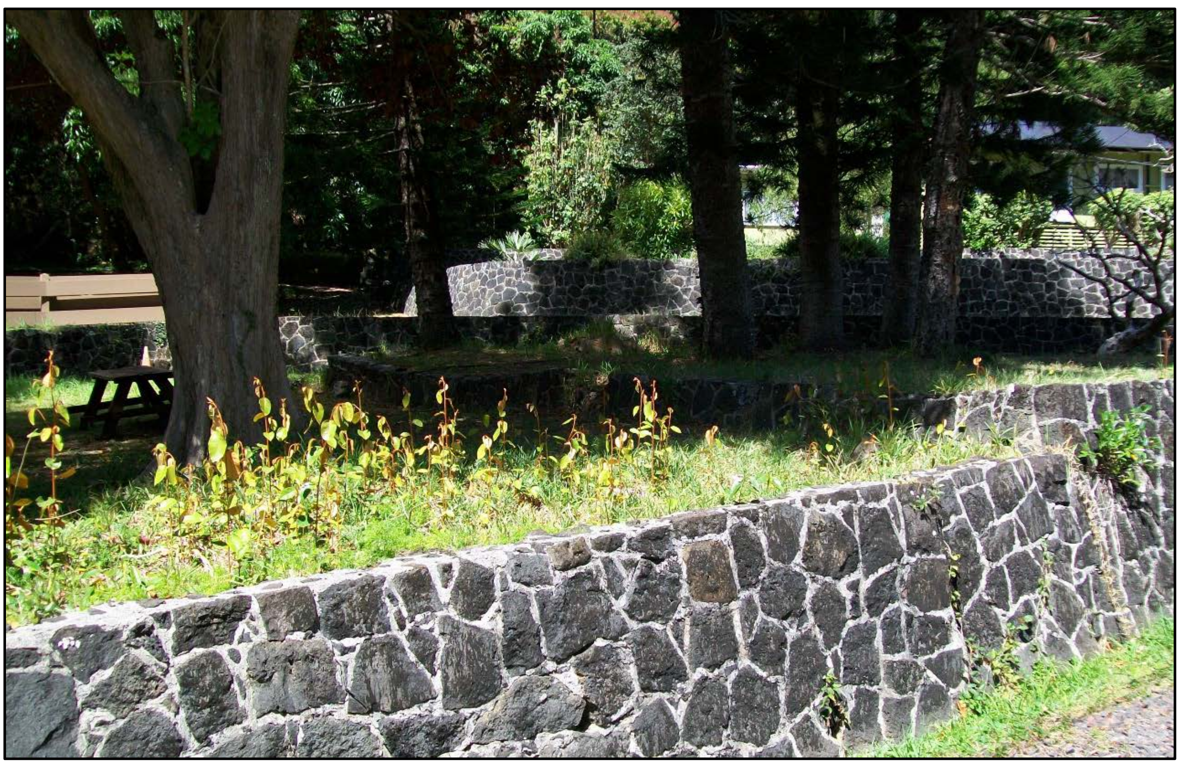


Figure 49. Terrace walls on either side of a driveway in the southwest additional project area

APPENDIX D

Biological Surveys Conducted for the DOFAW Makiki Base Yard Master Plan, Honolulu District, Island of O‘ahu. (October 2015)

Prepared by: Rana Biological Consulting, Inc

Biological Surveys Conducted for the DOFAW Makiki Base Yard Master Plan, Honolulu District, Island of Oʻahu

Prepared by:

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Prepared for:
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Honolulu, Hawaii 96813

September 29 2014
Revised October 8, 2015

Table of Contents

Introduction

The State of Hawaiʻi, Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) is proposing to improve its existing base yard facility located in Makiki on the island of Oahu. The proposed improvements include additional buildings to facilitate program operational activities. Proposed improvements include an extension to the existing administration building, additional buildings for Forestry, Wildlife, and Nā Ala Hele program requirements. Also included is a fuel storage building, a general storage building, dumpster locations, and covered parking (Figure 1 – Site Plan).

This report describes the methods used and the results of the botanical, avian and mammalian surveys conducted on the subject property as part of the environmental disclosure process associated with the proposed project.

The primary purpose of the surveys was to determine if there are any botanical, avian or mammalian species currently listed, or proposed for listing under either federal or State of Hawaiʻi endangered species statutes within or adjacent to the study area. The federal and State of Hawaiʻi listed species status follows species identified in the following referenced documents, (Department of Land and Natural Resources (DLNR) 1998; U. S. Fish & Wildlife Service (USFWS) 2005a, 2005b, 2014). Fieldwork was conducted on August 14, 2014.

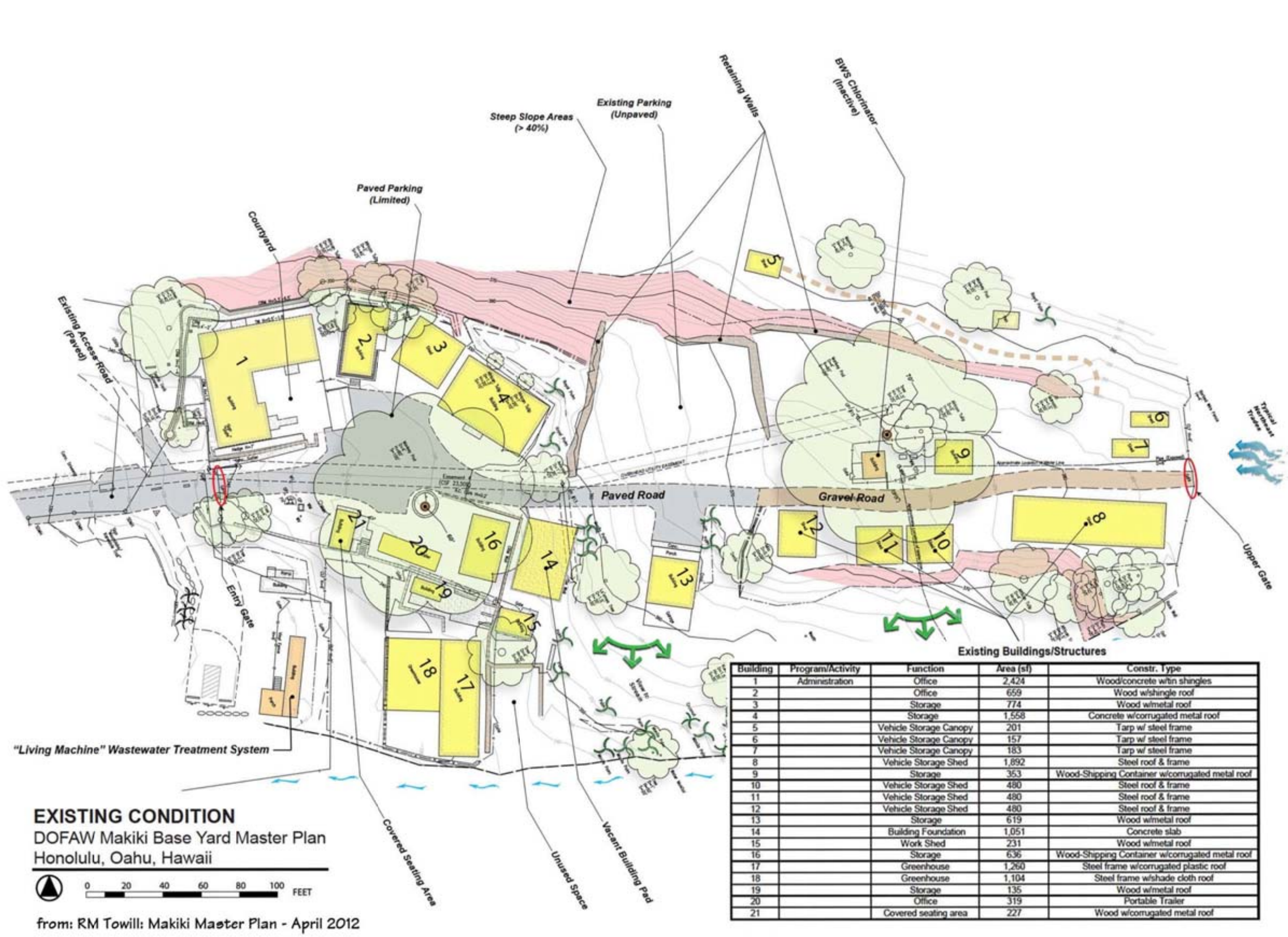
Hawaiian and scientific names are italicized in the text. A glossary of technical terms and acronyms used in the document, which may be unfamiliar to the reader, are included at the end of the narrative text.

General Site Description

The DOFAW Makiki Base Yard is located mid-way up Makiki Valley on the Island of Oahu, at approximately 100 meters above mean sea level. The site is extremely verdant receiving roughly 150 centimeters of rain a year (Giambelluca et al, 2011). Current infrastructure present on the site is illustrated in Figure 2 – Existing Conditions. There are numerous buildings and shelters of various kinds on the site (Figures 4 and 5) and they are in varying conditions (Figures 5 and 6). The driveway is paved for approximately the first 85 meters and then is composed of graded gravel to it's termination at the mauka boundary of the Base Yard approximately 70 meters further upslope.

Vegetation in the survey area is landscaping, with a mixed, secondary forest on the slopes surrounding the developed area. The Makiki Base Yard is located along the *mauka* or inland edge of the Honolulu urban environment.


SITE PLAN
MAKIKI BASE YARD
MAR, 2016
Mason Architects
APPROX. SCALE: 1"=120'
0' 60' 120' 180'
FUTURE CHLORINATION BUILDING
20 FOOT RIGHT-OF-WAY AND TURNAROUND
COVERING OVER PARKING BAYS (SHOWN DASHED IN)
NEW NA ALA HELE BUILDING
OVERFLOW PARKING
NEW FIRE HYDRANT
NEW 2-STORY OPERATIONS BUILDING
NEW 1-STORY OFFICE BUILDING
NEW OFFICE SPACE
EXISTING NURSERY AND GREENHOUSE
EXISTING ADMINISTRATION BUILDING
NEW COVERING OVER EXISTING COURTYARD (SHOWN DASHED IN)
NEW 2-STORY ADMINISTRATION BUILDING ADDITION
EXISTING STORAGE BUILDING
EXISTING OPEN-AIR PAVILION
EXISTING FIRE HYDRANT
PROPOSED AREA FOR IWS SYSTEM & HAWAII NATURE CENTER MESI GARDEN
DOFAW BOUNDARY
STATE PARKS BOUNDARY
STATE PARKS COMFORT STATION
HAWAII NATURE CENTER
SHARED DOFAW AND HAWAII NATURE CENTER COTTAGE
STREAM SETBACK



Existing Buildings/Structures

Building	Program/Activity	Function	Area (sf)	Constr. Type
1	Administration	Office	2,424	Wood/concrete w/tin shingles
2		Office	659	Wood w/shingle roof
3		Storage	774	Wood w/metal roof
4		Storage	1,558	Concrete w/corrugated metal roof
5		Vehicle Storage Canopy	201	Tarp w/ steel frame
6		Vehicle Storage Canopy	157	Tarp w/ steel frame
7		Vehicle Storage Canopy	183	Tarp w/ steel frame
8		Vehicle Storage Shed	1,892	Steel roof & frame
9		Storage	353	Wood-Shipping Container w/corrugated metal roof
10		Vehicle Storage Shed	480	Steel roof & frame
11		Vehicle Storage Shed	480	Steel roof & frame
12		Vehicle Storage Shed	480	Steel roof & frame
13		Storage	619	Wood w/metal roof
14		Building Foundation	1,051	Concrete slab
15		Work Shed	231	Wood w/metal roof
16		Storage	636	Wood-Shipping Container w/corrugated metal roof
17		Greenhouse	1,260	Steel frame w/corrugated plastic roof
18		Greenhouse	1,104	Steel frame w/shade cloth roof
19		Storage	135	Wood w/metal roof
20		Office	319	Portable Trailer
21		Covered seating area	227	Wood w/corrugated metal roof

7

Figure 4 – Mauka terminus of the base yard showing gate and covered parking structures

Figure 5 – Central unpaved parking midway down the site – note dense mixed forest that borders the site

Figure 6 – General storage building and paved driveway aslso showing mixed vegetation

Figure 7 – Main office at the makai boundary of the base yard

Methods

Plant names follow *Manual of the Flowering Plants of Hawai'i* (Wagner *et al*., 1990, 1999) for native and naturalized flowering plants, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for crop and ornamental plants. Some plant species names have been updated following more recently published literature as summarized in Imada (2012). The avian phylogenetic order and nomenclature used in this report follows the *AOU Check-List of North American Birds* (American Ornithologists' Union, 1998), and the 42nd through the 55th supplements to the Check-List (American Ornithologists' Union, 2000; Banks et al., 2002, 2003, 2004, 2005, 2006, 2007, 2008; Chesser *et al*., 2009, 2010, 2011, 2012, 2013, 2014). Mammal scientific names follow (Wilson and Reeder, 2005). Place names follow (Pukui *et al.*, 1976).

Botanical Survey Methods

The botanical survey involved a wandering pedestrian transect that completely traversed the property with the exception of the DLNR plant nursery (structures 17 and 18 in Figure 2). A GNSS unit (Trimble, GeoXH 6000 Series) was used to record the progress track of the botanist and provide real time feedback on survey area coverage. Plant species were identified as they were encountered. For a few species not immediately recognized in the field, photographs were taken and/or material collected for identification in the laboratory. Although field notations were recorded in an effort to develop a qualitative sense of individual species abundance, the vegetation within the site proved to be so eclectic in its mix of planted ornamentals and natives, naturalized weeds, and other plants growing in the surrounding forest vegetation, that attempting to quantify by species was abandoned as essentially meaningless.

The survey period encompassed the late dry season, which has been recorded as above average for O'ahu (USGS, 2014). Between June and August this year, rainfall was about 167% of average. The three-month zone map provided by NOAA (2014) through July 2014 shows the Makiki vicinity to be moderately wet. Certainly, the vegetation at the survey site was not stressed due to a lack of rainfall. Unknown is the extent to which supplemental watering of the landscaping was and is provided.

Avian Survey Methods

Two avian count stations were sited equidistant from each other within the project site. A single eight-minute avian point count was made at each count station. The stations were counted twice with an hour break between the count replications. Field observations were made with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. The point counts were conducted between 7:30am and 9:00 am. Time not spent counting the point count stations was used to search the rest of the site for species and habitats not detected during the point counts.

Mammalian Survey Methods

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *ʻōpeʻapeʻa* as it is known locally, all terrestrial mammals currently found on the Island of Oʻahu are alien species, and most are ubiquitous. The survey of mammals was limited to visual and auditory detection, coupled with visual observation of scat, tracks, and other animal sign. A running tally was kept of all terrestrial vertebrate mammalian species detected within the project area during the time spent on the site.

Results

Botanical Surveys, Flora

Vegetation — Vegetation on the Makiki Base Yard site is a mix of landscape plants and weeds, surrounded by a forest on three sides and merging into urban mixed forest on the downslope side.

Flora — "Flora" is the diversity of plant species living in the survey area. A plant checklist (Table 1) was compiled from field observations, with entries arranged alphabetically under plant family names (standard practice). Included in the list are scientific name, common name, and status (for example, whether native or non-native, naturalized or ornamental) for each species observed during the August survey.

Qualitative estimates of plant abundance were not developed for each species. In part because of the diverse functions occurring on the site and in part because, in the final analysis, the vegetation is essentially landscaping in various stages of maintenance, abundance estimates are essentially meaningless.

Site use and site history are important determinants of the flora extant on a piece of property. Without researching a detailed history of the Makiki Base Yard site, certain aspects of that history have likely influenced the present flora in the direction of the very eclectic mix of plants found there. Photographs by the U. H. botanist, Charles Lamoureux, available from "University of Hawaii Museum" (flickr, 2014; undated, but from before 1968) show a plant nursery along Makiki Heights Drive where today the public charter school, Hālau Kū Māna is located. Labeled "forestry nursery, Makiki Valley" in one Lamoureux photo, plant collection records at B.P. Bishop Museum describe the "Old Makiki Nursery" and "old Choi nursery foundation" in this area. The Makiki Nursery owned by Wilbert Choi (a former chairman of the State Land Use Commission) is described as the "[s]tate's largest landscape contractor" in 1966 (Men and Women of Hawaii-1966). However, a government nursery in Makiki is described from an even earlier time (Judd, 1920). This nursery specialized in supplying mostly non-native trees and shrubs for planting all over public lands in Hawaiʻi. From the mix of old palms and other large trees on the survey site, it would appear that plantings were made up into the valley to the Makiki Base Yard site from Makiki Heights Drive. To further complicate the existing landscape picture, DLNR operates a plant nursery on the site, which now specializes in growing native plants. Thus, in various places scattered among the older non-native specimen plants, are found more recent plantings of native threes and shrubs.

Table 1 - Flora for the DOFAW Makiki Base Yard, Honolulu, O'ahu.

SPECIES	Common Name	Status	Notes
FERN ALLIES			
PSILOTACEAE			
Psilotum nudum (L.) Griseb.	*moa*	**Ind**	
PTERIDOPHYTES ~ FERNS			
NEPHROLEPIDACEAE			
Nephrolepis cf. *multiflora* (Roxburgh) Jarrett ex Morton	sword fern	Nat	
Nephrolepis cordifolia (L.) C. Presl.	---	**Ind**	<1>
POLYPODIACEAE			
Platycerium sp.	staghorn fern	Nat	
Phymatosorus grossus (Langsd. & Fisch.) Brownlie	*laua`e*	Nat	
Phlebodium aureum (L.) J. Smith	hare's foot fern	Nat	
PTERIDACEAE			
Pteris vittata L.	Chinese brake	Nat	
GYMNOSPERMS			
ARAUCARIACEAE			
Araucaria columnaris (H. Forst.) J.D. Hook.	Cook- pine	Nat	
FLOWERING PLANTS ~ DICOTYLEDONS			
ACANTHACEAE			
Asystasia gangetica (L.) T. Anderson.	Chinese violet	Nat	
AMARANTHACEAE			
Amaranthus spinosus L.	spiny amaranth	Nat	
Amaranthus viridis L.	slender amaranth	Nat	
ANACARDIACEAE			
Mangifera indica L.	mango	Nat	
APOCYNACEAE			
Plumeria rubra L.	temple flower	Orn	
ARALIACEAE			
Schefflera actinophylla (Endl.) Harms.	octopus tree	Nat	
ASTERACEAE			
Calyptocarpus vialis Less.	---	Nat	
Emilia fosbergii Nicolson	Flora's paintbrush	Nat	
Sphagneticola trilobata (L.) Pruski	wedelia	Nat	
Synedrella nodiflora (L.) Gaertn.	nodeweed	Nat	
Youngia japonica (L.) DC.	Oriental hawksbeard	Nat	

Table 1 continued

SPECIES	Common Name	Status	Notes
BASELLACEAE			
Anredera cordifolia (Ten.) Steenis	Madeira vine	Nat	
BIGNONIACEAE			
Macfadyena unguis-cati (L.) A. Gentry	cat's claw climber	Nat	
Spathodea campanulata P. Beauv.	African tulip	Nat	
BORAGINACEAE			
Cordia subcordata Lam.	*kou*	**Pol**	<1>
BRASSICACEAE			
Lepidium virginicum L.	---	Nat	
CARICACEAE			
Carica papaya L.	papaya	Nat	
CARYOPHYLACEAE			
Drymaria cordata (L.) Willd. ex Roem. & Schult.	*pipili*	Nat	
CLUSIACEAE			
Clusia rosea Jacq.	copey	Nat	
CONVOLVULACEAE			
Ipomoea cf. *obscura* (L.) Ker-Gawl.	---	Nat	<3>
Ipomoea triloba L.	little bell	Nat	
CUCURBITACEAE			
Momordica charantia L.	wild bitter melon	Nat	
EUPHORBIACEAE			
Aleurites moluccana (L.) Willd.	*kukui*	**Pol**	<1>
Euphorbia hirta L	garden spurge	Nat	
Euphorbiae hypersifolia L.	graceful spurge	Nat	
Euphorbia prostrata Aiton	prostrate spurge	Nat	
Euphorbia heterophylla L.	*kaliko*	Nat	
Phyllanthus debilis Klein ex Willd.	niuri	Nat	
FABACEAE			
Albizia saman F. Muell.	monkeypod	Nat	
Alysicarpus vaginalis (L.) DC.	Alyce clover	Nat	
Bauhinia cf. x*blakeana* Dunn	orchid tree	Orn	
Caesalpinia pulcherrima (L.) Swartz	*'ohai ali'i*	Orn	
Canavalia cathartica Thours	*maunaloa*	Nat	
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat	
Desmodium incanum DC.	Spanish clover	Nat	
Indigofera hendecaphylla Jacq.	creeping indigo	Nat	
Leucaena leucocephala (Lam.) deWit	koa haole	Nat	
Lysiloma aurita (Schitdl.) Benth.	---	Orn	
Macroptilium lathyroides (L.) Urb.	cow pea	Nat	
Mimosa pudica L.	sensitive plant	Nat	
Pithecellobium dulce (Roxb.) Benth.	*'opiuma*	Nat	
Peltophorum pterocarpum (A. P. de Cand.) K. Heyne	yellow poinciana	Orn?	
indet. Fabaceae	large tree	Orn	<3>

Table 1 continued

SPECIES	Common Name	Status	Notes
LAURACEAE			
Persea americana Mill.	alligator pear	Nat	
GOODINACEAE			
Scaevola taccada (J. Gaertn.) Roxb.	*naupaka kahakai*	**Ind**	<1>
MALVACEAE			
Hibiscus clayi Deg. & I. Deg.	*aloalo*	**End**	<1>
Hibiscus kokio Hillebr.	*koki'o*	**End**	<1>
Hibiscus tiliaceus L.	*hau*	**Pol**	
Malachra alceifolia Jacq.	---	Nat	
Sida ciliaris L.	---	Nat	
Thespesia populnea (L.) Sol ex Corrêa	*milo*	**Ind**	<1>
Waltheria indica L.	*'uhaloa*	**Ind**	
MORACEAE			
Artocarpus communis Forst.	breadfruit, *'ulu*	Orn	
Ficus elastic Hornemann	India rubber tree	Orn	
Ficus microcarpa L.	Chinese banyan	Nat	
MYOPORACEAE			
Myoporum sandwicense A. Gray	*naio papa*	**Ind**	<1>
MYRTACEAE			
Psidium guajava L.	commom guava	Nat	
NYCTAGINACEAE			
Boerhavia coccinea Mill.	false *alena*	Nat	
OCHNACEAE			
Ochna kirkii Willd.	Mickey Mouse plant	Orn	
OLEACEAE			
Fraxinus uhdei (Wenzig.) Lingelsh.	tropical ash	Nat	<2>
ONAGRACEAE			
Ludwigia octovalvis (Jacq.) Raven	primrose willow, *kāmole*	Nat	
OXALIDACEAE			
Oxalis corniculata L.	*`ihi`ai*	**Ind**	
PHYTOLACCACEAE			
Rivina humilis L.	coral berry	Nat	
PLUMBAGINACEAE			
Plumbago zeylanica L.	*'ilie'e*	**Ind**	<1>
POLYGONACEAE			
Antigonon leptopus Hook. & Arnott	Mexican creeper	**Ind**	<1>
PRIMULACEAE			
Anagallis arvensis L.	scarlet pimpernel	Nat	
PROTEACEAE			
Macadamia integrifolia Maiden & Betche	macadamia	Orn	
RUBIACEAE			
Canthium odoratum (G. Forster) Seem.	*alahe'e*	**Ind**	<1>
Gardenia sp.	gardenia or *nānū*	---	<1,3>
Hedyotis corymbosa (L.) Lam.	---	Nat	

Table 1 continued

SPECIES	Common Name	Status	Notes
RUBIACEAE (continued)			
Paederia foetida L.	*maile pilau*	Nat	
SAPINDACEAE			
Sapindus oahuensis Hillebr. ex Radlk.	*āulu*	**End**	<1>
Indet. tree	---	**?**	<3>
SAPOTACEAE			
Chrysophyllum oliviforme (L.) Wettst.	satin leaf	Nat	
THYMELIACEAE			
Wikstroemia uva-ursi A. Gray	*'ākia*	**End**	<1>
URTICACEAE			
Pilea microphylla (L.) Liebm.	artillery plant	Nat	
VERBENACEAE			
Citharexylum caudatum L.	fiddlewood	Nat	
Citharexylum spinosum L.	fiddlewood	Nat	
ZYGOPHYLLACEAE			
Guaiacum officinale L.	lignum-vitae	Nat	<1>
FLOWERING PLANTS ~ MONOCOTYLEDONS			
AGAVACEAE			
Cordyline fruticosa (L.) A. Chev.	*ki*, ti	**Pol**	<1>
Sansevieria trifaciata Prain	bowstring-hemp	Orn?	
ALOEACEAE			
Aloë vera (L.) N. L. Burm.	aloë	Orn	
ARACEAE			
Calocasia esculenta (L.) Schott	*kalo*, taro	**Pol**	<1>
Epipremnum pinnatum (L.) Engl.	---	Nat	
Monstera delicosa Lieb.	monstera	Orn	
Syngonium sp.	nephthys	Nat	
Xanthosoma robustum Schott	*'ape*	Nat	
ARECACEAE			
Chrysalidocarpus lutescens (Bory) Wendl.	golden-fruited palm	Nat	
Cocos nucifera L.	*niu*, coconut palm	**Pol**	
Latania loddigesii Martius	blue latan	Orn	
Pritchardia sp.	*loulu*	**End**	<1,3>
Ptychosperma macarthuri (Wendl.) Nichols	MacArthur palm	Orn	
Roystonia regia (Kunth) O. F. Cook	royal palm	Orn	
CANNACEAE			
Canna indica L.	Indian shot	Orn	
COMMELINACEAE			
Commelina diffusa Burm. f.	day flower	Nat	
Dichorisandra thyrsiflora Mikan	blue ginger	Orn	
Tradescantia spathacea Swartz	moses-in-the-boat	Orn	
CYPERACEAE			
Cyperus gracilis R. Br.	McCoy grass	Nat	

Table 1 continued

SPECIES	Common Name	Status	Notes
CYPERACEAE (continued)			
Cyperus involuratus Rottb.	umbrella sedge	Nat	
Cyperus polystachyos Rottb	---	**Ind**	
Fimbristylis dichotoma (L.) Vahl	fimbry	**Ind**	
Kyllinga brevifolia Rottb.	*kili'o'opu*	Nat	
Kyllinga nemoralis (Forst.) Dandy ex Hutch. & Dalz.	*kili'o'opu*	Nat	
HELICONIACEAE			
Heliconia sp.	heliconia	Orn	<3>
LILIACEAE			
Asparagus densiflorus (Kunth) Jessop	asparagus fern	Orn	
Dianella sandwicensis Hook. & Arnott	*'uki'uki*	**Ind**	<1>
MUSACEAE			
Musa hybrid	banana	**Pol**	<1>
PANDANACEAE			
Pandanus tectorius S. Parkinson ex Z.	*hala*	**Ind**	<1>
POACEAE (GRAMINEAE)			
Axonopus compressus (Swartz) P. Beauv.	brd-lvd. carpet grass	Nat	
Axonopis fisifolius (Raddi) Kuhlm.	nrw-lvd. carpet grass	Nat	
Bambusa vulgaris J.C. Wendl.	giant bamboo	Nat	
Bothriochloa pertusa (L.) A. Camus	pitted beardgrass	Nat	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	
Chloris virgata Sw.	feather finger grass	Nat	
Coix lachryma-jobi L.	Job's tears	Nat	
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	
Dactyloctenium aegyptium (L.) Willd.	beach wiregrass	Nat	
Digitaria ciliaris (Retz.) Koeler	Henry's crabgrass	Nat	
Digitaria insularis (L.) Mez ex Ekman	sourgrass	Nat	
Echinochloa colona (L.) Link	jungle rice	Nat	
Eleusine indica (L.) Gartn.	wiregrass	Nat	
Eragrostis pectinacea (Michx.) Nees	Carolina lovegrass	Nat	
Paspalum conjugatum Bergius	Hilo grass	Nat	
Paspalum fimbriatum Kunth	Panama paspalum	Nat	
Pennisetum purpureum (L.) Schult.	elephant grass	Nat	
Sporobolus cf. *indicus* (L.) R.Br.	Indian dropseed	Nat	
Setaria parviflora (Poir.) Kerguelen	yellow foxtail	Nat	
Urochloa maxima (Jacq.) Webster	Guinea grass	Nat	
Urochloa mutica (Forssk.) Nguyen	para grass	Nat	
Zoysia matrella (L.) Merr.	Mascarene grass	Nat	

Legend to Table 1:

Status = distributional status

End =endemic; native to Hawai'i and found naturally nowhere else.

Ind = indigenous; native to Hawai'i, but not unique to the Hawaiian Islands.

Table 1 (continued)

Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.
Orn = ornamental; a non-native planted as a landscape element and not naturalized.

Notes:
<1> - native species planted as an ornamental at this location.
<2> - found in the forest border at this location.
<3> - plant lacking flower or fruit; identification uncertain.

A total of 138 species is listed as growing in the survey area. A few, mostly trees, could not be identified as these were lacking fruit or flower and not familiar to the botanist. Considering the diverse history of plantings on the site, it would require several revisits to these not yet identified plants to put a name on them. All are likely to be ornamentals.

The ratio of native plants to non-native ones (as a percent of the total number of species recorded) was 14 percent native (Ind or End) and 19 percent native or early Polynesian (Pol) introductions. Although the percentage of "natives" is high compared with most lowland areas on O'ahu, these plants are mostly common species and mostly planted (landscape) specimens (note <1>). Perhaps 7 (5 percent) native and early Polynesian species are plants naturalized on the property; these seven are mostly small and generally common herbaceous species. All of the endemics are planted specimens (note <1>).

Avian Survey

A total of 225 individual birds of 20 species, representing 16 separate families, were recorded during point counts. No additional species were detected on the site while transiting between stations or inspecting the remainder of the site. All but one of the 20 avian species detected are alien to the Hawaiian Islands (Table 2). A lone White-tailed Tropicbird (*Phaeton Lepturus*) was seen soaring over the site. No avian species currently listed or proposed for listing under either the federal of State of Hawaii endangered species statutes were recorded during the coursed of this survey (Table 2).

Avian diversity and densities were in keeping with the location and the eclectic mix of vegetation present on the site. Three species, Common Waxbill (*Estrilda astrild*), Red-vented Bulbul (*Pycnonotus jocosus*), and Rose-ringed Parrot (*Psittacula krameri*), accounted for 58 percent of the total number of birds recorded. Common Waxbill was the most commonly tallied species, and accounted for 26 percent of the birds recorded during point counts. An average of 56 birds were recorded per station count, which is a relatively high number and reflects the diverse habitat available on and adjacent to the site.

Table 2 – Avian Species Detected During Point Counts DOFAW Makiki Base Yard			
Common Name	***Scientific Name***	***ST***	***RA***
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Domestic Chicken	*Gallus ?*	D	3.75
	PHAETHONIFORMES		
	PHAETHONTIDAE - Tropicbirds		
White-tailed Tropicbird	*Phaethon lepturus*	Ib	0.25
	ARDEIDAE - Herons, Bitterns & Allies		
Cattle Egret	*Bubulcus ibis*	A	0.25
	COLUMBIFORMES		
	COLUMBIDAE – Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	A	1.75
Zebra Dove	*Geopelia striata*	A	7.25
	PSITTACIFORMES		
	PSITTACIDAE - Lories Parakeets, Macaws & Parrots		
	Psittacinae - Typical Parrots		
Rose-ringed Parakeet	*Psittacula krameri*	A	8.00
	PASSERIFORMES		
	PYCNONOTIDAE - Bulbuls		
Red-whiskered Bulbul	*Pycnonotus jocosus*	A	1.75
Red-vented Bulbul	*Pycnonotus cafer*	A	10.25
	CETTIIDAE - Cettia Warblers & Allies		
Japanese Bush-Warbler	*Cettia diphone*	A	0.25
	ZOSTEROPIDAE - White-eyes		
Japanese White-eye	*Zosterops japonicus*	A	4.50
	TIMALIIDAE - Babblers		
Red-billed Leiothrix	*Leiothrix lutea*	A	2.25
	TURDIDAE - Thrushes		
White-rumped Shama	*Copsychus malabaricus*	A	2.00
	STURNIDAE – Starlings		
Common Myna	*Acridotheres tristis*	A	3.75
	THRAUPIDAE - Tanagers		
Red-crested Cardinal	*Paroaria coronata*	A	2.00

Table 2 continued

Common Name	*Scientific Name*	ST	RA
	CARDINALIDAE - Cardinals Saltators & Allies		
Northern Cardinal	*Cardinalis cardinalis*	A	3.25
	FRINGILLIDAE – Fringilline and Carduleline Finches & Allies		
	Carduelinae – Carduline Finches		
House Finch	*Haemorhous mexicanus*	A	4.50
Yellow-fronted Canary	*Serinus mozambicus*	A	0.50
	PASSERIDAE - Old World Sparrows		
House Sparrow	*Passer domesticus*	A	0.50
	ESTRILDIDAE – Estrildid Finches		
Common Waxbill	*Estrilda astrild*	A	14.50
Scaly-breasted Munia	*Lonchura punctulata*	A	1.75

Legend to table 2

ST = Status
D = Domestic – human assisted species, not currently listed as being established in the wild by the Hawaii Bird Record Committee
A = Alien – Introduced to the Hawaiian Islands by humans
RA = Relative Abundance - Number of birds detected divided by the number of point counts (~4)

Mammalian Survey

Three terrestrial mammalian species were detected during the course of this survey. One small Indian mongoose (*Herpestes auropunctatus*) were seen close to the dumpster within the base yard. Several dogs (*Canis familiaris*), all on leashes were seen between the lower base yard gate and the bottom gate. Two cats (*Felis catus*) were also seen in that area.

No mammalian species currently proposed for listing or listed under either the federal or State of Hawaiʻi endangered species statutes was recorded on this site (DLNR 1998; USFWS, 2014).

Discussion

Botanical Resources

Clearly, the Makiki Base Yard property has a number of botanical resources of value, including native species and perhaps unusual if not rare non-native botanical specimens. Two or possibly three of the natives observed are listed species (see below). Other larger trees could be considered valuable landscape elements. No trees are listed for the DLNR Makiki Base Yard in the City & County of Honolulu, Exceptional Trees Program (C&C, 2014).

Avian Resources

The findings of the avian survey are consistent with the current habitat within the base yard. During the course of this survey 20 avian species, were recorded. All but one of these is an alien species. The lone native species detected, White-tailed Tropicbird was seen soaring high over the site. This seabird species is an indigenous breeding species seen throughout the Hawaiian Islands. There is no habitat present on or immediately adjacent to he base yard suitable as nesting habitat for this or any other resident seabird species know from the Island of Oʻahu. No avian species currently listed or proposed for listing under either the federal of State of Hawaii endangered species statutes were recorded during the coursed of this survey (Table 2).

Although not detected and not expected on the site two seabird species, Wedge-tailed Shearwater (*Puffinus pacificus*) and Newell's Shearwater (*Puffinus auricularis newelli*) have been downed on Oʻahu due to light attraction during the annual seabird fledging season. The primary cause of mortality in resident seabirds is thought to be predation by alien mammalian species at the nesting colonies (USFWS 1983; Simons and Hodges 1998; Ainley *et al.,* 2001). Collision with man-made structures is considered to be the second most significant cause of mortality in locally nesting seabird species in Hawaiʻi. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. When disoriented, seabirds often collide with manmade structures, and if they are not killed outright, the dazed or injured birds are easy targets of opportunity for feral mammals (Hadley 1961; Telfer 1979; Sincock 1981; Reed *et al*., 1985; Telfer *et al*., 1987; Cooper and Day, 1998; Podolsky *et al*. 1998; Ainley *et al.*, 2001; Hue *et al.*, 2001; Day *et al* 2003).

Mammalian Resources

The findings of the mammalian survey are consistent with the current habitat present on the site. All of the mammalian species detected are alien species.

Although no rodents were detected during the course of this survey, it is likely that one or more of the four established alien Murid*ae* found on Oʻahu, roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), European house mouse (*Mus musculus domesticus*) and possibly black rats (*Rattus exulans hawaiiensis*) use various resources found within the general project area on a seasonal basis. These human commensal species are drawn to areas of human habitation and activity. All of these introduced rodents are deleterious to native ecosystems and the native faunal species dependent on them.

No Hawaiian hoary bats were detected during the course of this survey. It is only in recent years that this species is being recorded on a regular basis on the Island of Oʻahu. It is within the realm of possibility that this species may use resources within the project area on a seasonal basis. There is dense woody vegetation on and adjacent to the site that is suitable for bat roosting (USFWS, 1998; David, 2014, Michelle Bogardus, 2014 pers. comm.).

Potential Impacts to Protected Species

Botanical

Hibiscus clayi is an endangered species (USFWS, 1994) found naturally only on Kauaʻi. It has been planted in the decorative border fronting the main office building (visible in Figure 7) and one of each of these native red hibiscus are planted beside the entrance driveway to the Hawaii Nature Center. However, the fact that these are obviously landscape plantings on an island where the species are not known to occur in the wild does not change the protected status of the plants present in the DLNR Makiki Base Yard. We understand that no changes are contemplated for these particular locations.

Natives palms of the genus *Pritchardia* (*loulu*) may also be listed as threatened or endangered. Twenty-four species of *loulu* are described from the Hawaiian Islands (Hodel, 2012), most distributed on but a single island. Eight are presently listed as endangered (including one candidate species). Most are considered "species of concern". The *loulu* growing in the survey area is within a grove of other planted natives located in an area designated to become a drainage basin (Figure 6) downslope of Bldg. 13. This palm tree would need to be identified before establishing whether it can be moved or cut down, if not to be retained where it presently is located.

Seabirds

The principal potential impact that the construction of the project poses to protected seabirds is the increased threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main areas that outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction, if it is deemed expedient, or necessary to conduct nighttime construction activities, 2) following build-out, the potential use of streetlights or other exterior lighting during the seabird nesting season. It should be borne in mind that there are currently no documented records of any species of seabirds being downed in the general area of the base yard, so any such possibility of such a light attraction is likely to be remote.

Hawaiian hoary bat

The principal potential impact that construction of the base yard improvements poses to bats is during the clearing and grubbing phase of the construction. The trimming or removal of foliage and/or trees within the construction area may temporarily displace individual bats, which may use the vegetation as a roosting location. As bats use multiple roosts within their home territories, the potential disturbance resulting from the removal of the vegetation is likely to be minimal. During the pupping season female carrying their pups may be less able to rapidly vacate a roost site as the vegetation is cleared, additionally adult female bats sometimes leave their pups in the roost tree while they themselves forage, very small pups may be unable to flee a tree that is being felled. Potential adverse effects from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 meters (15-feet), between June 1 and September 15, the period in which bats are potentially at risk from vegetation clearing.

Recommendations

- If nighttime construction activity or equipment maintenance is proposed during the construction phases of the project, all associated lights should be shielded, and when large flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground.

- If streetlights or exterior facility lighting is installed in conjunction with the project, it is recommended that the lights be shielded to reduce the potential for interactions of nocturnally flying seabirds with external lights and man-made structures (Reed et al., 1985; Telfer et al., 1987).

- It is recommended that, where appropriate and practicable, native plant species should be used in landscaping efforts. Not only is this ecologically prudent, but also will likely save maintenance and watering costs over the long term.

- Establish clearly the fate of the actual and potential listed plant species identified in the survey.

Critical Habitat

There is no federally delineated Critical Habitat present on or adjacent to the property. Thus the further development and operation of DOFAW Makiki Base Yard will not result in impacts to federally designated Critical Habitat. There is no equivalent statute under state law.

Glossary

Alien – Introduced to Hawaiʻi by humans
Domesticated – Feral species, not considered established in the wild on the Island of Oʻahu by the Hawaii Bird Records Committee (HBRC)
Endangered – Listed and protected under the Endangered Species Act of 1973, as amended (ESA) as an endangered species
Endemic – Native to the Hawaiian Islands and unique to Hawaiʻi
Indigenous – Native to the Hawaiian Islands, but also found elsewhere naturally
*Maka*i – Down-slope, towards the ocean
Mauka – Upslope, towards the mountains
Muridae – Rodents, including rats, mice and voles, one of the most diverse families of mammals
Naturalized – A plant or animal that has become established in an area that it is not native to
Nocturnal – Night-time, after dark
ʻŌpeʻapeʻa – Endemic endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*)
Pelagic – An animal that spends its life at sea – in this case seabirds that only return to land to nest and rear their young
Phylogenetic – The evolutionary order that organisms are arranged by
Ruderal – Disturbed, rocky, rubbishy areas, such as old agricultural fields and rock piles
Sign – Biological term referring tracks, scat, rubbing, odor, marks, nests, and other signs created by animals by which their presence may be detected
Threatened – Listed and protected under the ESA as a threatened species

DLNR – Hawaiʻi State Department of Land & Natural Resources
DOFAW – Division of Forestry and Wildlife
ESA – Endangered Species Act of 1973, as amended
HBRC – Hawaii Bird Records Committee
USFWS – United State Fish & Wildlife Service

Literature Cited

Ainley, D. G, R. Podolsky, L. Deforest, G. Spencer, and N. Nur. 2001. The Status and Population Trends of the Newell's Shearwater on Kaua'i: Insights from Modeling, *in*: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Studies in Avian Biology No. 22: Cooper's Ornithological Society, Allen Press, Lawrence, Kansas. (Pg. 108-123).

American Ornithologist's Union. 1998. *Check-list of North American Birds*. 7th edition. AOU. Washington D.C. 829pp.

______. 2000. Forty-second supplement to the American Ornithologist's Union *Check-list of North American Birds*. The Auk 117:847-858.

Banks, R. C., C. Cicero, J. L. Dunn, A. W. Kratter, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2002. Forty-third supplement to the American Ornithologist's Union *Check-list of North American Birds*. The Auk 119:897-906.

______. 2003 Forty-fourth supplement to the American Ornithologist's Union *Check-list of North American Birds*. The Auk 120:923-931.

______. 2004 Forty-fifth supplement to the American Ornithologist's Union *Check-list of North American Birds*. The Auk 121:985-995.

______. 2005 Forty-sixth supplement to the American Ornithologist's Union *Check-list of North American Birds*. The Auk 122:1026-1031.

______. 2006 Forty-seventh supplement to the American Ornithologist's Union *Check-list of North American Birds*. The Auk 123:926-936.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz. 2007 Forty-eighth supplement to the American Ornithologist Union *Check-list of North American Birds*. The Auk 124:1109-1115.

Banks, R. C., C. R. Terry Chesser, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2008 Forty-ninth supplement to the American Ornithologist Union *Check-list of North American Birds*. The Auk 125:758-768.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2009. Fiftieth supplement to the American Ornithologist Union *Check-list of North American Birds*. The Auk 126:1-10.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, and D. F. Stotz, and K. Winker. 2010. Fifty-first supplement to the American Ornithologist Union *Check-list of North American*

Birds. The Auk, 127: 726-744.

_____.2011. Fifty-second supplement to the American Ornithologist Union *Check-list of North American Birds*. The Auk 128:600-613.

_______. 2012. Fifty-third supplement to the American Ornithologist Union *Check-list of North American Birds*. The Auk 129:573-588.

_____. 2013. Fifty-fourth supplement to the American Ornithologist Union *Check-list of North American Birds*. The Auk 130: 558:571.

Chesser, R. T., R. C. Banks, F. K. Barker, C. Cicero, J. L. Dunn, A. W. Kratter, I. J. Lovette, A. G. Navarro-Sigüenza, P. C. Rasmussen, J. V. Remsen, Jr., J. D. Rising, D. F. Stotz, and K. Winker. 2014. Fifty-fifth supplement to the American Ornithologist Union Check-list of North American Birds. The Auk, Ornithological Advances, 131: CSi-CSxv.

City and County of Honolulu (C&C). 2014. Exceptional Tree Program (website). Available online at URL: http://www1.honolulu.gov/parks/exceptionaltrees.htm; last visited on September 29, 2014.

Cooper, B. A and R. H. Day. 1998. Summer Behavior and Mortality of Dark-rumped Petrels and Newells' Shearwaters at Power Lines on Kauai. Colonial Waterbirds, 21 (1): 11-19.

Day, R. H., B. Cooper, and T. C. Telfer. 2003. Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii. The The Auk 120: 669-679.

David, R. E. 2011. Unpublished field notes – Oʻahu 1980 - 2011.

Department of Land and Natural Resources (DLNR). 1998. Indigenous Wildlife, Endangered And Threatened Wildlife And Plants, And Introduced Wild Birds. Department of Land and Natural Resources. State of Hawaii. Administrative Rule §13-134-1 through §13-134-10, dated March 02, 1998.

flickr. 2014. Series of photos of lower Makiki Valley from Michael Thomas, U. H. Museum. Available at URL: https://www.flickr.com/photos/uhmuseum/7151375607/in/photostream/; visited September 26, 2014

Giambelluca TW, Chen Q, Frazier AG, Price JP, Chen Y-L, Chu P-S, Eischeid J., and Delparte, D. 2011. "The Rainfall Atlas of Hawaiʻi." <http://rainfall.geography.hawaii.edu>.

Hadley, T. H. 1961. Shearwater calamity on Kauai. Elepaio 21:60.

Hodel, D. R. 2012. *Loulu. The Hawaiian Palm*. University of Hawaiʻi Press, Honolulu. 190 pp.

Hue, D., C. Glidden, J. Lippert, L. Schnell, J. MacIvor and J. Meisler. 2001. Habitat Use and Limiting Factors in a Population of Hawaiian Dark-rumped Petrels on Mauna Loa, Hawaiʻi. , *in:* : Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology,* *Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna*. Studies in Avian Biology No. 22. Cooper's Ornithological Society, Allen Press, Lawrence, Kansas (Pg. 234-242).

Imada, Clyde T. 2012. Hawaiian Native and Naturalized Vascular Plants Checklist (December 2012 update). Bishop Museum Tech. Rept. 60. 380 pp.

Judd, C. S. 1920. "The Makiki Nursery". *The Hawaiian Forester and Agriculturist*, 17(4): 124-6.

National Oceanographic and Atmospheric Administration (NOAA). 2014. Standardized Precipitation Index (SPI) Page. National Weather Service Forecast Office, Honolulu, HI. At URL: http://www.prh.noaa.gov/hnl/hydro/pages/spi_web_page.php; visited on September 26, 2014.

Podolsky, R., D.G. Ainley, G. Spencer, L. de Forest, and N. Nur. 1998. "Mortality of Newell's Shearwaters Caused by Collisions with Urban Structures on Kaua'i". Colonial Waterbirds 21:20-34.

Pukui , M. K., S. H. Elbert, and E. T. Mookini 1976. *Place Names of Hawaii*. University of Hawaii Press. Honolulu, Hawai'i. 289 pp.

Reed, J. R., J. L Sincock, and J. P. Hailman 1985. Light Attraction in Endangered Procellariform Birds: Reduction by Shielding Upward Radiation. The Auk 102: 377-383.

Simons, T. R., and C. N. Hodges. 1998. Dark-rumped Petrel (*Pterodroma phaeopygia*). *In* A. Poole and F. Gill (editors). The Birds of North America, No. 345. The Academy of Natural Sciences, Philadelphia, PA. and the American Ornithologists Union, Washington, D.C.

Sincock, J. L. 1981. Saving the Newell's Shearwater. Pages 76-78 in Proceedings of the Hawaii Forestry and Wildllife Conference, 2-4 October 1980. Department of Land and Natural Resources, State of Hawaii, Honolulu.

Staples, G. W. and D. R. Herbst. 2005. *A Tropical Garden Flora. Plants Cultivated in the Hawaiian Islands and other Tropical Places.* Bishop Museum, Honolulu. 908 pp.

Telfer, T. C. 1979. Successful Newell's Shearwater Salvage on Kauai. 'Elepaio 39:71

Telfer, T. C. , J. L. Sincock, G. V. Byrd, and J. R. Reed. 1987. Attraction of Hawaiian seabirds to lights: Conservation efforts and effects of moon phase. Wildlife Society Bulletin 15:406-413.

U.S. Fish & Wildlife Service (USFWS) 1988. Recovery Plan for the Hawaiian Hoary Bat. U.S. Fish & Wildlife Service, Portland, Oregon.

______. 1994. Endangered and Threatened Wildlife and Plants. Determination of Endangered and Threatened Status for 24 from the Island of Kauai, Hi. Federal Register, 59: 9304-9329.

______. 2005a. Endangered and Threatened Wildlife and Plants. 50CFR 17:11 and 17:12 (Tuesday, November 1, 2005).

______. 2005b. 50 CFR 17. Endangered and Threatened Wildlife and Plants. Review of Species That Are Candidates or Proposed for Listing as Endangered or Threatened; Annual Notice of Findings on Resubmitted Petition; Annual Description of Progress on Listing Actions. Federal Register, 70 No. 90 (Wednesday, May 11, 2005): 24870-24934.

______. 2013. USFWS Threatened and Endangered Species System (TESS), online at http://ecos.fws.gov/tess_public/StartTESS.do Last accessed on September 27, 2013.

U.S. Geological Service (USGS). 2014. Pacific Islands Water Science Center. Online at URL: http://hi.water.usgs.gov/recent/hawaii/; visited September 26, 2014.

Wagner, W.L., D. R. Herbst, and S.H. Sohmer. 1990. *Manual of the Flowering Plants of Hawaiʻi*. University of Hawaii Press, Honolulu, Hawaii 1854 pp.

Wagner, W.L., and D. R. Herbst. 1999. *Supplement to the Manual of the flowering plants of Hawaiʻi*, pp. 1855-1918. *In:* Wagner, W.L., D.R. Herbst, and S.H. Sohmer, Manual of the flowering plants of Hawaiʻi. Revised edition. 2 vols. University of Hawaii Press and Bishop Museum Press, Honolulu.

Wilson, D.E., and D. M. Reeder, (Editors), 2005. *Mammal species of the world: a taxonomic and geographic reference.* 3rd edition. 2 vols. John Hopkins University Press. Baltimore, Maryland. 2142 pp.

APPENDIX E

Traffic Impact Analysis Report Division of Forestry & Wildlife Makiki Baseyard
(November, 2015)

Prepared by: Austin, Tsutsumi, & Associates, Inc.

TRAFFIC IMPACT ANALYSIS REPORT
DIVISION OF FORESTRY & WILDLIFE
MAKIKI BASEYARD

Makiki, Oahu, Hawaii

FINAL

November 16, 2015

Prepared for:

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TRAFFIC IMPACT ANALYSIS REPORT
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November 16, 2015

TABLE OF CONTENTS

Page

TABLE OF CONTENTS
Cont'd

TABLES

FIGURES

TABLE OF CONTENTS
Cont'd

APPENDICES

AUSTIN, TSUTSUMI & ASSOCIATES, INC. CIVIL ENGINEERS • SURVEYORS
CONTINUING THE ENGINEERING PRACTICE FOUNDED BY H. A. R. AUSTIN IN 1934

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TRAFFIC IMPACT ANALYSIS REPORT
DIVISION OF FORESTRY AND WILDLIFE MAKIKI BASEYARD
Makiki, Oahu, Hawai'i

1. INTRODUCTION

This report documents the findings of a traffic study conducted by Austin, Tsutsumi & Associates, Inc. (ATA) to evaluate the potential traffic impacts resulting from the proposed Division of Forestry and Wildlife (DOFAW) Makiki Baseyard Improvements (hereinafter referred to as the "Project").

1.1 Location

The Project will be located on the existing DOFAW Makiki Baseyard site. The Project is located in the Makiki neighborhood of Honolulu on the island of Oahu on approximately 3.05 acres of land more specifically identified as a portion of TMKs: (1) 2-5-019:portion of 008. The Project site is located in the mauka portion of the Makiki neighborhood; off of Makiki Heights Drive, on land owned by the State of Hawaii. Figure 1.1 shows the Project location.

1.2 Project Description

The existing Project site currently provides office space, support structures (i.e. vehicle storage canopy and shed, work shed, etc.), and two green houses. Improvements and renovations for the Project is anticipated to be completed by Year 2026. Upon completion, the Project proposes to expand the office space from 6,000 square feet (SF) to approximately 23,000 SF. Additionally, the Project proposes to renovate and expand support spaces.

The Project assumed no additional traffic increases from the support space but anticipates an overall increase of 24 employees at the Makiki Baseyard, from its existing 30 employees to 54 employees by Year 2026. Figure 1.2 shows the Project site plan.

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HONOLULU, HAWAII
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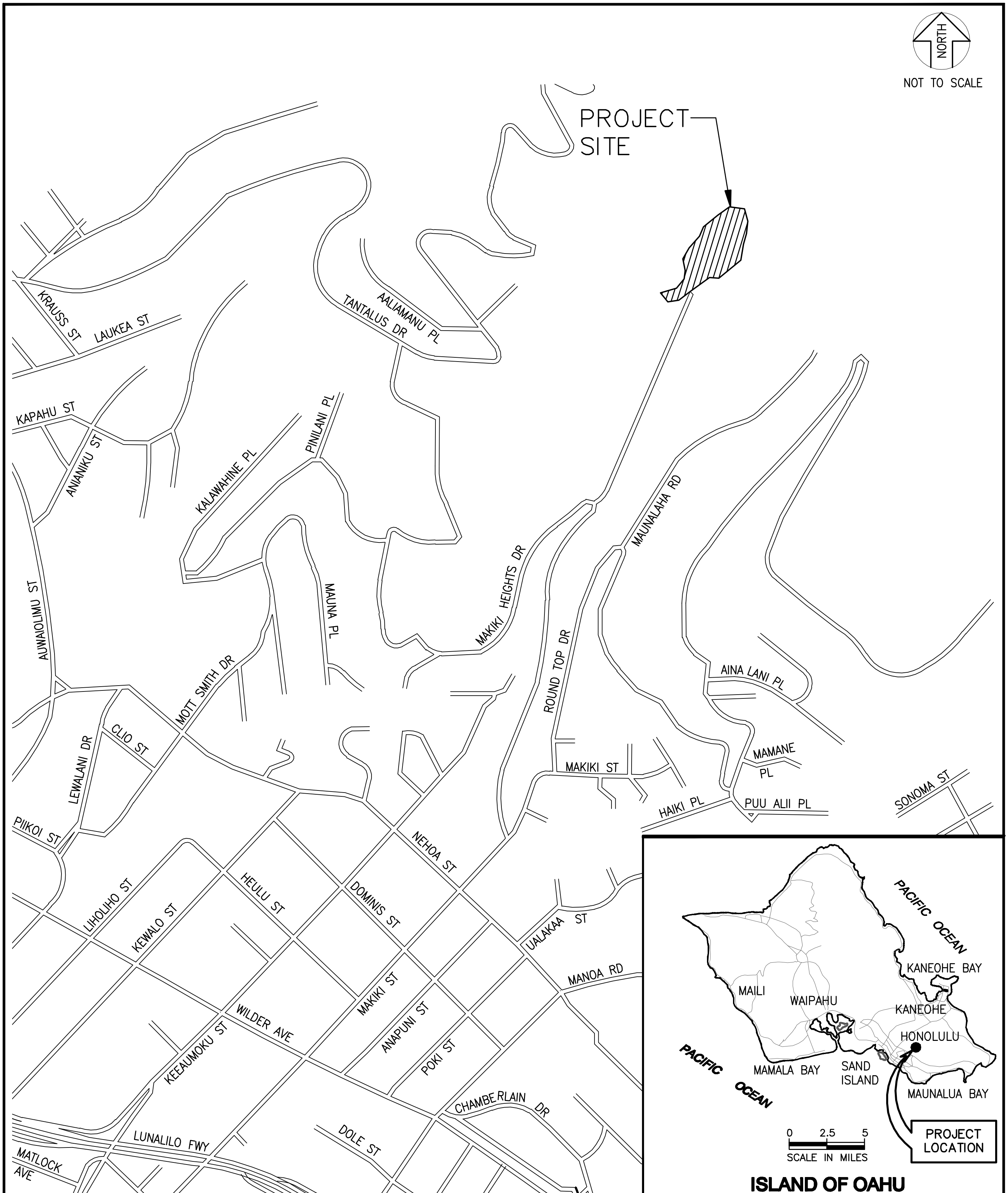
HILO, HAWAII

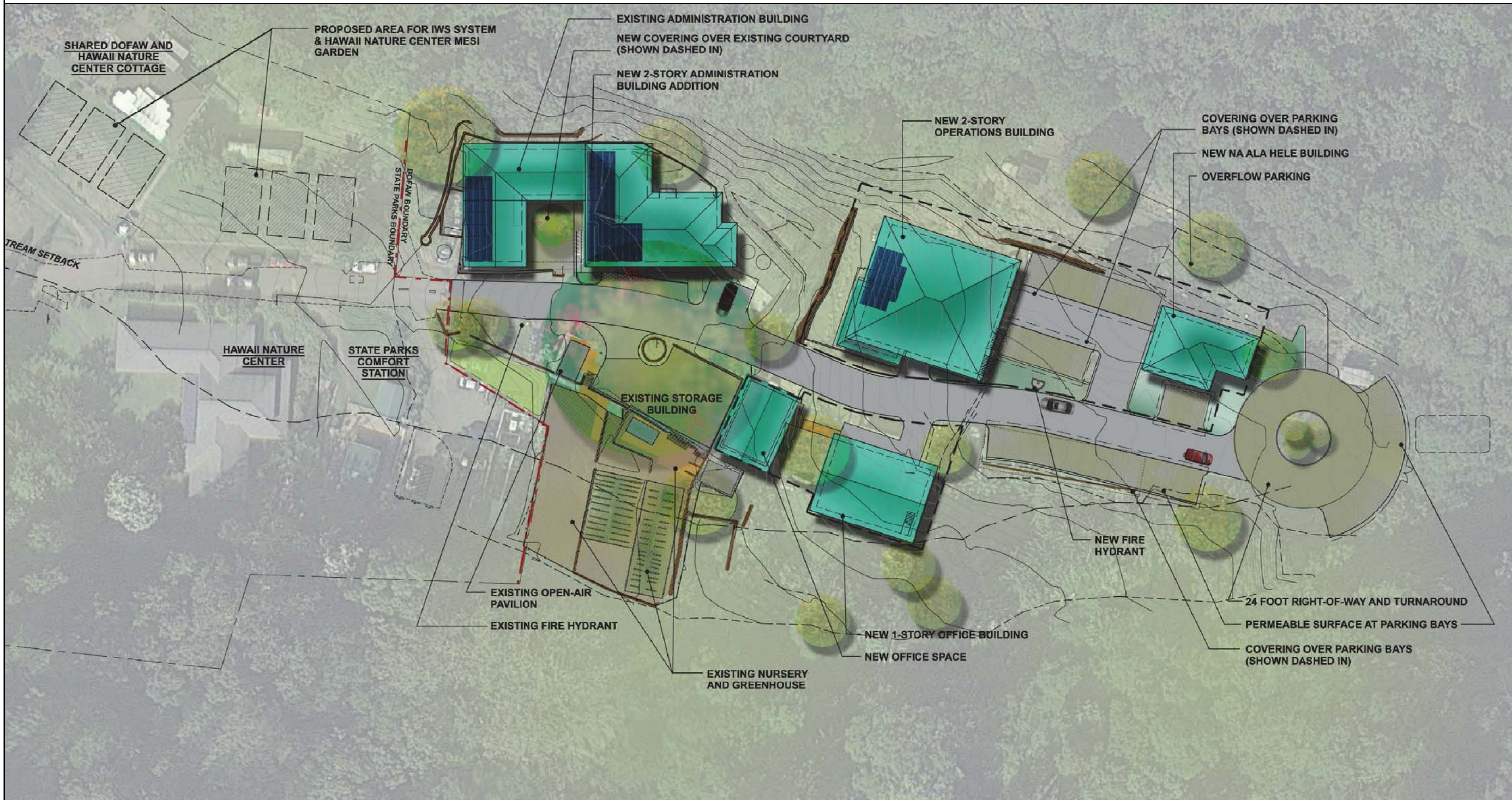


DOFAW MAKIKI BASEYARD

AUSTIN, TSUTSUMI & ASSOCIATES, INC.
ENGINEERS, SURVEYORS • HONOLULU, HAWAII

PROJECT LOCATION

FIGURE
1.1



DOFAW MAKIKI BASEYARD	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII PROJECT SITE PLAN	FIGURE 1.2

2. STUDY METHODOLOGY

Level of Service (LOS) is a qualitative measure used to describe the conditions of traffic flow at intersections, with values ranging from free-flow conditions at LOS A to congested conditions at LOS F. The Highway Capacity Manual (HCM), dated 2010, methodology for calculating volume to capacity ratios, delays and corresponding Levels of Service was utilized in this study. LOS definitions for signalized and unsignalized intersections are provided in Appendix B.

2.1 Intersection Analysis

For applicable intersections shown in Section 2.2, intersection analysis was performed using the traffic analysis software Synchro, which prepares Highway Capacity Manual (HCM) reports. The reports contain quantitative delay results, as based on intersection lane geometry, signal timing (including coordination and actuated minimums and maximums), and hourly traffic volume.

Based on the vehicular delay, reserve capacity and critical gaps at the intersection, a LOS is assigned (see Appendix B) as a qualitative measure of performance. These results constitute the technical analysis that will form the basis of the recommendations outlined in this report.

2.2 Study Area Intersection Analysis

Intersection analysis within the study area was performed on the following intersections based on their proximity to the Project:

- DOFAW Access Road/Makiki Heights Drive
- Makiki Heights Drive/Makiki Street
- Makiki Street/Nehoa Street

3. EXISTING TRAFFIC CONDITIONS

The existing conditions scenario represents the traffic conditions within the study area as it currently stands, without the Project.

3.1 Roadway Network

DOFAW Access Road is generally a north-south, two-way, undivided access road. This roadway also provides access to the Halau Ku Mana Charter School, the Hawaii Nature Center, Makiki Valley State Recreation Area, and DOFAW Makiki Baseyard. A public parking lot for the Na Ala Hele trail system and the Hawaii Nature Center is located approximately 350 feet mauka of Makiki Heights Drive, with a gate restricting vehicular access beyond that point to local residents and DOFAW employees.

Makiki Heights Drive is generally a winding, two-way, undivided local hillside roadway which provides access to residential areas. Makiki Heights Drive begins south of the Project at its intersection with Makiki Street and proceeds to wind uphill along the Ewa side of Makiki Valley until its terminus at Tantalus Drive. The posted speed limit is generally 25 miles per hour (mph).

Makiki Street is generally a north-south, two-lane, undivided local roadway providing access to residential areas and Hanahauoli School. This roadway begins to the north at its intersection with Makiki Place and terminates as a dead end street, south of Wilder Avenue. The posted speed limit is generally 25 mph.

Nehoa Street is generally an east-west, two-way, undivided collector roadway that provides a link between Manoa (intersecting with Manoa Road) and Punchbowl (terminating at Prospect Street) providing access to residential areas between Punahou School and Roosevelt High School. The posted speed limit is generally 25 mph.

3.2 Existing Traffic Volumes

The existing traffic volume data at the study intersections were collected on Thursday, September 24, 2015. Based on this traffic count data, the weekday AM peak hour of traffic was determined to be from 7:00 AM to 8:00 AM and the PM peak hour of traffic was determined to be from 3:30 PM to 4:30 PM. See the traffic count data provided in Appendix A for the existing intersections studied.

3.3 Existing Traffic Conditions Analysis and Observations

Pedestrians were observed walking along Makiki Heights Drive, during the AM peak hour of traffic, toward the DOFAW Access Road. The administrators of Halau Ku Mana Charter School mentioned that students come from all over the island of Oahu, therefore, the students utilize the City Bus and walk from various city bus stops in the vicinity to the school. Bus stops are located on Nehoa Street and Makiki Street, where sidewalks do exist, however, none exist on Makiki Heights Drive. Additionally, hikers accessing the Makiki Arboretum Trail walk up Makiki Heights Drive during the AM peak hours of traffic.

DOFAW Access Road/Makiki Heights Drive is an unsignalized two-way stop-controlled (TWSC) T-intersection with shared lanes on all approaches and the southbound DOFAW Access Road approach as the stop-controlled approach. All movements at this intersection currently operate at LOS B or better with no significant queueing observed during the AM and PM peak hours of traffic.

Makiki Heights Drive/Makiki Street is an unsignalized TWSC T-intersection with shared lanes on all approaches and the eastbound Makiki Heights Drive approach as the stop controlled approach. All movements currently operate at LOS B or better with no significant queueing observed during the AM and PM peak hours of traffic.

During the PM peak hour of traffic, the entrance to Hanahauoli School, which is located on Makiki Heights Drive near its intersection with Makiki Street, experienced queues of up to 8 vehicles along Makiki Heights Drive. These queues were observed to begin at 3:00 PM (end of school) and clear by 3:15 PM, and were not observed to occur during the PM peak hour of traffic.

Makiki Street/Nehoa Street is a signalized intersection. The Nehoa Street eastbound and westbound approaches are striped as a single left-turn/through/right-turn lane, however, due to the width of the approach, vehicles utilize the lane similar to an exclusive left-turn lane and shared through/right-turn lane. This report analyzes the east and west approaches as utilized. The south leg is provided with a shared left-turn/through lane and an exclusive right-turn lane and the north leg is provided with a shared left-turn/through/right-turn lane. All movements at this intersection currently operate at LOS D with no significant queuing observed during the AM and PM peak hours of traffic.

Existing traffic volumes, lane configuration and movement LOS are illustrated in Figure 3.1. Table 3.1 shows the existing delay, v/c ratio, and LOS for the study intersections, with the full LOS summary tables provided in Appendix C.

DATE OF COUNTS:
THURSDAY, SEPTEMBER 24, 2015

AM PEAK HOUR:
7:00 AM – 8:00 AM

PM PEAK HOUR:
3:30 PM – 4:30 PM

LEGEND

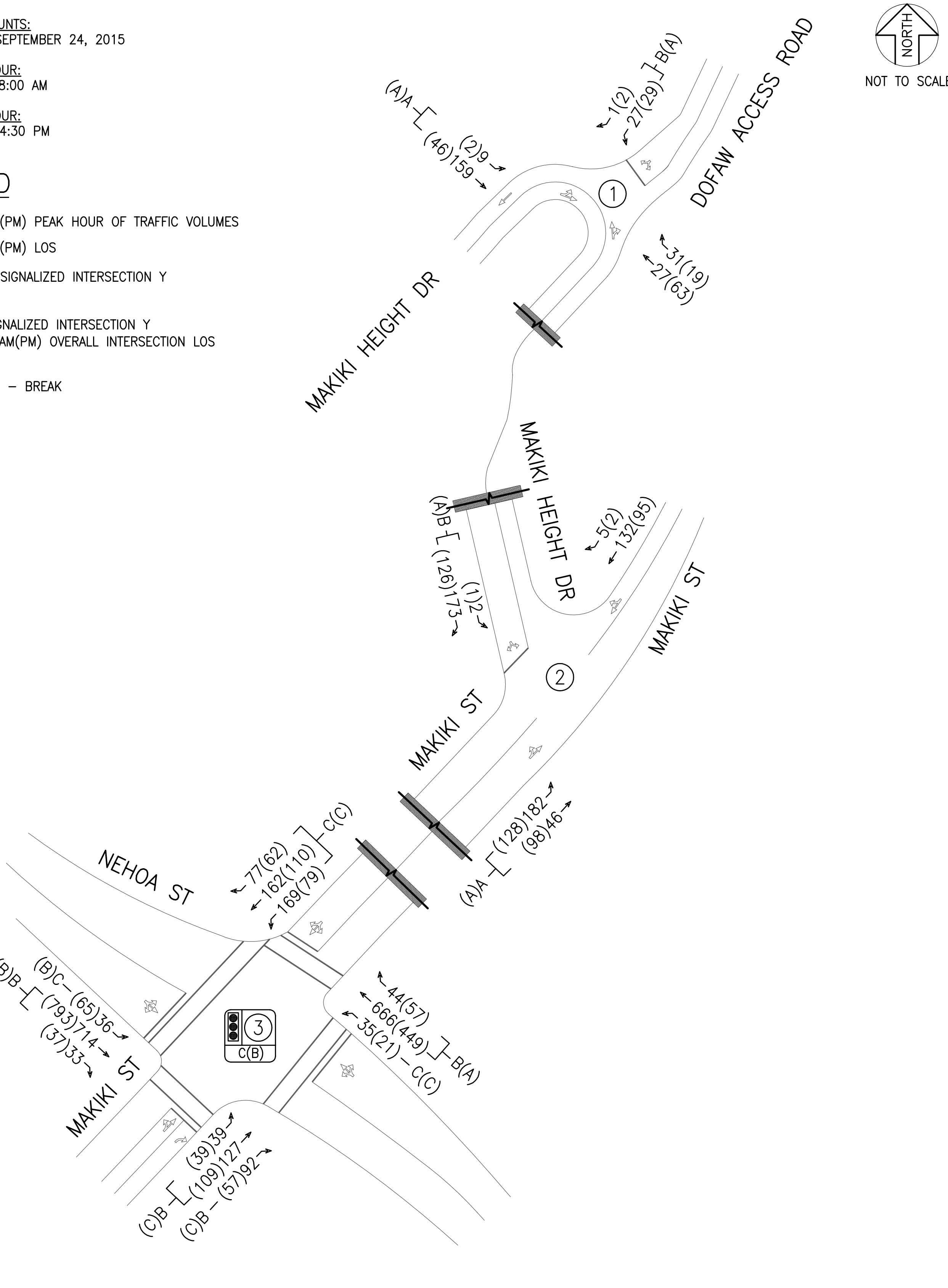
#(#) – AM(PM) PEAK HOUR OF TRAFFIC VOLUMES

A(A) – AM(PM) LOS

(Y) – UNSIGNALIZED INTERSECTION Y

(Y) A(A) – SIGNALIZED INTERSECTION Y
AM(PM) OVERALL INTERSECTION LOS

– BREAK



DOFAW MAKIKI BASEYARD	AUSTIN, TSUTSUMI & ASSOCIATES, INC. ENGINEERS, SURVEYORS • HONOLULU, HAWAII	FIGURE
	EXISTING LANE CONFIGURATION, VOL AND LOS	3.1

Table 3.1: Existing Conditions LOS

	Existing Conditions					
	AM			PM		
Intersection	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
DOFAW Access Road/Makiki Heights Drive						
EB LT/TH	7.4	0.01	A	7.4	0.00	A
WB TH/RT	0.0	0.00	A	0.0	0.00	A
SB LT/RT	10.0	0.04	B	9.3	0.04	A
Makiki Heights Drive/Makiki Street						
EB LT/RT	10.2	0.21	B	7.7	0.09	A
NB LT/TH	7.9	0.14	A	0.0	0.00	A
SB TH/RT	0.0	0.00	A	9.5	0.15	A
Makiki Street/Nehoa Street						
EB LT	22.7	0.15	C	12.7	0.15	B
EB TH/RT	18.4	0.79	B	16.7	0.80	B
WB LT	24.5	0.15	C	22.2	0.09	C
WB TH/RT	16.9	0.75	B	9.3	0.50	A
NB LT/TH	20.5	0.32	C	22.3	0.31	C
NB RT	19.2	0.21	B	20.5	0.15	C
SB LT/TH/RT	35.7	0.81	D	26.8	0.55	C
OVERALL	21.5	--	C	16.5	--	B

4. BASE YEAR 2026 TRAFFIC CONDITIONS

4.1 Defacto Growth Rate

Projections for Base Year 2026 traffic were based upon the Oahu Regional Traffic Demand Model (ORTDM). The growth rate in the vicinity of the Project was determined to be approximately 1.0 percent per year. This growth rate was applied to the existing traffic volumes.

4.2 Traffic Forecasts for Known Developments

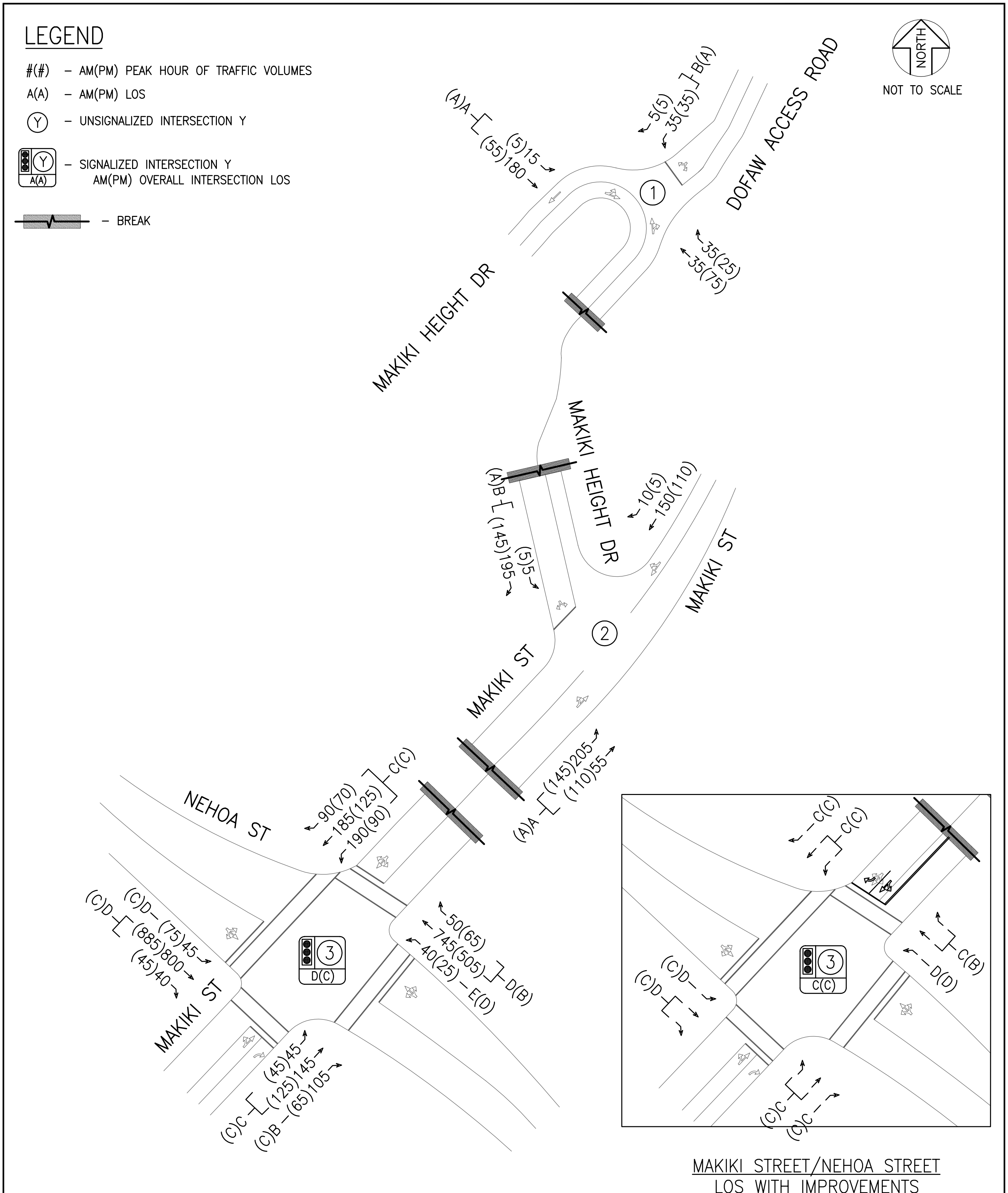
By the year 2026, the Halau Ku Mana Charter School proposes to improve their facilities, however, will does not project an increase in traffic volume. Therefore, there are no traffic forecasts as a result of other known developments in the vicinity of the Project.

4.3 Base Year 2026 Analysis

By year 2026 without the Project, all movements at the study intersections are forecast to operate at LOS D or better during AM and PM peak hours of traffic with the exception of the westbound left-turn movement at the Makiki Street/Nehoa Street intersection, which is forecast to operate at LOS E and near capacity during the AM peak hour of traffic.

To mitigate the LOS E and near capacity conditions during the AM peak hour of traffic, restriping the Makiki Street/Nehoa Street southbound approach to provide a shared left-turn/through lane and an exclusive right-turn lane, all movements are forecast to operate at LOS D or better.

Figure 4.1 illustrates the forecast traffic volumes, lane configuration, and movement LOS for Base Year 2026 conditions. Table 4.1 shows the Base Year 2026 LOS at the study intersections, with the full LOS summary tables provided in Appendix C.



DOFAW MAKIKI BASEYARD

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BASE YEAR 2026
LANE CONFIGURATION, VOL AND LOS

FIGURE 4.1

Table 4.1: Base Year Conditions LOS

Intersection	Base Year 2026						Base Year 2026 with Improvements					
	AM			PM			AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
DOFAW Access Road/Makiki Heights Drive												
EB LT/TH	7.4	0.01	A	7.4	0.00	A						
WB TH/RT	0.0	0.00	A	0.0	0.00	A						
SB LT/RT	10.3	0.06	B	9.5	0.05	A						
Makiki Heights Drive/Makiki Street												
EB LT/RT	10.7	0.26	B	9.9	0.18	A						
NB LT/TH	8.0	0.16	A	7.8	0.11	A						
SB TH/RT	0.0	0.00	A	0.0	0.00	A						
Makiki Street/Nehoa Street												
EB LT	53.6	0.42	D	22.3	0.22	C	47.2	0.34	D	22.3	0.22	C
EB TH/RT	49.2	0.99	D	34.0	0.94	C	38.5	0.94	D	34.0	0.94	C
WB LT	63.6	0.49	E	46.4	0.22	D	54.0	0.38	D	46.4	0.22	D
WB TH/RT	39.1	0.94	D	14.7	0.58	B	32.2	0.89	C	14.7	0.58	B
NB LT/TH	20.2	0.32	C	25.9	0.33	C	22.6	0.32	C	25.7	0.31	C
NB RT	18.8	0.19	B	23.5	0.14	C	21.2	0.20	C	23.5	0.14	C
SB LT/TH/RT	34.5	0.79	C	30.3	0.54	C	--	--	--	--	--	--
SB LT/TH	--	--	--	--	--	--	33.7	0.70	C	27.4	0.41	C
SB RT	--	--	--	--	--	--	20.8	0.17	C	23.6	0.15	C
OVERALL	40.0	--	D	27.1	--	C	33.6	--	C	26.6	--	C

5. FUTURE YEAR 2026 TRAFFIC CONDITIONS

The future traffic conditions scenario represents the traffic conditions within the Project study area with full build-out of the Project. According to the current Project plan, this will occur by Year 2026.

5.1 Background

As previously mentioned in Section 1.2, the Project proposes in improve and expand office space and support structures. The office space will increase from 2,424 SF to approximately 6,000 SF.

The Project assumed no additional traffic increases from the support spaces but anticipates an overall increase of 24 employees at the Makiki Baseyard, from its existing 30 employees to 54 employees by Year 2026.

5.2 Travel Demand Estimations

5.2.1 Trip Generation

The Institute of Transportation Engineers (ITE) publishes a book based on empirical data compiled from a body of more than 4,250 trip generation studies submitted by public agencies, developers, consulting firms, and associations. This publication, titled Trip Generation Manual, 9th Edition, provides trip rates and/or formulae based on graphs that correlate vehicular trips with independent variables. See Tables 5.1 and 5.2 for Trip Generation formulae and projections for the Project.

5.2.2 Trip Distribution

Trips generated by the Project were distributed throughout the study area based upon existing travel patterns within the vicinity of the Project and anticipated nearby roadway configurations. The traffic generated by the Project was added to the forecast Base Year 2026 traffic volumes within the vicinity of the Project to constitute the traffic volumes for the Future Year 2026 traffic conditions with the Project. All Project-generated trips are anticipated to access the site via Makiki Heights Drive from Makiki Street. Traffic volumes at Makiki Street/Nehoa Street were distributed based on existing traffic volumes. Figure 5.1 illustrates the Project-generated trip distribution.

Table 5.1: Project Trip Generation Rates

Land Use Type (ITE Code)	Independent Variable	AM Peak Hour		PM Peak Hour	
		Rate	% Enter	Rate	% Enter
Government Office Complex (ITE 733)	1,000 SF	2.21	89%	2.85	31%

Notes:
SF = Square Feet
Source: Institute of Transportation Engineers, Trip Generation Manual, 9th Edition

Table 5.2: New Project Generated Trips

Land Use Type (ITE Code)	Quantity	AM Peak Hour			PM Peak Hour		
		Enter	Exit	Total	Enter	Exit	Total
Government Office Building (ITE 733)	17,000 SF	34	4	38	15	34	49

5.3 Future Year 2026 Analysis

Upon completion of the Project with the roadway improvements described in section 4.3, all study intersection movements are forecast to operate with LOS similar to Base Year 2026 conditions. No roadway improvements are recommended.

Figure 5.2 illustrates the forecast traffic volumes, lane configuration, and LOS for Future Year 2026 conditions. Table 5.3 summarizes the delay, V/C, and LOS at the study intersections for the Future Year 2026 conditions. Full LOS summary tables are provided in Appendix C.

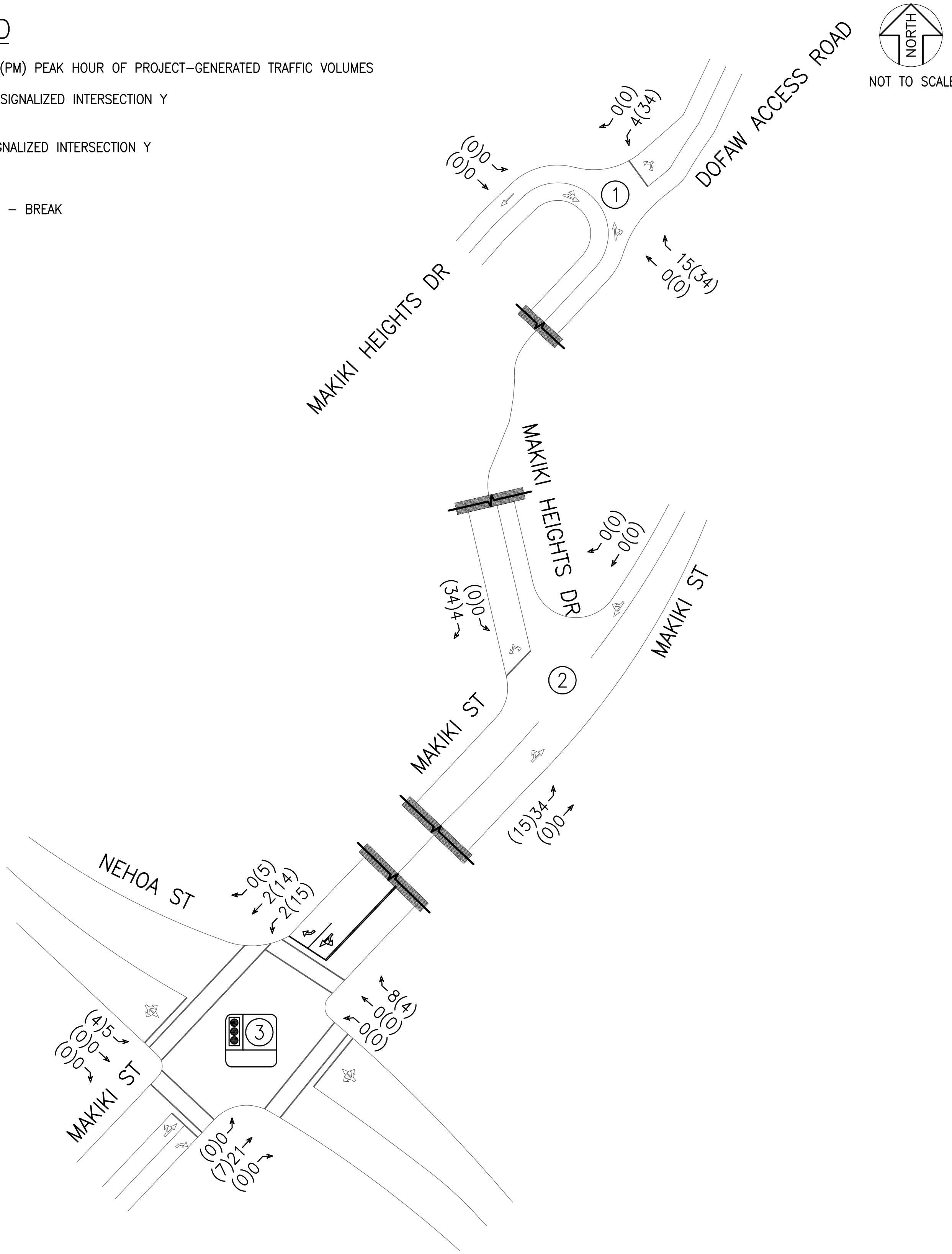
LEGEND

#(#) – AM(PM) PEAK HOUR OF PROJECT–GENERATED TRAFFIC VOLUMES

(Y) – UNSIGNALIZED INTERSECTION Y

– SIGNALIZED INTERSECTION Y

– BREAK



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ENGINEERS, SURVEYORS • HONOLULU, HAWAII

DOFAW MAKIKI BASEYARD

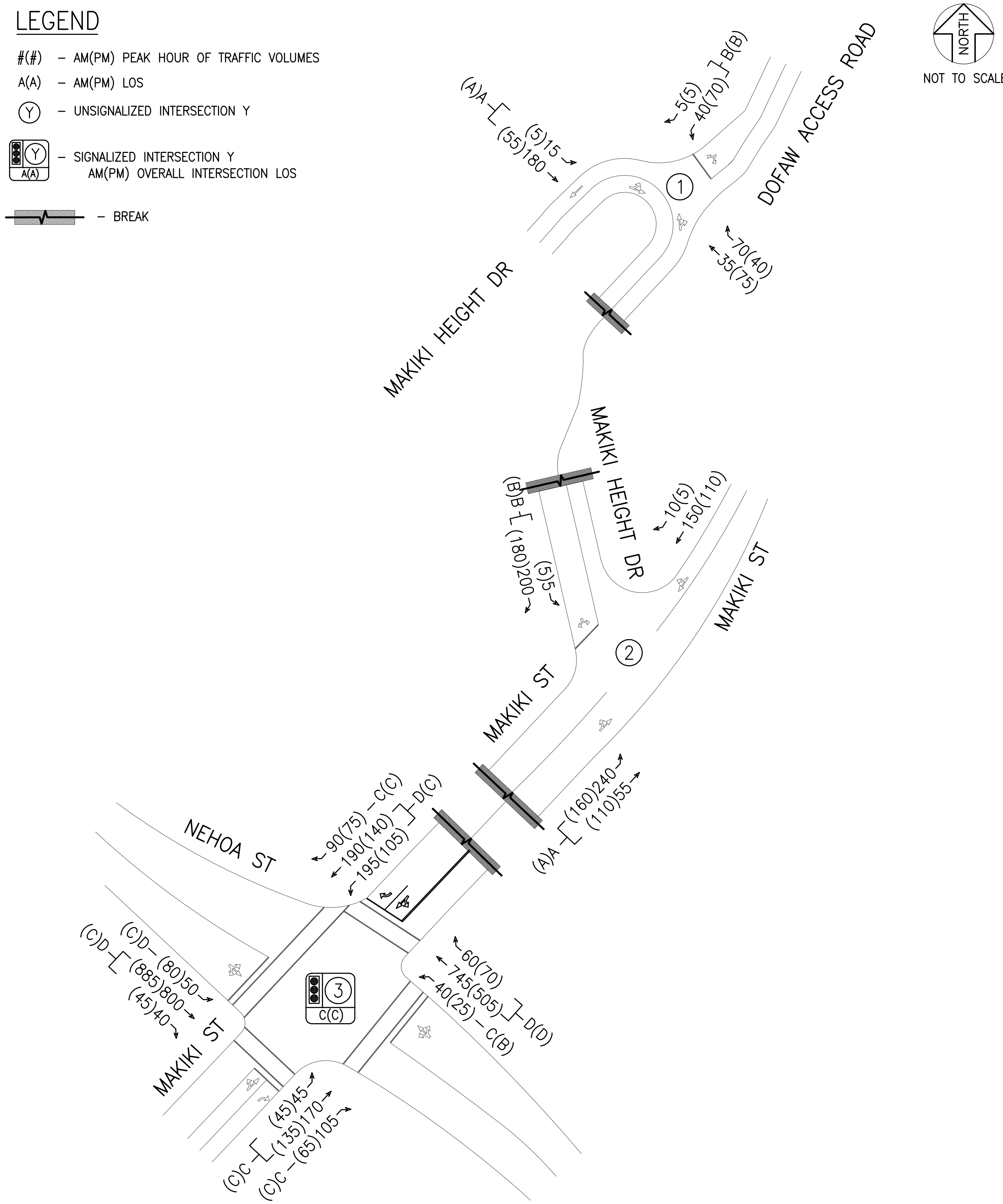
PROJECT–GENERATED TRAFFIC VOLUMES

FIGURE 5.1

LEGEND

- #(#) – AM(PM) PEAK HOUR OF TRAFFIC VOLUMES
- A(A) – AM(PM) LOS
- (Y) – UNSIGNALIZED INTERSECTION Y
- SIGNALIZED INTERSECTION Y, A(A) – AM(PM) OVERALL INTERSECTION LOS
- BREAK

NOT TO SCALE



DOFAW MAKIKI BASEYARD

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ENGINEERS, SURVEYORS • HONOLULU, HAWAII

FUTURE YEAR 2026
LANE CONFIGURATION, VOL AND LOS

FIGURE
5.2

Table 5.3: Future Year Conditions LOS

Intersection	Future Year 2026 Conditions					
	AM			PM		
	HCM Delay	v/c Ratio	LOS	HCM Delay	v/c Ratio	LOS
DOFAW Access Road/Makiki Heights Drive						
EB LT/TH	7.4	0.01	A	7.4	0.00	A
WB TH/RT	0.0	0.00	A	0.0	0.00	A
SB LT/RT	10.4	0.07	B	9.6	0.07	B
Makiki Heights Drive/Makiki Street						
EB LT/RT	10.8	0.26	B	10.0	0.19	B
NB LT/TH	8.1	0.17	A	7.8	0.11	A
SB TH/RT	0.0	0.00	A	0.0	0.00	A
Makiki Street/Nehoa Street						
EB LT	50.8	0.40	D	22.8	0.24	C
EB TH/RT	38.5	0.94	D	34.0	0.94	C
WB LT	54.0	0.38	D	46.4	0.22	D
WB TH/RT	33.7	0.90	C	14.9	0.59	B
NB LT/TH	23.2	0.36	C	26.0	0.32	C
NB RT	21.2	0.20	C	23.5	0.14	C
SB LT/TH	36.2	0.74	D	29.0	0.43	C
SB RT	20.8	0.17	C	23.8	0.16	C
OVERALL	24.5	--	C	26.8	--	C

6. CONCLUSIONS and RECOMMENDATIONS

Existing Conditions

All study intersection movements currently operate at LOS C or better with no significant queuing observed during the AM and PM peak hours of traffic.

Pedestrians were observed along Makiki Heights Drive where no sidewalk is provided.

Base Year 2026 WITHOUT the Project

This TIAR assumes that the Project will be completed by Year 2026. Traffic volumes within the vicinity of the Project are anticipated to experience approximately 1.0 percent growth per year based on the ORTDM.

By Year 2026 without the Project, all movements at the study intersections are forecast to operate at LOS C or better during the AM and PM peak hours of traffic with the exception of the westbound left-turn movement at the Makiki Street/Nehoa Street intersection, which is forecast to operate at LOS E during the AM peak hour of traffic. By restriping the southbound approach to a shared left-turn/through lane and an exclusive right-turn lane, all movements will operate at LOS D or better during the AM and PM peak hours of traffic.

Future Year 2026 WITH the Project

The Project plans to renovate the DOFAW Baseyard in Makiki. Upon full build-out, the Project proposes to renovate and expand the office spaces and support spaces. Office spaces will increase from an existing 6,000 SF to a proposed 17,000 SF. The support spaces are not anticipated to generate additional vehicular traffic. These proposed land uses are forecast to generate an additional 9 AM and 12 PM peak hour trips, which were distributed throughout the study area based upon existing travel patterns and added to the forecast Base Year 2026 traffic volumes.

Upon completion of the Project, all movements at the study intersections are forecast to operate with LOS similar to Base Year 2026 conditions. No roadway improvements are required as a result of the Project.

7. REFERENCES

1. Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2009.
2. PBR Hawaii & Associates, Inc., Halau Ku Mana Public Charter School Improvements Final Environmental Assessment, September 2014.
3. Transportation Research Board, Highway Capacity Manual, 2010.
4. Institute of Transportation Engineers, Trip Generation, 9th Edition, 2012.

Y:\2015\15-555\Report\Draft - DOFAW Baseyard TIAR 151021.docx

APPENDICES

APPENDIX A

TRAFFIC COUNT DATA

Austin Tsutsumi & Associates

501 Sumner Street, Suite 521
Honolulu, HI 96817-5031
Phone: (808) 533-3646   Fax: (808) 526-1267

File Name : AM_DOFAW Makiki Access Rd - Makiki Heights Dr
Site Code : 00000000
Start Date : 9/24/2015
Page No : 1

Groups Printed- Unshifted

	MAKIKI HEIGHTS DR Eastbound				MAKIKI HEIGHTS DR Westbound				Northbound				DOFAW MAKIKI ACCESS RD Southbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	1	4	0	0	0	4	7	0	0	0	0	0	11	0	1	0	28
06:45 AM	0	9	0	0	0	3	7	0	0	0	0	0	6	0	0	0	25
Total	1	13	0	0	0	7	14	0	0	0	0	0	17	0	1	0	53
07:00 AM	2	31	0	0	0	2	10	0	0	0	0	0	7	0	0	0	52
07:15 AM	3	45	0	0	0	4	12	0	0	0	0	0	10	0	0	0	74
07:30 AM	0	52	0	0	0	10	6	0	0	0	0	0	4	0	0	0	72
07:45 AM	4	31	0	0	0	11	3	0	0	0	0	0	6	0	0	0	55
Total	9	159	0	0	0	27	31	0	0	0	0	0	27	0	0	0	253
08:00 AM	1	16	0	0	0	4	13	0	0	0	0	0	7	0	1	0	42
08:15 AM	4	8	0	0	0	9	11	0	0	0	0	0	7	0	1	0	40
Grand Total	15	196	0	0	0	47	69	0	0	0	0	0	58	0	3	0	388
Apprch %	7.1	92.9	0	0	0	40.5	59.5	0	0	0	0	0	95.1	0	4.9	0	
Total %	3.9	50.5	0	0	0	12.1	17.8	0	0	0	0	0	14.9	0	0.8	0	

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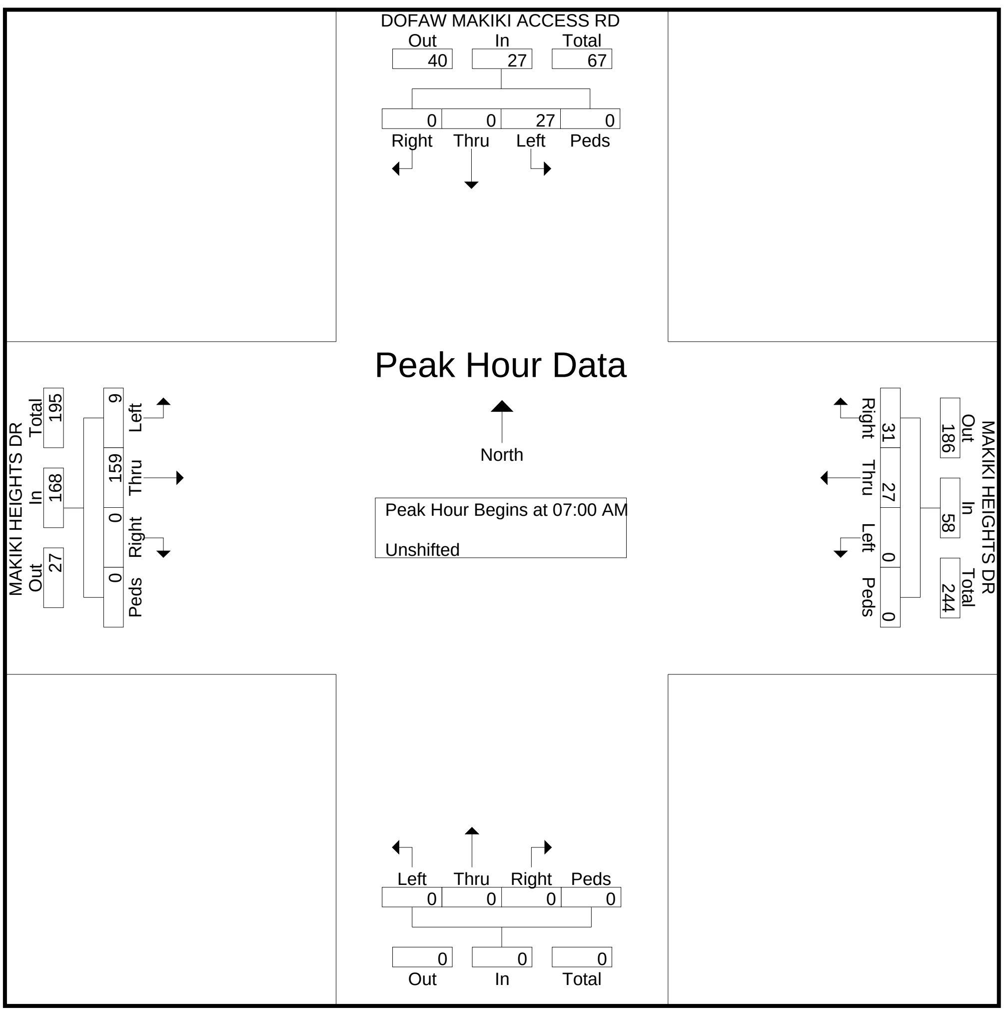
Site Code : 00000000
Start Date : 9/24/2015
Page No : 2

	MAKIKI HEIGHTS DR Eastbound					MAKIKI HEIGHTS DR Westbound					Northbound					DOFAW MAKIKI ACCESS RD Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	2	31	0	0	33	0	2	10	0	12	0	0	0	0	0	7	0	0	0	7	52
07:15 AM	3	45	0	0	48	0	4	12	0	16	0	0	0	0	0	10	0	0	0	10	74
07:30 AM	0	52	0	0	52	0	10	6	0	16	0	0	0	0	0	4	0	0	0	4	72
07:45 AM	4	31	0	0	35	0	11	3	0	14	0	0	0	0	0	6	0	0	0	6	55
Total Volume	9	159	0	0	168	0	27	31	0	58	0	0	0	0	0	27	0	0	0	27	253
% App. Total	5.4	94.6	0	0		0	46.6	53.4	0		0	0	0	0		100	0	0	0		
PHF	.563	.764	.000	.000	.808	.000	.614	.646	.000	.906	.000	.000	.000	.000	.000	.675	.000	.000	.000	.675	.855



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File Name : AM_Makiki St - Makiki Heights Dr
Site Code : 00000000
Start Date : 9/24/2015
Page No : 1

Groups Printed- Unshifted

	MAKIKI HEIGHTS DR Eastbound				Westbound				MAKIKI ST Northbound				MAKIKI ST Southbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	0	0	15	0	0	0	0	0	21	6	0	0	0	15	1	0	58
06:45 AM	1	0	14	0	0	0	0	0	26	6	0	0	0	22	0	0	69
Total	1	0	29	0	0	0	0	0	47	12	0	0	0	37	1	0	127
07:00 AM	0	0	38	0	0	0	0	0	25	13	0	0	0	43	1	0	120
07:15 AM	1	0	48	0	0	0	0	0	43	9	0	0	0	31	1	0	133
07:30 AM	1	0	53	0	0	0	0	0	55	11	0	0	0	34	1	0	155
07:45 AM	0	0	34	0	0	0	0	0	59	13	0	0	0	24	2	0	132
Total	2	0	173	0	0	0	0	0	182	46	0	0	0	132	5	0	540
08:00 AM	2	0	37	0	0	0	0	0	43	14	0	0	0	17	0	0	113
08:15 AM	0	0	25	0	0	0	0	0	37	9	0	0	0	21	2	0	94
Grand Total	5	0	264	0	0	0	0	0	309	81	0	0	0	207	8	0	874
Apprch %	1.9	0	98.1	0	0	0	0	0	79.2	20.8	0	0	0	96.3	3.7	0	
Total %	0.6	0	30.2	0	0	0	0	0	35.4	9.3	0	0	0	23.7	0.9	0	

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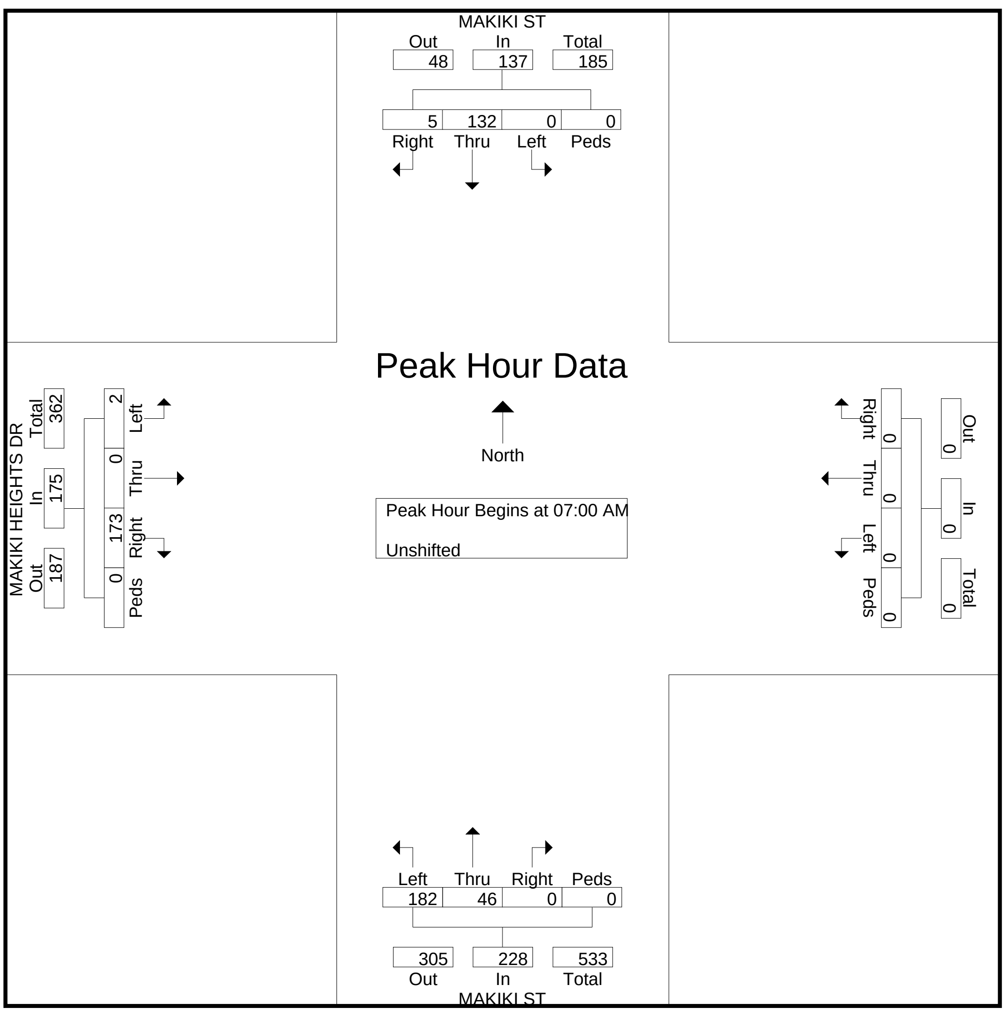
Site Code : 00000000
Start Date : 9/24/2015

	MAKIKI HEIGHTS DR Eastbound					Westbound					MAKIKI ST Northbound					MAKIKI ST Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	0	0	38	0	38	0	0	0	0	0	25	13	0	0	38	0	43	1	0	44	120
07:15 AM	1	0	48	0	49	0	0	0	0	0	43	9	0	0	52	0	31	1	0	32	133
07:30 AM	1	0	53	0	54	0	0	0	0	0	55	11	0	0	66	0	34	1	0	35	155
07:45 AM	0	0	34	0	34	0	0	0	0	0	59	13	0	0	72	0	24	2	0	26	132
Total Volume	2	0	173	0	175	0	0	0	0	0	182	46	0	0	228	0	132	5	0	137	540
% App. Total	1.1	0	98.9	0		0	0	0	0		79.8	20.2	0	0		0	96.4	3.6	0		
PHF	.500	.000	.816	.000	.810	.000	.000	.000	.000	.000	.771	.885	.000	.000	.792	.000	.767	.625	.000	.778	.871



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File Name : AM_Makiki St - Nehoa St
Site Code : 00000000
Start Date : 9/24/2015
Page No : 1

Groups Printed- Unshifted

	NEHOA ST Eastbound				NEHOA ST Westbound				MAKIKI ST Northbound				MAKIKI ST Southbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
06:30 AM	4	110	2	0	2	84	11	0	3	11	8	0	7	11	12	0	265
06:45 AM	4	155	4	0	5	137	5	0	10	22	9	0	16	22	10	0	399
Total	8	265	6	0	7	221	16	0	13	33	17	0	23	33	22	0	664
07:00 AM	5	198	8	0	5	140	8	0	11	19	25	0	35	37	20	0	511
07:15 AM	10	182	8	0	9	179	12	0	11	33	22	0	39	41	16	0	562
07:30 AM	11	204	6	0	5	175	13	0	8	31	32	0	52	43	21	0	601
07:45 AM	10	130	11	0	16	172	11	0	9	44	13	0	43	41	20	0	520
Total	36	714	33	0	35	666	44	0	39	127	92	0	169	162	77	0	2194
08:00 AM	12	123	8	0	10	176	15	0	9	29	5	0	26	28	18	0	459
08:15 AM	9	125	6	0	7	112	11	0	11	25	4	0	12	24	13	0	359
Grand Total	65	1227	53	0	59	1175	86	0	72	214	118	0	230	247	130	0	3676
Apprch %	4.8	91.2	3.9	0	4.5	89	6.5	0	17.8	53	29.2	0	37.9	40.7	21.4	0	
Total %	1.8	33.4	1.4	0	1.6	32	2.3	0	2	5.8	3.2	0	6.3	6.7	3.5	0	

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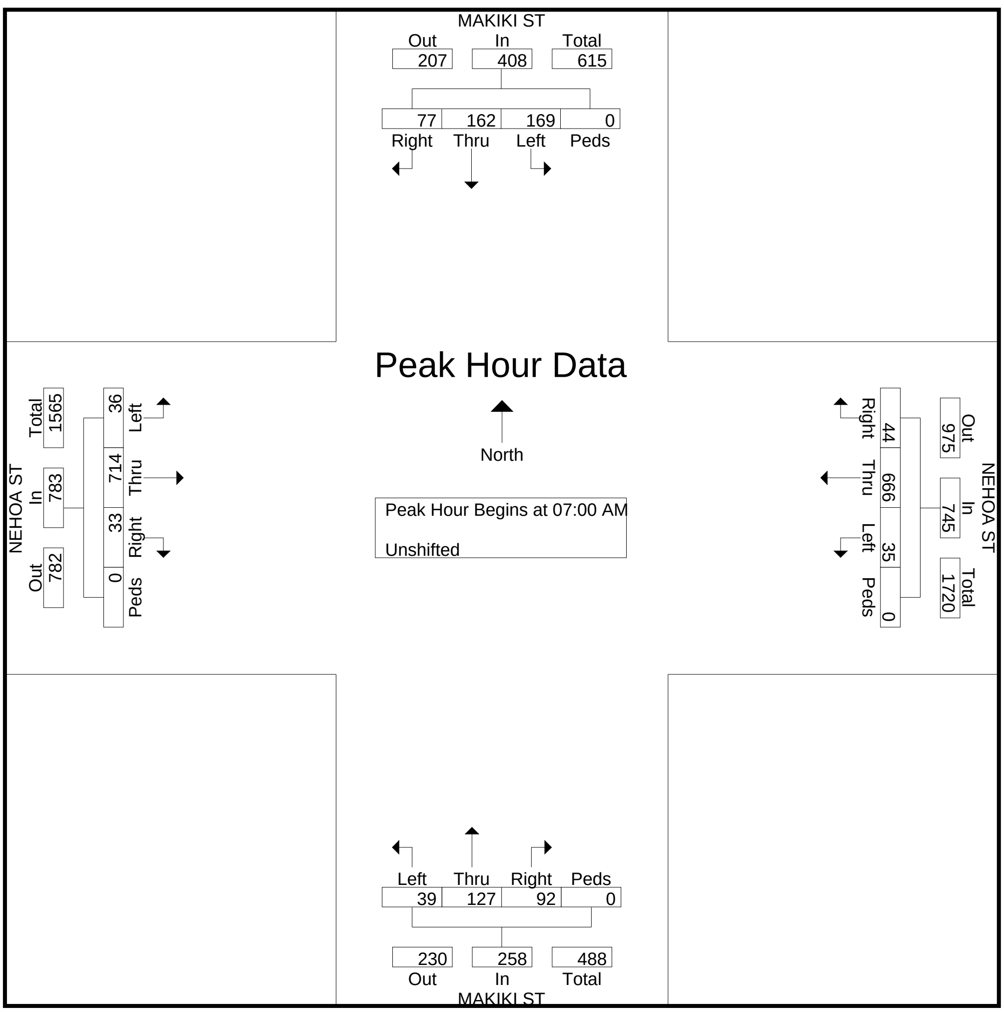
File Name : AM_Makiki St - Nehoa St
Site Code : 00000000
Start Date : 9/24/2015
Page No : 2

	NEHOA ST Eastbound					NEHOA ST Westbound					MAKIKI ST Northbound					MAKIKI ST Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 06:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:00 AM																					
07:00 AM	5	198	8	0	211	5	140	8	0	153	11	19	25	0	55	35	37	20	0	92	511
07:15 AM	10	182	8	0	200	9	179	12	0	200	11	33	22	0	66	39	41	16	0	96	562
07:30 AM	11	204	6	0	221	5	175	13	0	193	8	31	32	0	71	52	43	21	0	116	601
07:45 AM	10	130	11	0	151	16	172	11	0	199	9	44	13	0	66	43	41	20	0	104	520
Total Volume	36	714	33	0	783	35	666	44	0	745	39	127	92	0	258	169	162	77	0	408	2194
% App. Total	4.6	91.2	4.2	0		4.7	89.4	5.9	0		15.1	49.2	35.7	0		41.4	39.7	18.9	0		
PHF	.818	.875	.750	.000	.886	.547	.930	.846	.000	.931	.886	.722	.719	.000	.908	.813	.942	.917	.000	.879	.913



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File Name : PM_DOFAW Makiki Access Rd - Makiki Heights Dr
Site Code : 00000000
Start Date : 9/24/2015
Page No : 1

Groups Printed- Unshifted

	MAKIKI HEIGHTS DR Eastbound				MAKIKI HEIGHTS DR Westbound				Northbound				DOFAW MAKIKI ACCESS RD Southbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
02:45 PM	2	8	0	0	0	6	7	0	0	0	0	0	3	0	2	0	28
Total	2	8	0	0	0	6	7	0	0	0	0	0	3	0	2	0	28
03:00 PM	0	5	0	0	0	12	7	0	0	0	0	0	9	0	0	0	33
03:15 PM	0	16	0	0	0	7	5	0	0	0	0	0	8	0	0	0	36
03:30 PM	0	10	0	0	0	22	2	0	0	0	0	0	8	0	0	0	42
03:45 PM	1	9	0	0	0	14	11	0	0	0	0	0	5	0	0	0	40
Total	1	40	0	0	0	55	25	0	0	0	0	0	30	0	0	0	151
04:00 PM	0	17	0	0	0	12	2	0	0	0	0	0	8	0	0	0	39
04:15 PM	1	10	0	0	0	15	4	0	0	0	0	0	8	0	2	0	40
04:30 PM	1	24	0	0	0	23	9	0	0	0	0	0	19	0	2	0	78
04:45 PM	1	12	0	0	0	9	5	0	0	0	0	0	8	0	0	0	35
Total	3	63	0	0	0	59	20	0	0	0	0	0	43	0	4	0	192
Grand Total	6	111	0	0	0	120	52	0	0	0	0	0	76	0	6	0	371
Apprch %	5.1	94.9	0	0	0	69.8	30.2	0	0	0	0	0	92.7	0	7.3	0	
Total %	1.6	29.9	0	0	0	32.3	14	0	0	0	0	0	20.5	0	1.6	0	

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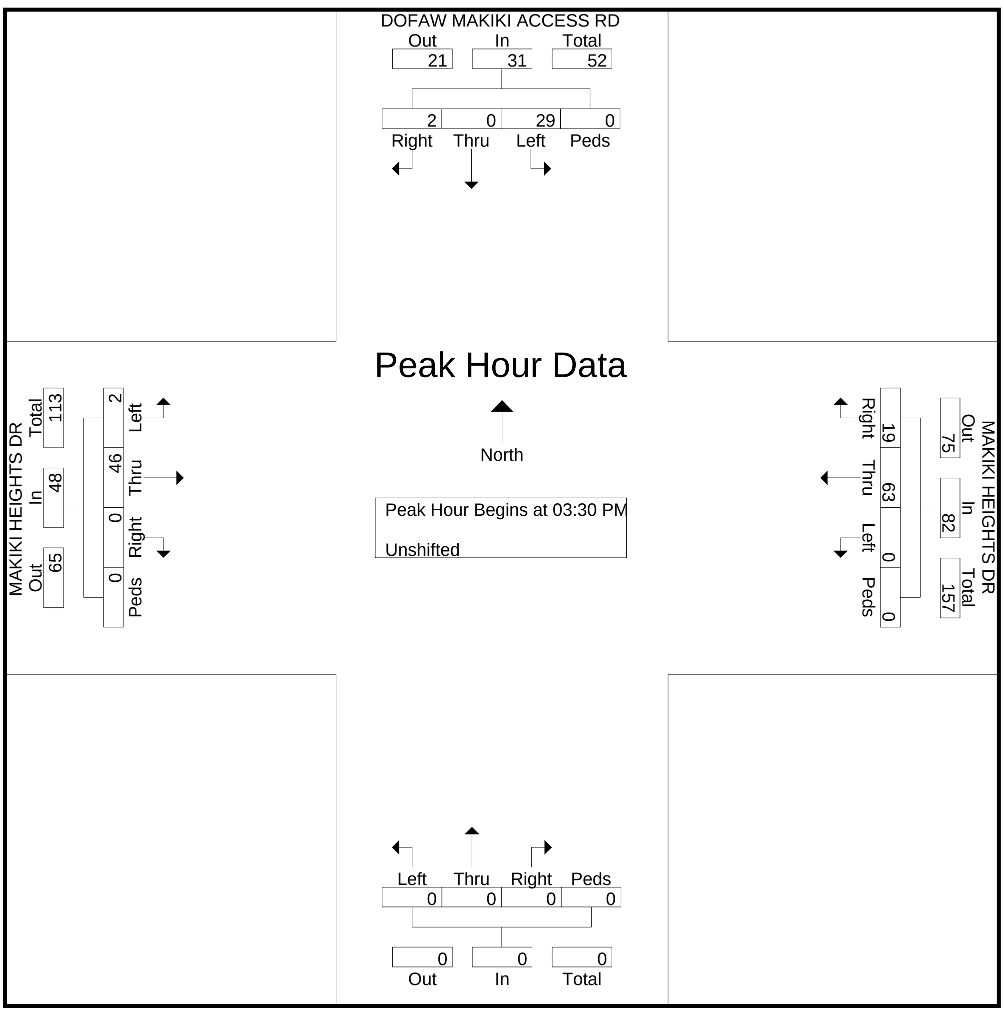
File Name : PM_DOFAW Makiki Access Rd - Makiki Heights Dr
Site Code : 00000000
Start Date : 9/24/2015

Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1
Peak Hour for Entire Intersection Begins at 03:30 PM

	MAKIKI HEIGHTS DR Eastbound					MAKIKI HEIGHTS DR Westbound					Northbound					DOFAW MAKIKI ACCESS RD Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
03:30 PM	0	10	0	0	10	0	22	2	0	24	0	0	0	0	0	8	0	0	0	8	42
03:45 PM	1	9	0	0	10	0	14	11	0	25	0	0	0	0	0	5	0	0	0	5	40
04:00 PM	0	17	0	0	17	0	12	2	0	14	0	0	0	0	0	8	0	0	0	8	39
04:15 PM	1	10	0	0	11	0	15	4	0	19	0	0	0	0	0	8	0	2	0	10	40
Total Volume	2	46	0	0	48	0	63	19	0	82	0	0	0	0	0	29	0	2	0	31	161
% App. Total	4.2	95.8	0	0		0	76.8	23.2	0		0	0	0	0		93.5	0	6.5	0		
PHF	.500	.676	.000	.000	.706	.000	.716	.432	.000	.820	.000	.000	.000	.000	.000	.906	.000	.250	.000	.775	.958



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File Name : PM_Makiki St - Makiki Heights Dr
Site Code : 00000000
Start Date : 9/24/2015
Page No : 1

Groups Printed- Unshifted

	MAKIKI HEIGHTS DR Eastbound				Westbound				MAKIKI ST Northbound				MAKIKI ST Southbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
02:45 PM	0	0	10	0	0	0	0	0	46	29	0	0	0	28	1	0	114
Total	0	0	10	0	0	0	0	0	46	29	0	0	0	28	1	0	114
03:00 PM	0	0	18	0	0	0	0	0	65	24	0	0	0	28	4	0	139
03:15 PM	0	0	26	0	0	0	0	0	41	27	0	0	0	11	0	0	105
03:30 PM	1	0	43	0	0	0	0	0	44	26	0	0	0	34	2	0	150
03:45 PM	0	0	29	0	0	0	0	0	35	26	0	0	0	20	0	0	110
Total	1	0	116	0	0	0	0	0	185	103	0	0	0	93	6	0	504
04:00 PM	0	0	30	0	0	0	0	0	20	25	0	0	0	20	0	0	95
04:15 PM	0	0	24	0	0	0	0	0	29	21	0	0	0	21	0	0	95
04:30 PM	2	0	24	0	0	0	0	0	24	36	0	0	0	20	2	0	108
04:45 PM	1	0	23	0	0	0	0	0	27	38	0	0	0	21	0	0	110
Total	3	0	101	0	0	0	0	0	100	120	0	0	0	82	2	0	408
Grand Total	4	0	227	0	0	0	0	0	331	252	0	0	0	203	9	0	1026
Apprch %	1.7	0	98.3	0	0	0	0	0	56.8	43.2	0	0	0	95.8	4.2	0	
Total %	0.4	0	22.1	0	0	0	0	0	32.3	24.6	0	0	0	19.8	0.9	0	

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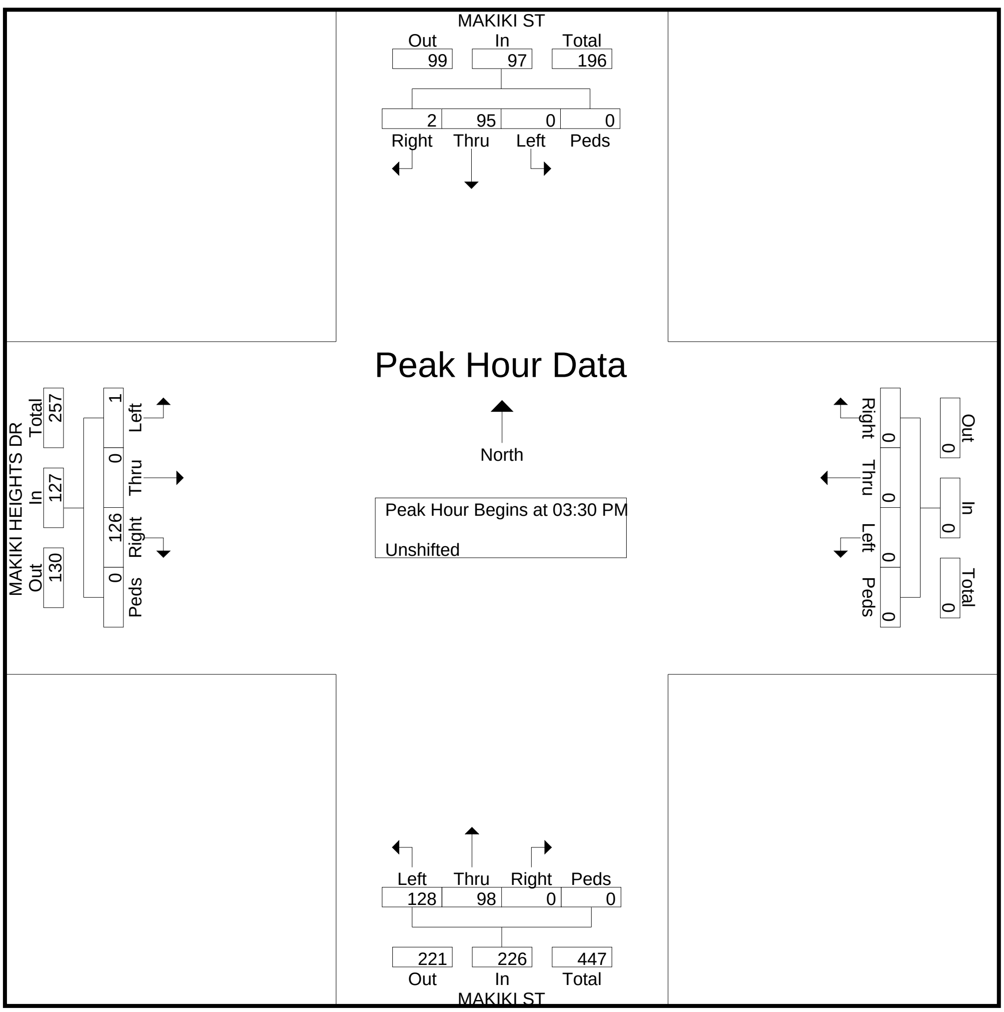
Site Code : 00000000
Start Date : 9/24/2015
Page No : 2

	MAKIKI HEIGHTS DR Eastbound					Westbound					MAKIKI ST Northbound					MAKIKI ST Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	1	0	43	0	44	0	0	0	0	0	44	26	0	0	70	0	34	2	0	36	150
03:45 PM	0	0	29	0	29	0	0	0	0	0	35	26	0	0	61	0	20	0	0	20	110
04:00 PM	0	0	30	0	30	0	0	0	0	0	20	25	0	0	45	0	20	0	0	20	95
04:15 PM	0	0	24	0	24	0	0	0	0	0	29	21	0	0	50	0	21	0	0	21	95
Total Volume	1	0	126	0	127	0	0	0	0	0	128	98	0	0	226	0	95	2	0	97	450
% App. Total	0.8	0	99.2	0		0	0	0	0		56.6	43.4	0	0		0	97.9	2.1	0		
PHF	.250	.000	.733	.000	.722	.000	.000	.000	.000	.000	.727	.942	.000	.000	.807	.000	.699	.250	.000	.674	.750



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File Name : PM_Makiki St - Nehoa St
Site Code : 00000000
Start Date : 9/24/2015

Groups Printed- Unshifted

	NEHOA ST Eastbound				NEHOA ST Westbound				MAKIKI ST Northbound				MAKIKI ST Southbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
02:45 PM	15	145	7	0	4	102	19	0	9	33	12	0	17	25	11	0	399
Total	15	145	7	0	4	102	19	0	9	33	12	0	17	25	11	0	399
03:00 PM	18	148	5	0	3	100	24	0	6	45	14	0	25	36	28	1	453
03:15 PM	20	166	8	1	4	110	22	0	9	23	14	0	26	27	12	0	442
03:30 PM	24	185	12	0	5	97	16	0	12	28	11	0	22	40	20	0	472
03:45 PM	17	182	9	0	8	96	18	0	10	27	13	0	14	28	15	0	437
Total	79	681	34	1	20	403	80	0	37	123	52	0	87	131	75	1	1804
04:00 PM	11	209	10	0	3	134	11	0	10	30	15	0	25	21	14	0	493
04:15 PM	13	217	6	0	5	122	12	0	7	24	18	0	18	21	12	0	475
04:30 PM	17	220	5	0	3	125	17	0	8	20	10	0	15	25	14	0	479
04:45 PM	7	219	7	0	4	120	18	0	9	28	12	0	18	20	19	0	481
Total	48	865	28	0	15	501	58	0	34	102	55	0	76	87	59	0	1928
Grand Total	142	1691	69	1	39	1006	157	0	80	258	119	0	180	243	145	1	4131
Apprch %	7.5	88.9	3.6	0.1	3.2	83.7	13.1	0	17.5	56.5	26	0	31.6	42.7	25.5	0.2	
Total %	3.4	40.9	1.7	0	0.9	24.4	3.8	0	1.9	6.2	2.9	0	4.4	5.9	3.5	0	

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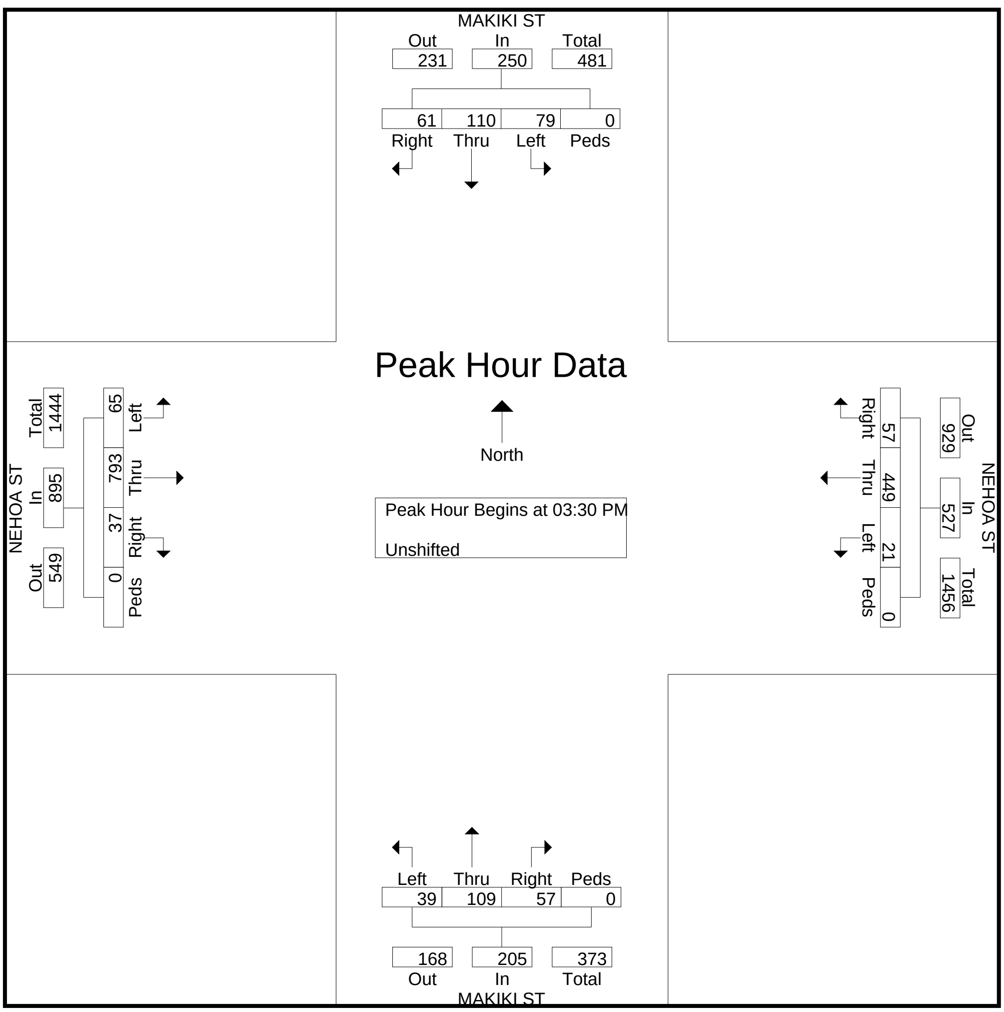
File Name : PM_Makiki St - Nehoa St
Site Code : 00000000
Start Date : 9/24/2015

	NEHOA ST Eastbound					NEHOA ST Westbound					MAKIKI ST Northbound					MAKIKI ST Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 03:30 PM to 04:15 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 03:30 PM																					
03:30 PM	24	185	12	0	221	5	97	16	0	118	12	28	11	0	51	22	40	20	0	82	472
03:45 PM	17	182	9	0	208	8	96	18	0	122	10	27	13	0	50	14	28	15	0	57	437
04:00 PM	11	209	10	0	230	3	134	11	0	148	10	30	15	0	55	25	21	14	0	60	493
04:15 PM	13	217	6	0	236	5	122	12	0	139	7	24	18	0	49	18	21	12	0	51	475
Total Volume	65	793	37	0	895	21	449	57	0	527	39	109	57	0	205	79	110	61	0	250	1877
% App. Total	7.3	88.6	4.1	0		4	85.2	10.8	0		19	53.2	27.8	0		31.6	44	24.4	0		
PHF	.677	.914	.771	.000	.948	.656	.838	.792	.000	.890	.813	.908	.792	.000	.932	.790	.688	.763	.000	.762	.952



APPENDIX B

LEVEL OF SERVICE CRITERIA

APPENDIX B – LEVEL OF SERVICE (LOS) CRITERIA

VEHICULAR LEVEL OF SERVICE FOR SIGNALIZED INTERSECTIONS (HCM 2010)

Level of service for vehicles at signalized intersections is directly related to delay values and is assigned on that basis. Level of Service is a measure of the acceptability of delay values to motorists at a given intersection. The criteria are given in the table below.

Level-of Service Criteria for Signalized Intersections

Level of Service	Control Delay per Vehicle (sec./veh.)
A	< 10.0
B	>10.0 and ≤ 20.0
C	>20.0 and ≤ 35.0
D	>35.0 and ≤ 55.0
E	>55.0 and ≤ 80.0
F	> 80.0

Delay is a complex measure, and is dependent on a number of variables, including the quality of progression, the cycle length, the green ratio, and the v/c ratio for the lane group or approach in question.

VEHICULAR LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS (HCM 2010)

The level of service criteria for vehicles at unsignalized intersections is defined as the average control delay, in seconds per vehicle.

LOS delay threshold values are lower for two-way stop-controlled (TWSC) and all-way stop-controlled (AWSC) intersections than those of signalized intersections. This is because more vehicles pass through signalized intersections, and therefore, drivers expect and tolerate greater delays. While the criteria for level of service for TWSC and AWSC intersections are the same, procedures to calculate the average total delay may differ.

Level of Service Criteria for Two-Way Stop-Controlled Intersections

Level of Service	Average Control Delay (sec/veh)
A	≤ 10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	> 50

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing AM Peak

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	9	159	27	31	27	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	173	29	34	29	1

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	63	0	-	0	238	46
Stage 1	-	-	-	-	46	-
Stage 2	-	-	-	-	192	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1540	-	-	-	750	1023
Stage 1	-	-	-	-	976	-
Stage 2	-	-	-	-	841	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1540	-	-	-	745	1023
Mov Cap-2 Maneuver	-	-	-	-	745	-
Stage 1	-	-	-	-	976	-
Stage 2	-	-	-	-	835	-

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	10
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1540	-	-	-	752
HCM Lane V/C Ratio	0.006	-	-	-	0.04
HCM Control Delay (s)	7.4	0	-	-	10
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	2	173	182	46	132	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	188	198	50	143	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	592	146	149	0	-	0
Stage 1	146	-	-	-	-	-
Stage 2	446	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	469	901	1432	-	-	-
Stage 1	881	-	-	-	-	-
Stage 2	645	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	402	901	1432	-	-	-
Mov Cap-2 Maneuver	402	-	-	-	-	-
Stage 1	881	-	-	-	-	-
Stage 2	553	-	-	-	-	-

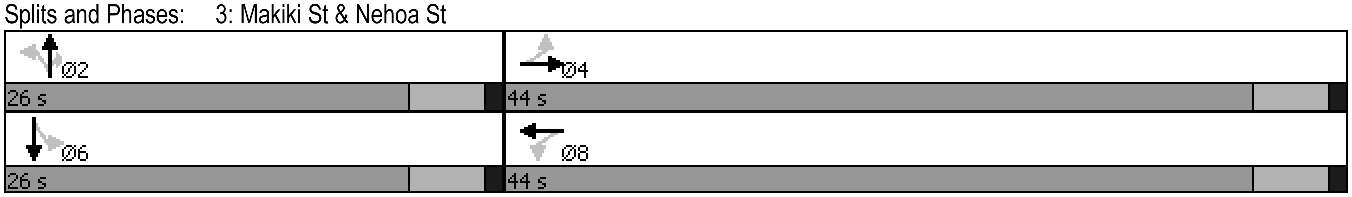
Approach	EB	NB	SB
HCM Control Delay, s	10.2	6.3	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1432	-	888	-	-
HCM Lane V/C Ratio	0.138	-	0.214	-	-
HCM Control Delay (s)	7.9	0	10.2	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.5	-	0.8	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	36	714	35	666	39	127	92	169	162
Future Volume (vph)	36	714	35	666	39	127	92	169	162
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	44.0	44.0	44.0	44.0	26.0	26.0	26.0	26.0	26.0
Total Split (%)	62.9%	62.9%	62.9%	62.9%	37.1%	37.1%	37.1%	37.1%	37.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0		5.0	5.0		5.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Natural Cycle: 65
Control Type: Semi Act-Uncoord

Splits and Phases: 3: Makiki St & Nehoa St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	36	714	33	35	666	44	39	127	92	169	162	77
Future Volume (veh/h)	36	714	33	35	666	44	39	127	92	169	162	77
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1891	1900	1900	1877	1900
Adj Flow Rate, veh/h	39	776	36	38	724	48	42	138	100	184	176	84
Adj No. of Lanes	1	1	0	1	1	0	0	1	1	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	0	0	0	0	0	0
Cap, veh/h	268	984	46	244	963	64	139	416	484	258	200	90
Arrive On Green	0.56	0.56	0.56	0.56	0.56	0.56	0.30	0.30	0.30	0.30	0.30	0.30
Sat Flow, veh/h	695	1766	82	669	1728	115	253	1387	1615	618	667	300
Grp Volume(v), veh/h	39	0	812	38	0	772	180	0	100	444	0	0
Grp Sat Flow(s),veh/h/ln	695	0	1848	669	0	1843	1639	0	1615	1585	0	0
Q Serve(g_s), s	3.2	0.0	24.3	3.3	0.0	22.4	0.0	0.0	3.2	13.8	0.0	0.0
Cycle Q Clear(g_c), s	25.5	0.0	24.3	27.6	0.0	22.4	5.2	0.0	3.2	18.9	0.0	0.0
Prop In Lane	1.00		0.04	1.00		0.06	0.23		1.00	0.41		0.19
Lane Grp Cap(c), veh/h	268	0	1030	244	0	1027	555	0	484	548	0	0
V/C Ratio(X)	0.15	0.00	0.79	0.16	0.00	0.75	0.32	0.00	0.21	0.81	0.00	0.00
Avail Cap(c_a), veh/h	268	0	1030	244	0	1027	555	0	484	548	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	21.5	0.0	12.2	23.2	0.0	11.8	19.0	0.0	18.3	23.5	0.0	0.0
Incr Delay (d2), s/veh	1.1	0.0	6.1	1.4	0.0	5.1	1.5	0.0	1.0	12.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.7	0.0	13.9	0.7	0.0	12.6	2.9	0.0	1.6	10.1	0.0	0.0
LnGrp Delay(d),s/veh	22.7	0.0	18.4	24.5	0.0	16.9	20.5	0.0	19.2	35.7	0.0	0.0
LnGrp LOS	C		B	C		B	C		B	D		
Approach Vol, veh/h		851			810			280			444	
Approach Delay, s/veh		18.6			17.3			20.1			35.7	
Approach LOS		B			B			C			D	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		26.0		44.0		26.0		44.0
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		21.0		39.0		21.0		39.0
Max Q Clear Time (g_c+I1), s		7.2		27.5		20.9		29.6
Green Ext Time (p_c), s		3.8		8.1		0.0		6.8

Intersection Summary	
HCM 2010 Ctrl Delay	21.5
HCM 2010 LOS	C

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Existing PM Peak

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	46	63	19	29	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	50	68	21	32	2

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	89	0	-	0	133	79
Stage 1	-	-	-	-	79	-
Stage 2	-	-	-	-	54	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1506	-	-	-	861	981
Stage 1	-	-	-	-	944	-
Stage 2	-	-	-	-	969	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1506	-	-	-	860	981
Mov Cap-2 Maneuver	-	-	-	-	860	-
Stage 1	-	-	-	-	944	-
Stage 2	-	-	-	-	968	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	9.3
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1506	-	-	-	867
HCM Lane V/C Ratio	0.001	-	-	-	0.039
HCM Control Delay (s)	7.4	0	-	-	9.3
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	4.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	1	126	128	98	95	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	137	139	107	103	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	489	104	105	0	-	0
Stage 1	104	-	-	-	-	-
Stage 2	385	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	538	951	1486	-	-	-
Stage 1	920	-	-	-	-	-
Stage 2	688	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	485	951	1486	-	-	-
Mov Cap-2 Maneuver	485	-	-	-	-	-
Stage 1	920	-	-	-	-	-
Stage 2	620	-	-	-	-	-

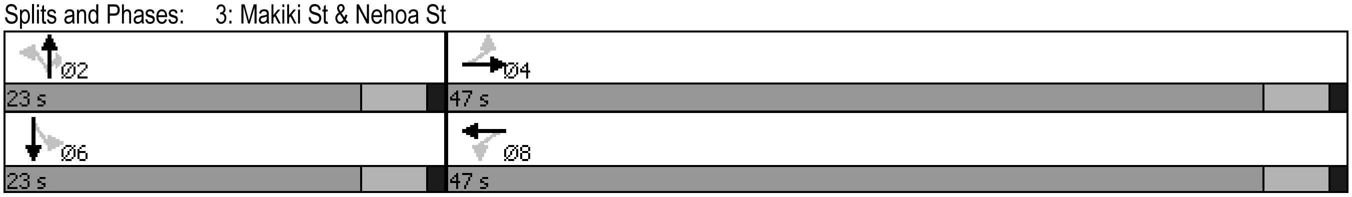
Approach	EB	NB	SB
HCM Control Delay, s	9.5	4.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1486	-	944	-	-
HCM Lane V/C Ratio	0.094	-	0.146	-	-
HCM Control Delay (s)	7.7	0	9.5	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.3	-	0.5	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	65	793	21	449	39	109	57	79	110
Future Volume (vph)	65	793	21	449	39	109	57	79	110
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	47.0	47.0	47.0	47.0	23.0	23.0	23.0	23.0	23.0
Total Split (%)	67.1%	67.1%	67.1%	67.1%	32.9%	32.9%	32.9%	32.9%	32.9%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5	4.5		4.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 70
Actuated Cycle Length: 70
Natural Cycle: 60
Control Type: Semi Act-Uncoord

Splits and Phases: 3: Makiki St & Nehoa St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	65	793	37	21	449	57	39	109	57	79	110	62
Future Volume (veh/h)	65	793	37	21	449	57	39	109	57	79	110	62
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	71	862	40	23	488	62	42	118	62	86	120	67
Adj No. of Lanes	1	1	0	1	1	0	0	1	1	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	477	1072	50	246	984	125	148	373	418	174	218	105
Arrive On Green	0.61	0.61	0.61	0.61	0.61	0.61	0.26	0.26	0.26	0.26	0.26	0.26
Sat Flow, veh/h	854	1766	82	615	1621	206	313	1411	1583	401	825	399
Grp Volume(v), veh/h	71	0	902	23	0	550	160	0	62	273	0	0
Grp Sat Flow(s),veh/h/ln	854	0	1848	615	0	1826	1724	0	1583	1625	0	0
Q Serve(g_s), s	3.6	0.0	26.2	2.1	0.0	11.8	0.0	0.0	2.1	5.2	0.0	0.0
Cycle Q Clear(g_c), s	15.4	0.0	26.2	28.3	0.0	11.8	4.8	0.0	2.1	10.0	0.0	0.0
Prop In Lane	1.00		0.04	1.00		0.11	0.26		1.00	0.32		0.25
Lane Grp Cap(c), veh/h	477	0	1122	246	0	1109	521	0	418	497	0	0
V/C Ratio(X)	0.15	0.00	0.80	0.09	0.00	0.50	0.31	0.00	0.15	0.55	0.00	0.00
Avail Cap(c_a), veh/h	477	0	1122	246	0	1109	521	0	418	497	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	12.1	0.0	10.6	21.4	0.0	7.7	20.7	0.0	19.7	22.5	0.0	0.0
Incr Delay (d2), s/veh	0.7	0.0	6.1	0.8	0.0	1.6	1.5	0.0	0.7	4.3	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	14.9	0.4	0.0	6.3	2.7	0.0	1.0	5.2	0.0	0.0
LnGrp Delay(d),s/veh	12.7	0.0	16.7	22.2	0.0	9.3	22.3	0.0	20.5	26.8	0.0	0.0
LnGrp LOS	B		B	C		A	C		C	C		
Approach Vol, veh/h		973			573			222			273	
Approach Delay, s/veh		16.4			9.8			21.8			26.8	
Approach LOS		B			A			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		23.0		47.0		23.0		47.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		18.5		42.5		18.5		42.5
Max Q Clear Time (g_c+I1), s		6.8		28.2		12.0		30.3
Green Ext Time (p_c), s		2.2		9.2		1.6		8.2

Intersection Summary			
HCM 2010 Ctrl Delay			16.5
HCM 2010 LOS			B

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2026 AM Peak

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	15	180	35	35	35	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	196	38	38	38	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	76	0	-	0	285	57
Stage 1	-	-	-	-	57	-
Stage 2	-	-	-	-	228	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1523	-	-	-	705	1009
Stage 1	-	-	-	-	966	-
Stage 2	-	-	-	-	810	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1523	-	-	-	697	1009
Mov Cap-2 Maneuver	-	-	-	-	697	-
Stage 1	-	-	-	-	966	-
Stage 2	-	-	-	-	800	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	10.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1523	-	-	-	725
HCM Lane V/C Ratio	0.011	-	-	-	0.06
HCM Control Delay (s)	7.4	0	-	-	10.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	6.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	5	195	205	55	150	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	212	223	60	163	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	673	168	174	0	-	0
Stage 1	168	-	-	-	-	-
Stage 2	505	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	421	876	1403	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	606	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	352	876	1403	-	-	-
Mov Cap-2 Maneuver	352	-	-	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	507	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	10.7	6.3	0
HCM LOS	B		

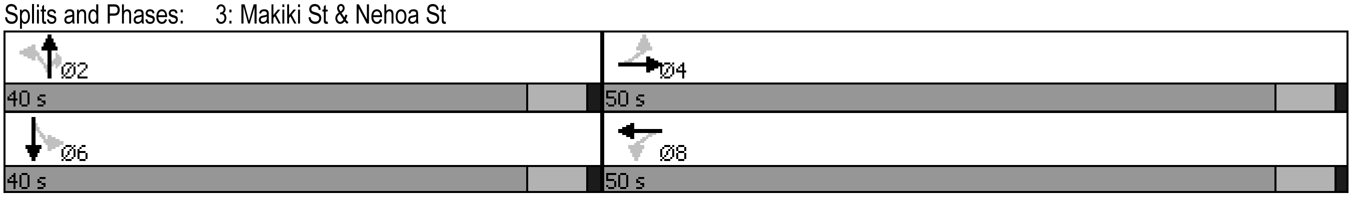
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1403	-	845	-	-
HCM Lane V/C Ratio	0.159	-	0.257	-	-
HCM Control Delay (s)	8	0	10.7	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.6	-	1	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	45	800	40	745	45	145	105	190	185
Future Volume (vph)	45	800	40	745	45	145	105	190	185
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	50.0	50.0	50.0	50.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	55.6%	55.6%	55.6%	55.6%	44.4%	44.4%	44.4%	44.4%	44.4%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0		5.0	5.0		5.0
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Natural Cycle: 75
Control Type: Semi Act-Uncoord

Splits and Phases: 3: Makiki St & Nehoa St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	800	40	40	745	50	45	145	105	190	185	90
Future Volume (veh/h)	45	800	40	40	745	50	45	145	105	190	185	90
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	49	870	43	43	810	54	49	158	114	207	201	98
Adj No. of Lanes	1	1	0	1	1	0	0	1	1	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	117	880	44	87	864	58	159	487	616	287	242	114
Arrive On Green	0.50	0.50	0.50	0.50	0.50	0.50	0.39	0.39	0.39	0.39	0.39	0.39
Sat Flow, veh/h	638	1760	87	609	1727	115	283	1251	1583	594	623	292
Grp Volume(v), veh/h	49	0	913	43	0	864	207	0	114	506	0	0
Grp Sat Flow(s),veh/h/ln	638	0	1847	609	0	1842	1534	0	1583	1510	0	0
Q Serve(g_s), s	5.3	0.0	44.0	1.0	0.0	39.7	0.0	0.0	4.3	20.5	0.0	0.0
Cycle Q Clear(g_c), s	45.0	0.0	44.0	45.0	0.0	39.7	7.1	0.0	4.3	27.6	0.0	0.0
Prop In Lane	1.00		0.05	1.00		0.06	0.24		1.00	0.41		0.19
Lane Grp Cap(c), veh/h	117	0	924	87	0	921	646	0	616	644	0	0
V/C Ratio(X)	0.42	0.00	0.99	0.49	0.00	0.94	0.32	0.00	0.19	0.79	0.00	0.00
Avail Cap(c_a), veh/h	117	0	924	87	0	921	646	0	616	644	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	43.0	0.0	22.2	44.9	0.0	21.2	18.9	0.0	18.1	25.1	0.0	0.0
Incr Delay (d2), s/veh	10.6	0.0	27.0	18.7	0.0	18.0	1.3	0.0	0.7	9.4	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	29.0	1.5	0.0	24.5	3.7	0.0	2.0	13.2	0.0	0.0
LnGrp Delay(d),s/veh	53.6	0.0	49.2	63.6	0.0	39.1	20.2	0.0	18.8	34.5	0.0	0.0
LnGrp LOS	D		D	E		D	C		B	C		
Approach Vol, veh/h		962			907			321			506	
Approach Delay, s/veh		49.4			40.3			19.7			34.5	
Approach LOS		D			D			B			C	

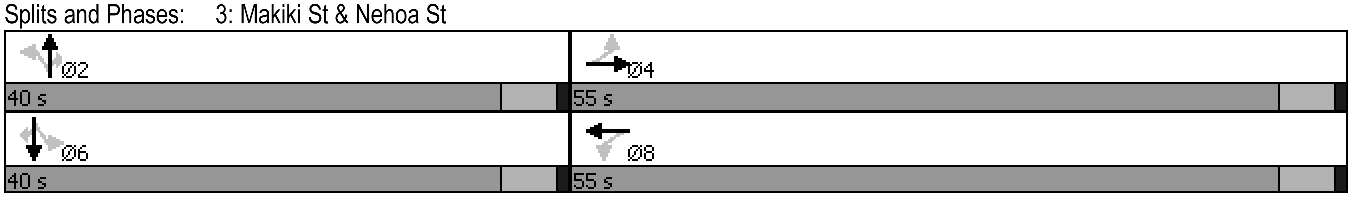
Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.0		50.0		40.0		50.0
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		35.0		45.0		35.0		45.0
Max Q Clear Time (g_c+I1), s		9.1		47.0		29.6		47.0
Green Ext Time (p_c), s		5.7		0.0		2.4		0.0

Intersection Summary	
HCM 2010 Ctrl Delay	40.0
HCM 2010 LOS	D

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	45	800	40	745	45	145	105	190	185	90
Future Volume (vph)	45	800	40	745	45	145	105	190	185	90
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	55.0	55.0	55.0	55.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	57.9%	57.9%	57.9%	57.9%	42.1%	42.1%	42.1%	42.1%	42.1%	42.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 95
Actuated Cycle Length: 95
Natural Cycle: 80
Control Type: Semi Act-Uncoord

Splits and Phases: 3: Makiki St & Nehoa St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	45	800	40	40	745	50	45	145	105	190	185	90
Future Volume (veh/h)	45	800	40	40	745	50	45	145	105	190	185	90
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	49	870	43	43	810	54	49	158	114	207	201	98
Adj No. of Lanes	1	1	0	1	1	0	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	145	927	46	114	909	61	159	486	583	325	260	583
Arrive On Green	0.53	0.53	0.53	0.53	0.53	0.53	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	638	1760	87	609	1727	115	304	1320	1583	727	706	1583
Grp Volume(v), veh/h	49	0	913	43	0	864	207	0	114	408	0	98
Grp Sat Flow(s),veh/h/ln	638	0	1847	609	0	1842	1624	0	1583	1433	0	1583
Q Serve(g_s), s	7.1	0.0	44.0	6.0	0.0	39.7	0.0	0.0	4.7	16.5	0.0	4.0
Cycle Q Clear(g_c), s	46.8	0.0	44.0	50.0	0.0	39.7	7.8	0.0	4.7	24.3	0.0	4.0
Prop In Lane	1.00		0.05	1.00		0.06	0.24		1.00	0.51		1.00
Lane Grp Cap(c), veh/h	145	0	972	114	0	970	645	0	583	585	0	583
V/C Ratio(X)	0.34	0.00	0.94	0.38	0.00	0.89	0.32	0.00	0.20	0.70	0.00	0.17
Avail Cap(c_a), veh/h	145	0	972	114	0	970	645	0	583	585	0	583
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	40.9	0.0	21.1	44.8	0.0	20.1	21.3	0.0	20.4	26.9	0.0	20.2
Incr Delay (d2), s/veh	6.2	0.0	17.4	9.2	0.0	12.2	1.3	0.0	0.7	6.8	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	0.0	26.8	1.4	0.0	23.2	4.1	0.0	2.1	10.5	0.0	1.8
LnGrp Delay(d),s/veh	47.2	0.0	38.5	54.0	0.0	32.2	22.6	0.0	21.2	33.7	0.0	20.8
LnGrp LOS	D		D	D		C	C		C	C		C
Approach Vol, veh/h		962			907			321			506	
Approach Delay, s/veh		38.9			33.3			22.1			31.2	
Approach LOS		D			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.0		55.0		40.0		55.0
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		35.0		50.0		35.0		50.0
Max Q Clear Time (g_c+I1), s		9.8		48.8		26.3		52.0
Green Ext Time (p_c), s		5.0		1.1		3.1		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		33.6
HCM 2010 LOS		C

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Base Year 2026 PM Peak

Intersection	
Int Delay, s/veh	2.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	5	55	75	25	35	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	60	82	27	38	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	109	0	-	0	166	95
Stage 1	-	-	-	-	95	-
Stage 2	-	-	-	-	71	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1481	-	-	-	824	962
Stage 1	-	-	-	-	929	-
Stage 2	-	-	-	-	952	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1481	-	-	-	822	962
Mov Cap-2 Maneuver	-	-	-	-	822	-
Stage 1	-	-	-	-	929	-
Stage 2	-	-	-	-	949	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	9.5
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1481	-	-	-	837
HCM Lane V/C Ratio	0.004	-	-	-	0.052
HCM Control Delay (s)	7.4	0	-	-	9.5
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	5	145	145	110	110	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	158	158	120	120	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	557	122	125	0	-	0
Stage 1	122	-	-	-	-	-
Stage 2	435	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	491	929	1462	-	-	-
Stage 1	903	-	-	-	-	-
Stage 2	653	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	434	929	1462	-	-	-
Mov Cap-2 Maneuver	434	-	-	-	-	-
Stage 1	903	-	-	-	-	-
Stage 2	577	-	-	-	-	-

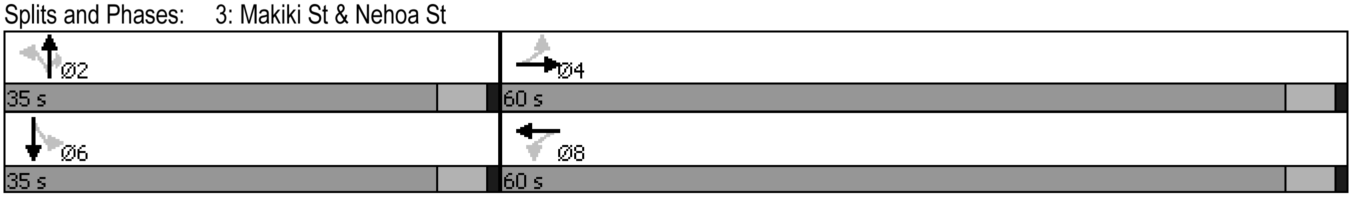
Approach	EB	NB	SB
HCM Control Delay, s	9.9	4.4	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1462	-	895	-	-
HCM Lane V/C Ratio	0.108	-	0.182	-	-
HCM Control Delay (s)	7.8	0	9.9	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0.4	-	0.7	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	75	885	25	505	45	125	65	90	125
Future Volume (vph)	75	885	25	505	45	125	65	90	125
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA
Protected Phases		4		8		2			6
Permitted Phases	4		8		2		2	6	
Detector Phase	4	4	8	8	2	2	2	6	6
Switch Phase									
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	60.0	60.0	60.0	60.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	63.2%	63.2%	63.2%	63.2%	36.8%	36.8%	36.8%	36.8%	36.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5	4.5		4.5
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 95
Actuated Cycle Length: 95
Natural Cycle: 70
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Makiki St & Nehoa St

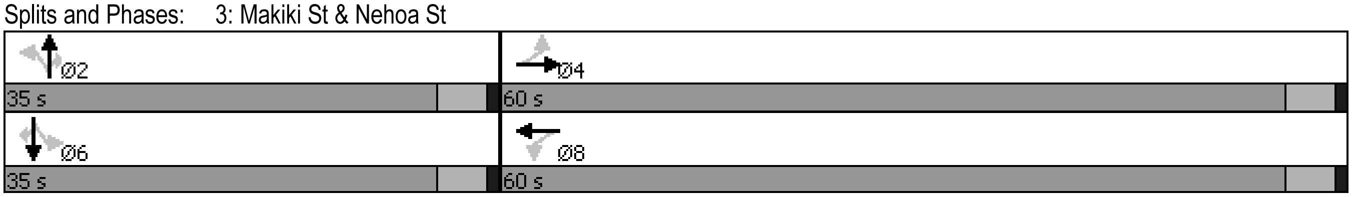


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	75	885	45	25	505	65	45	125	65	90	125	70
Future Volume (veh/h)	75	885	45	25	505	65	45	125	65	90	125	70
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1863	1900	1863	1900
Adj Flow Rate, veh/h	82	962	49	27	549	71	49	136	71	98	136	76
Adj No. of Lanes	1	1	0	1	1	0	0	1	1	0	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	372	1027	52	121	945	122	157	411	508	188	253	127
Arrive On Green	0.58	0.58	0.58	0.58	0.58	0.58	0.32	0.32	0.32	0.32	0.32	0.32
Sat Flow, veh/h	800	1757	90	555	1617	209	340	1279	1583	431	789	396
Grp Volume(v), veh/h	82	0	1011	27	0	620	185	0	71	310	0	0
Grp Sat Flow(s),veh/h/ln	800	0	1847	555	0	1826	1619	0	1583	1616	0	0
Q Serve(g_s), s	6.8	0.0	47.8	4.5	0.0	20.3	0.0	0.0	3.0	7.0	0.0	0.0
Cycle Q Clear(g_c), s	27.1	0.0	47.8	52.2	0.0	20.3	7.6	0.0	3.0	14.5	0.0	0.0
Prop In Lane	1.00		0.05	1.00		0.11	0.26		1.00	0.32		0.25
Lane Grp Cap(c), veh/h	372	0	1079	121	0	1067	568	0	508	569	0	0
V/C Ratio(X)	0.22	0.00	0.94	0.22	0.00	0.58	0.33	0.00	0.14	0.54	0.00	0.00
Avail Cap(c_a), veh/h	372	0	1079	121	0	1067	568	0	508	569	0	0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	0.00
Uniform Delay (d), s/veh	21.0	0.0	18.1	42.1	0.0	12.4	24.3	0.0	22.9	26.6	0.0	0.0
Incr Delay (d2), s/veh	1.4	0.0	15.9	4.2	0.0	2.3	1.5	0.0	0.6	3.7	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	28.9	0.8	0.0	10.8	3.9	0.0	1.4	7.3	0.0	0.0
LnGrp Delay(d),s/veh	22.3	0.0	34.0	46.4	0.0	14.7	25.9	0.0	23.5	30.3	0.0	0.0
LnGrp LOS	C		C	D		B	C		C	C		
Approach Vol, veh/h		1093			647			256			310	
Approach Delay, s/veh		33.2			16.1			25.2			30.3	
Approach LOS		C			B			C			C	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		35.0		60.0		35.0		60.0				
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5				
Max Green Setting (Gmax), s		30.5		55.5		30.5		55.5				
Max Q Clear Time (g_c+I1), s		9.6		49.8		16.5		54.2				
Green Ext Time (p_c), s		3.4		4.7		2.9		1.1				
Intersection Summary												
HCM 2010 Ctrl Delay			27.1									
HCM 2010 LOS			C									

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	75	885	25	505	45	125	65	90	125	70
Future Volume (vph)	75	885	25	505	45	125	65	90	125	70
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	60.0	60.0	60.0	60.0	35.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	63.2%	63.2%	63.2%	63.2%	36.8%	36.8%	36.8%	36.8%	36.8%	36.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5	4.5		4.5	4.5
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 95
Actuated Cycle Length: 95
Natural Cycle: 70
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Makiki St & Nehoa St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	75	885	45	25	505	65	45	125	65	90	125	70
Future Volume (veh/h)	75	885	45	25	505	65	45	125	65	90	125	70
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	82	962	49	27	549	71	49	136	71	98	136	76
Adj No. of Lanes	1	1	0	1	1	0	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	372	1027	52	121	945	122	164	431	508	246	321	508
Arrive On Green	0.58	0.58	0.58	0.58	0.58	0.58	0.32	0.32	0.32	0.32	0.32	0.32
Sat Flow, veh/h	800	1757	90	555	1617	209	362	1342	1583	599	1001	1583
Grp Volume(v), veh/h	82	0	1011	27	0	620	185	0	71	234	0	76
Grp Sat Flow(s),veh/h/ln	800	0	1847	555	0	1826	1704	0	1583	1599	0	1583
Q Serve(g_s), s	6.8	0.0	47.8	4.5	0.0	20.3	0.0	0.0	3.0	3.0	0.0	3.3
Cycle Q Clear(g_c), s	27.1	0.0	47.8	52.2	0.0	20.3	7.2	0.0	3.0	10.2	0.0	3.3
Prop In Lane	1.00		0.05	1.00		0.11	0.26		1.00	0.42		1.00
Lane Grp Cap(c), veh/h	372	0	1079	121	0	1067	595	0	508	567	0	508
V/C Ratio(X)	0.22	0.00	0.94	0.22	0.00	0.58	0.31	0.00	0.14	0.41	0.00	0.15
Avail Cap(c_a), veh/h	372	0	1079	121	0	1067	595	0	508	567	0	508
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.0	0.0	18.1	42.1	0.0	12.4	24.3	0.0	22.9	25.2	0.0	23.0
Incr Delay (d2), s/veh	1.4	0.0	15.9	4.2	0.0	2.3	1.4	0.0	0.6	2.2	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.6	0.0	28.9	0.8	0.0	10.8	3.9	0.0	1.4	5.2	0.0	1.5
LnGrp Delay(d),s/veh	22.3	0.0	34.0	46.4	0.0	14.7	25.7	0.0	23.5	27.4	0.0	23.6
LnGrp LOS	C		C	D		B	C		C	C		C
Approach Vol, veh/h		1093			647			256			310	
Approach Delay, s/veh		33.2			16.1			25.1			26.5	
Approach LOS		C			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		35.0		60.0		35.0		60.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		30.5		55.5		30.5		55.5
Max Q Clear Time (g_c+I1), s		9.2		49.8		12.2		54.2
Green Ext Time (p_c), s		3.0		4.7		2.9		1.1

Intersection Summary		
HCM 2010 Ctrl Delay		26.6
HCM 2010 LOS		C

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2026 AM Peak

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	15	180	35	70	40	5
Future Vol, veh/h	15	180	35	70	40	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	196	38	76	43	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	114	0	-	0	304	76
Stage 1	-	-	-	-	76	-
Stage 2	-	-	-	-	228	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1475	-	-	-	688	985
Stage 1	-	-	-	-	947	-
Stage 2	-	-	-	-	810	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1475	-	-	-	680	985
Mov Cap-2 Maneuver	-	-	-	-	680	-
Stage 1	-	-	-	-	947	-
Stage 2	-	-	-	-	800	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	10.5
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1475	-	-	-	704
HCM Lane V/C Ratio	0.011	-	-	-	0.069
HCM Control Delay (s)	7.5	0	-	-	10.5
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	6.3

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	5	200	240	55	150	10
Future Vol, veh/h	5	200	240	55	150	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	217	261	60	163	11

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	750	168	174	0	-	0
Stage 1	168	-	-	-	-	-
Stage 2	582	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	379	876	1403	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	559	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	306	876	1403	-	-	-
Mov Cap-2 Maneuver	306	-	-	-	-	-
Stage 1	862	-	-	-	-	-
Stage 2	452	-	-	-	-	-

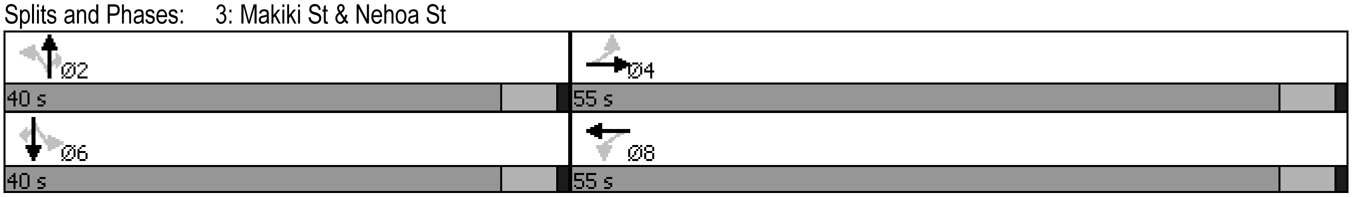
Approach	EB	NB	SB
HCM Control Delay, s	10.8	6.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1403	-	838	-	-
HCM Lane V/C Ratio	0.186	-	0.266	-	-
HCM Control Delay (s)	8.2	0	10.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.7	-	1.1	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	50	800	40	745	45	170	105	195	190	90
Future Volume (vph)	50	800	40	745	45	170	105	195	190	90
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
Total Split (s)	55.0	55.0	55.0	55.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (%)	57.9%	57.9%	57.9%	57.9%	42.1%	42.1%	42.1%	42.1%	42.1%	42.1%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	5.0	5.0	5.0	5.0		5.0	5.0		5.0	5.0
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 95
Actuated Cycle Length: 95
Natural Cycle: 90
Control Type: Semi Act-Uncoord

Splits and Phases: 3: Makiki St & Nehoa St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	50	800	40	40	745	60	45	170	105	195	190	90
Future Volume (veh/h)	50	800	40	40	745	60	45	170	105	195	190	90
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	54	870	43	43	810	65	49	185	114	212	207	98
Adj No. of Lanes	1	1	0	1	1	0	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	136	927	46	114	896	72	142	510	583	315	252	583
Arrive On Green	0.53	0.53	0.53	0.53	0.53	0.53	0.37	0.37	0.37	0.37	0.37	0.37
Sat Flow, veh/h	631	1760	87	609	1702	137	262	1385	1583	701	685	1583
Grp Volume(v), veh/h	54	0	913	43	0	875	234	0	114	419	0	98
Grp Sat Flow(s),veh/h/ln	631	0	1847	609	0	1839	1647	0	1583	1386	0	1583
Q Serve(g_s), s	8.0	0.0	44.0	6.0	0.0	40.9	0.0	0.0	4.7	17.7	0.0	4.0
Cycle Q Clear(g_c), s	48.9	0.0	44.0	50.0	0.0	40.9	8.9	0.0	4.7	26.6	0.0	4.0
Prop In Lane	1.00		0.05	1.00		0.07	0.21		1.00	0.51		1.00
Lane Grp Cap(c), veh/h	136	0	972	114	0	968	653	0	583	568	0	583
V/C Ratio(X)	0.40	0.00	0.94	0.38	0.00	0.90	0.36	0.00	0.20	0.74	0.00	0.17
Avail Cap(c_a), veh/h	136	0	972	114	0	968	653	0	583	568	0	583
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	42.4	0.0	21.1	44.8	0.0	20.3	21.7	0.0	20.4	27.8	0.0	20.2
Incr Delay (d2), s/veh	8.4	0.0	17.4	9.2	0.0	13.4	1.5	0.0	0.7	8.3	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0.0	26.8	1.4	0.0	24.0	4.7	0.0	2.1	11.3	0.0	1.8
LnGrp Delay(d),s/veh	50.8	0.0	38.5	54.0	0.0	33.7	23.2	0.0	21.2	36.2	0.0	20.8
LnGrp LOS	D		D	D		C	C		C	D		C
Approach Vol, veh/h		967			918			348			517	
Approach Delay, s/veh		39.2			34.7			22.5			33.3	
Approach LOS		D			C			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		40.0		55.0		40.0		55.0
Change Period (Y+Rc), s		5.0		5.0		5.0		5.0
Max Green Setting (Gmax), s		35.0		50.0		35.0		50.0
Max Q Clear Time (g_c+I1), s		10.9		50.9		28.6		52.0
Green Ext Time (p_c), s		5.3		0.0		2.7		0.0

Intersection Summary		
HCM 2010 Ctrl Delay		34.5
HCM 2010 LOS		C

APPENDIX C

LEVEL OF SERVICE CALCULATIONS

- Future Year 2026 PM Peak

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Traffic Vol, veh/h	5	55	75	40	70	5
Future Vol, veh/h	5	55	75	40	70	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	60	82	43	76	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	125	0	-	0	174	103
Stage 1	-	-	-	-	103	-
Stage 2	-	-	-	-	71	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1462	-	-	-	816	952
Stage 1	-	-	-	-	921	-
Stage 2	-	-	-	-	952	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1462	-	-	-	813	952
Mov Cap-2 Maneuver	-	-	-	-	813	-
Stage 1	-	-	-	-	921	-
Stage 2	-	-	-	-	948	-

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	9.9
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1462	-	-	-	821
HCM Lane V/C Ratio	0.004	-	-	-	0.099
HCM Control Delay (s)	7.5	0	-	-	9.9
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.3

Intersection	
Int Delay, s/veh	5.5

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Vol, veh/h	5	180	160	110	110	5
Future Vol, veh/h	5	180	160	110	110	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	196	174	120	120	5

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	589	122	125	0	-	0
Stage 1	122	-	-	-	-	-
Stage 2	467	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	471	929	1462	-	-	-
Stage 1	903	-	-	-	-	-
Stage 2	631	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	411	929	1462	-	-	-
Mov Cap-2 Maneuver	411	-	-	-	-	-
Stage 1	903	-	-	-	-	-
Stage 2	551	-	-	-	-	-

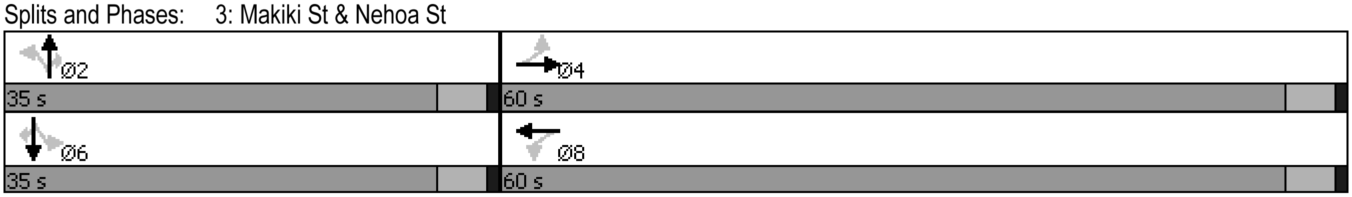
Approach	EB	NB	SB
HCM Control Delay, s	10.2	4.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1462	-	898	-	-
HCM Lane V/C Ratio	0.119	-	0.224	-	-
HCM Control Delay (s)	7.8	0	10.2	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.4	-	0.9	-	-

Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	80	885	25	505	45	135	65	105	140	75
Future Volume (vph)	80	885	25	505	45	135	65	105	140	75
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		8		2			6	
Permitted Phases	4		8		2		2	6		6
Detector Phase	4	4	8	8	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Minimum Split (s)	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5
Total Split (s)	60.0	60.0	60.0	60.0	35.0	35.0	35.0	35.0	35.0	35.0
Total Split (%)	63.2%	63.2%	63.2%	63.2%	36.8%	36.8%	36.8%	36.8%	36.8%	36.8%
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	4.5	4.5	4.5	4.5		4.5	4.5		4.5	4.5
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Max	Max	Max	Max	Max	Max	Max	Max	Max	Max

Intersection Summary
Cycle Length: 95
Actuated Cycle Length: 95
Natural Cycle: 70
Control Type: Actuated-Uncoordinated

Splits and Phases: 3: Makiki St & Nehoa St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	80	885	45	25	505	70	45	135	65	105	140	75
Future Volume (veh/h)	80	885	45	25	505	70	45	135	65	105	140	75
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1863	1863	1900	1863	1863	1900	1900	1863	1863	1900	1863	1863
Adj Flow Rate, veh/h	87	962	49	27	549	76	49	147	71	114	152	82
Adj No. of Lanes	1	1	0	1	1	0	0	1	1	0	1	1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	369	1027	52	121	936	130	154	436	508	250	307	508
Arrive On Green	0.58	0.58	0.58	0.58	0.58	0.58	0.32	0.32	0.32	0.32	0.32	0.32
Sat Flow, veh/h	797	1757	90	555	1602	222	332	1359	1583	609	956	1583
Grp Volume(v), veh/h	87	0	1011	27	0	625	196	0	71	266	0	82
Grp Sat Flow(s),veh/h/ln	797	0	1847	555	0	1824	1691	0	1583	1565	0	1583
Q Serve(g_s), s	7.4	0.0	47.8	4.5	0.0	20.6	0.0	0.0	3.0	4.9	0.0	3.5
Cycle Q Clear(g_c), s	28.0	0.0	47.8	52.2	0.0	20.6	7.8	0.0	3.0	12.7	0.0	3.5
Prop In Lane	1.00		0.05	1.00		0.12	0.25		1.00	0.43		1.00
Lane Grp Cap(c), veh/h	369	0	1079	121	0	1065	590	0	508	557	0	508
V/C Ratio(X)	0.24	0.00	0.94	0.22	0.00	0.59	0.33	0.00	0.14	0.48	0.00	0.16
Avail Cap(c_a), veh/h	369	0	1079	121	0	1065	590	0	508	557	0	508
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	21.3	0.0	18.1	42.1	0.0	12.5	24.5	0.0	22.9	26.0	0.0	23.1
Incr Delay (d2), s/veh	1.5	0.0	15.9	4.2	0.0	2.4	1.5	0.0	0.6	2.9	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	0.0	28.9	0.8	0.0	10.9	4.2	0.0	1.4	6.1	0.0	1.6
LnGrp Delay(d),s/veh	22.8	0.0	34.0	46.4	0.0	14.9	26.0	0.0	23.5	29.0	0.0	23.8
LnGrp LOS	C		C	D		B	C		C	C		C
Approach Vol, veh/h		1098			652			267			348	
Approach Delay, s/veh		33.1			16.2			25.3			27.7	
Approach LOS		C			B			C			C	

Timer	1	2	3	4	5	6	7	8
Assigned Phs		2		4		6		8
Phs Duration (G+Y+Rc), s		35.0		60.0		35.0		60.0
Change Period (Y+Rc), s		4.5		4.5		4.5		4.5
Max Green Setting (Gmax), s		30.5		55.5		30.5		55.5
Max Q Clear Time (g_c+I1), s		9.8		49.8		14.7		54.2
Green Ext Time (p_c), s		3.3		4.7		3.0		1.1

Intersection Summary			
HCM 2010 Ctrl Delay			26.8
HCM 2010 LOS			C

APPENDIX F

F-1 Preliminary Engineering Report (PER) Assessment of Civil Infrastructure for Department of Forestry and Wildlife Makiki Baseyard (November 2015)

Prepared by Sam O. Hirota Inc.

Preliminary Engineering Report (PER) -
Assessment of Civil Infrastructure for
Department of Forestry and Wildlife Makiki Base yard

TMK: 2-5-019:008

PREPARED FOR:

Mason Architects
119 Merchant Street, #501
Honolulu, Hawaii 96813

PREPARED BY:

SAM O. HIROTA, INC.
Engineers and Surveyors
864 South Beretania Street
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November 2015

Introduction

The Department of Forestry and Wildlife Makiki Base yard (TMK 2-5-019:008) is located along at the end of an access road, off Makiki Heights Drive. This preliminary engineering report will be limited to storm water management, drainage report and, and storm water catchment options and best management practices.

The site has been previously developed with existing buildings and sheds throughout the site. Portions of the access road are asphaltic concrete. The remainder of the access road is loosely compacted gravel. Various CRM retaining and CMU wall the the property. The remainder of the site consists of dense vegetation and large trees. An inactive BWS chlorinator located in the middle of the property. The USDA Natural Resource Conservation Website classifies the soils as Kaena Stoney clay (Kaed), with slopes ranging from 12-200% considered highly erodible and expansive. The site gradually slopes from the north-south towards Kanealole Stream, with a mean sea level elevation of approximately 360 feet, down to south with an elevation of approximately 330 feet. FEMA FIRM Map 15003C0360G, dated January 19, 2011, lists the site in a "Zone D" flood zone, where flood hazards are undetermined, but possible. The project earthwork and area disturbance will require a grading permit from the County of Honolulu, requiring compliance with Rules Relating t Soil Erosion Standards and Guideline. Project land disturbance will require an NPDES General Form C permit for construction activities from eth State of Hawaii Clean Water Branch. The project will be completed in two phases. Phase 1 will include site demolition, construction of a new administration building, 20-foot wide fire access road and turnaround, site utilities(sewer, water and drain systems, septic system) and retaining walls to complete the complete the fire access road. Phase 2 will included the Forestry/NARS building, parking lot between the two building, associated retaining walls and remainder of sewer, water and drain utilities.

Storm Drainage

Existing Condition

The Makiki base yard generates 3.56 cfs of runoff based the 10-year, 1-hour storm event, based in the City and County of Honolulu Storm Drainage Standards. Storm water generally flows from north to south, meandering through the Makiki base yard before entering in the Kanealole Stream. A concrete swale and CRM wall drainage system are located on the north-western corner of the property capturing a portion of offsite runoff. A series of grassed swales throughout the site direct water away from building a and towards the stream. The current access road is about 12-feet wide consisting of asphaltic pavement and crushed gravel. The current access road is no compliant with current HFD standards.

Proposed condition

The proposed development will generate 11.95 cfs of runoff. The proposed development will decrease storm runoff by 4.00% as a result of employing pervious pavement and onsite retention systems to limiting runoff from the site. The rainfall value for the 10-year 1-hour storm is 5 inches. The runoff coefficient for a developed area is 0.40. The runoff coefficient for/impervious surfaces is 0.90.The Administration and NARS/Forestry building runoff will be collected in rainwater catchment systems onsite. The parking lot between the NARS and Na Hele building will be retained in an 3,000 gallon underground retention tank. The area fronting the Na Hele building and the parking area long the Kanealole stream will be retained in an 5,000 gallon underground retention tank. The turnaround area will consists compacted gravel. The 20-foot fire access road will consist of 2-1/2" asphaltic concrete, over 6" base course over a 6" sub base. Sections with a road grade of 12% or higher will be of 6-inch Portland concrete cement pavement, over 6-inch base course and 6-inch sub base. The new road will have a 2% cross slope towards Kanealole Stream. The remainder of disturbed area will be grassed or landscaped. A portion of offsite storm water will be diverted around Administration building through the existing swale located in the western corner of the property. A series of 18 to 24-inch drain system will route water away from the buildings, before exiting on the stream side of the property. The remainder of the site will follow the existing drainage pattern. (See Exhibit 1)

Water System:

Existing System:

A BWS chlorination building is located in the middle of the property. An active 8-inch water main follow the existing roadway alignment and terminates in front of the chlorination building. Existing 8-inch and 4-inch water main from HBWS spring sources are located within the project site. Domestic water to the site is serviced through a 1-1/2" water BWS meter located near the entrance to the property. A fire hydrant is located 4-feet away from the water meter. A request for flow and pressure date for the site from HBWS indicates a static pressure of 162 psi, a residual pressure of 20 psi with a flow of 1,500 gpm (ref. 10).

Proposed water system:

Waterline construction shall be in compliance with the Honolulu Board of Water Supply's, Water System Standards 2002, as amended. The BWS chlorination facility will be demolished by others. An equivalent area of land will be designated near the proposed turn around for a replacement chlorinator facility, mauka of the existing gate. The new 8-inch waterline will be realigned within the new 20-foot road rights of way. A minimum 12-footwide easement will be required for the new waterline. An air relief valve shall be installed near the end of the waterline and at any high point along the waterlines vertical profile. The Honolulu Fire Department (HFD) requires a new onsite fire hydrant will be constructed fronting the NARS/Forestry building, so access can be provided 150-feet from the fire access road to the furthest exterior wall. HFD regulates all onsite fire hydrant shall providing a flow of 2000 gpm, for a 2 hour duration. The current HBWS water system to the site cannot provide adequate pressure to meet the HFD fire flow requirements. HBWS mentioned that increasing the water line to an

16-inch from an 8-inch will not provide adequate fire flow pressure to the site. The project site is located in a remote location and the end of the water system which does not provide adequate fire flow pressure . HBWS doesn't not plan to do any upgrade to the site water system in the near future. A 4-inch thick concrete hydrant curb guard shall be built around the fire hydrant. All new buildings will have a fire sprinkler system installed per current NFPA. HBWS requires an offsite fire hydrant shall be constructed 125 feet, mauka of the property line. Installation timeframe of the off site is pending further BWS review. All new building connection connecting to the 8-inch HBWS water main shall have a BWS water meter sized accordingly. A HBWS approved reverse backflow preventer will be required at the building and irrigation connections. Existing 8-inch and 4-inch water mains from the HBWS spring source shall be retained and cut and plugged for future use (See Exhibit 2).

<u>Sewer System:</u>

Existing Condition:

The closest City and County of Honolulu sewer system is an 8 inch sewer line located approximately 4,000 feet from the site. Wastewater from the various buildings flows into a septic tank and into the onsite treatment system called the "Green Machine". Flows from the Ranger Cottage are contained in a cesspool. Details for the existing sewer condition can be found in the Makiki Baseyard Wastewater Treatment Facility Evaluation by HDR.

Proposed Condition:

The cesspool serving the ranger station will be abandoned in place. The Green Machine will also be abandoned. A new 6-inch sewer main will follow the alignment of the new road laterals shall be constructed to City and County of Honolulu, Design Standards of the Wastewater Management, Volume 1. July 1993, as amended. A concrete sewer manhole shall be constructed at each change in direction or bend in sewer alignment within the roadway. Building connection shall be 6-inch laterals. A cleanout to grade shall be installed 5-feet from the building face. Cleanouts shall be located outside of parking areas and road travel way (See Exhibit 2). The new sewer line will connect an individual wastewater system (IWS). The IWS shall be in compliance with the State of Hawaii Department of Health Title 11 Chapter 62 Wastewater systems. The IWS will consist of a traffic rated concrete septic tank discharging to a distribution box and leech field. Sizing of the leech field will be determined by the results of an onsite percolation test in compliance with Title 11-Chapter 62.

Resources

1. "Rules Relating to Storm Drainage Standards", City and County of Honolulu, Department of Planning and Permitting, as Amended, Revised December, 2012.

2. "Design Standards of the Department of Wastewater Management, Volume I, City and County of Honolulu, State of Hawaii, as Amended, July 1993.

3. Water System Standards, Honolulu Board of Water Supply, County of Honolulu, 2002

4. "Guidelines on Rainwater Catchment Systems for Hawaii", Mcomber, Patricia S.H., University of Hawaii, College of Tropical Agriculture and Human Resources. Revised Edition 2010.

5. "Flood Hazard Assessment Report", State of Hawaii, DLNR, June 2013, Firm Index Date 4/2/2004.

6. Makiki Base yard Master plan, Helber, Haster and Fee, October 2012

7. Title 11 Chapter 62 Wastewater Systems, State of Hawaii Department of Health, 2012.

8. Makiki Base yard Wastewater Treatment Facility Evaluation Study, HDR, 2012.

9. Rules Relating to Soil Erosion Standards and Guidelines, City and County of Honolulu, April 1999.

10. BWS Flow and Pressure Data, dated July 24, 2014

BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843

July 24, 2014

RECEIVED
JUL 29 2014
SAM O. HIROTA, INC.
By

Mr. Jon Loeswick, LEED AP BD&C
Sam O. Hirota, Inc.
864 South Beretania Street
Honolulu, Hawaii 96813

Dear Mr. Loeswick:

Subject: Your Email Dated July 15, 2014 Requesting Flow and Pressure Data for the Meter Serving the Makiki Baseyard at the Makiki Valley State Park - Tax Map Key: 2-5-019: 008

The Board of Water Supply has suspended fire flow tests on fire hydrants as a water conservation measure. However, you may use the following calculated flow data for location near the meter serving the Makiki Baseyard:

Static Pressure...	162	psi
Residual Pressure..	20	psi
Flow...	1500	gpm

The data are based on the existing water system, and the static pressure represents the theoretical pressure at the point of calculation with the reservoir full and no demands on the water system. The static pressure is not indicative of the actual pressure in the field. Therefore, in order to determine the flows that are available to the site, you will have to determine the actual field pressure by taking on-site pressure readings at various times of the day and correlating that field data with the above hydraulic design data.

The map showing the location of the fire flow calculation is attached.

If you have any questions, please contact Robert Chun, Project Review Branch of our Water Resources Division at 748-5443.

Very truly yours,

Robert Chun

ROBERT CHUN
Project Review Branch

Attachment

MAKIKI CHLORINATOR (INACTIVE)
2225 MAKIKI HEIGHTS DR
2109 MAKIKI HEIGHTS DR
2135 MAKIKI HEIGHTS DR
2131 MAKIKI HEIGHTS DR
METROPOLITAN 705
2179B MAKIKI HEIGHTS DR
2221 MAKIKI HEIGHTS DR
2427 MAUNALAHA RD
MAUNALAHA RD

EXHIBIT 1 - SITE GRADING PLAN

SCALE: 1"=20'

OCTOBER 2015

EXHIBIT 2 - SITE UTILITY PLAN

SCALE: 1"=20'

OCTOBER 2015

APPENDIX F

F-2 Makiki Baseyard Wastewater Treatment Facility Evaluation Study for Department of Forestry and Wildlife Makiki Baseyard (October 2015)

Prepared by: HDR

Makiki Baseyard Wastewater Treatment Facility Evaluation Study

Introduction

The Division of Forestry and Wildlife (DOFAW) of the Hawaii Department of Land and Natural Resources (DLNR) is proposing to improve its existing Baseyard located in Makiki. The proposed improvements include additional buildings to facilitate program activities; an extension to the existing administration building; and an additional building for Forestry, Wildlife, and Na Ala Hele programs.

This study has been prepared in accordance with the State of Hawaii Administrative Rules Title 11, Chapter 62 (HAR 11-62) entitled “Wastewater Systems.” HAR 11-62 [11-62-06(n)] states: “Whenever a building modification is proposed, the wastewater system serving the building shall be required to be upgraded in order to meet the applicable requirements of this rule.” HAR 11-62 also requires that the disposal of wastewater and sludge generated from the treatment of wastewater shall not contaminate or pollute any valuable water resource, and does not become a hazard or potential hazard to the public health, safety and welfare.

The purpose of this study is to evaluate alternatives for improvements to or replacement of the existing wastewater treatment and disposal system. The study considered projected growth and subsequent additional flows anticipated to be generated at the DOFAW Baseyard as well as consider wastewater flows generated from the Hawaii Nature Center, which is located adjacent to the DOFAW facilities.

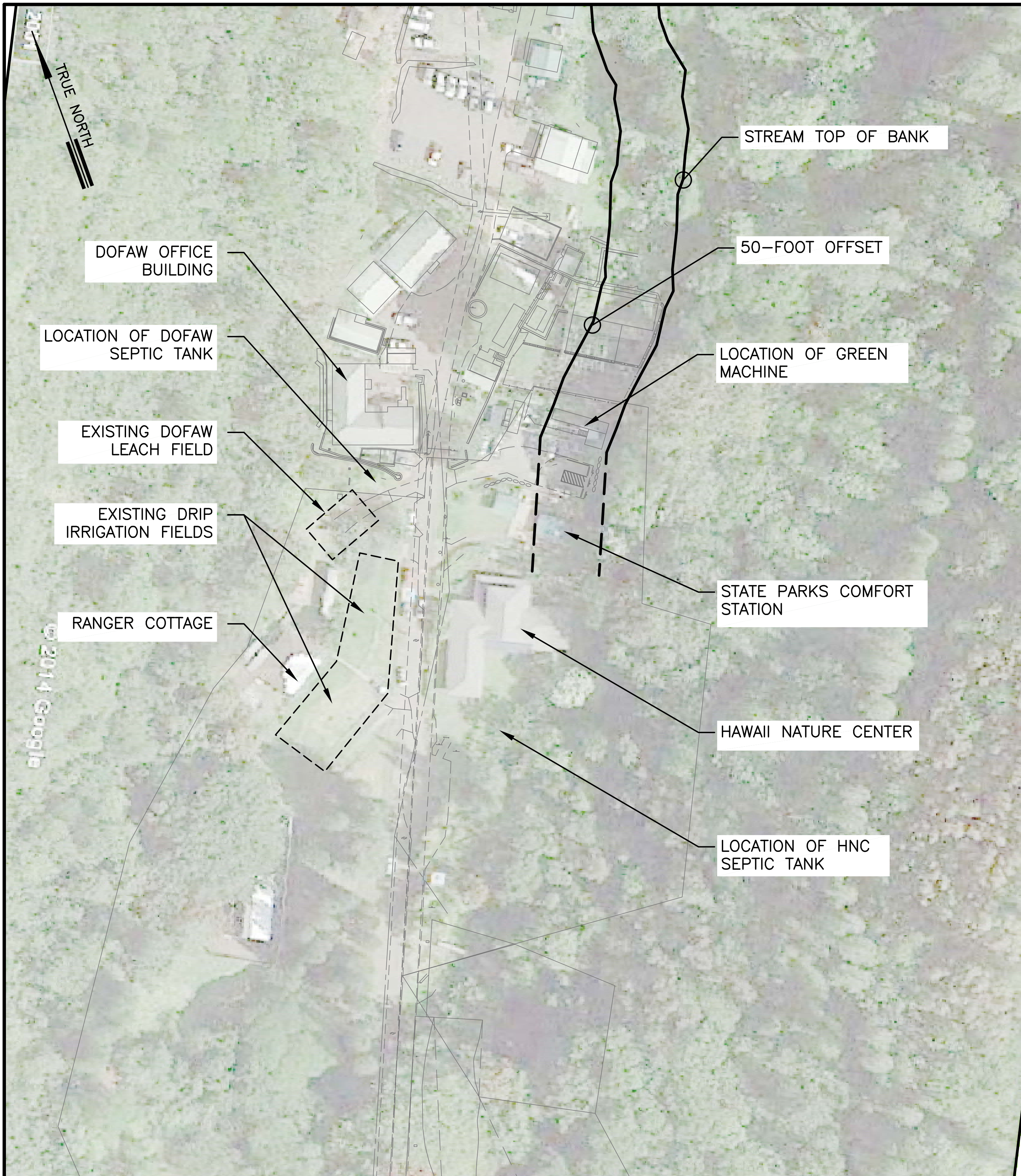
Existing Wastewater Treatment Conditions

Prior to 2009, all wastewater flows generated at the DOFAW facility were collected into a septic tank for treatment. Treated water was discharged to a series of leach fields located onsite. In 2009, DOFAW reached an agreement with the Hawaii Nature Center (HNC) that allowed DOFAW to begin pumping waste flows from its septic tank to the HNC’s onsite treatment system, called the Green Machine (GM). The agreement was beneficial for both parties in that the HNC provided operation and maintenance personnel to help manage DOFAW’s wastewater flows, and the Green Machine gained additional flow to help in the overall operation of the system.

In addition to the DOFAW and HNC systems, a field services building (Ranger Cottage) shared by DOFAW and the HNC is located Makai of the DOFAW administrative building and is used as a field office and as a temporary, short duration residence for field personnel. Wastewater from this building is diverted to an adjacent cesspool. This study assumes that flows from the Ranger Cottage will be diverted to the recommended treatment alternative, and that the cesspool will be abandoned in place.

Wastewater Treatment Facility Existing Conditions

Wastewater is pumped from both DOFAW and HNC septic tanks to the Green Machine. The GM was constructed approximately 20 years ago as an above grade “constructed wetlands” type of system. The GM originally began operating as a pilot system in 1994-1995 at a slaughter house facility on Oahu. It was eventually donated to the HNC in 2004 and began operation at the current location, treating wastewater from the HNC’s facility. In 2009 it began accepting flows from DOFAW. The location of the existing septic tanks, leach fields and GM are shown on Figure 1.



HDR	DIVISION OF FORESTRY AND WILDLIFE MAKIKI BASEYARD	EXISTING SITE LAYOUT SCALE: 1" = 100'	FIGURE 1

The GM consists of an above grade steel tank that is separated into two independent treatment trains (Figure 2). Each train consists of seven separate chambers that are 4'×4'×8' deep. Wastewater is pumped from the HNC and DOFAW property septic tanks into the first chamber in batches, where it then flows by gravity through the next five chambers (Figure 3). The seventh and final chamber in each treatment train is used as a final holding cell for the treated and chlorinated water. Chlorination is achieved by use of chlorine tablets in which flows pass over when entering the final chamber (Figure 4). Finished wastewater is pumped out from the holding chambers to a series of two irrigation drain fields located on the western side of the service road Figure 5).

Figure 2. The Green Machine

Detention time through the Green Machine averages between 12-14 days at current flows. Typically both treatment trains are operated simultaneously in order to maintain the vegetation populations. The first six treatment chambers are aerated by a single 1/8 horsepower regenerative blower to keep the system in an aerobic state to enhance biological treatment. Chambers 2 through 6 are planted with native Hawaiian rushes and sedges to help in the removal of nutrients from the waste stream.

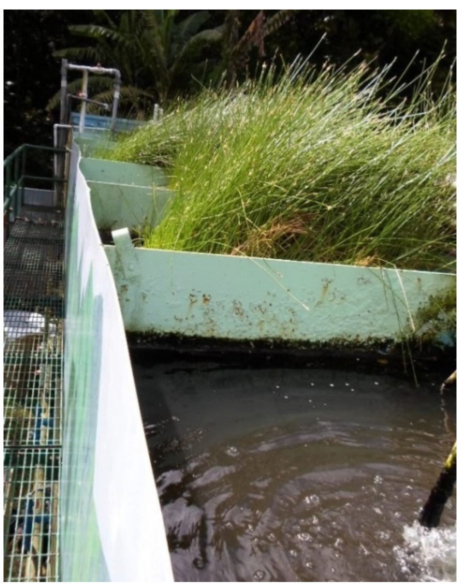


Figure 3. Treatment Chambers with Native Vegetation

Figure 4. Final Chamber Showing Chlorination System

A solar photovoltaic (PV) and battery storage system powers the blower and pumps for GM. An extension cord that runs from the adjacent DOFAW utility storage building is used as the sole source for backup power. A totalizing flow meter is installed on the effluent line, but is currently not functional.

Treated water from the GM is comparable to R2 quality water (disinfected secondary reclaimed water) as defined by HAR 11-62. The treated effluent is pumped to two irrigation fields employing drip irrigation. The drip irrigation lines are approximately 6'' below the ground surface. The irrigation fields occupy approximately 4,000 square feet of area. Solids that are accumulated and settled in the GM are pumped back to one of the septic tanks approximately every three months.

The existing wastewater flow is generated from domestic activities only with no contributing industrial or commercial activities. There are also no onsite kitchens or food preparation operations that would contribute significant quantities fats, oils or greases. Therefore while not specifically monitored or tested, the influent wastewater would be expected to exhibit characteristics typical of domestically generated wastewater. There is a small laboratory attached to the GM that is capable of conducting microbiological and total nitrogen (TN) analyses. The existing GM is not regulated by DOH as a "wastewater treatment works" under HAR 11-62, and therefore testing results are not required to be submitted to DOH and testing is not performed on a regular basis.

Figure 5. Location of Drip Irrigation Fields

The GM was originally located at its current position as a temporary treatment facility with the understanding that HNC would use the facility as an educational tool for visitors and classes. The temporary status allowed for the GM to remain situated on the tractor trailer bed that was used to haul it to the current position, and consequently it is exposed to the elements. This constant exposure to the environment has caused significant deterioration to the GM system, including corrosion of the steel tank, deterioration of exposed PVC piping, damage from termites to the wood support structure, and corrosion to the wheel and axles of the trailer (Figures 6-7). Corrosion to the steel tank appears to be occurring primarily at and above the water surface in the steel chambers, and on the exterior of the tank. The condition of the steel underside of the GM is unknown.

Figure 6. Trailer Wheel/Axle and Exterior Piping

Figure 7. Corrosion on Inside of Tanks.

HAR 11-62 Regulatory Requirements

HAR 11-62-31 outlines the rules and regulations for the installation of individual wastewater systems (IWS), which includes the provision that flow into an individual IWS shall not exceed 1,000 gpd. As defined under HAR 11-62-31, IWSs are typically considered to be systems utilizing septic tanks, which provide for solids settlement and primary treatment of the wastewater. The GM is considered to be a variation of an IWS system that is capable of producing secondary quality effluent. Although the GM is a secondary treatment system that has a capacity of 10,000 gpd, it is currently only permitted by DOH to accept and treat up to 1,000 gpd, and is not classified or regulated as a "wastewater treatment works" as defined by HAR 11-62.

The DOFAW and HNC sites are located adjacent to the valley streambed. HAR 11-62 Appendix F states that wastewater treatment units must be installed a minimum of 50 feet from a stream's top of bank line, as well as 5 feet from any building or property line. The locations of the existing septic tanks are within the minimum setback requirements; however the existing location of the GM does not comply with the setback requirements. The setback requirements will need to be considered for any new wastewater treatment facilities that are proposed to be constructed.

Current Wastewater Flows

Currently all wastewater received at the GM are from the DOFAW and HNC facilities. Both sites collect flows into separate 1,250 gallon septic tanks which pump up to the GM. The DOFAW Makiki Baseyard facility currently has 17 employees assigned. Based on discussions with staff, 10 employees typically work at the baseyard for the entire work day, and are therefore classified as full-time employees (FTEs) for the purpose of estimating the wastewater flows. Seven employees are considered transient in that they typically do not spend a full workday at the facility, and are therefore classified as part-time employees (PTEs) for the purpose of estimating the wastewater flows. At current staffing conditions, the design existing flows from the DOFAW facility are expected to be approximately 210 gpd. This is based on office worker design water use of 15 gallons per day per FTE. Design flows for PTEs are assumed to 7.5 gpd based on the assumption that PTEs will be onsite only one-half of the workday and therefore only use half of the water of FTEs.

Flows generated from the HNC are primarily from working staff and visiting groups of students and teachers. Currently there are 5 FTEs and 12 PTEs that work at the HNC facility. Staff has indicated that the number of visitors is typically dependent on seasonal variations, with 2 months in the spring and 2 months in the fall exhibiting peaks in student classes and visitor attendance. During the peak months, the number of visitors is estimated to be 135 per day for up to 5 days per week. During non-peak months, visitor counts typically average 60 per day for 5 days per week. It is conservatively assumed that each visitor will generate 5 gpd of flow.

Current design flows for both DOFAW and HNC facilities are shown in Table 1. The treatment facilities should be designed to accommodate peak day flows that could result from heavy visitor loadings. The existing computed flows based on peak day conditions are 205 gpd for DOFAW and 835 gpd for HNC. However since FTE and PTE staff is expected to work 5 of 7 days per week, a factor of 80% was applied to the design flow to compute the design average and peak flows associated with the workers at the facilities. Based on application of the workday factor of 80%, the current design flows based on peak day conditions are 165 gpd for DOFAW and 670 gpd for HNC.

According to observations from operations staff the GM typically receives flows, pumped in batches, of 200 to 300 gallons every 2 to 3 days. Based on these observed flows, the GM averages a total of approximately 100 gpd with peaks up to 500 gpd depending on HNC visiting group activities. The much higher current design flows in Table 1 compared to the reported observed current flows is likely due to the inherently conservative assumptions used to compute the design flows. For example, the design flow is based on each visitor using 5 gpd, while in reality, visitors may likely average 2 gpd per person based on typical water usage of 1.6 gpd flush for water saving toiles. Similarly, a design flow of 15 gpd is used for FTEs in an office setting, when actual flow may be less than 10 gpd. Despite the obvious conservatism in the design values, the computed flows are not unreasonable when compared to typical residential homes that may readily generate 400 gpd or more for larger families.

Table 1. Summary of Estimated Populations and Wastewater Flows

	DOFAW		HNC		Ranger Cottage		TOTAL	
POPULATION	Current	Future	Current	Future	Current	Future	Current	Future
FTEs	10	34	5	7	-	3	15	44
PTEs	7	12	12	15	-	-	19	27
Visitors at HNC (peak day)	-	-	134	134	-	-	134	134
Visitors at HNC (average day)	-	-	60	60	-	-	60	60
FLOWS (gpd)								
FTEs	150	510	75	105	-	210	225	825
PTEs	55	90	90	115			145	205
Visitors to HNC (peak day)	-	-	670	670	-	-	670	670
Visitors to HNC (average day)	-	-	300	300	-	-	300	300
Flow (gpd) (peak day)	**205**	**600**	**835**	**890**	**-**	**210**	**1,040**	**1,700**
Flow (gpd) (average day)	**205**	**600**	**465**	**520**	**-**	**210**	**670**	**1,330**
Design Flow (80%) (gpd) (peak day)	**165**	**480**	**670**	**710**	**-**	**210**	**830**	**1,400**
Design Flow (80%) (gpd) (average day)	**165**	**480**	**375**	**415**	**-**	**210**	**535**	**1,105**

1. Flows based on: 15 gpd per FTE; 7.5 gpd per PTE; 5 gpd per NHC visitor, and; 70 gpd per residential dweller (Ranger Cottage).
2. Projected future population and flows associated with HNC FTEs residing at the Ranger Cottage are included in the HNC FTE numbers.
3. Design average and peak flows are assumed to be 80 percent of the flows due to reduced loads on weekends.

Future Developments and Projected Flows

DOFAW

At full build-out, the planned new facilities as part the DOFAW Baseyard upgrades are anticipated to generate as much as 24 additional FTE positions and up to 5 additional PTEs positions. The planned improvements are anticipated to be primarily office space with some additional garage/storage space. Future increases in flow are therefore based on the flow generated by additional office workers. Projected design wastewater flows generated from future DOFAW improvements are expected to add approximately 315 gpd, increasing the design total flow to 480 gpd. While full build-out of the DOFAW Baseyard is anticipated to be completed in phases, it is recommended that improvements to the wastewater collection and treatment facilities be implemented to accommodate the projected flows at full build-out due to economy of scale factors and to help minimize the need for future upgrades and additional construction costs.

Hawaii Nature Center

Based on discussions with staff at the HNC, the number of FTEs and PTEs at the facility are anticipated to increase to 7 and 15, respectively. The FTE counts include employees that are or would be stationed or working in the HNC-owned Ranger Cottage. The overall number of visitors to the HNC is not projected to increase as the HNC is already at the upper working capacity for student programs. The HNC future peak day design flow is therefore only projected to increase by 40 gpd to a total of 710 gpd.

Ranger Cottage

The HNC has indicated that the cottage is also occasionally used by employees for short term residence (up to 6 months at a time) in preparation for field service trips. Currently flows from the cottage are discharged to an existing cesspool. Future improvements to the DOFAW Baseyard should include abandonment of the cesspool and installing new sewer lines to redirect the cottage flows to the new upgraded wastewater treatment system. This study assumes that will occur and future deign peak day flows include flows from the Ranger Cottage.

Combined Wastewater Flows

Based on the proposed improvements at the DOFAW Makiki Baseyard, anticipated additional staff at the HNC, and the addition of flows from the Ranger Cottage, the projected combined design future wastewater flow is anticipated to be 1,105 gpd during average visitor attendances and 1,400 gpd on peak visitor days. The design future flows are based on the application of the 80% workday factor. A breakdown of the projected population and flows by facility is shown in Table 1.

As noted above, HAR 11-62 considers each septic tank system to be an IWS provided that the flow to each is under 1,000 gpd. Based on the projected future flows for the DOFAW and HNC systems presented in Table 1, each existing septic tank system is considered to be an IWS since both design and average flows are projected to be less than 1,000 gpd for each system.

Description of Alternatives

Based on discussions with DOFAW and the HNC, the alternatives presented below assume that flows from both facilities' IWS systems, which consist of existing septic tanks for each facility, will be managed as a single secondary treatment system. In all alternatives below, with the exception of Alternative 5 which proposes to abandon the septic tanks, the continued use of separate septic tanks for each facility is proposed. Septic tank effluent from the two systems is proposed to be combined and treated and disposed of utilizing a new or upgraded wastewater system.

Since the combined DOFAW and HNC design flows is expected to exceed 1,000 gpd in the future, a variance from DOH will likely be required to have the facility not designated as a "wastewater treatment works" under HAR 11-62 and regulated as a modified IWS. DOH has granted variances in the past for large systems with flows more than several thousand gallons per day. Variances are typically granted for system that serve public facilities such as schools and utilize "low-tech" systems such as septic tanks and leach fields. Classification of the system as a wastewater treatment works would increase both construction and operating costs substantially due to more stringent design, operation, and monitoring requirements. If DOH determines that a variance is not appropriate, a reasonable and cost-effective alternative would be to construct two separate independently operated parallel systems, each with a capacity not exceeding 1,000 gpd. Installation of independent parallel systems may be desirable to allow for one treatment train to be temporarily taken out of service for maintenance.

It is assumed that DOH and the Board of Water Supply (BWS) will grant approval for the installation of a wastewater treatment and subsurface disposal system located above the BWS established No-Pass Zone. Leaching of pathogens and excessive nitrates into the potable aquifer should not be a concern due to the relatively low flow, and ability to design all of the alternative systems to remove pathogens and most of the alternatives to significantly lower nitrogen levels. It should be noted that the much of the Makiki and Punchbowl areas are currently serviced by septic tank and cesspool IWS systems due to lack of sewer service and that septic tank and cesspool systems are not designed to provide high levels of nitrogen removal.

The five alternatives evaluated in this study are as follows:

- Alternative 1: Rehabilitate Existing Green Machine
- Alternative 2: Construct New Leach Fields
- Alternative 3: Construct New Green Machine
- Alternative 4: Construct New Constructed Wetlands
- Alternative 5: Connect to City Sewer System

For Alternatives 1 through 4, potential locations for the facilities are shown on Figure 10. Each of the alternatives are described and evaluated below.

Alternative 1: Rehabilitate Existing Green Machine

Rehabilitation of the existing GM would include recoating of the interior of all 14 individual steel chambers, as well as the exterior of the entire tank system, relocating the entire tank structure onto a new concrete pad, bringing the electrical system up to code, and replacing the steel catwalk and handrails. The GM is currently located within the 50-foot stream setback and would need to be relocated to be outside the setback.

The existing foundation system of a tractor trailer supported with concrete footing blocks and wood struts is considered temporary. If the GM is to be used as a permanent treatment solution, it would need to be installed on and anchor-tied down to a new concrete pad in order to meet seismic codes. In the event of an earthquake with the current method of support, there is minimal protection from the tank falling or overturning and causing a wastewater spill. The new concrete foundation pad would be a minimum of 12 feet wide by 32 feet long.

During the rehabilitation process, one train of steel chambers (seven chambers) would be taken offline and drained. The other train of steel chambers (seven) would perform the daily wastewater treatment as usual. Once recoating of the first train of steel chambers was completed, it would be reconnected and refilled with wastewater and the second train would be drained and recoated. Once recoating is completed and the new concrete foundation is in place, the GM would need to be drained and relocated onto the pad for permanent installation. Temporary wastewater disposal methods, such as tankering from the septic tanks, would need to be coordinated.

Both the existing catwalk and hand railings appear to have some level of corrosion damage, and the existing handrail height is too low and does not comply with current building code requirements. A completely new catwalk and handrail system will be installed. Both the catwalk and handrails would either be constructed of corrosion resistant materials such as fiberglass reinforced polyester (FRP) or provided with industrial-quality coating for corrosion protection.

Other improvements would include replacing the backup power supply (currently an extension cord from the nearby tool shed) with a hard wired receptacle at the GM in accordance with electrical codes. The flow meter would be replaced to allow for more accurate flow monitoring. Exterior piping would also be replaced.

Because the Green Machine is considered an active secondary treatment plan, including biological removal, aeration and disinfection, HAR 11-61 would require a licensed treatment plant operator to operate the facility. However because the system is not a typical wastewater treatment plant, it may be possible that DOH would grant an exemption for requiring a licensed operator.

The existing 4,000 square feet of irrigation area is anticipated to be adequate in accommodating the projected future flows for this alternative.

Advantages:

A. The existing system has more than enough capacity to accommodate all future developments.
B. Provides for the opportunity for continued use as an educational tool by the HNC.
C. Provides a higher quality of effluent and degree of nitrogen removal than septic tanks and leach fields.

Disadvantages:

A. Relatively difficult construction constraints. New footprint for concrete foundation required.
B. Requires knowledgeable operator and some mechanical support to operate and maintain the system. DOH may require a licensed operator if the system is classified as a "wastewater treatment works."
C. Capital and operating cost are substantial (see Table 2).

Typical maintenance tasks:

A. Routine maintenance of pumps, blowers and other equipment, with replacements as needed.
B. Routine harvesting and replenishing of the in-chamber nutrient saturated vegetation and aquatic life.
C. Ongoing corrosion monitoring and touch up recoating would be required. Complete recoating may be required as often as every 15-20 years or sooner.
D. Removal of sludge from the septic tanks every 1-3 years depending on actual loadings and rate of solids accumulation.

Table 2. Detailed Costs for Alternative 1

Alternative 1. Rehabilitate Existing Green Machine	
Capital Costs	
Recoating, Repairing and Replacing of Steel Structures	$140,000
New Concrete Foundation	$20,000
Electrical Improvements	$7,500
Locating GM onto New Concrete Foundation	$10,000
Abandon Cesspool and Connect Ranger Station to Septic Tank	$15,000
Archeological Monitoring	$30,000
Engineering Costs	$80,000
Total Capital Costs	**$302,500**
Annualized O&M Costs	
Licensed Operator Salary (assumed 1/2 time)	$20,000

Alternative 1. Rehabilitate Existing Green Machine	
Clean Septic Tanks (assumed every 2 years)	$300
GM Equipment Service and Replacement	$200
Power, Chemicals (chlorine tablets), and Misc. Supplies/Services	$2,000
Septic Tank Pump Replacements (assumed every 5 years)	$300
Total Annualized O&M Costs	**$22,800**

Alternative 2: Construct New Leach Fields

Wastewater flows from the DOFAW Administrative Building were originally designed to connect to a 1,250 gallon septic tank and leach field system. The septic tank and leach field were installed in 1994 and are located at the makai side of the Administrative Building (Figure 8). The approximate location of the leach field has become an informal driveway over the years for access to the HNC Ranger Cottage and the leach field drain lines appear to have been compromised over the years. It is presumed that the continued vehicular traffic over the lines has caused compaction and has inhibited the ability of the field to percolate water efficiently.

When building a leach field, the size of field is determined primarily by the infiltration rate of the soil. From Hydrologic Soil Groups for the United States, soils are classified in to 4 groups as indicated in Table 3 below (from United States Department of Agriculture, *Urban Hydrology for Small Watersheds*, 210-VI-TR-55, Second Ed., 1986: A-1). Soil application rates for the different soil groups, in gallons per square foot (gpsf) are also shown in Table 3 (from U.S. Environmental Protection Agency, *Onsite Wastewater Treatment and Disposal Systems Design Manual*, 1980).

Figure 8. Location of Existing DOFAW Leach Field.

Table 3. Soil Application Rate for Different Soil Groups

Soil Group	Description	Soil Application Rate (gpsf))
Group A	Sand, Loamy Sand or Sandy Loam	0.8
Group B	Silty Loam or Loam	0.6
Group C	Sandy Clay Loam	0.45
Group D	Clay Loam, Silty Clay Loam, Sandy Clay, Silty Clay or Clay	0.2

Based on the Hydrologic Soil Groups for the United States, soils found in the Makiki valley are classified into soil Group B Silty Loam or Loam (United States Department of Agriculture, *Urban Hydrology for*

Small Watersheds, 210-VI-TR-55, Second Ed., 1986: A-23), indicating a typical absorption capacity of 0.6 gpsf. Under this option, a percolation test would be recommended to confirm the soil application rate.

The drainage area of the leach field is determined by dividing the average design daily flow by the soil application rate. Due to the anticipated variations in flow based on seasonal and workday factors, a flow of 1,400 gpd was used for preliminary sizing of the leach fields. To accommodate combined flows from DOFAW, HNC and the Ranger Cottage, the area required for a leach field would be as follows:

Area = (Average Design Flow) ÷ (Soil Application Rate)

DOFAW	= (480 gpd) ÷ (0.6 gallons/ft^2)	= 800 ft^2
HNC + Ranger Cottage	= (710+210 gpd) ÷ (0.6 gallons/ft^2)	= 1,533 ft^2
Total	= (1,400 gpd) ÷ (0.6 gallons/ft^2)	= 2,333 ft^2
		≈ 2,400 ft^2

Employing a leach field disposal system for the combined DOFAW and HNC flows would require approximately 2,400 sf of application area. Separate leach fields could be constructed to accommodate flows from each facility as long as each new leach field is designed to handle the flow from the specific facility.

Based on the layout from the original design drawings the existing DOFAW leach field is approximately 20 feet wide and 35 feet long, providing an application area of 700 square feet. There appears to be space available at the existing location to construct a new leach field sized at 800 sf to accommodate projected future DOFAW flow. Replacement rather than restoration of the existing leach fields is recommended. There is evidence that the existing leach field has been structurally compromised, which would not be unexpected due to vehicular traffic over the leach field for which it was not designed. Replacement would include removal of the existing leach field piping and bedding material and construction of a new leach field in generally the same location.

Assuming DOFAW flows will be accommodated by replacement of the existing leach field, and based on the preliminary sizing calculations, an additional 1,600 square feet of new leach fields would be required to be constructed to accommodate the projected combined DOFAW and HNC future flow demands. Possible locations for additional leach fields include the existing irrigation area and other areas further south as shown on Figure 10.

It should be noted that even if DOFAW and HNC septic tank flows were disposed of separately, projected future flows for both facilities separately would require additional leach field area to be constructed for both systems.

From a treatment standpoint, while septic tanks will remove a portion of the organic matter and nutrients in the wastewater, such systems are not designed to produce effluent low in nitrogen and other nutrients. Since the system is located over a potable water aquifer, the Honolulu BWS may oppose the use of a new leach field disposal system to replace the existing GM that provides a high level of nitrogen removal.

Advantages:

A. Once constructed, leach fields have comparatively minimal operational and maintenance needs.
B. Relatively low capital investment.

Disadvantages:

A. Construction of additional leach fields would be required.
B. If not designed and maintained properly (for example if allowed to be routinely driven over), frequent replacement of leach field components may be necessary.
C. Existing footprint would no longer be available as a driveway and parking area.
D. The potential for use as an educational tool by the HNC is eliminated.
E. A septic tank and leach field disposal system would not provide as high degree of nitrogen removal as other options and obtaining DOH and Honolulu BWS approval may be a challenge.

Typical maintenance tasks:

A. Removal of sludge from the septic tank every 1-3 years depending on actual loadings and rate of solids accumulation.

Table 4. Detailed Costs for Alternative 2

Alternative 2. Construct New Leach Fields	
Capital Costs	
Construct New Leach Fields	$60,000
Demolition, Removal & Disposal of Green Machine	$15,000
Abandon Cesspool and Connect Ranger Station to Septic Tank	$15,000
Archeological Monitoring	$30,000
Engineering Costs	$50,000
Total Capital Costs	**$170,000**
Annualized O&M Costs	
Clean Septic Tanks (assumed every 2 years)	$300
Septic Tank Pump Replacements (assumed every 5 years)	$300
Total Annualized O&M Costs	**$600**

Alternative 3: Construct a New Green Machine

Although the proposed new development will result in an increase in flow, the existing GM that is designed for a 10,000 gpd capacity will continue to be highly underutilized. Constructing a new downsized GM at a suitable location outside of the 50-foot stream setback is a viable alternative. The smaller Green Machine would be a completely new unit with new tanks and supporting equipment, including pumps, blowers and new PV power system. A new backup power source would also be installed.

Combined wastewater flows will increase to an estimated peak day flow of 1,400 gpd. Construction of a new, appropriately sized treatment system similar to the existing GM would allow for comparable biological treatment and nutrient removal while operating in a smaller footprint. Utilizing a configuration and concept similar to the existing GM, including utilization of the type of fish populations and native plants in the treatment chambers, the new GM tank with two treatment trains would be approximately half the size of the existing system.

The tank could be constructed from steel with a protective coating, or from corrosion resistant materials such as high density polyethylene (HDPE). HDPE or other corrosion resistant materials would eliminate corrosion issues, while a coated steel tank would tend to have concerns with structural integrity issues related to thermal expansion, UV exposure, and foundation issues. For the purposes of this study it is assumed that a smaller Green Machine treatment plant will be constructed of steel with a high performance industrial-grade protective coating.

Similar to the existing Green Machine, a licensed wastewater treatment plant operator would be required to operate the facility if it is classified as a “wastewater treatment works” rather than a modified IWS system by the DOH.

Similar to Alternative No. 1, the existing 4,000 square feet of irrigation area is anticipated to be adequate in accommodating the projected future flows.

Advantages:

A. Properly sized treatment facility would operate more efficiently and occupy a smaller area than the existing GM.
B. Design could be customized based on specific characteristics of the site, including use of PV, equipment layout and locations, treatment capabilities, and potential educational uses.
C. Provides for the opportunity for continued use as an educational tool by the HNC.
D. Provides a higher quality of effluent and degree of nitrogen removal than septic tanks and leach fields.
E. A new facility, if adequately maintained, may result in a longer service life and lower maintenance costs that a refurbished GM.

Disadvantages:

A. Relatively difficult construction constraints. New footprint for concrete foundation required.
B. Requires licensed WWTP operator to operate and maintain the system.

Typical Maintenance tasks include:

A. Routine maintenance of pumps, blowers and other equipment, with replacements as needed.
B. Routine harvesting and replenishing of the in-chamber nutrient saturated vegetation and aquatic life.
C. Ongoing corrosion monitoring and touch up recoating would be required (with steel tanks). Complete recoating may be required as often as every 15-20 years or sooner.
D. Removal of sludge from the septic tanks every 1-3 years depending on actual loadings and rate of solids accumulation.

Table 5. Detailed Costs for Alternative 3

Alternative 3. Construct New Green Machine	
Capital Costs	
Construct New Green Machine (Steel Construction)	$160,000
New Concrete Foundation	$13,000
Electrical Improvements	$7,500
Demolition, Removal & Disposal of Existing Green Machine	$15,000
Abandon Cesspool and Connect Ranger Station to Septic Tank	$15,000
Archeological Monitoring	$30,000

Alternative 3. Construct New Green Machine	
Engineering Costs	$100,000
Total Capital Costs	**$340,500**
Annualized O&M Costs	
Licensed Operator Salary (assumed 1/2 time)	$20,000
Clean Septic Tanks (assumed every 2 years)	$300
GM Equipment Replacements	$200
Power, Chemicals (chlorine tablets), and Misc. Supplies/Services	$2,000
Septic Tank Pump Replacements (assumed every 5 years)	$300
Total Annualized O&M Costs	**$22,800**

Alternative 4: Construct New Constructed Wetlands

A constructed wetlands provides for secondary levels of treatment of wastewater using natural wetland ecosystems to provide stabilization of organic material, reduction of pathogens, and nutrient removal. A constructed wetland is an engineered ecosystem involving the application of wastewater to specially designed media beds in which selected wetland plants are grown. There are two types of wetland systems; free water surface (FWS) systems with a shallow water depth, or subsurface flow (SSF) systems with water flowing laterally through a sand or gravel bed. Both types of wetlands systems provide secondary levels of treatment, and the choice to construct either is dependent on the specific needs and constraints of the site. For the Makiki Baseyard site, it is assumed that an SSF type of wetlands system that does not normally have an exposed free water surface will be constructed to reduce the potential for exposing staff and visitors to pathogens in partially treated wastewater.

In accordance with the Federal Clean Water Act (CWA) and HAR 11-54, treated wastewater from the constructed wetlands would not be allowed to discharge directly to surface waters of the state without a discharge permit. Compliance with effluent limits that would be included in a stream discharge permit would be virtually impossible due to extremely stringent nutrient limits in the State water quality standards. An absorption bed or drip irrigation field would need to be constructed to accept treated effluent. The existing subsurface drip irrigation fields could be utilized depending on the location and design of the wetlands. For the purposes of cost analysis, it is assumed that new subsurface drip irrigation fields will be constructed.

An SSF constructed wetlands system is typically designed to treat primary effluent based on a 0.5 to 1 square foot (sf) per gallon per day loading rate. A typical retention time of wastewater in an SSF type of wetland system is between 2-5 days. Assuming that the combined design peak day flow of 1,400 gpd from both DOFAW and the HNC septic tanks would feed into the wetlands, a total area of approximately 1,600 sf of wetlands area would be required, including space for perimeter berms. The existing septic tanks would be utilized to provide primary treatment to remove a large portion of the settleable solids. Wastewater would be pumped from the septic tanks to the wetlands in batches similar to the current GM configuration. Effluent from the wetland system would not be disinfected and would not be expected to meet or exceed HAR 11-62 R-3 standards for water reuse quality.

A typical SSF constructed wetlands system design would include a single basin, with a typical length to width ratio of 2:1, and approximately 3 to 4 feet in depth. A non-permeable liner, of either natural (such as bentonite clay) or synthetic material, would be installed in the basin and then backfill with the engineered media suitable for the selected plants. A perimeter berm would be constructed around the wetland to contain rainwater collecting within the wetland basin and to prevent entry of stormwater runoff. A perimeter fence would be required, likely to be 5-foot tall, to restrict public access to the wetland site. Potential locations for a constructed wetlands system could include the current location of the drip irrigation fields or a location further downslope, as shown on Figure 10.

One or more new drip irrigation fields will be required for disposal of the treated wetland treatment system effluent. Additional irrigation field capacity will be required to dispose of flow in excess of the wastewater flow due to the need to dispose of additional water generated by rain falling on the wetlands area. Subsurface disposal of rainwater is preferred, and the additional capacity of irrigation field required, and therefore additional square footage required, is not anticipated to exceed the size of the existing drip irrigation fields. The wetlands system will have minimal mechanical components and should require less skill and labor than the GM systems. However some knowledge and additional labor will be required to maintain the wetland plants. Periodic harvesting of the plants will be required to maintain the system's desired level of nutrient levels and nutrient removal efficiencies.

Advantages:

A. When operated within the limits of design criteria, a constructed wetlands treatment system will require minimal vegetation management.
B. Less skilled labor required due to minimal mechanical components.
C. Will create additional green space and wildlife habitat.
D. The constructed wetland is not expected to produces residual biosolids or sludge that would require subsequent treatment and disposal.
E. Provides for the opportunity for use as an educational tool by the HNC.

Disadvantages:

A. Additional subsurface disposal system capacity will be required to accommodate disposal of rainwater accumulating within the wetland area (however the additional area is not anticipated to be significant).
B. Stormwater runoff and accumulated rainwater resulting from heavy rain will need to be managed and precautionary measures implemented to prevent washout or overtopping of berms, and excessive submergence or washout of the vegetation.
C. Excessive die-off and loss of vegetation could potentially occur due to poor system management

Typical Maintenance Tasks:

A. Vegetation monitoring and routine harvesting and replenishing of the nutrient saturated vegetation.
B. Removal of sludge from the septic tanks every 1-3 years depending on actual loadings and rate of solids accumulation.

Table 6. Detailed Costs for Alternative 4

Alternative 4. Construct New Constructed Wetlands	
Capital Costs	
New Constructed Wetlands (including piping, liners, vegetation, fencing)	$90,000
New Drain Irrigation Fields & Piping	$40,000
Demolition, Removal & Disposal of Existing Green Machine	$15,000
Abandon Cesspool and Connect Ranger Station to Septic Tank	$15,000

Alternative 4. Construct New Constructed Wetlands	
Archeological Monitoring	$30,000
Engineering Costs	$75,000
Total Capital Costs	**$265,000**
Annualized O&M Costs	
Vegetation Management & Replacement	$500
Clean Septic Tanks (Assumed Every 2 Years)	$300
Fence & Perimeter Berm Maintenance	$200
Septic Tank Pump Replacements (Assumed Every 5 Years)	$300
Total Annualized O&M Costs	**$1,300**

Alternative 5: Connect to City Sewer System

Flows from the DOFAW Baseyard and HNC facility could be directed to the City's sewer system through the construction of a new sewer line. The nearest City mainline sewer connection is approximately 4,000 feet from the DOFAW offices building, located on Makiki Street near the intersection of Nehoa Street. The pipe would be classified as a private lateral running down the access road to the Baseyard (Figure 9) until it reaches Makiki Heights Drive, approximately 1,500 feet from the DOFAW office, at which point it would become a City asset. It is assumed that construction of the pipe will be the burden of DOFAW.

Figure 9. Alignment of New City Sewer Connection

Based on the City and County of Honolulu Design Standards, for the portion that is considered a private lateral either a 6 or 8-inch diameter pipe could be installed. Once it reaches the City property, the pipe would be a City sewer and an 8-inch diameter line would be required. Given the substantial distance of the lateral portion, it is recommended that the entire sewer line be 8-inches in diameter. In addition to reducing concerns with clogging and minimizing the need and cost for periodic cleaning, this would allow for the potential of other stakeholders to utilize the pipe if agreed upon, such as HNC or the Hālau Kū Māna Public Charter School.

The installation of a City sewer connection pipe would essentially remove any future costs related to an onsite wastewater treatment and disposal system. However, there would be monthly sewer service charge, which would currently be approximately $120 per month. Design and construction would be estimated to take up to 2 years for full completion from the time of approval to move forward with the project. Additional activities associated with this option would include removal of the Green Machine and its supporting facilities, demolition (most likely fill in place) of the septic tank, and abandonment of the leach field and irrigation drain fields.

Advantages:

A. No onsite treatment or discharge facilities to operate or maintain.

B. No future equipment operations & maintenance costs.
C. Below-ground sewer pipe will allow DOFAW to reclaim the space currently occupied by the Green Machine.

Disadvantages:

A. Construction of 4,000 linear feet of sewer pipe will be disruptive to DOFAW and HNC operations, and affected neighboring properties.
B. Cost of construction is comparatively high.
C. Monthly sewer service fees would apply.
D. If no other stakeholders are willing to share the cost of the sewer line, the full burden of the construction cost would fall on DOFAW.
E. The potential for use of a wastewater system as an educational tool by the HNC is eliminated.

Typical Maintenance Tasks:

A. Typical routine maintenance may include cleaning and root control measures on a 3-5 year cycle.

Table 7. Detailed Costs for Alternative 5

Alternative 5. Connect to City Sewer System	
Capital Costs	
Construct 4,000 LF of 8-inch Sewer Pipe	$1,221,000
Connection Fee to City Sewer	$6,000
Demolition, Removal & Disposal of Existing Green Machine	$15,000
Abandon Cesspool and Connect Ranger Station to Sewer Pipe	$15,000
Archeological Monitoring	$40,000
Engineering Costs	$275,000
Total Capital Costs	**$1,572,000**
Annualized O&M Costs	
Annual Sewer Fees	$1,500
Cleaning & Root Control	$200
Total Annualized O&M Costs	**$1,700**

Alternatives Life Cycle Cost Analysis

A 20-year life cycle cost (LCC) analysis was completed to provide a comparison of costs for each alternative. The present worth life cycle costs were annualized based on an assumed five percent discount rate with no salvage value. Capital costs are based on current construction costs on Oahu, and include a 30 percent factor for engineering services for design and construction services, archeological monitoring services, and the abandonment of the existing cesspool associated with the Ranger Cottage. A comparison of life cycle costs for each alternative is shown in Table 3 below. A breakdown of specific costs for each Alternative is shown in each of the Alternatives Analysis sections above.

Table 3. 20-Year Life Cycle Cost Analysis

Alternative	Capital Costs	Annual O&M Costs	Present Worth O&M Costs	Total Life Cycle Costs
1. Rehabilitate Existing Green Machine	$302,500	$22,800	$284,200	**$586,7000**
2. Construct New Leach Fields	$170,000	$600	$7,500	**$177,500**
3. Construct New Green Machine	$340,500	$22,800	$284,200	**$624,700**
4. Construct New Constructed Wetlands	$265,000	$1,300	$16,300	**$281,300**
5. Connect to City Sewer System	$1,572,000	$1,700	$34,000	**$1,606,000**

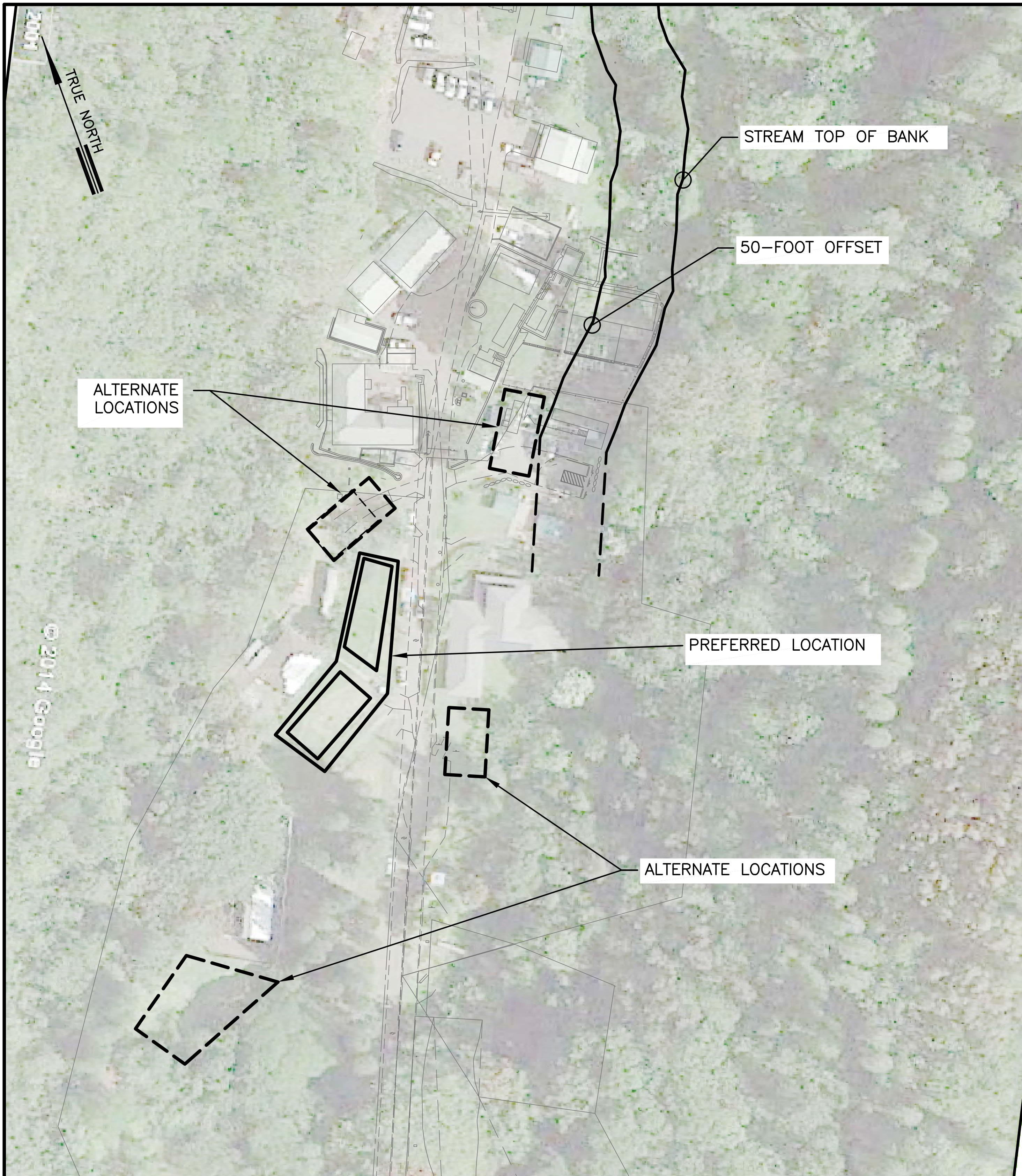
The alternative with the lowest life cycle costs, including both capital and present worth O&M costs is Alternative No.2 - Construct New Leach Fields. While present work O&M costs for Alternative No.4 - Construct New Constructed Wetlands are relatively similar to Alternative No.2, capital costs are almost 1.6 times greater due to the engineered subsurface strata, wetlands perimeter fencing and construction of new drip irrigation fields. Capital costs could be reduced if the existing irrigation fields can be incorporated into the wetlands design layout.

Present worth O&M costs for Alternatives No.1 and 3 are equivalent since operation of either sized GM type system would require comparable effort, energy and equipment maintenance. They are substantially greater than the other alternatives because of the approximate half-time salary of a licensed operator. Present worth O&M costs for Alternative No. 5 - Connect to City Sewer System are based on pipe cleaning services and the monthly sewer fees.

Preferred Alternative

Based on the above findings, and through discussions with both the Division of Forestry and Wildlife and the Hawaii Nature Center, the recommended alternative for providing treatment and disposal of wastewater generated from the facilities is Alternative No. 4 - Construction of a Constructed Wetlands. From a cost perspective. this alternative is projected to have the second lowest capital costs as well as O&M cost. Alternative No.2 – Construct New Leach Fields has both lower capital and O&M costs than Alternative 4.

In addition to the monetary benefits of this alternative (with the exception of Constructing New Leach Fields), construction of a natural wetlands treatment and disposal system under Alternative No. 4 will allow DOFAW and the HNC to meet environmental and sustainable operations goals. Constructed wetlands will operate with minimal electrical usage while allowing naturally occurring processes to treat the wastewater. The HNC will also be able to continue to utilize the natural treatment processes of the constructed wetlands as an educational tool for the school classes and general public. These important non-monetary benefits outweigh the direct cost benefits of utilizing leach fields in Alternative No. 2.



SCALE: 1" = 100'

HDR	DIVISION OF FORESTRY AND WILDLIFE MAKIKI BASEYARD	POTENTIAL LOCATIONS FOR CONSTRUCTION OF NEW WASTEWATER TREATMENT AND DISPOSAL SYSTEM	FIGURE 10

HHF PLANNERS
places for people