BOARD OF WATER SUPPLY

CITY AND COUNTY OF HONOLULU
630 SOUTH BERETANIA STREET
HONOLULU, HI 96843
www.boardofwatersupply.com

June 6, 2023

Ms. Mary Alice Evans, Director
Office of Planning and Sustainable Development
Environmental Review Program
State of Hawaii
235 South Beretania Street, Suite 702
Honolulu, Hawaii 96813

Dear Ms. Evans:

Subject: Honolulu Board of Water Supply Draft Environmental Assessment for the Proposed Waiawa 228' Reservoir Facility in Pearl City, Island of Oahu, Hawaii, Tax Map Key (1) 9-6-004: 024

The Honolulu Board of Water Supply (BWS) has prepared the Draft Environmental Assessment (DEA) for the subject project at Tax Map Key parcel (1) 9-6-004: 024 and anticipates a Finding of No Significant Impact determination. Please publish the notice of availability of the DEA for this project in the next edition of the periodic bulletin.

BWS kindly submits the required items for publication including a searchable pdf file of the DEA.

If you have any questions about this submittal, please contact our consultant, Jason Nakata of The Limtiaco Consulting Group at 808-386-5241 or via email to jason.n@tlcghawaii.com.

Very truly yours,

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

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Tuesday, June 13, 2023 1:33:58 PM

Action Name

Honolulu Board of Water Supply Waiawa 228 Reservoir Facility

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds

Judicial district

ʻEwa, Oʻahu

Tax Map Key(s) (TMK(s))

(1) 9-6-004:024

Action type

Agency

Other required permits and approvals

National Pollutant Discharge Elimination System (NPDES), Public Infrastructure Map (PIM) Revision, Community Noise, Building, Grading and Grubbing Permit, Others (see Section 5 of document)

Proposing/determining agency

Honolulu Board of Water Supply

Agency contact name

Christopher Sugimoto

Agency contact email (for info about the action)

csugimoto@hbws.org

Agency contact phone

(808) 748-5945

Agency address

630 S. Beretania St.
Honolulu, Hawaii 96843
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

The Limtiaco Consulting Group

Consultant contact name

Jason Nakata

Consultant contact email

jason.n@tlcghawaii.com

Consultant contact phone

(808) 386-5241

Consultant address

1622 Kanakanui St.
Honolulu, Hawaii 96817
United States
Map It

Action summary

The Honolulu Board of Water Supply (BWS) proposes construction of a new 8.5 million-gallon (MG) reservoir facility in the Waiawa area of Pearl City to offset the existing 55 MG storage deficit in its Metro Low System identified in the BWS Water Master Plan. The preliminary plan for the facility calls for three (3) reservoirs: one (1) 2.0 MG reservoir, one (1) 2.5 MG reservoir, and one (1) 4.0 MG reservoir. The reservoirs will be located within a single new BWS facility on undeveloped former agriculture land owned by the Bernice Pauahi Bishop Trust Estate (dba Kamehameha Schools).

30-inch (in) influent and effluent mains will be constructed to connect the proposed reservoir facility to an existing 42-in BWS transmission main located approximately 3,700 feet from the project site. Construction of an access roadway to the site is required. Alignment of the utility and access road infrastructure will be determined in coordination with Kamehameha Schools.

Reasons supporting determination

HRS 343 significance criteria are discussed in Section 6, Determination of the Draft EA.

Attached documents (signed agency letter & EA/EIS)

- DEA_Waiawa-228-Reservoir_Final_Compiled.pdf
- Ltr-to-Mary-Evans-DEA-Proposed-Waiawa-228-Res.pdf

Action location map

- Area-of-Impact.zip

Authorized individual

Jason Nakata

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Draft Environmental Assessment

Honolulu Board of Water Supply
Waiawa 228 Reservoir Facility

Pearl City, Oahu, Hawaii

May 2023

Prepared for:

City and County of Honolulu
Board of Water Supply

Prepared by:

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

Draft Environmental Assessment

for the

Waiawa 228 Reservoir Facility

Pearl City, Island of Oahu, Hawaii

This environmental document has been prepared pursuant to
Chapter 343, Hawaii Revised Statutes

Prepared For:

City and County of Honolulu
Board of Water Supply
630 South Beretania Street
Honolulu, Hawaii 96843

Prepared By:

The Limtiaco Consulting Group
Civil Engineering and Environmental Consultants
1622 Kanakanui Street
Honolulu, Hawaii 96817

May 2023

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LIST OF ABBREVIATIONS

Abbreviation	Definition
ac	acre(s)
AFONSI	Anticipated Finding of No Significant Impact
ASA	Aquifer Sector Area
ASYA	Aquifer System Area
BGS	Below-Ground-Surface
BMP(s)	Best Management Practice(s)
BWS	Honolulu Board of Water Supply
City	City and County of Honolulu
cfs	cubic feet per second
CSH	Cultural Surveys Hawaii
cy	cubic yards
CZM	Coastal Zone Management
DoFAW	State of Hawaii, Division of Forestry and Wildlife
DOH	State of Hawaii, Department of Health
DOT	State of Hawaii, Department of Transportation
DTS	City and County of Honolulu, Department of Transportation Services
EA	Environmental Assessment
ft	foot/feet
FONSI	Finding of No Significant Impact
HAR	Hawaii Administrative Rules
HECO	Hawaiian Electric Company
HFD	Honolulu Fire Department
HPD	Honolulu Police Department
HRS	Hawaii Revised Statutes
in	inch(es)
Kamehameha Schools	Bernice Pauahi Bishop Trust Estate
LUO	Land Use Ordiance
MG	million-gallon(s)

LIST OF ABBREVIATIONS (Continued)

Abbreviation	Definition
MSL	Mean-Sea-Level
NAAQS	National Ambient Air Quality Standards
NFPA	National Fire Protection Association
NPDES	National Pollutant Discharge Elimination System
PDU	Portable Ditch Unit
PV	Photovoltaic
ROH	Revised Ordinances of Honolulu
SAAQS	State Ambient Air Quality Standards
SHPD	State Historic Preservation Division
SIHP	State Inventory of Historic Places
SMA	Special Management Area
TMK	Tax Map Key
UIC	Underground Injection Control
USFWS	U.S. Fish and Wildlife Service

PROJECT SUMMARY

Proposing/Determination Agency:	Board of Water Supply, City and County of Honolulu (BWS)
Contact:	Mr. Chris Sugimoto, P.E.
Location:	Pearl City, Oahu, Hawaii
Tax Map Keys:	(1) 9-6-004:024 (por.)
Land Area:	7.7 acres (ac) of a 1,567 ac parcel
Recorded Fee Owner:	Bernice Pauahi Bishop Trust Estate (dba Kamehameha Schools)
Existing Use:	Undeveloped (formerly sugar cane cultivation)
Proposed Use:	BWS Reservoir Facility
Community Plan Region:	Central Oahu
Land Use Designations:	
State Land Use	Agricultural
Development Plan	Urban/Park/Agricultural and Preservation Areas
County Zoning	AG-1 (Agricultural)
	The BWS proposes construction of a new 8.5 million-gallon (MG) reservoir facility in the Waiawa area of Pearl City to help offset the existing 55 MG storage deficit in the Metro Low System identified by the BWS *Water Master Plan* (BWS 2016). The preliminary plan for the facility calls for three (3) separate reservoirs: one (1) 2.0 MG reservoir, one (1) 2.5 MG reservoir, and one (1) 4.0 MG reservoir. The reservoirs will be located within a single new BWS facility.
Agency Determination:	Anticipated Finding of No Significant Impact (AFONSI)

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1. SETTING AND PROJECT DESCRIPTION

1.1. Introduction and Background

The Honolulu Board of Water Supply (BWS) is a semi-autonomous agency of the City and County of Honolulu (City) that manages the development, operation, and maintenance of Oahu's municipal water system. The agency is responsible for maintaining the water resource and distribution system throughout Oahu in order to meet the current and future water supply needs of its customers.

The BWS proposes to improve the reliability and storage capacity of its Metro Low potable water supply and distribution system, which serves the lower elevation areas from Hawaii Kai to Moanalua, by constructing a new 8.5 million-gallons (MG) potable water reservoir facility. The proposed reservoir facility will consist of three (3) enclosed reinforced-concrete reservoirs with a 228-foot (ft) spillway elevation in the Waiawa area of Pearl City, Oahu, Hawaii. No additional wells are proposed as part of the project.

The proposed project will use BWS funds and requires preparation of an Environmental Assessment (EA) pursuant to Chapter 343, Hawaii Revised Statutes (HRS) and associated Title 11, Chapter 200, Hawaii Administrative Rules (HAR). This EA addresses the technical, environmental, social, and economic consequences of the project. Agencies, individuals, and community groups with jurisdiction or interest in the proposed project have been consulted during the preparation of this EA.

1.2. Project Need and Objectives

The BWS supplies water to its customers through a series of interconnected wells, pumps, reservoirs, and pipelines. Storage provided by reservoirs plays an important role in the water supply system. Adequate reservoir storage minimizes fluctuations in water pressure, provides water for emergencies, and helps to meet peak consumption demands. Reservoir facilities allow for stabilized rates of water pumping, rather than in response to consumption demand. Water stored during periods of low demand is utilized during peak demand hours. Pumps operate to refill the reservoirs when stored water decreases to a predetermined level. Water storage facilities help to maintain service continuity and reduces stress on the system during periods of peak demand. Reservoir storage also supplies water to the distribution system when pumping is unavailable, such as during power outages or well maintenance. Reservoir storage also helps to provide sufficient water supply and pressure for high demand uses such as firefighting.

The BWS Metro Low system, which serves low elevation customers in the Honolulu metro area, operates with a reservoir storage capacity below that recommended by

its designed standards. The *Water Master Plan* (BWS, 2016) identifies an existing water storage deficit of approximately 55 MG per the Water System Standards (BWS et al, 2002). The BWS is able to meet peak demand using well sources, however, the addition of reservoir capacity will improve reliability and decrease stress on the system. The BWS also projects water demand on the Metro Low system to increase over time, further increasing the need for new storage capacity in the system.

1.3. Site Location and Description

The proposed facility will be located on a 3.7-acre (ac) portion of Tax Map Key (TMK) Parcel (1) 9-6-004:024. The 1,567-ac parcel is owned by the Bernice Pauahi Bishop Trust Estate (dba Kamehameha Schools). The project will also include approximately 4.0 ac for construction of an access road and utility lines to connect the facility to existing infrastructure. The site is located adjacent to the H-2 Interstate Freeway at the foot of Waiawa Ridge. The site is east of the Waipio Gentry development and northwest of the Pearl City Industrial Park. A map showing the proposed project site is provided in Figure 1.

The site is currently undeveloped and is covered by dry brush consisting of koa haole and guinea grass. The site has a moderately increasing slope from North to South. The site can only currently be accessed by dirt roads operated by Kamehameha Schools. There is no public access to the site.

The project will also involve construction of connection infrastructure, such as access roads and utility lines. An access road and potable water pipelines are required to connect the proposed reservoir to the existing BWS water distribution system. Details of the roadway and pipeline alignment will be coordinated with the landowner, Kamehameha Schools, during the design of the proposed facility. Electrical service is also required, and will be coordinated with the Hawaiian Electric Company (HECO) during the design phase. Plans for potential drainage and telecommunication utilities will also be developed during the design phase. Details to be developed are dependent on land disposition agreements with the landowner.

HONOLULU BOARD OF WATER SUPPLY WAIAWA 228 RESERVOIR	FIGURE 1
LOCATION PLAN	

File: L:\1. PROJECTS\06 - BWS\510514 - Waiawa 228 Reservoir EA\FIGURES\EA\Figures.dwg 7/13/2022

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1.4. Technical Considerations

The project proposes construction of a new reservoir facility on previously undeveloped land. The facility will consist of a total of three (3) reservoirs: one (1) 4.0 MG reservoir, one (1) 2.5 MG reservoir, and one (1) 2.0 MG reservoir. The reservoirs will have a finished floor elevation of 208 ft above mean-sea-level (MSL) and a spillway elevation of 228 ft above MSL (see Figure 2 and Figure 3). The proposed reservoirs will be constructed of reinforced-concrete, as is typical of most BWS reservoirs.

Mass grading (primarily cut) will be required to achieve the desired reservoir elevation. Perimeter roads will encircle the new reservoir in conformance with the Water System Standards. The guidelines state that perimeter roads shall have a minimum width of 10 feet (BWS, et al, 2002). The preliminary site plan provides for larger access roads for maintenance purposes.

30-inch (in) influent and effluent mains will be constructed to connect the Waiawa 228 Reservoir facility to an existing 42-in BWS transmission main located approximately 3,700 ft from the project site. Construction of an access roadway meeting Water System Standards is required. Alignment of utility and access road infrastructure is not known at this time and will be coordinated with the landowner, Kamehameha Schools, during the design phase of the project. The access roadway shown in Figure 2 is shown for illustrative purposes.

The *Water System Standards* of the BWS require washout and overflow drainage lines for reservoirs. The washout line allows the reservoir to be drained for maintenance purposes, and the overflow line prevents damage to the reservoir in emergency situations (e.g., over-filling due to sensor malfunctions). Because the site is undeveloped and there is no nearby City storm drain system, overland discharge following the existing drainage patterns will likely be utilized for reservoir drainage as shown in Figure 3. If overland discharge is not feasible, construction of a new storm drain system will be required to connect the new facility to the nearest municipal storm drain capable of carrying reservoir discharges.

Electrical, control, and monitoring systems are required for operation of the new reservoir facility. A control building will be constructed within the facility.

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BP BISHOP TRUST ESTATE
TMK: 9-6-004:024

6' HIGH CHAIN LINK FENCE

12' BENCH

LIMITS OF GRADING

PROPERTY LINE (APPROXIMATE)

12' BENCH

106'

INTERSTATE H-2 FREEWAY EASEMENT

2.5 MG TANK
FF = 208.00

2.0 MG TANK
FF = 208.00

25' MIN.

INSTRUMENT HOUSE

12' PERIMETER ROAD

4.0 MG TANK
FF = 208.00

12' WIDE PROPOSED ACCESS ROADWAY

N
Scale:
1" = 60'

HONOLULU BOARD OF WATER SUPPLY WAIAWA 228 RESERVOIR	FIGURE 2
SITE PLAN	

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BP BISHOP TRUST ESTATE
TMK: 9-6-004:024

PROPERTY LINE
(APPROXIMATE)

INTERSTATE H-2
FREEWAY EASEMENT

250
240
230
220
210
206

WASHOUT
LINE (TYP.)

BEVEL GEARED
GATE VALVE (TYP.)

DMH

30" WASHOUT
LINE

30" EFFLUENT
LINE

ALTITUDE
VALVE BOX

INSTRUMENT
HOUSE

30" INFLUENT
LINE

BEVEL GEARED
GATE VALVE

BEVEL GEARED
GATE VALVE (TYP.)

DMH

WASHOUT
DRAIN
(TYP.)

OVERFLOW
LINE (TYP.)

DRAIN OUTLET

N
Scale:
1" = 60'

HONOLULU BOARD OF WATER SUPPLY WAIAWA 228 RESERVOIR	FIGURE 3
UTILITY PLAN	

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1.5. Environmental Considerations

The proposed action involves siting a new 8.5 MG reservoir facility on undeveloped former agricultural land. The project site will need to be grubbed and graded to prepare the land for construction of the facility. The facility will be cut into the side of a slope adjacent to the Interstate H-2 Freeway. A geologic survey of the affected area confirmed that soils at the project site are suitable for construction of the proposed reservoir facility.

Biological surveys found no endangered or threatened species or their critical habitat at the project site. An archaeological survey identified remnant sections of an irrigation ditch that was part of the Waiahole Ditch irrigation system that provided water to agricultural lands.

Construction activities associated with the proposed project would generate short-term effects such as fugitive dust, noise, intermittent traffic, solid waste, and potential disruptions to utility services that would cease upon project completion. Anticipated short-term impacts will be mitigated to the extent practical with the use of appropriate construction techniques and Best Management Practices (BMPs). In the long term, the increased potable water storage capacity improves the reliability and storage capacity of the area to better accommodate the water service needs in the BWS Metro Low system.

1.6. Land Use and Zoning

State land use designation for the project site is agricultural (see Figure 4). County zoning for the site is AG-1 (Agricultural) (see Figure 5). The BWS facility is a public use and structure that is permitted in the AG-1 Agricultural District. Applicable zoning requirements as specified in the City's Land Use Ordinance (LUO), which is Chapter 21 of the Revised Ordinances of Honolulu (ROH), include a 15-ft front yard setback and 10-foot side/rear yard setback for uses other than dwellings. The maximum building height envelope ranges from 15- to 25-ft and the maximum buildable area is 10% of the zoning lot for non-agricultural uses.

1.7. Project Schedule and Cost

The environmental review process, which includes publication and public review of the EA, may be concluded by calendar year 2023. The design phase of the project will commence upon completion of the environmental review process.

The estimated cost for construction of the Waiawa 228 Reservoir Facility is approximately $43.5 million.

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N
Scale:
1” = 500’

LEGEND

U = URBAN

A = AGRICULTURAL

HONOLULU BOARD OF WATER SUPPLY
WAIAWA 228 RESERVOIR

STATE LAND USE MAP

FIGURE
4

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HONOLULU BOARD OF WATER SUPPLY WAIAWA 228 RESERVOIR	FIGURE
COUNTY ZONING MAP	5

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2. DESCRIPTION OF EXISTING ENVIRONMENT, PROJECT IMPACTS, AND MITIGATION

2.1. Climate and Air Quality

The climate throughout the State of Hawaii is generally characterized by mild temperatures with low daily and monthly variability, moderate humidity, persistent trade winds, and abundant sunshine. The Hawaiian climate is further characterized by a two-season year: the summer season from May through September is generally warmer and less wet than the cooler, winter season from October through April (Western Regional Climate Center, 2014). Rainfall distribution across the State of Hawaii varies greatly according to geographic conditions, elevation and long-term climatic cycles.

The project site has a mild semi-tropical climate similar to rest of the State of Hawaii. Average temperatures at the project site range from 70 degrees Fahrenheit in February to 77 degrees Fahrenheit in August (Giambelluca et al, 2014). The mean annual rainfall at the project site is 29 inches, with above average rainfall from October through March and below average rainfall from April through September (Ibid). Average solar radiation received at the project site is approximately 200 watts per square meter (Ibid). The project site receives trade winds in the project vicinity are generally from the northeast. Strong winds are known to occur in connection with storm systems that disrupt climatic patterns.

Ambient air quality in the State of Hawaii consistently meets National Ambient Air Quality Standards (NAAQS) established by the U.S. Environmental Protection Agency per requirements of the Clean Air Act and State Ambient Air Quality Standards (SAAQS) established by the State of Hawaii, Department of Health (DOH). The State standards for select parameters are more stringent than their federal counterparts. In recent years, exceedance of NAAQS and SAAQS were primarily reported on Hawaii island due to volcanic activity (DOH, 2023).

The project site is located within an undeveloped area covered in grass and dry shrub brush. During drier periods, air quality may be affected locally by loose dirt picked up by wind. The project site is located within close proximity to the H-2 Interstate Freeway and is subject to vehicle emissions. Prevailing northeast trade winds may help to disperse vehicular emissions and other airborne pollutants.

Impacts and Mitigation Measures

No measurable adverse effect on climate conditions is anticipated from construction of the proposed reservoir facility and connecting roadway and utility infrastructure.

Local ambient air quality will be temporarily affected during construction due to grading and grubbing and the operation of construction-related vehicles and equipment, which will result in fugitive dust and emissions. The construction contractor will be responsible for complying with HAR Title 11, Chapter 60.1, "Air Pollution Control." The contractor will be responsible for the implementation of erosion and dust control measures as necessary for compliance with the above-mentioned rules. Examples of dust control methods include but are not limited to the following:

- Use of water for the control of fugitive dust during construction operations and grading/grubbing of land;
- Covering or application of water on material stockpiles;
- Using fabric filters or other containment methods for the handling of dusty materials;
- Covering of moving, open-bodied trucks transporting materials which may result in fugitive dust;
- Phasing construction operations to minimize the amount of fugitive dust-generating materials and activities;
- Landscaping, paving, or otherwise stabilizing bare areas after ground disturbance.

Construction equipment and vehicles shall be properly maintained in order to control vehicular emissions. Said exhaust emissions are anticipated to have negligible impacts on air quality in the project vicinity since the carbon monoxide and nitrogen oxide emissions would be intermittent and readily dissipated.

Effects to local ambient air quality will cease upon completion of the project. Operation and maintenance of the facility is not anticipated to result in impacts to climate or air quality.

2.2. Geology and Soils

The Island of Oahu comprises the remnants of two basaltic volcanoes that eroded to form the Waianae and Koolau Ranges, which are connected by a central plateau. The mountain range formed by the older Waianae volcano spans a distance of about 20 miles across the western third of Oahu. The younger Koolau volcano contributed to the main mountain range on Oahu that extends for 37 miles in a northwest to southeast alignment across the eastern two thirds of the island. The Koolau Range consists of thin, narrow layers of basaltic lava flows. Dissected valleys were etched into the basalt range formations through weathering and natural erosion processes.

Numerous dikes and small amounts of volcanic ash are present. The valley floors contain alluvium (e.g., clay, silt, sand, gravel, or similar material) and unconsolidated non-calcareous sediments transported from valley slopes by stream flows.

In order to determine whether the proposed reservoir can be supported by soils at the project site, exploratory borings, sampling and laboratory analysis were conducted by Yogi Kwong Engineers in support of the proposed project. Two borings were drilled to investigate the subsurface soil conditions at the project site to verify suitability of the soils to support the proposed reservoir facility. The borings were conducted near the northern-most and southern-most boundaries of the facility and were drilled to depths of 71-ft and 40-ft below-ground-surface (BGS), respectively.

The exploratory borings found that anticipated subsoils at the project site can be generalized into three local geologic units: Residual Soils, Highly Weathered Basalt, and Basalt Lava Flows. Residual soils extend approximately 14.5 ft BGS at both boring locations. Highly Weathered Basalt dispersed between Basalt Lava Flows were found at varying depths at each boring location. Groundwater was not encountered during exploratory borings, however, the potential for perched or local groundwater seepage is likely during or after rainy periods.

Impacts and Mitigation Measures

The preliminary geotechnical investigation determined that the proposed reservoirs could be supported by shallow spread, continuous footing, or large mat foundations. The reservoir foundations may bear on different geological unit, which could result in differential settlement of the reservoirs. Over long periods of time, differential settlement of the reservoir could result in increased repair and maintenance demands. To mitigate the potential for differential settlement, the area under the reservoirs can be over-excavated and backfilled with properly compacted imported materials, allowing settlement to occur more uniformly across the reservoir. As a result, there are no long-term impacts associated with the construction of the proposed facility.

Additional geotechnical surveys will be conducted as part of the project's design process. The new reservoir and associated facilities will be properly designed with respect to subsurface conditions within the footprint of new construction.

Earth-disturbing activities during construction will create exposed areas at the project site that are susceptible to erosion from wind and rain. The contractor will be required to follow the City's "Rules for Soil Erosion Standards and Guidelines." Mitigation that addresses sediment-laden runoff is discussed in Section 2.4, Water Resources. Areas affected by project actions will be

stabilized and either paved or landscaped, which reduces the long-term potential for erosion by water and wind.

2.3. Topography

The proposed reservoir facility is located at an elevation ranging from approximately 250 ft above MSL on the northern end of the site to 200 ft above MSL on the southern end. Slopes gradually increase from north to south across the site.

The land slopes steeply to the west of the site where the area was excavated for construction of the Interstate H-2. A large natural gully is located immediately to the southeast of the site. The gully slopes in a southwesterly direction toward the Interstate H-2. Figure 6 shows the existing topography in the area around the project site.

Impacts and Mitigation Measures

To establish a level foundation for the proposed reservoirs, excavation will be required with estimated depths ranging from 0 to 45 ft across the site (see Figure 2). Excavation volume is estimated to be approximately 118,000 cubic yards (cy) and fill volume is estimated to be approximately 15 cy.

The initial geotechnical study indicates that the site may be susceptible to rock dislodgement along the excavated slope over the long term due to weathering and erosion. The risk of rockfall would be at the base of the cut slope, within the proposed BWS facility. Falling rocks have the potential to damage BWS assets within the facility.

Rockfall mitigation measures are proposed along the cut slope on the northern portion of the facility. Rockfall mitigation measures that may be used include rockfall barriers (fences design to capture falling rocks), setback (buffer) zones, and slope stabilization (e.g., wire mesh). Rockfall mitigation measures could be used alone or in combination to prevent falling rocks from causing damage or harm to the reservoir facility. The mitigation measures to be used will be determined during the project's design phase.

HONOLULU BOARD OF WATER SUPPLY
WAIAWA 228 RESERVOIR

EXISTING TOPOGRAPHY

FIGURE
6

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2.4. Water Resources

The project site is within the Waipahu-Waiawa Aquifer System Area (ASYA) that is part of the greater Pearl Harbor Aquifer Sector Area (ASA). Sustainable yield for the Waipahu-Waiawa ASYA is 105 MGD. This comprises the majority of the sustainable yield from the Pearl Harbor ASA which has a total sustainable yield of 166 MGD. *Sustainable yield* refers to "the quantity of water that can be extracted from an aquifer indefinitely without diminishing the quantity or quality of the water withdrawn" (CWRM, 2008). The proposed project does not involve installation of new water sources.

The Underground Injection Control (UIC) line as determined by the DOH Safe Drinking Water Branch demarcates the boundary and associated restrictions that apply to areas with non-drinking water aquifers or underground sources of drinking water. Injection well activity is more restricted in areas above the UIC line to protect underground sources of drinking water from injected fluids that may contain chemical, physical, radioactive, and biological contamination. The project site is above or *mauka* of the UIC line, which indicates that the underlying groundwater is considered a potential source of drinking water (see Figure 7). No injection wells are proposed as part of the subject project.

There are no freshwater streams, rivers, ponds or other open water bodies located within the project site. Based on topographic information, over-land stormwater flow from the project site will generally sheet flow from north to south across the project site. An unnamed gully located along the southern edge of the project site will collect the stormwater runoff and convey flows in the southwesterly direction towards the Interstate H-2 Freeway. Stormwater is then conveyed beneath the freeway via three (3) 60-in culverts and then discharged into Panakauahi Gulch, which lies on the Ewa side of the freeway, opposite the project site.

The Panakauahi Gulch flows in a southerly direction parallel to the H-2 Freeway before crossing back under the freeway to its confluence with Waiawa Stream. Flows in Waiawa Stream are then conveyed approximately 9,500 ft to the outlet into Pearl Harbor West Loch.

Based on Flood Insurance Study information for the area nearest the proposed project site, the projected 100-year peak discharge for Panakauahi Gulch just downstream of the three (3) 60-inch culverts is 13,500 cubic feet per second (cfs) and at the confluence with Waiawa Stream is 14,200 cfs. The 100-year peak discharge Waiawa Stream at the outlet to Pearl Harbor West Loch is 34,000 cfs.

There are no wetlands (or marshes, swamps, bogs, etc.) located within or immediately adjacent to the project site. The area in and around the project site are

designated as Class 2 inland according to the DOH Water Quality Standards Map (DOH, 2014) as shown in Figure 8.

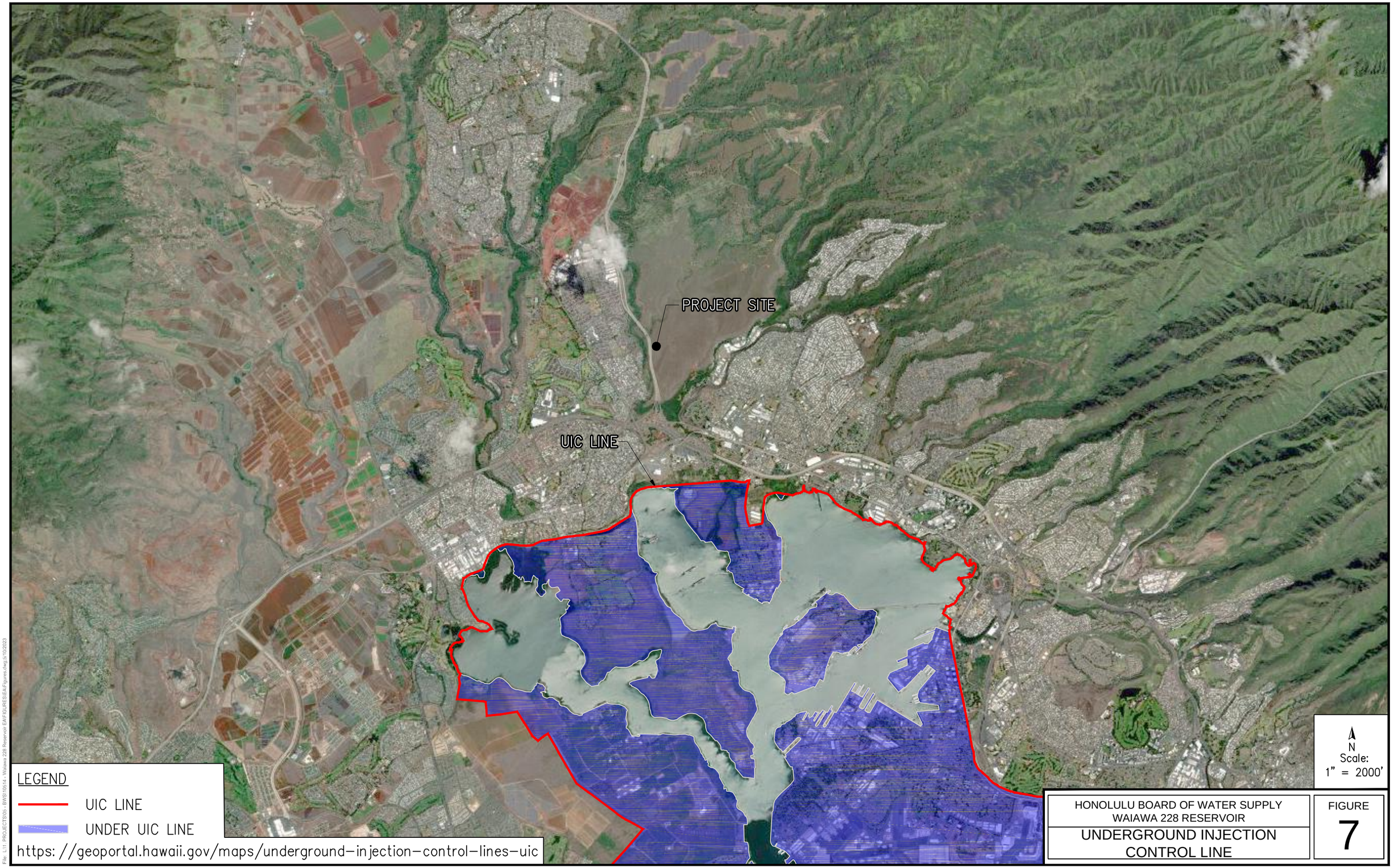
Impacts and Mitigation Measures

The proposed project does not involve installation of new water wells and will not increase the amount of water usage from the groundwater aquifer. Construction of the proposed reservoir facility will add storage capacity to the BWS Metro Low system, but this will serve to increase reliability of the existing system. Water usage in the system will not change due to construction of the proposed facility as peak demands are already met by running existing wells. The reservoirs will help to offset the amount of time that wells need to be operated, decreasing stress on the system. Since no additional wells will result from the proposed activity, no impacts to groundwater sources are anticipated.

A short-term and temporary impact of the project may occur from the generation of sediment-laden surface runoff during earth-disturbing activities, especially if heavy rains coincide with the activity. A National Pollutant Discharge Elimination System (NPDES) Permit for discharges of pollutants, including storm water runoff (e.g., construction dewatering effluent) is required for the disturbance of one ac or more of total land area pursuant to HAR Title 11, Chapter 55. The construction contractor will be required to obtain an NPDES permit for construction activities and will be required to comply with stormwater pollution mitigation measures required by DOH. Additional NPDES permits may be required for hydrotesting and/or dewatering activities. This impact will cease upon completion of construction as the project site will be stabilized by hardened surfaces and appropriate landscaping.

Construction of the proposed facility will result in an increase in impervious surface area of approximately 3.7 ac which increases the amount of stormwater runoff generated at the project site. The Rational Method was used to evaluate stormwater runoff based on guidelines from the Rules Relating to Storm Drainage Standards (City and County of Honolulu, 2012). Based on the Rational Method, the post-construction increase in stormwater runoff is estimated to be approximately 15.0 cfs for a 10-year, 1-hour storm event.

The “Rules Relating to Water Quality” also sets forth requirements to ensure that water quality requirements are met for the post-construction condition. Based on the proposed site disturbance exceeding one (1) ac, the project would be classified as Priority A, which has the highest level of treatment required for pollutant reduction.



HONOLULU BOARD OF WATER SUPPLY
WAIAWA 228 RESERVOIR

UNDERGROUND INJECTION CONTROL LINE

FIGURE 7

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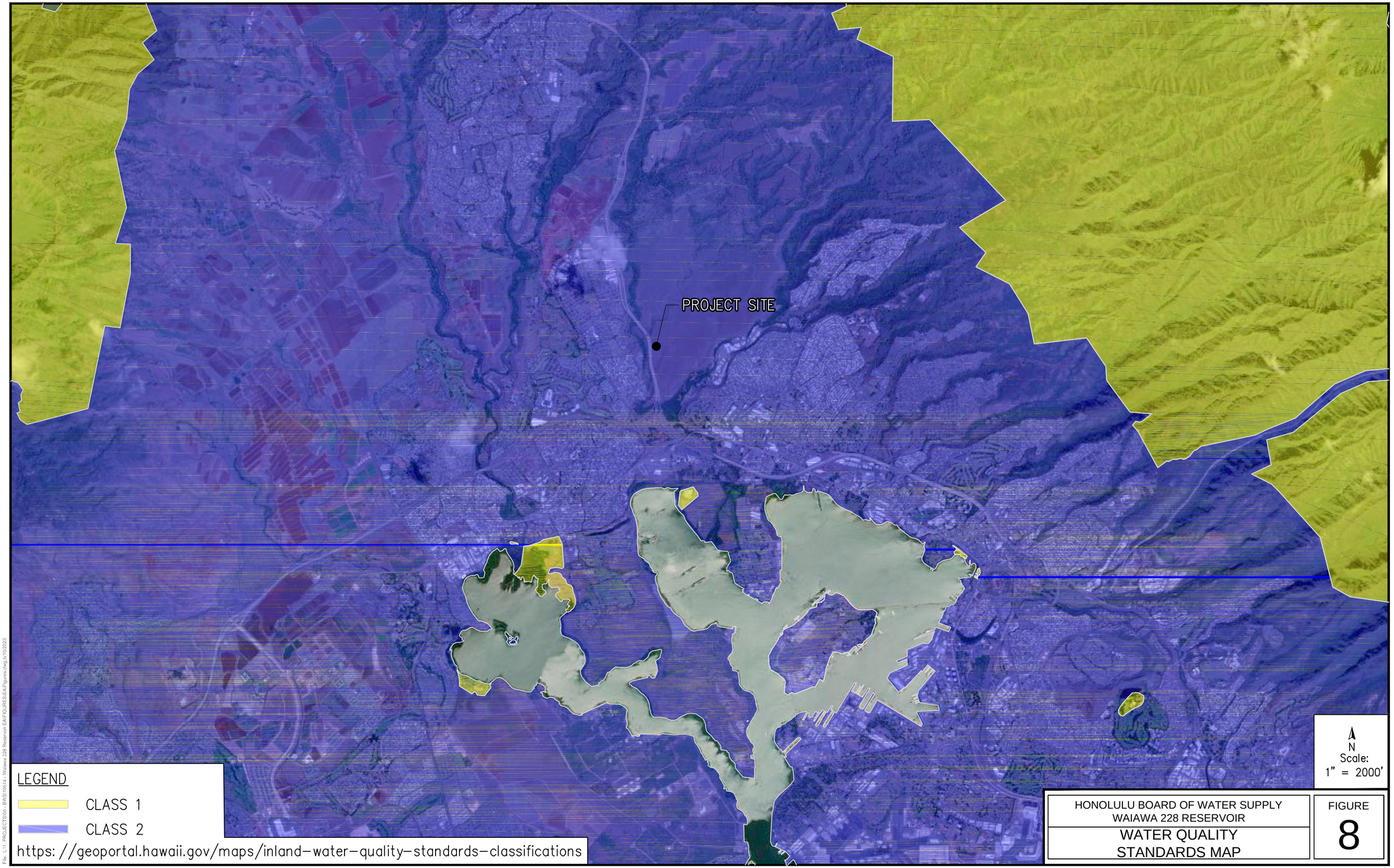

HONOLULU BOARD OF WATER SUPPLY
WAIAWA 228 RESERVOIR

WATER QUALITY
STANDARDS MAP

FIGURE
8

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Priority A projects are required to retain the required storm water runoff on-site through the use of storm water management techniques that promote infiltration, evapotranspiration or harvest/reuse. Examples of retention-based Best Management Practices (BMPs) that may be applicable to the site include:

- Infiltration Basins
- Infiltration Trenches
- Subsurface Infiltration
- Dry Wells
- Bioretention Basins
- Permeable Pavement
- Harvest / Reuse

If full retention is not feasible, the remaining storm water runoff shall be treated using storm water management techniques that rely on biofiltration for treatment. Examples of biofiltration BMPs that may be applicable to the site include:

- Vegetated Bio-Filters
- Enhanced Swales
- Vegetated Swales
- Vegetated Buffer Strips

2.5. Hazardous Materials and Solid Waste

There are no known threats pertaining to hazardous materials at the project site. The exposure risks to hazardous materials (e.g., asbestos-containing substances, lead-based paint, mercury-containing light fixtures, electrical equipment containing polychlorinated biphenyls, and radioactive smoke detectors) is low for the subject project.

There are no known Underground Storage Tanks at the project site.

Impacts and Mitigation Measures

Construction activities at the project site would temporarily increase the volume of solid waste including construction debris that must be transported offsite for disposal. The BWS is expected to ensure that appropriate waste management and disposal practices are implemented by the construction contractor.

Construction will comply with State regulations promulgated in Title 11 Chapter 58.1 “Solid Waste Management Control” which requires that solid wastes are properly delivered to permitted solid waste management facilities.

2.6. Natural Hazards

Natural hazards that may threaten life and property on Oahu include tsunami inundation, tropical cyclones, earthquakes, volcanic activity, floods, drought, wildfires, sea level rise, high wind and landslides. In general, the exposure to natural hazards from unpredictable events is no greater at the project site than at other locations on Oahu. Earthquakes, hurricanes and storms have resulted in power outages for extended periods in localized areas of Oahu.

Tsunami evacuation zone maps for the State of Hawaii identify low lying areas where excavation is recommended since extensive damage to life and property may occur from seismic sea waves. The project site is located well outside the tsunami evacuation zone (Hawaii State Civil Defense, n.d.).

The project site is within Zone D according to the Flood Insurance Rate Map Panel No. 15003C0237F for Hawaii (map revised September 30, 2004) prepared by the Federal Emergency Management Agency. The Zone D designation refers to areas with possible but undetermined flood hazards. No flood hazard analysis has been conducted. The project is adjacent to and at a higher elevation than Zone X around Panakauahi Gulch. Zone X indicates areas of low-to-moderate risk that are outside the 0.2 percent annual chance (or 500-year) floods. The project site is at a higher elevation than the adjacent Zone X areas, indicating a very low flood risk for the project site. The Flood Hazard Rate Map for the project site is provided in Appendix A.

Due to the dry nature of brush surrounding the project site, threats from wildfires are possible. Drought conditions and high winds could exacerbate the fire hazard.

Impacts and Mitigation Measures

The threats to humans and property from unpredictable natural events will always be present. Proposed activities at the project site would not affect the occurrence of naturally occurring hazards. Project actions would increase the potable water storage capacity of the Honolulu Metro system to better meet the needs of the community during an emergency. Reservoir storage can supply water, for example, if wells are shut down due to loss of power.

Best management practices are recommended during construction to mitigate the potential for fire, such as the removal of trash and construction debris,

proper storage and management of flammable materials, and the use of non-flammable materials for construction, where possible.

2.7. Floral and Faunal Resources

A biological field survey was conducted by AECOS, and is provided in Appendix B.

The project site is predominantly covered by koa haole and guinea grass. Two indigenous species were identified: *ilima* and *uhaloa*. Both species are common on Oahu. No plants listed on the federal or state endangered species list was detected.

Eight (8) bird species were identified, all of which were non-native species. No species currently protected or proposed for protection under either the federal or state endangered species programs were detected. No mammals were identified during the field survey.

The project site does not contain federal delineated Critical Habitat for endangered or threatened species.

The State Division of Forestry and Wildlife (DoFAW), in its comment letter dated September 30, 2022, stated that the endangered Hawaiian Hoary Bat and Hawaiian Short-Eared owl could potentially occur in the project vicinity. The DoFAW also stated that artificial lighting can adversely impact seabirds that may pass through the area at night by causing them to become disoriented.

Impacts and Mitigation Measures

Construction of the proposed project will involve the grubbing and removal of vegetation over the 3.7-ac site and 4.0-ac roadway and utility corridors. However, no species listed by the U.S. Fish and Wildlife Service (USFWS) or in the Endangered Species Act were observed at the project site.

The State listed Hawaiian Hoary Bat or ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*) could potentially occur at or in the vicinity of the project and may roost in nearby trees. DoFAW provides the following recommendations for mitigating potential impacts on the Hawaiian Hoary Bat due to the subject project:

- Any required site clearing should be timed to avoid disturbance to bats during their birthing and pup rearing season (June 1 through September 15).
- During this period woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed.

- Barbed wire should also be avoided for any construction because bats can become ensnared and killed by such fencing material during flight. The BWS will consider the use of taller fences in lieu of barbed wire to mitigate potential impacts to the Hawaiian Hoary Bat.

The State endangered Hawaiian Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) could potentially occur in the project vicinity. DoFAW provides the following recommendations for mitigation of potential impacts to the pueo:

- Before clearing any vegetation, DoFAW recommends twilight pre-construction surveys by a qualified biologist.
- If pueo nests are present, DoFAW staff should be notified and a buffer zone should be established in which no clearing occurs until nesting is completed.

Temporary or permanent artificial lighting can adversely impact seabirds at night by causing them to become disoriented. DoFAW recommends that night work should be avoided during the seabird fledging season, from September 15 through December 15. Additionally, fully shielded lighting should be used for any permanent light fixtures installed at the proposed facility.

Activities during construction could result in the movement of plant or soil material between worksite containing pathogens, pests, or invasive plant parts that could harm native species. The Oahu Invasive Species Committee recommends regular cleaning and equipment best management practices to prevent the spread of invasive species to new areas (see Appendix C). DoFAW also recommends the use of native plant species for any proposed landscaping.

2.8. Archaeological, Architectural and Cultural Resources

An archaeological field investigation was conducted by Cultural Surveys Hawaii (CSH) as part of the scope of this study. A literature review and site investigation (pedestrian survey) was conducted and is provided in Appendix D.

Previous archaeological studies have identified a complex of irrigation ditches in the vicinity of the project site. The irrigation ditch system is associated with historic commercial sugar cane cultivation by the Oahu Sugar Company in the early 1900s. The irrigation ditch system was previously designated as State Inventory of Historic Places (SIHP) #50-80-09-2273 by the State Historic Preservation Division (SHPD). Site -2273 covers an extensive network of ditches, flumes, siphons, reservoirs,

pumping stations and wells. The system was built after 1916 after the Waiahole Ditch was constructed to transport large quantities of water from the Koolau Mountains for agricultural use in the Ewa plains. Many features of Site -2273 were identified by previous archaeological surveys outside, but in the vicinity of the project site. Features include a concrete-lined retention basin, dam-like features, siphons, cut basalt and mortar ditches, earthen ditches, flumes, valves, culverts and basalt and mortar water basins. An archaeological study performed in 2015 found the irrigation complex to be significant under Criteria C and D for eligibility for listing on the Hawaii Register of Historic Places and significant under HAR §13-284-6 Criteria c and d. Four (4) of the more significant features of Site -2273 were preserved.

During the pedestrian survey performed by CSH, 12 portable ditch units (PDU) were identified within the project site that were identical to some features identified by the 2015 study. It is reasonable to believe that these PDU are additional features of the irrigation complex designated as Site -2273. However, the PDU segments within the project site appear to be mass-produced and interchangeable in nature.

No traditional Hawaiian or early historic period properties have been reported at the project site or were observed during the field investigation. The probability of finding traditional Hawaiian or early historic period properties at the project site is low.

A literature review was also performed for the purpose of identifying cultural resources and practices within the area surrounding the project area. A copy of the cultural literature review is provided in Appendix E. Based on the findings of the review, no impacts to cultural resources and practices are anticipated due to the proposed project.

Impacts and Mitigation Measures

Construction of the proposed project will require removal or relocation of PDU units likely associated with Site -2273. Location and alignment of the PDU should be documented prior to construction. Due to their mass-produced nature, this documentation should serve as sufficient mitigation.

No impacts are anticipated to traditional Hawaiian or early historic period resources since none are believed to be present. The contractor will be required to stop work and notify the SHPD should any such resources be discovered during construction.

SHPD will be consulted during the planning and design phases of the project, pursuant to HRS §6E-8.

2.9. Visual Resources

The project site is undeveloped and dominated by dry shrub brush (predominantly koa haole and guinea grass). Public views of the site are predominately from north-bound lanes of the Interstate H-2 Freeway.

Impacts and Mitigation Measures

The proposed reservoir will be constructed into the hillside along the Interstate H-2 Freeway. The proposed facility will be cut into the hillside to provide the appropriate reservoir elevation. As a result, the reservoirs will not have a significant visual impact on surrounding areas. Visual impacts may be further mitigated using various measures such as painting the reservoirs green or installing perimeter landscaping, which is a common practice for many BWS reservoirs.

2.10. Noise

The project site is located adjacent to the Interstate H-2 Freeway where the primary noise source is related to vehicular traffic. Generally, the amount of ambient noise is high due to the vicinity of the project site to the freeway.

Impacts and Mitigation Measures

Audible noise from demolition and construction activity is expected to be intermittent and unavoidable since construction vehicles, heavy equipment and impact tools generate noise as part of normal operations. The mitigation of noisy activities to inaudible levels will not be practical in all cases due to the intensity and exterior nature of the work. Ambient noise levels in the vicinity of the project site will therefore increase during construction periods. Construction noise is temporary in nature and will cease upon completion of the project.

Project activities shall comply with the provisions of HAR Title 11, Chapter 46, “Community Noise Control.” The noise regulations require a noise permit if the noise level from construction activity is expected to exceed allowable levels stated in the Chapter 11-46 rules. It shall be the contractor’s responsibility to minimize noise by properly maintaining noise mufflers and other noise-attenuating equipment and to maintain noise levels within regulatory limits. If construction activities occur outside of the allowable timeframes designated for the noise permit (i.e., nighttime, Sunday, holiday) and exceed allowable noise levels, a noise variance must be obtained prior to commencement of construction activities, as required. The construction contractor will obtain the appropriate permit or approvals (e.g., Notice of

Intent to Construct, Community Noise Permit, or Noise Variance). The BWS will ensure that the contractor complies with all permit conditions.

Potential noise impacts will also be mitigated by performing the majority of construction work during daytime hours (as opposed to night work), thereby avoiding the creation of construction noise impacts during nighttime hours. Daytime work will ensure minimal impacts to existing users adjacent to and in the vicinity of the project site.

Long term operation of the reservoir facility is not expected to result in substantial noise impacts. As such, no long-term noise mitigation is warranted.

2.11. Site Access, Circulation and Traffic

The project site is currently accessed by dirt roads operated by Kamehameha Schools. There is no public access to the project site.

The nearest publicly accessible roadways are Waihonu Street approximately 0.6 miles to the southwest in the Pearl City Industrial Park and Ka Uka Boulevard approximately 1.4 miles to the north near the Waiawa Correctional Facility. The Interstate H-2 freeway is located immediately to the west of the project site, however, there is no direct access from the freeway to the project site.

Impacts and Mitigation Measures

Construction of the proposed project includes installation of an access road, as required by BWS Water System Standards. BWS standards require the access road to have a minimum width of 12 ft and paved with asphalt-concrete on slopes up to 12% and concrete for grades above 12%. The proposed site plan shown in Figure 2 shows the proposed roadway leading to the South toward a connection with Waihonu Street. However, the road alignment and connection point to public roadways is undetermined at this time. Determination of the roadway alignment and connection must be negotiated with Kamehameha Schools, as it will be located on their property. Appropriate easements must be attained by Kamehameha Schools as part of this process.

The transportation of equipment and material to the site along with the removal of debris and construction waste from the site may cause an intermittent increase in traffic during construction. Appropriate traffic control devices including warning signs, lights, barricades, cones, and other safety equipment will be installed and maintained by the contractor during the construction period, if necessary. No traffic lane closures or traffic detours are

expected in conjunction with project activities; however, a traffic control plan shall be prepared prior to the commencement of the proposed project if lane closures or traffic detours are deemed necessary. The temporary closure of any portion of a City street or sidewalk for construction work requires a street usage permit from the Department of Transportation Services (DTS).

The transport of oversized and/or overweight materials and equipment on State highway facilities requires a permit from the State of Hawaii, Department of Transportation (DOT).

Bus routes, bus stops and paratransit operations are not expected to be impacted by project actions. The temporary increase in traffic due to vehicles and equipment accessing the project site will cease upon the completion of construction activities. The operation of the new reservoir at the project site will not increase vehicular traffic or affect site access and circulation patterns such that no mitigation is warranted. BWS personnel will continue to infrequently access the project site for monitoring and maintenance purposes as part of normal operations. Public access to the facility will be restricted, as is typical of BWS facilities to ensure safety and security of the municipal water supply.

2.12. Utilities (Water, Wastewater, Drainage)

The project site does not have existing water, wastewater, or drainage infrastructure.

The proposed reservoir facility will connect to an existing 42-in BWS transmission main located approximately 3,700 ft from the project site. The connection will be made by installing a 30-in influent and effluent mains from the reservoir to the connection point. The Water System Standards recommend that the transmission main be located along the access road alignment, if possible.

The proposed project does not require a wastewater connection so no connection to the municipal wastewater collection system or on-site treatment and disposal facilities are anticipated.

As discussed in Section 2.4 Water Resources, over-land stormwater flow from the project site will generally sheet flow from the project site to Panakauahi Gulch through culverts under the Interstate H-2 Freeway. Panakauahi Gulch flows into Waiawa Stream before ultimately flowing into Pearl Harbor West Loch.

Impacts and Mitigation Measures

Connection of the proposed reservoir facility to the existing water system will result in increased reservoir storage capacity for the BWS Metro Low system.

Increased storage capacity results in greater reliability and reduces stress on the distribution system. Additionally, it helps offset the anticipated growth in water demand on the system.

The proposed project will not affect wastewater utilities, as no wastewater connection is proposed.

BWS reservoirs require drainage lines that serve to empty the reservoir for maintenance and provide relief for reservoirs that may become over-filled due to faulty level readings. The BWS Water System Standards require that washout lines and blowoff lines shall be capable of draining each reservoir in 12 hours. Based on this requirement, the following drainage rates were calculated for each reservoir.

Tank Size	Drainage Time	Drainage Rate
2.0 MG	12 hours	6.19 cfs
2.5 MG	12 hours	7.74 cfs
4.0 MG	12 hours	12.38 cfs

These reservoir discharges will be rare. Overflow lines are intended to prevent the reservoir from being damaged if water level detection equipment is inoperable or the BWS cannot otherwise stop water from being pumped into the reservoir. BWS maintenance actions also do not typically result in large reservoir discharges as BWS prefers to draw down the reservoir through regular water use as opposed to emptying the reservoir through drainage lines.

Reservoir drainage may be handled by constructing underground drainage lines that connect to the existing City stormwater drainage system or can be discharged overland to follow existing drainage patterns. Because the site is undeveloped and there no existing City stormwater drainage system near the project site, it is likely that overland drainage will be used. However, this determination will be made during the project's design phase. Figure 3 provides a proposed layout for reservoir drainage and shows an outlet for overland discharge.

If overland discharge is used BWS will obtain a flowage easement from the downstream landowner, Kamehameha Schools. HDOT will also be consulted as natural drainage patterns flow through culverts under the Interstate H-2 Freeway. Reservoir drainage would enter Panakauahi Gulch and travel to its confluence with Waiawa Stream. The flow rates from reservoir washout and blowoff lines are not significant compared to the estimated 100-year flows in Panakauahi Gulch (14,200 cfs) and Waiawa Stream (34,000 cfs) (FEMA,

2014). These discharges would be potable water and not result in any water quality concerns.

If overland discharge is not feasible, construction of a new storm drain system will be required to connect the new facility to the nearest municipal storm drain capable of carrying reservoir discharges. The nearest storm drain systems is located in the Pearl City Industrial Park, approximately 3,000 ft from the project site. Available capacity of the municipal storm drain system will be confirmed during the design phase prior to construction if such a connection is required.

2.13. Power and Communications

There is currently no power or telecommunication service at the project site. Electrical, control, and monitoring systems for the new reservoir will be required for operation of the reservoir facility. Power is required for various purposes at the project site, such as operation of monitoring and control equipment. Telecommunications is required for monitoring and control of the reservoir facility. Service will be brought to the site by respective utility companies, and will be coordinated during the design phase of the project. Any power and telecommunication lines brought to the project site will require easements from the landowner, Kamehameha Schools.

Impacts and Mitigation Measures

Electrical lines and telecommunication lines will need to be installed to bring service to the project site. The alignments of these service lines are not known as they will need to be coordinated with their respective utility providers during the design phase. However, impacts of installation may be minimized by installing these utilities along the reservoir access road. This would minimize the areas to be disturbed and also provide easier access for maintenance.

The use of photovoltaic (PV) panels will be considered to reduce the electrical load to the grid from the proposed facility. BWS can mount PV panels on top of the proposed reservoirs to provide power to control and monitoring systems at the facility.

2.14. Socio-Economic Characteristics

The project site is located within the City's Central Oahu planning region, which is generally characterized as a stable population for which public actions will focus on supporting existing populations.

The project site is in census tract 83.1 which reports a median household income of around $170,000. The project area and most areas within the census tract, however, are undeveloped. The tract includes approximately 809 households primarily in the Mililani Mauka area, which is located approximately 5 miles from the project site (DBEDT, 2013).

Impacts and Mitigation Measures

The proposed project is intended to improve the reliability and storage capacity of the affected system, and will not affect population levels, housing or schools. The various phases of construction will create short-term jobs for people in design and construction, which will cease upon completion of construction.

2.15. Emergency Service Facilities and Shelters

Law enforcement is provided by the Honolulu Police Department (HPD). The nearest HPD police station to the project site is located approximately 1.5 miles from the project site on Waimano Home Road in Pearl City.

Fire protection services are provided by the Honolulu Fire Department (HFD). HFD's Station 20 is located approximately 1.75 miles from the project site on 1st Street in Pearl City.

Emergency service providers include critical care providers such as hospitals and clinics. Pali Momi Medical Center is located approximately 3.75 miles from the project site on Pali Momi Street in Pearl City.

Waipahu High School is a designated hurricane evacuation shelter. It is located about 1.5 miles from the project site on Farrington Highway in Waipahu.

Impacts and Mitigation Measures

No significant adverse impacts to police, fire, medical or emergency shelter facilities will occur from the proposed project. The addition of the proposed reservoir facility will increase water storage capacity in the affected system, which is a primary source of water supply for firefighting activities.

Due to the dry nature of the project area, best management practices are recommended during construction to mitigate the potential for fire, such as the removal of trash and construction debris, proper storage and management of flammable materials, and the use of non-flammable materials for construction, where possible.

Facility design will comply with National Fire Protection Association (NFPA) standards, as adopted by the City and County of Honolulu. The HFD will review the design of the proposed facility for compliance with NFPA standards during the design phase of the project. The HFD provided the following comments related to NFPA design standards:

- 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 (46 meters) 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; 2018 edition, Sections 18.2.3.2.2 and 18.2.3.2.2.1, as amended.)
- A fire department access road shall extend to within 50 feet (15 meters) of at least one exterior door that can be opened from the outside and that provides access to the interior of the building. (NFPA 1; 2018 Edition, Section 18.2.3.2.1.)
- An approved water supply capable of supplying the required fire flow for fire protection shall be provided to all premises upon which facilities, buildings, or portions of buildings are hereafter constructed or moved into the jurisdiction. The approved water supply shall be in accordance with NFPA 1; 2018 Edition, Sections 18.3 and 18.4.
- The fire department access roads shall be in accordance with NFPA 1; 2018 Edition, Section 18.2.3.

2.16. Recreational Resources

There are currently no recreational resources in the vicinity of the project site. The site is on Kamehameha Schools property and is not publicly accessible.

Impacts and Mitigation Measures

The proposed project will have no adverse impact to existing recreational resources. Once completed, the reservoirs will improve the reliability of the Honolulu Metro Low system which provides potable water to parks and other recreational resources.

3. RELATIONSHIP TO PLANS, POLICIES, AND CONTROLS

3.1. State Land Use District

The State Land Use Law (Chapter 205, HRS) is intended to preserve, protect, and encourage the development of lands in the State for uses which are best suited to the public health and welfare for Hawaii's people. All lands in the State are classified into four land use districts by the State of Hawaii, Land Use Commission: Urban, Agricultural, Conservation, and Rural.

Permissible uses within the Agricultural land use district governed based on the land study bureau's detailed land classification overall (master) productivity rating. Uses permitted in the highest productivity agricultural categories, A and B, are governed by statute. Uses in the lower productivity categories – C, D, E or U – are established by the Land Use Commission and include those allowed on class A or B lands as well as those stated under HRS §205-4.5.

HRS §205-4.5(7) lists "public, private, and quasi-public utility lines and roadways…major water storage tanks, and appurtenant small buildings such as booster pumping stations, but not including offices or yards for equipment, material, vehicle storage, repair or maintenance, treatment plants, corporation yards, or other similar structures" as a permissible use within the Agricultural land use district.

3.2. Hawaii State Plan

The Hawaii State Plan (Chapter 226, HRS) outlines broad goals, policies, and objectives to serve as guidelines for the future growth and development of the State. The excerpts below are Hawaii State Plan objectives, policies, and priority guidelines that pertain to the proposed project in Honolulu, Oahu.

The BWS is a semi-autonomous government agency that manages Oahu's municipal water resources and distribution system to meet the needs of customers now and in the future. The proposed project responds to the objectives and policies of the Hawaii State Plan with regards to water systems. Reliable water supplies support the economic and social welfare of the communities served by the BWS water system. The proposed reservoir facility improves reliability of the municipal potable water supply and helps to meet future growth in water demand.

§226-5 Objectives and policies for population.

(b)To achieve population objective, it shall be policy of the state to:

(7) Plan the development and availability of land and water resources in a coordinated manner so as to provide for the desired levels of growth in each geographic area.

§226-11 Objectives and policies for the physical environment--land-based, shoreline, and marine resources.

(a) Planning for the State's physical environment with regard to land-based, shoreline, and marine resources shall be directed towards achievement of the following objectives:

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

(2) Effective protection of Hawaii's unique and fragile environmental resources.

(b) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:

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

(8) Pursue compatible relationships among activities, facilities, and natural resources.

§226-13 Objectives and policies for the physical environment--land, air, and water quality.

(a) Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following objectives:

(1) Maintenance and pursuit of improved quality in Hawaii's land, air, and water resources.

(b) To achieve the land, air, and water quality objectives, it shall be the policy of this State to:

(2) Promote the proper management of Hawaii's land and water resources.

(3) Promote effective measures to achieve desired quality in Hawaii's surface, ground, and coastal waters.

(4) Encourage actions to maintain or improve aural and air quality levels to enhance the health and well-being of Hawaii's people.

(5) Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.

§226-14 Objective and policies for facility systems--in general.

(a) Planning for the State's facility systems in general shall be directed towards achievement of the objective of water, transportation, waste

disposal, and energy and telecommunication systems that support statewide social, economic, and physical objectives.

(b) To achieve the general facility systems objective, it shall be the policy of this State to:

(1) Accommodate the needs of Hawaii's people through coordination of facility systems and capital improvement priorities in consonance with state and county plans.

(2) Encourage flexibility in the design and development of facility systems to promote prudent use of resources and accommodate changing public demands and priorities.

(3) Ensure that required facility systems can be supported within resource capacities and at reasonable cost to the user.

§226-16 Objectives and policies for facility systems - water.

(a) Planning for the State's facility systems with regard to water shall be directed towards achievement of the objective of the provision of water to adequately accommodate domestic, agricultural, commercial, industrial, recreational, and other needs within resource capacities.

(b) To achieve the facility systems water objective, it shall be the policy of this State to:

(4) Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.

§226-26 Objectives and policies for socio cultural advancement – public safety.

(a) *Planning for the State's socio-cultural advancement with regard to public safety shall be directed towards the achievement of the following objectives:*

(1) *Assurance of public safety and adequate protection of life and property for all people.*

(2) Optimum organizational readiness and capability in all phases of emergency management to maintain the strength, resources, and social and economic wellbeing of the community in the event of civil disruptions, wars, natural disasters, and other major disturbances.

§226-27 Objectives and policies for socio cultural advancement – government.

(a) Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of the following objectives:

(1) Efficient, effective, and responsive government services at all levels in the State.

(b) To achieve the government objectives, it shall be the policy of this State to:
(1) Provide for necessary public goods and services not assumed by the private sector.
(5) Assure that government attitudes, actions, and services are sensitive to community needs and concerns.

3.3. City and County of Honolulu General Plan

The City's General Plan sets forth broad statements of social, economic, environmental, and design objectives and policies which are desired over the long-term. The excerpts below are General Plan policies and objectives that pertain to the proposed project. The proposed reservoir facility will help to ensure the continued delivery of water service to the BWS Metro Low service area. The BWS has considered the social, economic and environmental impacts of proposed water system improvements that respond to the needs of the community.

I. Population
Objective A: To plan for anticipated population in a manner that acknowledges the limits of Oahu's natural resources, protects the environment, and minimizes social, cultural, and economic disruptions.
Policy 1: Allocate efficiently the money and resources of the City in order to meet the needs of Oahu's current and future population.

III. Physical Development and Urban Design
Objective A: To protect and preserve the natural environment.
Policy 1: Protect Oahu's natural environment, especially the shoreline, valleys, and ridges, from incompatible development.
Policy 7: Protect the natural environment from damaging levels of air, water, and noise pollution.
Objective B: To preserve and enhance the natural monuments and scenic views of Oahu for the benefit of both residents and visitors.
Policy 3: Locate roads, highways, and other public facilities and utilities in areas where they will least obstruct important views of the mountains and the sea.

V. Transportation and Utilities
Objective C: To maintain a high level of service for all utilities.
Policy 2: Provide improvements to utilities in existing neighborhoods to reduce substandard conditions.
Policy 3: Plan for the timely and orderly expansion of utility systems.
Objective D: To maintain transportation and utility systems which will help Oahu continue to be a desirable place to live and visit.

Policy 1: Give primary emphasis in the capital- improvement program to the maintenance and improvement of existing roads and utilities.
Policy 4: Evaluate the social, economic, and environmental impact of additions to the transportation and utility systems before they are constructed.

IX. Health and Education
Objective A: To protect the health of the people of Oahu.
Policy 3: Coordinate City and County health codes and other regulations with State and Federal health codes to facilitate the enforcement of air-, water-, and noise-pollution controls.

3.4. Central Oahu Sustainable Communities Plan

There are eight community-oriented plans for the City that are intended to help guide government action and decision-making. The Central Oahu Sustainable Communities Plan was adopted in 2021. The key elements of the vision

Protect agricultural lands and open spaces;
Revitalize Waipahu and Wahiawa;
Build master planned residential communities that support walking, biking and transit use;
Design communities to reduce automobile usage;
Protect natural, historic and cultural resources; and
Provide adequate infrastructure to meet the needs of new and existing development.

Although the facility will be constructed on undeveloped former agricultural land, construction of additional reservoir storage capacity is important for improving the reliability of the water distribution system and supporting future water demand growth.

3.5. City and County of Honolulu Land Use Ordinance

The City's Land Use Ordinance (LUO) regulates land use in accordance with adopted land use policies, including the City's General Plan and the Development/Sustainable Community Plans. The zoning for the project site is AG-1 Agricultural District.

Revised Ordinances of Honolulu (ROH), Table 21-3 of the Land Use Ordinance (ROH, Chapter 21) outlines permitted uses within the various City zoning districts. The proposed facility is classified as a Utility Installation, Type A, which ROH 21-10.1 defines as "those with minor impact on adjacent land uses and typically include…water wells and tanks and distribution equipment". ROH Table 21-3 lists

Utility Installations, Type A as a permitted use subject to standards in Article 5 of ROH, Chapter 21. Article 5 states that when a Type A utility installation involving a transmitting antenna is located in the agricultural zoning district, it shall be fenced or otherwise restrict public access within the area exposed to a power density of 0.1 milliwatt/centimeter^2.

ROH, Table 21-3.1 lists the following development standards for development within the AG-1 zoning district:

- Minimum Lot Area: 5 ac
- Minimum lot width and depth: 150 ft
- Front yard: 15 ft
- Side and rear yard: 10 ft
- Maximum building area (percent of zoning lot): 10 (for non-agricultural uses)
- Maximum height: 15 – 25 ft (any portion of a structure exceeding 15 ft must be set back from every front, side and rear buildable area boundary line one foot for each 2 ft of additional height above 15 ft).

Land disposition is not finalized at the time of writing and must be negotiated with Kamehameha Schools. For the purpose of this section, it is assumed that the BWS will purchase and subdivide land for construction of the reservoir facility and that easements will be obtained for access, pipelines, and drainage. This would result in a 3.7-ac parcel, as shown in Figure 2. The proposed site plan is preliminary, however, as shown the proposed site plan would not conform with development standards for development in the AG-1 zoning district. Specifically, the minimum lot size is not met, the building area would be approximately 37% of the new zoning lot, and the reservoirs would exceed the height envelope. However, compliance with all zoning district development standards would require the BWS to obtain a much larger (13.7-ac) area of land for construction of the facility. Much of that land would remain unused as its primary purpose would be to meet the maximum building area of the new lot. Obtaining the proposed 3.7 ac for construction of the proposed facility is preferred as it minimizes impact to the current landowner (Kamehameha Schools) while also minimizing the funds that BWS requires to obtain the land.

The facility, as proposed, will require a waiver from the strict application of the development or design standards for lot size, building area, and height setback. ROH 21-2.130 states that a waiver may be granted by the Director of Planning and Permitting for public utility installations. DPP will be consulted during the design phase of the project.

DPP notes that there is an existing Conditional Use Permit (CUP) 2020/CUP-2 for the Waiawa Solar Farm that is previously approved for the existing lot. 2020/CUP-2

proposes construction of 65.12 ac of building area, which is 4% of the total area of the 1,567-ac zoning lot. If the BWS obtains 3.7 ac of land from Kamehameha Schools for construction of the proposed reservoir facility, this would reduce the existing lot size to 1,563 ac. This would not significantly change the percentage of building area coverage proposed by 2020/CUP-2, which would remain at 4%.

3.6. State Coastal Zone Management Program

Hawaii's Coastal Zone Management (CZM) program, established pursuant to Chapter 205A, HRS, as amended, is administered by the State of Hawaii, Office of Planning and provides for the beneficial use, protection, and development of the State's coastal zone. The CZM area consists of the entire state of Hawaii. The objective of the act is to protect, preserve, and restore recreational, historic, and scenic resources as well as implementing the state's ocean resources management plan and protecting coastal ecosystems. The act involves a system of permits to manage development within the coastal areas and encourages public participation.

Through the CZM program and pursuant to the Hawaii Coastal Zone Management Act (Chapter 205A, HRS, as amended), all counties have enacted ordinances establishing Special Management Areas (SMA). Any significant development within the SMA requires a SMA permit from the appropriate County. On Oahu, the SMA permit is administered by the DPP and acted upon by the City Council pursuant to Chapter 25, Revised Ordinances of Honolulu. The project site is not located within the SMA.

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4. POSSIBLE ALTERNATIVES

4.1. No-Action

The no-action alternative considers the implications of continuing existing conditions. In this alternative, no additional reservoir capacity is constructed and the total reservoir capacity of the BWS Metro Low system would remain unchanged.

No BWS facility would be developed at the project site. However, this does not preclude development of the project site by another party. No action implies that there would be no commitment of funding or capital improvement costs and no effort to construct a new reservoir that would address a storage need for the affected system. Construction of large water storage reservoirs represents a significant capital investment by the BWS.

In the no-action alternative, the existing storage deficit in the Metro Low system will remain unaddressed. The BWS would continue to rely on the use of wells to provide water during peak demand periods, which puts more stress on the BWS distribution system than using reservoir storage for peak water demand. Over the long term, this would result in increased repair and maintenance requirements.

The existing storage deficit would increase over time in the no-action alternative, as water demand in the Metro Low system is expected to increase due to population growth. This would diminish the ability to provide water service to customers in situations such as power outages when pumps are inoperable.

The affected system will not comply with BWS standards for storage requirements as a result of no action.

4.2. Delayed Action

A delayed action implies that a project of similar scope and size to the proposed action would occur at an unspecified future date. The environmental impacts resulting from a delayed action are generally expected to be the same as the proposed action so long as environmental conditions remain similar to the evaluated conditions described in this EA.

Construction of a new reservoir at a later date may result in increased construction costs due to inflation, changes in economic conditions or the labor supply since building materials and labor costs tend to increase with time. A delayed action may therefore necessitate a greater funding commitment for water system improvements. Hence, a delayed action is not favorable from the perspective of the BWS.

4.3. Alternate Location

The BWS considered numerous sites for construction of reservoirs to serve the Metro Low system. Initial studies focused on siting reservoirs nearest the system's service area and considered numerous sites between Waialae and Salt Lake. Due to the amount of existing development in these areas the BWS did not find many open sites available at the correct elevation and having sufficient space to site storage reservoirs. As a result, the BWS studied areas west of the Metro Low system to site new reservoirs. The proposed project site was identified as a favorable location for a new reservoir facility.

4.4. Construct the Waiawa 228 Reservoir Facility (Preferred Alternative)

The proposed action is construction of a new 8.5 MG reservoir facility in Waiawa. The project site involves land that was previously disturbed by historic agricultural activity and is currently undeveloped. Construction of the proposed facility will require coordination and land agreements with the landowner, Kamehameha Schools, for construction of the reservoir facility, access roads, pipelines and site drainage. Electrical and telecommunication service will also need to be brought to the site, as it is currently undeveloped.

The addition of 8.5 MG of reservoir capacity will help to offset the existing storage deficit in the BWS Metro Low system. This will reduce stress on the system by reducing the amount of well pumping required to meet peak demand periods, which will help to reduce the amount of repair and maintenance required on the system. The additional reservoir capacity will increase reliability of the system, as the reservoir can continue to supply water to customers in instances where wells are unavailable such as during power outages or well maintenance. Reservoir storage is also valuable for high intensity demands, such as fire-fighting.

5. PERMITS AND APPROVALS

Although exact permitting and approval requirements will be determined during the design phase, the following list contains permits and approvals that may be required for the proposed project:

State of Hawaii
- National Pollutant Discharge Elimination System Permit
- Stormwater Pollution Prevention Plan (SWPPP)
- Disability and Communication Access Board (DCAB)
- Community Noise Permit
- Community Noise Variance
- Oversized and Overweight Vehicles on State Highways Permit
- State Historic Preservation Division Chapter 6E-8 Determination
- DOT Plan Review
- DOT Construction Activities Discharge Permit

City and County of Honolulu
- Building Permit
- Grubbing, Grading, and Stockpiling Permit
- Erosion Control Plan/Best Management Practices
- Subdivision
- Public Infrastructure Map (PIM) Amendment
- Zoning Waiver

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6. DETERMINATION

A Finding of No Significant Impact (FONSI) determination is anticipated for the proposed project, which is not expected to have a significant impact on the physical or human environment. The supporting rationale for this finding as set forth in HAR Title 11, Chapter 200, Section 12 is discussed below.

(1) Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;

Land acquisition, construction of the new reservoir facility, and installation of access and utility connection infrastructure will not endanger any natural or cultural resources. The construction contractor shall stop work and contact SHPD immediately in the event any unanticipated buried archaeological or cultural resources are encountered.

(2) *Curtails the range of beneficial uses of the environment;*

No beneficial uses of the environment will be curtailed as a result of the proposed project. The project is located on an undeveloped portion of land that is predominantly covered in dry shrub brush. The project itself represents a beneficial use by providing critical water distribution infrastructure to the public.

(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 proposed project would be in conformance with State Environmental Policy, inclusive of its individual policies, goals, and guidelines for population growth; natural resources; biological resources; transportation; energy; and culture, as discussed in the individual resource categories throughout this EA.

(4) Substantially affects the economic welfare, social welfare, and cultural practices of the community or State;

The proposed project does not substantially or negatively affect the economic or social welfare and cultural practices of the community or State. The project creates short-term jobs in the design and construction industry. The installation of the new 8.5 MG reservoir facility and appurtenant infrastructure is not expected to negatively affect the cultural practices of the community or State.

(5) Substantially affects public health;

Public health will not be adversely affected during construction phases of the proposed project. Short-term and temporary effects such as surface runoff,

fugitive dust, noise, intermittent traffic, and solid waste are expected to cease upon project completion. The implementation of construction BMPs will minimize temporary impacts. Completion of the project would increase potable water storage capacity for the BWS Metro Low system and improve the overall reliability and redundancy of this water system to better meet public needs.

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

No substantial secondary impacts such as population shifts are anticipated from the proposed project, which represents a continuation of normal water system service by the BWS. The increase in potable water storage capacity allows the water system to better accommodate short periods of high water demand and to minimize stress on the existing water distribution system. The proposed improvements help to maintain service during power outages or during service to existing wells.

(7) Involves a substantial degradation of environmental quality;

The proposed project is not expected to degrade environmental quality. Environmental impacts that may occur during the various phases of construction will be mitigated through the implementation of construction BMPs, as appropriate. Appropriate mitigation measures have been identified throughout this EA.

(8) Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;

The proposed project that improves the reliability and redundancy of the water system represents a long-term commitment by the BWS to provide municipal water and distribution services to the community. The proposed project is not part of or associated with a supplemental future action.

(9) Substantially affects a rare, threatened, or endangered species, or its habitat;

No species listed by the U.S. Fish and Wildlife Service or in the Endangered Species Act are expected to be affected by the proposed project. The project site does not contain habitat for proposed, candidate, or listed threatened or endangered species.

(10) Detrimentally affects air or water quality or ambient noise levels;

Short-term impacts to air quality, water quality or ambient noise levels may occur during construction and demolition. No State or Federal air quality or

water quality standards should be violated during or after demolition and construction. Environmental impacts will be mitigated through proper construction techniques and compliance with applicable DOH rules and regulations. Operation of the new 8.5 MG reservoir facility and appurtenant infrastructure are not expected to negatively impact ambient air quality and background noise levels.

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

The project site is not situated within an environmentally sensitive area and is not anticipated to affect such areas.

(12) Substantially affects scenic vistas and view planes identified in county or state plans or studies; or

The new 8.5 MG reservoir facility will not obstruct or affect scenic vistas and view planes. Landscaping may further reduce the visual impact of the proposed reservoir.

(13) Requires substantial energy consumption.

The new reservoir facility is not anticipated to cause a substantial increase in energy consumption.

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7. PUBLIC AGENCY REVIEW AND CONSULTATION

7.1. Pre-Assessment Consultation

The consulted agencies, organizations, and individuals are listed below. There were thirteen (13) formal responses to the pre-assessment consultation letter, as indicated by the ✓ below. Comments and responses are included in Appendix F.

State of Hawaii

Department of Business, Economic Development, and Tourism
Office of Planning and Sustainable Development
Department of Land and Natural Resources
✓ Commission on Water Resource Management
State Historic Preservation Division
✓ Division of Forestry and Wildlife
✓ Land Division
✓ Engineering Division
Department of Health
Clean Air Branch
Clean Water Branch
✓ Indoor and Radiological Health Branch
Safe Drinking Water Branch
✓ Solid and Hazardous Waste Branch
Office of Hawaiian Affairs
Department of Transportation
✓ Highways Division
Office of Climate Change, Sustainability and Resiliency
Senator Clarence K. Nishihara (District 17)
Representative Ryan I. Yamane (District 37)

City and County of Honolulu

✓ Department of Design and Construction
✓ Department of Emergency Management
Department of Environmental Services
✓ Department of Facility Management
✓ Department of Planning & Permitting
Department of Transportation Services
✓ Honolulu Fire Department
✓ Honolulu Police Department
Councilmember Brandon J.C. Elefante (Honolulu City Council District 8)
Neighborhood Board No. 21

Organizations and Associations

Aha Malama, Corp.
Aina Momona
Association of Hawaiian Civic Clubs
Imua Hawaii
Kawaileo Law, A Limited Company
Koa Ike
Koolau Foundation
Na Koa Ikaika Ka Lahui Hawaii
Native Hawaiian Church
Order of Kamehameha I
PAI Foundation
Papa Ola Lokahi
Royal Hawaiian Academy of Traditional Arts
The I Mua Group

Property Owner

Kamehameha Schools, Community and Aina Resiliency
Kamehameha Schools, Commercial Real Estate Division
Kamehameha Schools, Community Relations and Communications Group

7.2. Draft EA Consultation

The BWS and TLCG will continue to coordinate and consult with governmental agencies that will review the Draft EA. Agency review comments and responses will be published in the Final EA. Public comments received from organizations and interested parties during the 30-day statutorily-mandated comment period will also be responded to and published in the Final EA.

8. REFERENCES

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APPENDIX A

Flood Insurance Rate Map

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 ME

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0237F

FIRM

FLOOD INSURANCE RATE MAP

CITY AND COUNTY OF HONOLULU, HAWAII

PANEL 237 OF 395

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
HONOLULU, CITY AND COUNTY OF	150001	0237	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
15003C0237F

MAP REVISED
SEPTEMBER 30, 2004

Federal Emergency Management Agency

APPENDIX B

A Natural Resources Assessment for the
BWS 228' Reservoir Site in Waiawa, Oahu

A natural resources assessment for the BWS 228' Reservoir site in Waiawa, Oʻahu

December 7, 2020 **DRAFT** *AECOS* No. 1631

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Introduction

The Honolulu Board of Water Supply (BWS) is proposing construction of three water tanks on a site designated "Waiawa 228' Reservoir" ("G6"), located at around the 200-ft (60-m) elevation directly east of the H-2 (Veterans Memorial Freeway) in Waiawa, central Oʻahu (Figures 1 and 2). The authors conducted a biological survey of the site and vicinity and prepared this assessment of the impacts of the project on the area natural resources.

Site Description

The site is located on property owned by Kamehameha Schools (TMK: 9-6-004:024) and accessed from Ka Uka Boulevard, to Mililani Memorial Park Road, to Waiawa Prison Road (or, alternatively from Pearl City Industrial Park). The site slopes down from north to south, increasing in steepness towards a gully running NE-SW on the south side of the G6 site. However, no streams, wetlands, or aquatic environments of any type occur on the site. This area is former sugar cane land and ample evidence of this past use is present in the form of concrete field channels (for distributing irrigation water). Sugar cane cropping ended in 1982.

Annual rainfall at the Project site is around 29 in (740 mm; Giambelluca, et al., 2013) indicative of an island leeward environment of generally dry mesic conditions (xeric environments receive under 10 in per year).

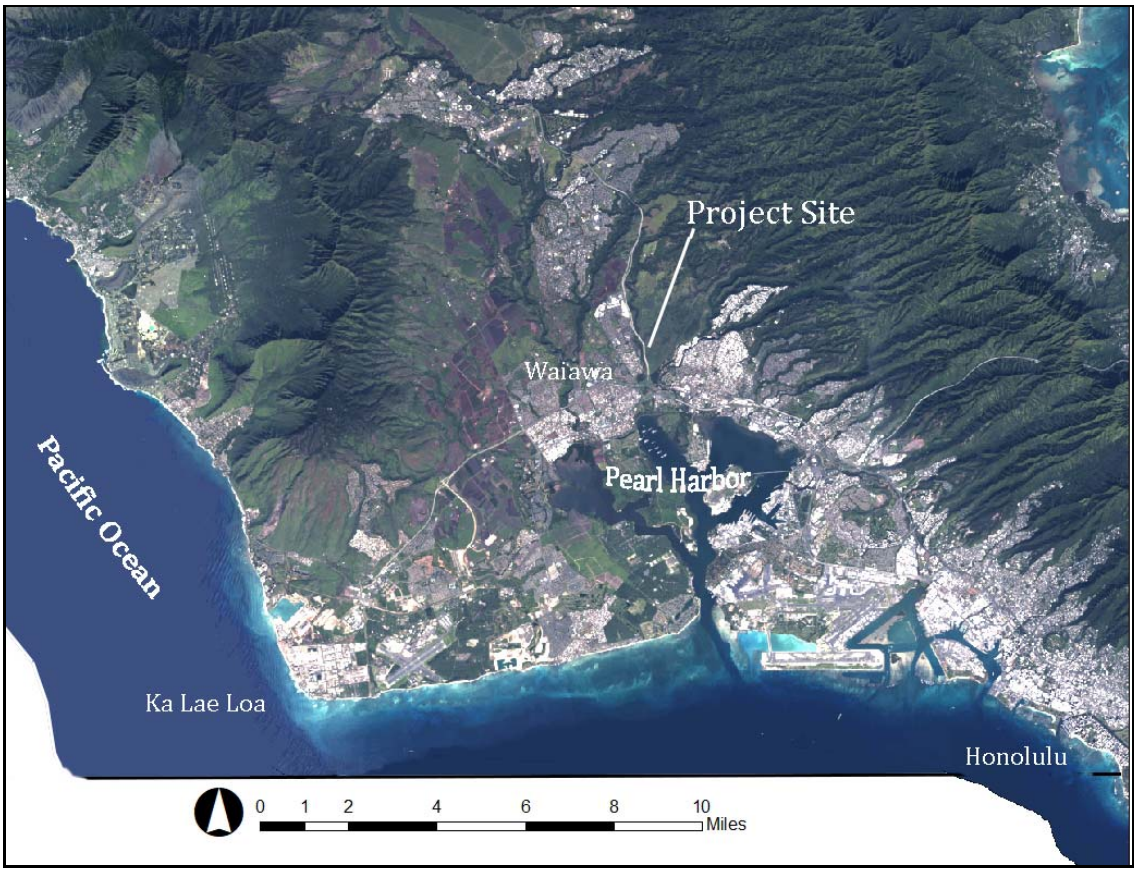

Figure 1. Project location, central O‘ahu.

Methods

Botanical Survey

A biological survey of the site was conducted on November 9, 2020 using a pedestrian transect methodology for the botanical survey. An approximate outline of the site was loaded into a handheld GNSS unit (Trimble GeoXH) to serve as a guide of the survey area. Plant species were identified as they were encountered and notations used to develop a qualitative sense of abundance of each species. The location of the Project on former cane lands at low elevation on O‘ahu strongly suggests that non-vascular plants, invertebrates, fishes, amphibians, or reptiles of conservation interest or concern would not be present.

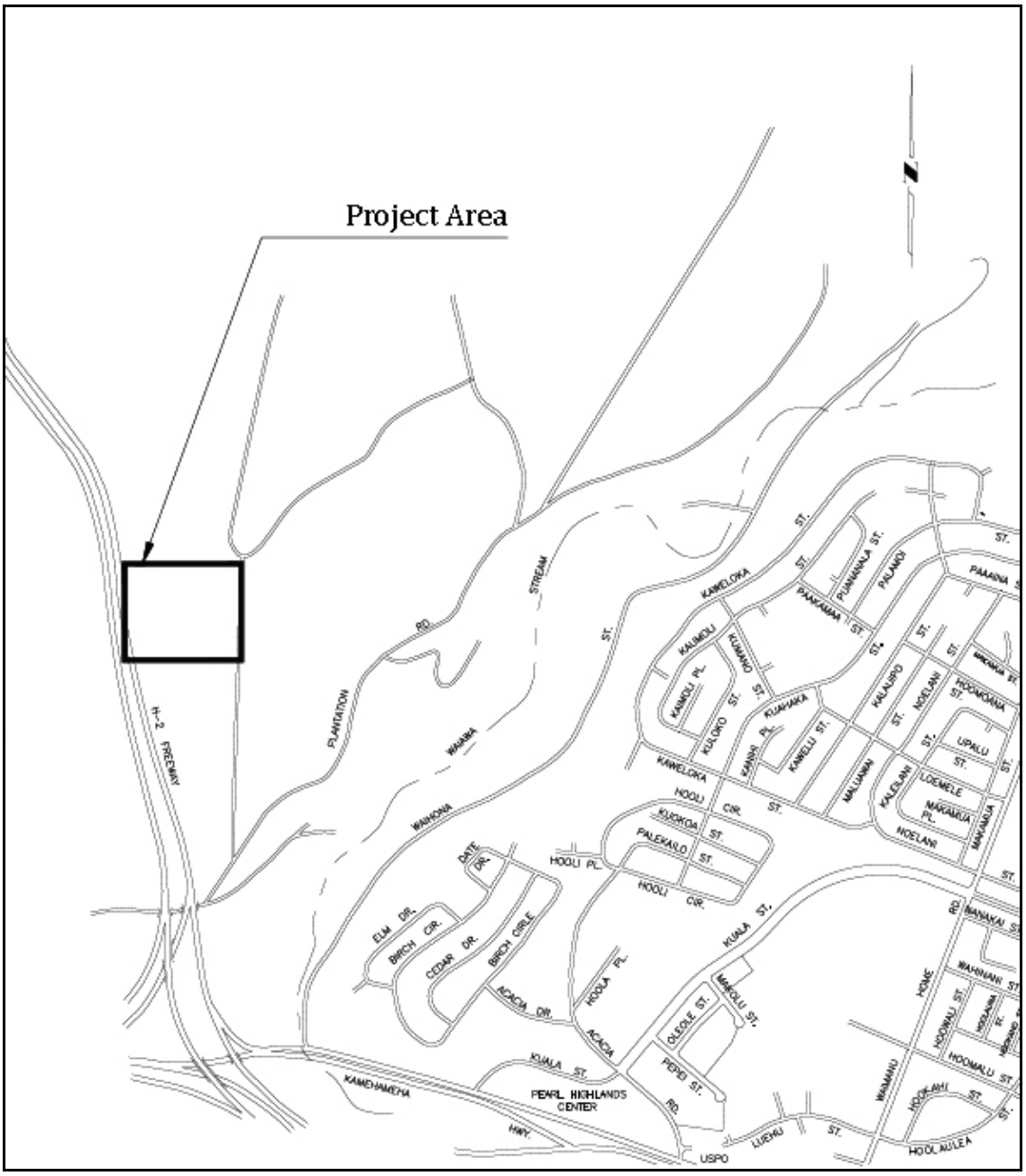

Figure 2. General Project area (modified from ATA, nd).

Plant names used in the report follow *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst, & Sohmer, 1999) for native and naturalized flowering plants. More recent name changes for naturalized plants follow Imada (2019).

Terrestrial Vertebrates Survey

Avian Survey

For the avian survey, a single avian count station was established on the Project site and an eight-minute avian point-count made. The avian point-count was conducted in the early morning on November 9, 2020. Field observations were made with the aid of Leica 8 X 42 binoculars and by listening for vocalizations. Time not spent counting at the point-count station was used to search the area for species and habitats not observed at the point-count station. Weather conditions were ideal, with 60% cloud cover, no precipitation, and light winds (0-5 mph) from the north.

The avian phylogenetic order and nomenclature used in this report follows the AOU *Check-List of North and Middle American Birds* 2018, and the Sixtieth Supplement to the American Ornithological Society's *Check-List of North American Birds* (Chesser et al., 2019, 2020).

Mammalian Survey

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 survey area. Mammal scientific names follow *Mammal species of the world: a taxonomic and geographic reference* (Wilson and Reeder, 2005).

Results

Vegetation

The site is entirely covered by a scrub forest of low stature *koa haole* (*Leucaena leucocephala*) with an understory of similarly low-stature Guinea grass (*Megathyrsus maximus*; see Figure 3). These two species constitute close to 100% of the site vegetation biomass.

Flora

The listing in Table 1 includes results from the present survey and from an earlier survey of the location made in 2017 (Guinther, 2017). A total of 17 plant species (includes an unidentified shrub) has been recorded from the site, although only 12 of these were observed in 2020. The flora is heavily

Table 1. Plant species observed at the BWS G6 Project site.

Species listed by family	Common name	Status	Abundance *	Notes
FLOWERING PLANTS				
DICOTYLEDONES				
ACANTHACEAE				
Aystasia gangetica (L.) T. Anderson	Chinese violet	Nat	U	<1>
AMARANTHACEAE				
Amaranthus viridis L.	slender amaranth	Nat	R	<2>
ASCLEPIADACEAE				
Stapelia gigantea N. E. Brown	giant toad plant	Nat	U	
ASTERACEAE (COMPOSITAE)				
Verbesina encelioides (Cav.) Benth. & Hook.	golden crown-beard	Nat	R	<2>
CONVOLVULACEAE				
Ipomoea obscura (L.) Ker-Gawl.	---	Nat	C (R)	
Merremia aegyptica (L.) Urb.	hairy merremia	Nat?	O	
FABACEAE				
Desmanthus pernambucanus (L.) Thellung	virgate mimosa	Nat	R (U)	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	AA (AA)	
Stylosanthes fruticosa (Retz.) Alston	---	Nat	R	<1>
MALVACEAE				
Abutilon grandifolium (Willd.) Sweet	hairy abutilon	Nat	R	<2>
Sida ciliaris L.	---	Nat	R	<1>
Sida fallax Walp.	*'ilima*	**Ind**	R	<1>
Waltheria indica L.	*'uhaloa*	**Ind**	R	<2>
PHYTOLACCACEAE				
Rivina humilis L.	coral berry	Nat	R	<2>
PORTULACEAE				
Portulaca oleracea L.	pig weed	Nat	R	<1>
FLOWERING PLANTS				
MONOCOTYLEDONES				
POACEAE				
Megathyrsus maximus (Jacq.) B.K. Simon & W.L. Jacobs	Guinea grass	Nat	AA (AA)	

* 2017 abundance values given in parentheses.

Table 1 (continued).

Legend to Table 1

STATUS = distributional status for the Hawaiian Islands:

Ind = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.

Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

ABUNDANCE = occurrence ratings for plant species:

R – Rare	seen in only one or perhaps two locations.
U - Uncommon	seen at most in several locations
O - Occasional	seen with some regularity
C - Common	observed numerous times during the survey
A - Abundant	found in large numbers; may be locally dominant.
AA - Very abundant	abundant and dominant; defining vegetation type.

Abundance value in parentheses = as recorded in 2017; species also seen in 2020.

NOTES: <1> – Recorded only from along farm roads.

<2> - Recorded in the 2017 survey of the site; not seen in 2020.

<3> – Plant lacking key diagnostic characteristics (flower, fruit); identification, therefore, uncertain.

Figure 3. Project site vegetation.

dominated by *koa haole* with a sparse understory of Guinea grass, which limit by shading combined with general dryness opportunities for other plant species to become established. Indeed, five of the 17 species recorded in the current survey were seen only along roads adjacent to the site. The nine other taxa noted as present in the survey occur in very small numbers (are rare or uncommon). Two of the species listed are indigenous plants: *ʻilima* (*Sida fallax*) and *ʻuhaloa* (*Waltheria indica*). Both species are common natives on Oʻahu.

Avian Fauna

Table 2 lists species of birds identified from the Project area in the survey of November 2020. A total of 28 individual birds of 11 species, representing 8 separate families, was recorded. All are introduced (non-native) species.

Table 2. Avian species detected along the November 9 survey.

Common Name	Scientific Name	ST	A
	GALLIFORMES		
	PHASIANIDAE - Pheasants & Partridges		
	Phasianinae - Pheasants & Allies		
Gray Francolin	*Francolinus pondicerianus*	NN	†
	COLUMBIFORMES		
	COLUMBIDAE - Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	NN	1
Zebra Dove	*Geopelia striata*	NN	1
	PASSERIFORMES		
	PYCNONOTIDAE - Bulbuls		
Red-vented Bulbul	*Pycnonotus cafer*	NN	5
Red-whiskered Bulbul	*Pycnonotus jocosus*	NN	1
	ZOSTEROPIDAE - White-eyes		
WarblingWhite-eye	*Zosterops japonicus*	NN	9
	MUSCICAPIDAE		
White-rumped Shama	*Copsychus malabaricus*	NN	2
	THRAUPIDAE - Tanagers		
Red-crested Cardinal	*Paroaria coronata*	NN	2

Table 2 (continued).

Common Name	Scientific Name	ST	*A*
	FRINGILLIDAE - Fringilline and Carduline Finches & Allies Carduelinae - Carduline Finches & Hawaiian H oneycreepers		
House Finch	*Haemorhous mexicanus*	NN	1
	ESTRILDIDAE - Estrildid Finches		
Common Waxbill	*Estrilda astrild*	NN	4
Java Sparrow	*Lonchura oryzivora*	NN	2

† Incidental observation (not seen at count-station).

Key to Table 2

ST Status

NN Alien – Introduced to the Hawaiian Islands by humans

A Abundance – Number of birds detected at count station.

Mammals

No mammals were detected during the field survey of the site.

Discussion and Recommendations

Recommendations are partly based on U.S. Fish and Wildlife Service, Animal Avoidance and Minimization Measures (USFWS-PIFWO, nd). Implementation of the recommendations (provided below as bulleted items) by the Project contractor will minimize impacts to protected species to the maximum extent practicable.

Floral Resources

Recent surveys on the property (general vicinity) have yielded much larger numbers of plant species as present: 62 species (*AECOS*, 2014), 39 species (*AECOS*, 2019a), 49 species (*AECOS*, 2019b), and 57 species (*AECOS*, 2020). The BWS site is located farther downslope where conditions are drier, favoring *koa haole* and Guinea grass and giving these hardy species an advantage over native and other introduced plant species as the land recovered from clearing and cropping for sugar cane. No plant listed under federal or state endangered species statutes (HDLNR, 1998; USFWS, nd-a) was detected during the course of our survey, nor are any expected to occur naturally at the site location.

Avian Resources

Avian diversity and densities are generally similar to those reported from previous surveys conducted in this area (*AECOS*, 2014, 2019a, b), although far less diverse than reported for the parcel further upslope where forested gullies and hillslopes are prominent (*AECOS*, 2020). No vertebrate species currently protected or proposed for protection under either the federal or state endangered species programs (HDLNR, 2015; USFWS, nd-a) were detected during the course of any of these surveys or the present survey.

Seabirds

Although no seabirds were detected during these surveys, it is possible that the endangered Hawaiian Petrel (*Puffinus sandwichesis*) and the threatened Newell's Shearwater (*Puffinus newelli*) over-fly the project area between April and the middle of December each year in very small numbers. Newell's Shearwater is not known to breed on the Island of O'ahu, though recent acoustical surveys have recorded low numbers of this species calling over the higher reaches of the Island (Young, et al., 2019). These authors also recorded Hawaiian Petrel over the Island.

The primary cause of mortality in Hawaiian Petrel and Newell's Shearwater 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 of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with man-made structures and, if not killed outright, become 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).

- Should an endangered waterbird appear on the Project site during construction, work in that area must cease until the animal leaves voluntarily.

- If night-time construction activity or equipment maintenance is conducted during construction, all associated lighting should be shielded and, if large work lights are used, these must be placed on poles that are high enough to allow the lights to be pointed directly towards the ground. Deleterious impacts to transiting seabirds can be avoided if construction occurs during daylight hours and all outdoor

lighting installed or utilized is fully "dark sky compliant" (HDLNR-DOFAW, 2016).

White Tern (*Gygis alba*), or *manu o Kū*, is an indigenous seabird listed as threatened under State of Hawai'i endangered species statute, HRS 195D (HDLNR, 2015). No individuals of White Tern were observed during this survey. In the main Hawaiian Islands, the majority of White Tern population is found in central urban and suburban Honolulu, with a known breeding range extending from Niu Valley to Hickam Air Force Base (VanderWerf and Downs, 2018). White Tern utilizing the Project area is unlikely, as the Project is outside of this species' known breeding range and lacks the larger trees utilized by this tern for roosting and nesting.

Owls

The Hawaiian endemic sub-species of Short-eared Owl or *pueo* (*Asio flammeus sandwichensis*) is state-listed as endangered on O'ahu only. Short-eared Owl nest on the ground and are thus susceptible to mammalian predation. The species is increasingly scarce on O'ahu (Cotin & Price, 2018) and no evidence of Short-eared Owl was found in our survey, nor is the densely *koa haole* covered slope attractive to use by owls.

Mammalian Resources

With but one exception, all terrestrial mammals currently found on the Island of O'ahu are alien species, and most are ubiquitous. It is likely that some of the alien Muridae found on O'ahu—roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), and Polynesian rat (*Rattus exulans hawaiiensis*)—use various resources within the general project area on a seasonal basis. All of these introduced rodents are deleterious to native ecosystems and native faunal species within them. No mammalian species currently protected or proposed for protection under either the federal or State of Hawai'i endangered species programs were detected during the course of this survey (DLNR, 1998; USFWS, 2015, nd-a.).

It is possible but unlikely that the Hawaiian hoary bat (*Lasiurus cinereus semotus* or *'ōpe'ape'a* as it is known locally) uses resources within the Project vicinity. This species is solitary and rare but with a potentially widespread distribution on O'ahu. No potential roost trees (trees over 15 ft tall) exist within the Project site.

Other Resources of Potential Concern

Critical Habitat

Federally delineated Critical Habitat is not present in the Project area (USFWS, nd-b). No equivalent designation exists under state law. Conservation zoning in Hawai'i is promulgated at the state level by state Conservation Districts. No Conservation Districts occur near the Project.

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APPENDIX C

Decontamination Protocols for Prevention of Invasive Species

DECONTAMINATION PROTOCOLS FOR PREVENTION OF INVASIVE SPECIES

Christy Martin, Coordinating Group on Alien Pest Species

Invasive plants, animals, and pathogens are a concern to public health, the economy, our watersheds, and the services they provide. Preventing the introduction of invasive species to new areas is important to eradication or containment efforts. Ensuring that gear and equipment are clean is a key component to stopping the spread and mitigating the impacts of invasive pests. Reporting newly arrived pests early in the infestation is crucial to eradication and significantly reduces resource spending and negative impacts.

WHAT to inspect & clean

- Gear, equipment, & tools

WHERE to inspect & clean

- Baseyard, site inspections

REPORTING invasive species

- What & how to report

Email: oisc@hawaii.edu

OISC
O'AHU INVASIVE SPECIES COMMITTEE
www.oahuisc.org

Call/Text: 808-286-4616

WHAT TO INSPECT & CLEAN

Look for seeds, plant material, soil, mud, insects, and other invertebrates.

LARGE EQUIPMENT & VEHICLES | **PERSONAL GEAR** | **SMALL EQUIPMENT & HAND TOOLS**

Large Equipment & Vehicles

(including but not limited to: hydraulic or wheel bulldozers, excavators, dump trucks, backhoes, chippers, bucket trucks, brush cutters, etc.)

Cleaning - Exterior

Manually remove clods of dirt with scraper, stiff brushes, or pry bar. Use compressed air to clean radiators and grills prior to using water. Use high pressure hose to wash from top to bottom.

Cleaning - Interior

Use brushes and/or vacuum to sweep out loose material (special attention to under mats, around seats and gear shifts).

Inspect & Clean Exterior

- Tires, tracks, rims, fender wells
- Spare tire mounting area
- Undercarriage & exhaust system
- Body (plates and panels)
- Light casings and mirrors
- Grills, bumpers and beds
- Chassis and engine bays
- Front and rear axles, brakes and shocks
- Boom, buckets, blade, and other attachments

Inspect & Clean Interior

- Beneath seats
- Beneath floor mats
- Upholstery
- Beneath foot pedals
- Inside folds of gear shift cover

WHAT TO INSPECT & CLEAN

Look for seeds, plant material, soil, mud, insects, and other invertebrates.

LARGE EQUIPMENT & VEHICLES **PERSONAL GEAR**

SMALL EQUIPMENT & HAND TOOLS

Personal Gear

- Clothing
- Hats/Helmets
- Jackets
- Gloves
- Socks
- Boots/shoes
- PPE (chaps, helmets, safety vests, etc.)

Cleaning:

Pockets should be thoroughly inspected for the above-listed materials. Pockets should be turned inside out to remove debris. Shoelaces and shoe tongues should be checked. Upon inspection, pre-clean personal gear by physical removal of dirt and mud with a stiff brush, lint remover, compressed air, or pressurized hot water. Clothing and gear that can be laundered, use soap and water. To kill fungal pathogens such as Rapid ʻŌhiʻa Death, spray footwear with 70% isopropyl alcohol and let sit for 15 seconds, AFTER mud and dirt are removed.

Areas of Concern:

Particular attention must be given to places where foreign material could become accidentally trapped, such as in the cuffs and folds of clothing, treads of boots or waders, or closures such as zippers or ties. Closures include: Zippers, belts, laces or ties, buckles, straps, Velcro grips, buttons and fasteners, and rivets. Attention to fabrics such as: canvas, nylon, cotton, poly blend, wool, fleece, netting, and suede. Other clothing items and accessories that should be checked include: socks and ankle grips, treads of footwear, cuffs and folds, seams, flaps, pockets, collars and hoods, and ventilation openings.

WHAT TO INSPECT & CLEAN

Look for seeds, plant material, soil, mud, insects, and other invertebrates.

LARGE EQUIPMENT & VEHICLES **PERSONAL GEAR**

SMALL EQUIPMENT & HAND TOOLS

Small Equipment & Hand Tools

(including but not limited to: riding mowers, zero-turn mowers, hedge-trimmers, chainsaws, leaf blowers, edgers, backpack sprayers, hand saws, loppers, shovels, machetes, rakes, etc.)

Inspect & Clean

- Mower decks
- Blades
- Undercarriages
- Wheels
- Seats
- Grills
- Safety guards
- Mufflers
- Air vents
- Housing covers
- Handles
- Moving parts
- Grooves
- Joints
- Cracks/Bends

Cleaning:

Manually remove clods of dirt with a scraper, stiff brush, or pry bar. Use compressed air to remove debris from radiators, grills, decks, and covers prior to using water. Wash with high-pressure hose or with water and brush. To kill fungal pathogens such as Rapid ʻŌhiʻa Death, spray footwear with 70% isopropyl alcohol and let sit for 15 seconds, AFTER mud and dirt are removed.

DECONTAMINATION PROTOCOLS FOR PREVENTION OF INVASIVE SPECIES

Where and when to inspect?

BASEYARD:
Before heading out for the day inspect all equipment, vehicles, hand tools, and clothing to ensure it is clean and free of debris. If it is not clean, note it on the daily inspection log (if available), then clean equipment before leaving for the site.

ARRIVAL AT WORK SITE:
Upon arrival, do a quick site assessment for any suspect invasive species of concern. If you find any, take a photo and report it to the O'ahu Invasive Species Committee (OISC) either by email: oisc@hawaii.edu or text: 808-286-4616.

DEPARTURE FROM WORK SITE:
Manually remove mud, dirt, and debris from personal gear and equipment before moving off the work site. Inspect all personal gear, tools, vehicles, and equipment.

RETURNING TO BASEYARD:
All vehicles, equipment, tools and personal gear should be completely free of all mud, dirt and debris. Inspections of equipment are logged daily to make sure it is clean (if available).

Reporting invasive species...

REPORT INVASIVE SPECIES
643-PEST
643pest.org
CALL OR CLICK TO PROTECT HAWAII

Not *every* invasive species in Hawai'i is managed because we simply have too many to tackle. However, some are managed statewide and some are managed island-wide. But not to worry! You don't have to know which species are managed or where. Just remember, **if it's weird report it** to the statewide pest hotline. They will take it from there and, if it is an actionable pest, they will forward the report to the appropriate agency.

DECONTAMINATION PROTOCOLS FOR PREVENTION OF INVASIVE SPECIES

OISC Target Species

OISC concentrates on species that pose the highest threat to the island's ecosystem, economy, and health of residents. We also consider those that have the greatest feasibility of eradication or containment. The following threats are priority species and are actively controlled by OISC. Sightings of these pests should be reported with a photo (if possible) immediately to OISC or www.643pest.org.

Report directly to OISC with location and photo via:
Email: oisc@hawaii.edu or Text: 808-286-4616

Click photo for link to species info or visit: www.oahuisc.org/target-pests/


Cane Tibouchina (Cane Ti)

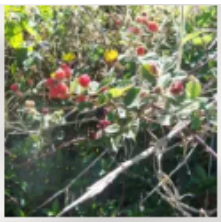

Coqui Frog


Glory Bush


Miconia


Cape Ivy


Devil Weed


Himalayan Blackberry


Pampas Grass


Coconut Rhinoceros Beetle


Fireweed


Little Fire Ant

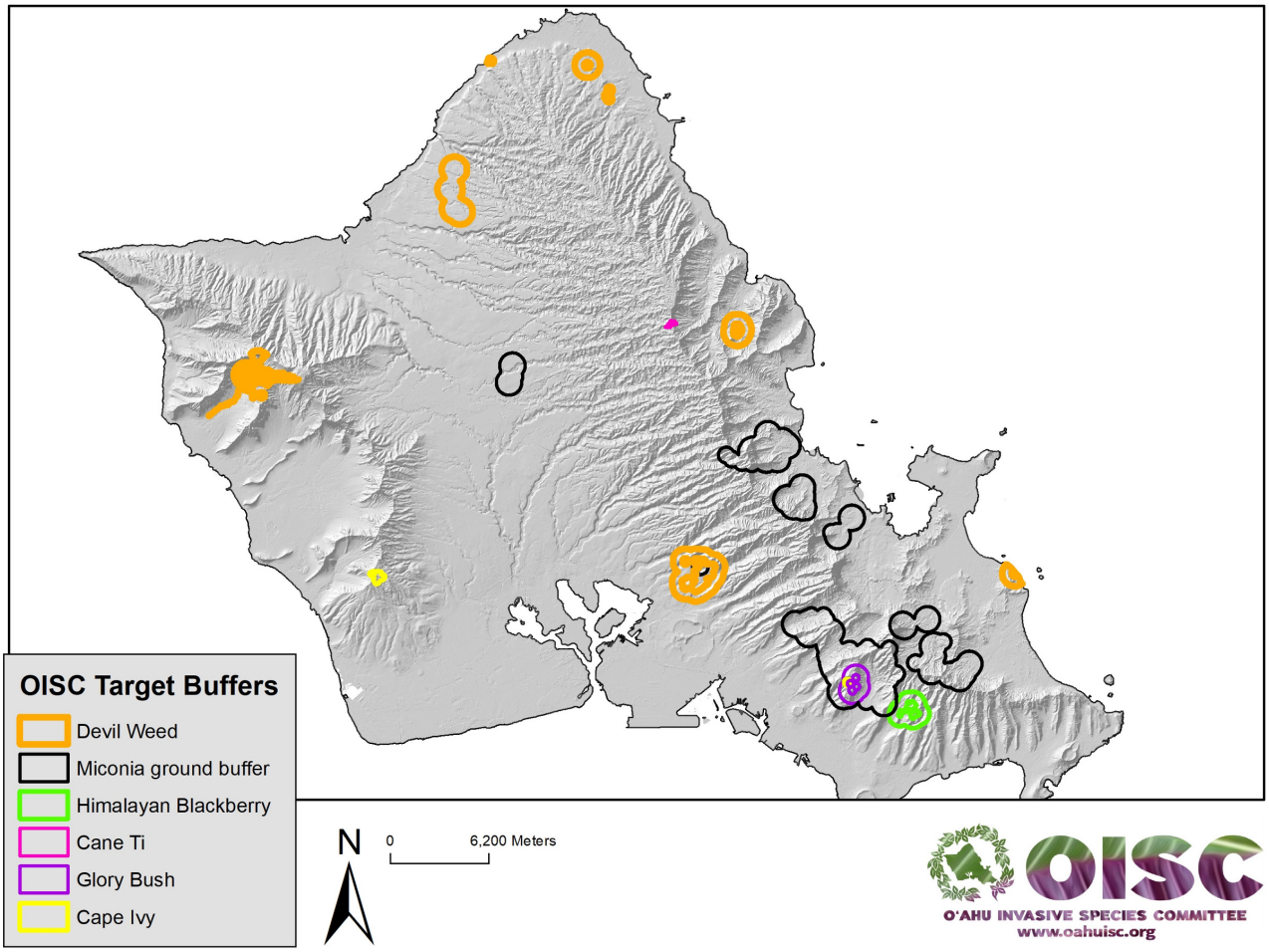

Rapid Ohia Death

DECONTAMINATION PROTOCOLS FOR PREVENTION OF INVASIVE SPECIES

OISC Target Species Locations

The maps below represent KNOWN locations under management. Please take extra care to decontaminate gear equipment and tools when working in these areas. These species could be present anywhere on O‘ahu. Report ALL suspect targets to OISC or the pest hotline, no matter where you see them.

Report directly to OISC with location and photo via:
Email: oisc@hawaii.edu or Text: 808-286-4616



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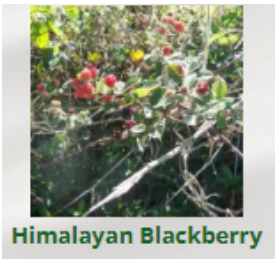
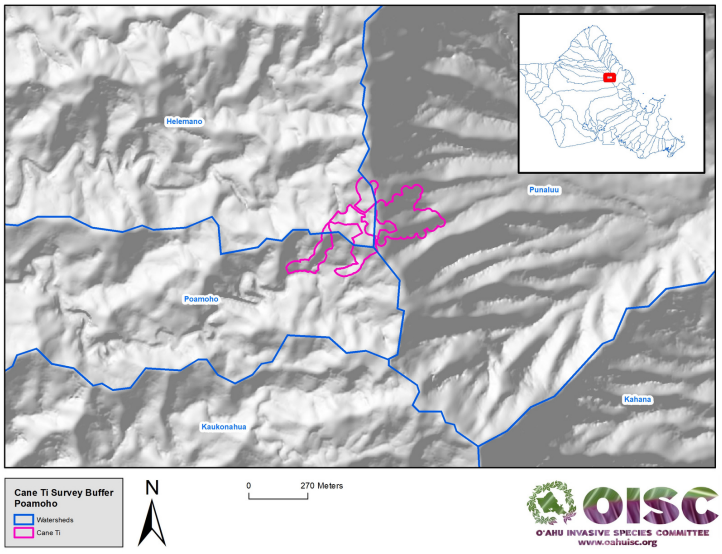
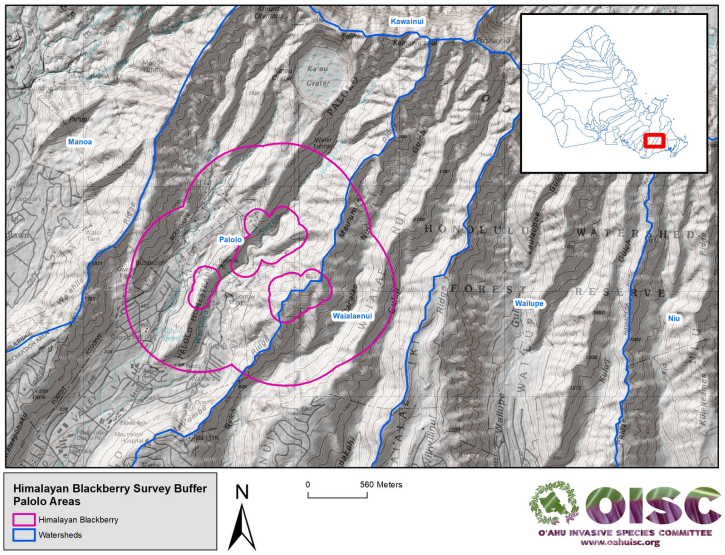
Cane Tibouchina (Cane Ti)



Himalayan Blackberry





DECONTAMINATION PROTOCOLS FOR PREVENTION OF INVASIVE SPECIES

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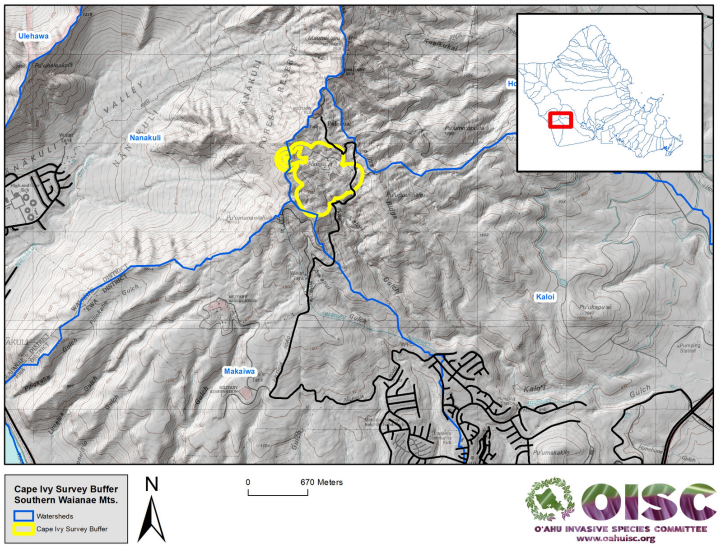
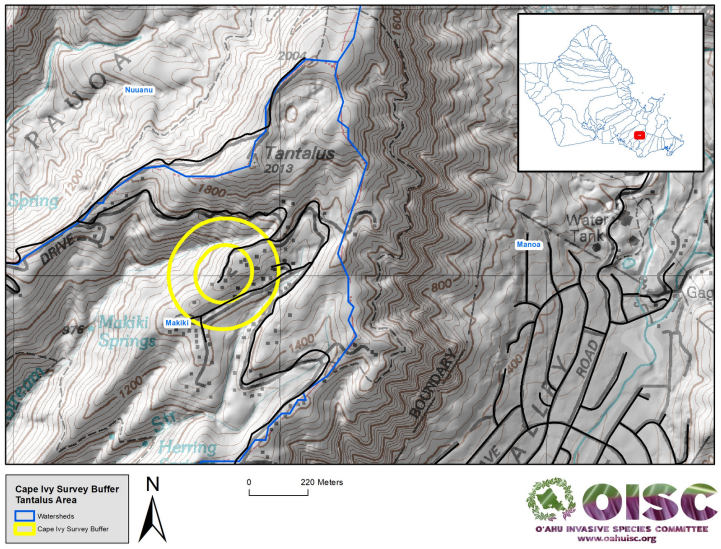
Click photo for link to species info or visit: www.oahuisc.org/target-pests/

There are only two KNOWN locations on O‘ahu that are being managed for Cape Ivy.


Cape Ivy





DECONTAMINATION PROTOCOLS FOR PREVENTION OF INVASIVE SPECIES

OISC Target Species Locations

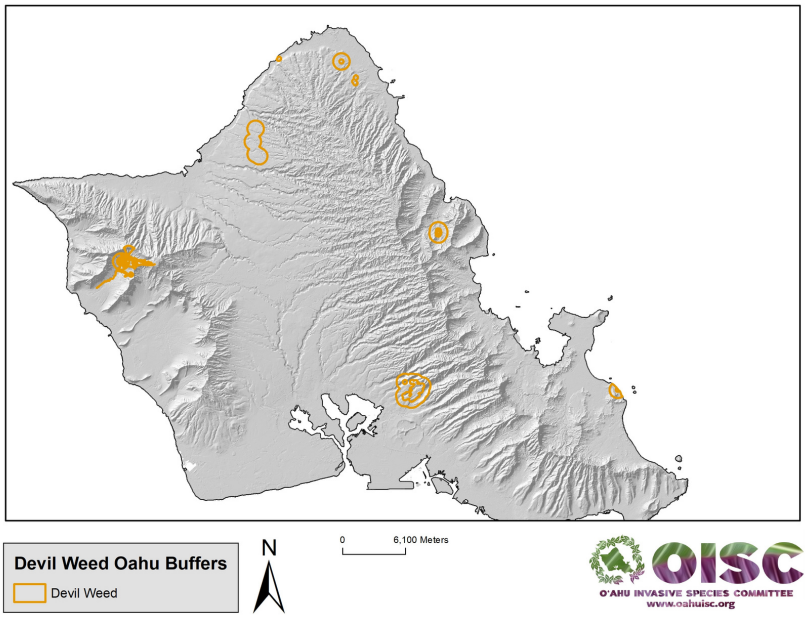
The maps below represent KNOWN locations under management. Please take extra care to decontaminate gear equipment and tools when working in these areas. These species could be present anywhere on O‘ahu. Report ALL suspect targets to OISC or the pest hotline, no matter where you see them.

Report directly to OISC with location and photo via:
Email: oisc@hawaii.edu or Text: 808-286-4616

Click photo for link to species info or visit: www.oahuisc.org/target-pests/

Devil Weed has become too widespread for island-wide eradication. It has only been detected on O‘ahu and Hawai‘i Island. Select locations are being managed by OISC to suppress its spread. OISC is recording all detections and cooperatively managed by private landowners and public volunteers.

Devil Weed



DECONTAMINATION PROTOCOLS FOR PREVENTION OF INVASIVE SPECIES

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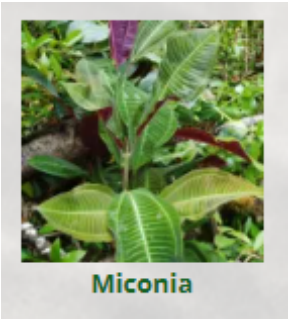
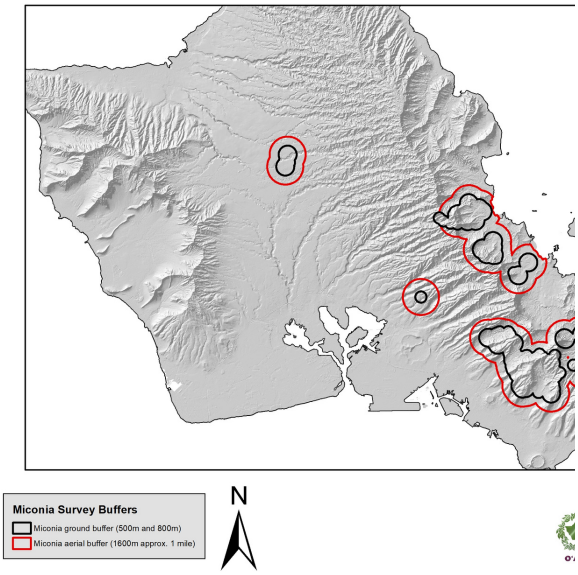
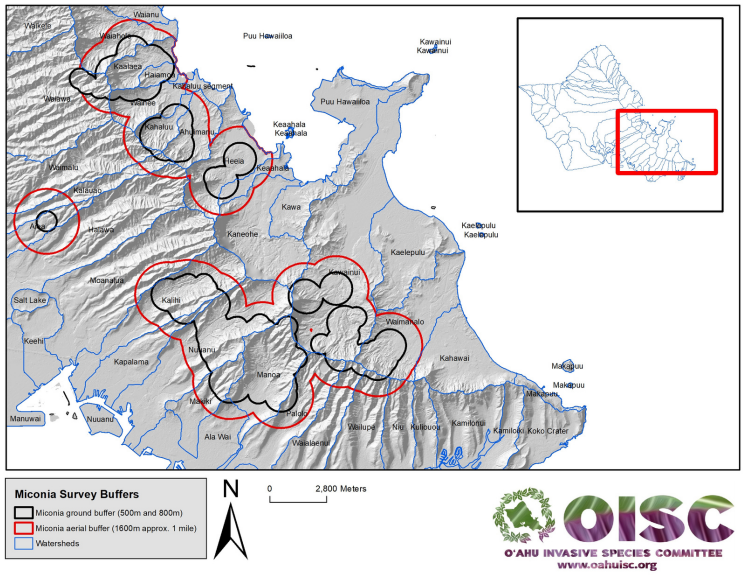

Miconia

Miconia is an OISC eradication target. The majority of the infested areas are concentrated in the southern Ko‘olau Mountain Range.





OISC
O'AHU INVASIVE SPECIES COMMITTEE
www.oahuisc.org

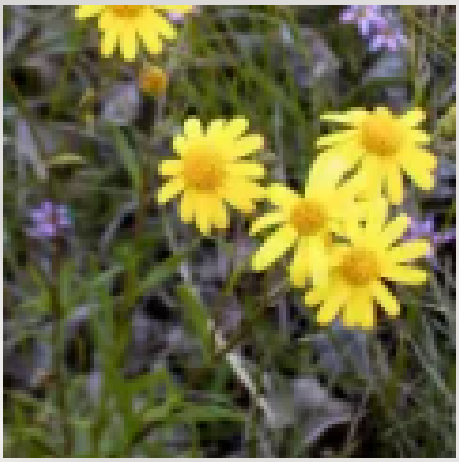
OISC Target Species Locations

The maps below represent KNOWN locations under management. Please take extra care to decontaminate gear equipment and tools when working in these areas. These species could be present anywhere on O'ahu. Report ALL suspect targets to OISC or the pest hotline, no matter where you see them.

Report directly to OISC with location and photo via:
Email: oisc@hawaii.edu or Text: 808-286-4616

Click photo for link to species info or visit: www.oahuisc.org/target-pests/

All wild populations of fireweed and pampas grass have been eradicated from O'ahu. Re-introduction is possible anytime/anywhere, as these species are established on other islands. Report ***any*** suspect sighting to OISC.



Fireweed

Pampas Grass

OISC Target Species Locations

The maps below represent KNOWN locations under management. Please take extra care to decontaminate gear equipment and tools when working in these areas. These species could be present anywhere on O‘ahu. Report ALL suspect targets to OISC or the pest hotline, no matter where you see them.

Report directly to OISC with location and photo via:
Email: oisc@hawaii.edu or Text: 808-286-4616

Click photo for link to species info or visit: www.oahuisc.org/target-pests/

These four species occur or could occur ***anywhere*** on O‘ahu.
Report all sightings.

Coconut Rhinoceros Beetle

Rapid Ohia Death

Coqui Frog

Little Fire Ant

DECONTAMINATION PROTOCOLS FOR PREVENTION OF INVASIVE SPECIES

QUICK TIPS

REPORT ANY SUSPECT INVASIVE SPECIES TO 643PEST.ORG OR YOUR LOCAL INVASIVE SPECIES COMMITTEE.

REPORT INVASIVE SPECIES
643-PEST
643pest.org
CALL OR CLICK TO PROTECT HAWAII

STINGING INSECTS: Most people notice little fire ants (LFA), not because they see them, but because they're getting stung. LFA can nest on the ground and in the trees. Report stinging ants and if possible collect ants for identification by your local Invasive Species Committee.

Check new materials for ants. Plants, planting materials, and building materials should be checked for LFA BEFORE use. Simply place coffee stirrers with a thin smear of peanut butter in and around new materials. Collect them after 1 hour, place any sticks with ants in a ziptop bag and freeze overnight. Mail or drop off ants for identification to your local Invasive Species Committee. For more details on where to submit your ants, visit: ww.stoptheant.org.

PALM DAMAGE & GRUBS: Coconut Rhinoceros Beetles (CRB) are most noticed by the damage to palm leaves and grubs in mulch and compost piles. For images of CRB damage to palm trees and beetle grubs, visit: www.crbhawaii.org

RAPID ʻŌHIʻA DEATH: Rapid ʻŌhiʻa Death (ROD) is a fungal disease that enters wounds of 'ōhiʻa trees. If you see an 'ōhiʻa tree with dead leaves attached, report it to your local Invasive Species Committee before pruning/removing. The tree will need to be tested for ROD and if it is infected, special protocols are required to reduce the risk of spreading the fungus. The ROD fungus can be present in the soil. Ensuring mud and debris are cleared and spraying gear and tools with 70% alcohol will kill fungal spores. Click here for a downloadable **ROD Sanitation Checklist**.

APPENDIX D

Archaeological Literature Review and Field Inspection Report for the
BWS Waiawa 228 Reservoir Project
Waiawa Ahupuaa, Ewa District, Oahu

Draft

Archaeological Literature Review and Field Inspection Report for the BWS Waiawa 228 Reservoir Project Waiawa Ahupua‘a, ‘Ewa District, O‘ahu TMK: [1] 9-6-004:024 por.

Prepared for
The Limtiaco Consulting Group
on behalf of the
City and County of Honolulu Board of Water Supply (BWS)

Prepared by
Scott Belluomini, B.A.,
and
David W. Shideler, M.A.

Cultural Surveys Hawai‘i, Inc.
Kailua, Hawai‘i
(Job Code: WAIAWA 14)

April 2021

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Management Summary

Reference	Archaeological Literature Review and Field Inspection Report for the BWS Waiawa 228 Reservoir Project, Waiawa Ahupua‘a, ‘Ewa District, O‘ahu, TMK: [1] 9-6-004:024 por. (Belluomini and Shideler 2021)
Date	April 2021
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: WAIAWA 14
Investigation Permit Number	CSH completed the fieldwork component of this study under archaeological fieldwork permit numberS 20-07 and 21-10, issued by the Hawai‘i State Historic Preservation Division (SHPD) per Hawai‘i Administrative Rules (HAR) §13-13-282.
Agencies	SHPD, City and County of Honolulu Board of Water Supply (BWS)
Land Jurisdiction	Kamehameha Schools
Project Proponent	BWS
Project Funding	BWS
Project Location	The project area is in the uplands of Waiawa, inland of Pearl City (a little more than a kilometer inland of Leeward Community College and the Middle Loch of Pearl Harbor) on lands owned by Kamehameha Schools. It is located on gently sloping table land centered on the 228-foot (ft) elevation (hence the name of the reservoir project) immediately east of the H-2 freeway. The study area is depicted on a portion of the 1998 Waipahu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle.
Project Description	Some details of project development are not known by CSH at this time. The project is anticipated to include bench grading for three large water reservoir tanks (of 2.0 million gallons or MG, 2.5 MG, and 4.0 MG) to be surrounded by a perimeter road and a chain-link fence. This portion of the project is relatively well defined. The project will also include an approximately 12-ft wide access road, a 30-inch influent main, and a 30-inch effluent main. The precise configuration of this access road and influent and effluent mains have yet to be determined.
Project Acreage	This archaeological literature review and field inspection (LRFI) report analyzes the project in terms of 1) a “Preliminary Project Area” supplied by client that includes the area of the reservoirs and a hairpin configuration of a possible road segment of 4.26 acres (1.72 hectare) and 2) a larger “study area” of 20.23 acres (8.19 hectare) thought likely to include the access road and influent and effluent mains alignments.
Document Purpose	This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the study area—to determine the likelihood that historic properties may be affected by the project and, based on findings, consider cultural resource management recommendations. This document is intended to

	facilitate the project's planning and support the project's historic preservation and environmental review compliance. The entirety of the present study area was covered in two prior archaeological studies: an "archaeological reconnaissance and inventory surveys" study (Goodman and Nees 1991) and a subsequent archaeological reconnaissance survey (Thurman et al. 2012). In support of geotechnical testing for this project, a study entitled *Letter Report in Support of Consultation with the SHPD for Geotechnical Testing for the BWS Waiawa 228 Reservoir Project, Waiawa Ahupua‘a, ‘Ewa District, O‘ahu TMK: [1] 9-6-004:024 por.* was prepared and submitted to the SHPD (assigned Log No. 2020.02235 on 28 September 2020).
Fieldwork Effort	Fieldwork was accomplished on 23 April 2020 and 3 August 2020 by CSH archaeologist David W. Shideler, M.A., and on 23 February 2021 by CSH archaeologists David Shideler, Tom Martel III, B.A., and Spencer Fry, B.A. This work required approximately 4 person-days to complete.
Consultation	A companion cultural impact assessment for this project (Tanaka and Hammatt 2021, in progress) is presently under way. A previous cultural impact assessment (Bushnell et al. 2003) that included the entirety of the present study area but was not specific to the present project included outreach to approximately 83 people. Additionally some cultural outreach was undertaken in the Goodman and Nees (1991) Waiawa study that included the entirety of the present study area.
Results Summary	The study area was traversed with pedestrian sweeps that confirmed the results of background research: the entire study area had been plowed in the course of commercial sugarcane cultivation over many decades. The only potential historic properties observed were sections of portable irrigation ditch, some of which were in situ in irrigation ditch alignments the way they were during commercial cultivation, some of which were in piles understood as for potential re-use, and many of which were fragmented and displaced as a result of bulldozer field clearing. The intact alignments of these portable ditch segments were understood as logically components of the State Inventory of Historic Places (SIHP) # 50-80-09-2273: Irrigation Complex described in the immediate vicinity by Goodman and Nees (1991) and Monahan (2015a). Some of the designated features (4, 5, 9, 12, and 20) of the SIHP # -2273: irrigation complex in the Monahan (2015a) study seem to be virtually identical to the sections of prefabricated concrete ditch segments observed in the present study area. No formal feature designations were given to the prefabricated concrete ditch segments observed in the present study.

Recommendations	The Monahan (2015a) study (accepted by the SHPD) concluded the SIHP # -2273: Irrigation Complex was significant under Criteria C and D for eligibility for inclusion on the Hawai‘i Register of Historic Places and was evaluated as significant under Criteria c and d in accordance with HAR §13-284-6 (Monahan 2015a:32) regarding historic properties. The resolution of mitigation for the SIHP # -2273: Irrigation Complex in the Monahan study area was preservation of two specific features (his designated Feature 19 and Feature 22) and portions of two additional specific features (his designated Feature 14 Sub-feature 3 and Feature 23) that included both more formal examples and representative examples of the historic property, with preservation measures to be described in a formal preservation plan (Monahan 2015a:142). A preservation plan (Monahan 2015b) was prepared and is understood as accepted by the SHPD. While the present study concludes the portable irrigation ditch units observed in the study area are indeed properly understood as features of SIHP # -2273, it is recommended that the previously agreed upon mitigation commitments are appropriate and sufficient for this historic property and need not be revisited in light of the identification of additional mundane and ubiquitous portable irrigation ditch alignments. In light of this recommendation, the results of this study would be consistent with and support a determination of “No historic properties affected” and no further archaeological work within the study area for the proposed project. A caveat here is that at this time (April 2021), the actual project area is unknown. CSH was provided with a 4.26-acre “Preliminary Project Area” that includes the area of the reservoirs and a hairpin configuration of a possible road segment. It was apparent that project-related ground disturbance for a project-related access road and for reservoir-related influent and effluent mains alignments would impact a larger area. A good-faith effort was made to address a much larger 20.23-acre study area in hopes of addressing additional areas of project-related subsurface impact but it is quite possible project-related ground disturbance will extend outside the present study area. Should project-related ground disturbance (for a project-related access road and for reservoir-related influent and effluent mains alignments) extend outside the present study area, further archaeological study of those additional areas is recommended.

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Section 1 Introduction

1.1 Project Background

At the request of The Limtiaco Consulting Group on behalf of the City and County of Honolulu Board of Water Supply (BWS), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this literature review and field inspection report (LRFI) for a BWS Waiawa 228 Reservoir Project, located in Waiawa Ahupua‘a, ‘Ewa District, O‘ahu (TMK: [1] 9-6-004:024 por.) The project area is owned by Kamehameha Schools and is located on gently sloping table land near the 228-foot (ft) elevation (hence the name of the reservoir project), north of the Middle Loch of Pearl Harbor and immediately east of the H-2 freeway.

This archaeological literature review and field inspection report analyzes the project in terms of 1) a “Preliminary Project Area” supplied by client that includes the area of the reservoirs and a hairpin configuration of a possible road segment of 4.26 acres (1.72 hectare) and 2) a larger “study area” of 20.23 acres (8.19 hectare) thought likely to include the access road and influent and effluent mains alignments.

The study area is depicted on a portion of the 1998 Waipahu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), tax map key (TMK) plat [1] 9-6-004 (Figure 2), and a 2016 aerial photograph (Figure 3). A preliminary site and grading plan for the Waiawa 228 Reservoir is provided in Figure 4 and a mock-up of how the project would appear from the H-2 Freeway, providing a feeling for the area, is provided in Figure 5. The study area was under commercial sugarcane cultivation for nearly a century (ca. 1897 to 1996) and since the end of sugarcane cultivation the lands of the study area vicinity have been fallow and are now overwhelmingly dominated by tall *haole koa* (*Leucaena glauca*) trees.

The BWS Waiawa 228 Reservoir project will involve significant grading of an approximately 3.57-acre area for the foundation of three closely sited tank reservoirs (of 2.0, 2.5, and 4.0 million gallon, or MG, capacity, see Figure 4) just east of the H-2 Freeway (see Figure 5). This will involve cutting into the northwest slope with a cut volume estimated at 105,385 cubic yards (and a fill volume of 15 cubic yards). The project will also include the construction of a 12-ft wide access road, a 30-inch influent main, and a 30-inch effluent main for which plans are still under development.

The present study area was a portion of two prior archaeological reconnaissance studies (Goodman and Nees 1991 and Thurman et al. 2012). Features of two historic properties were identified in the vicinity of the presently proposed Waiawa 228 Reservoir project area including features 19 and 20 of State Inventory of Historic Places (SIHP) # 50-80-09-2273 designated as “the irrigation complex” (Goodman and Nees 1991:59) and features 33, 35, and 36 of SIHP # 50-80-09-2270 designated as the “Road/railroad system” (Goodman and Nees 1991:90). Basically the sites were recommended as not significant under the criteria used for evaluation. That study concludes the significance of these sites “has been realized through field and archival research and no further work is recommended” (Goodman and Nees 1991:137). The Thurman et al. (2012) study did identify additional features in their area of study but did not identify any additional historic properties in the vicinity of the present study area.

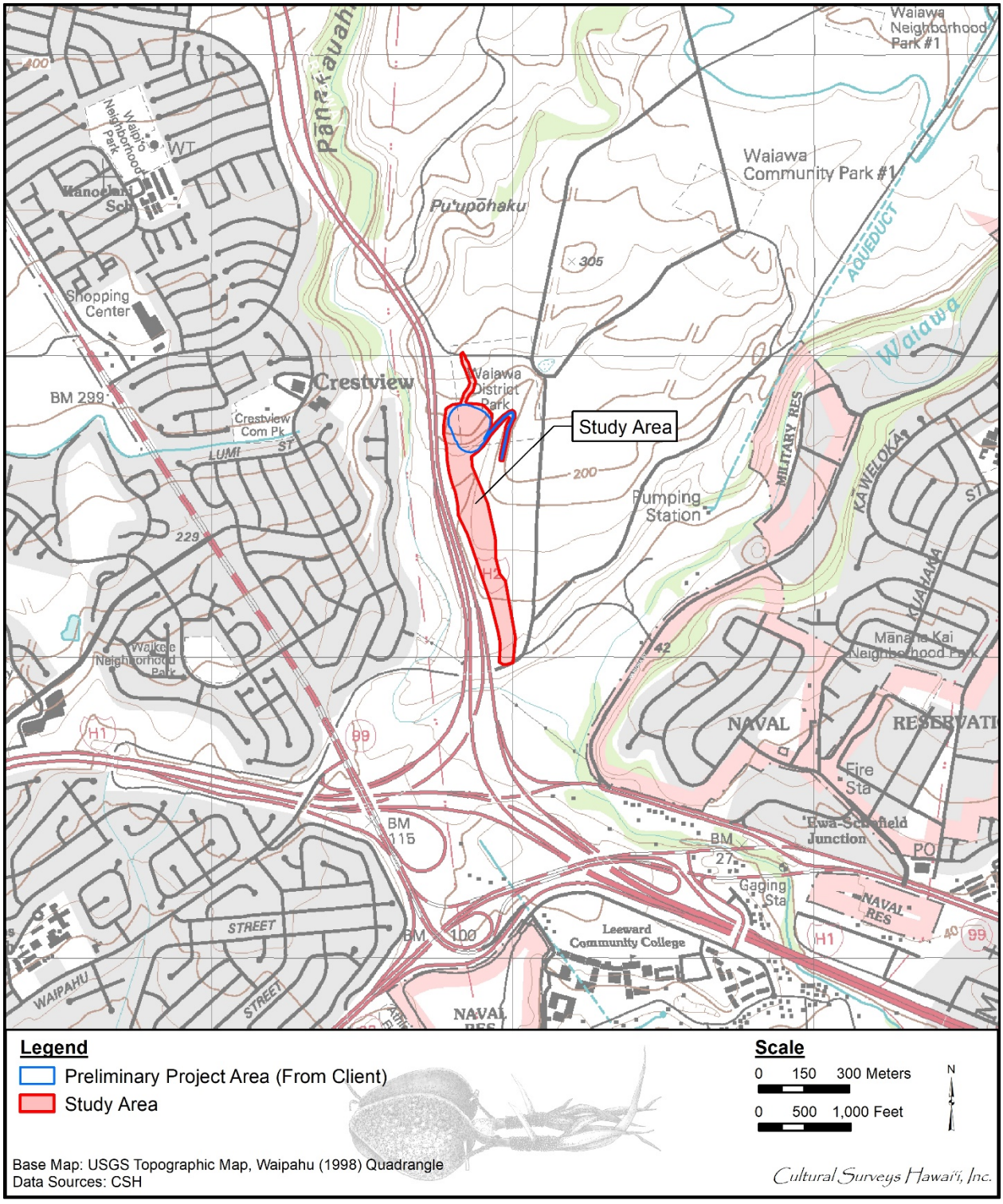

Figure 1. Portion of the 1998 Waipahu USGS 7.5-minute topographic quadrangle, showing the study area

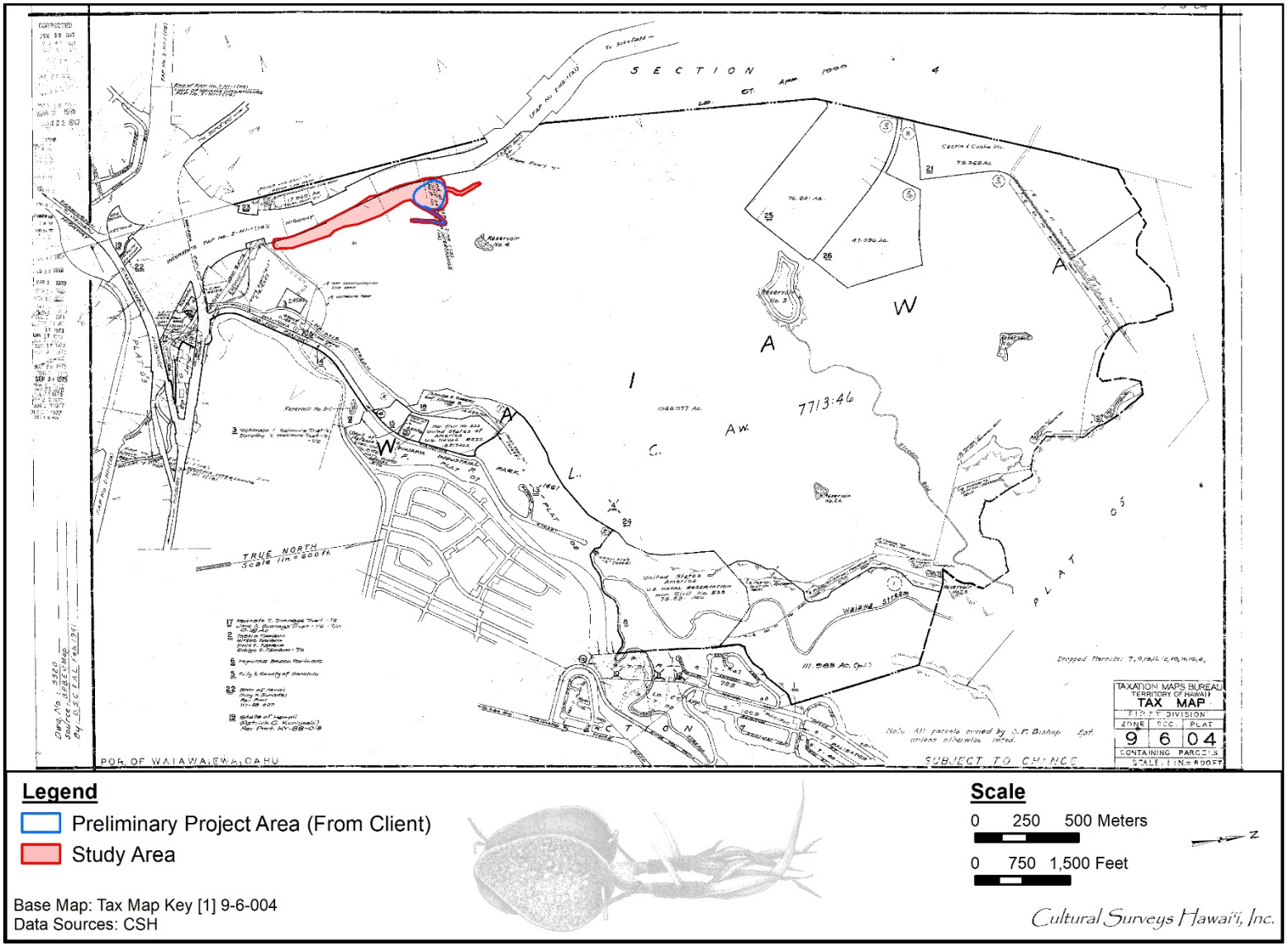

Figure 2. TMK: [1] 9-6-004 showing the study area (Hawai‘i TMK Service 2014)

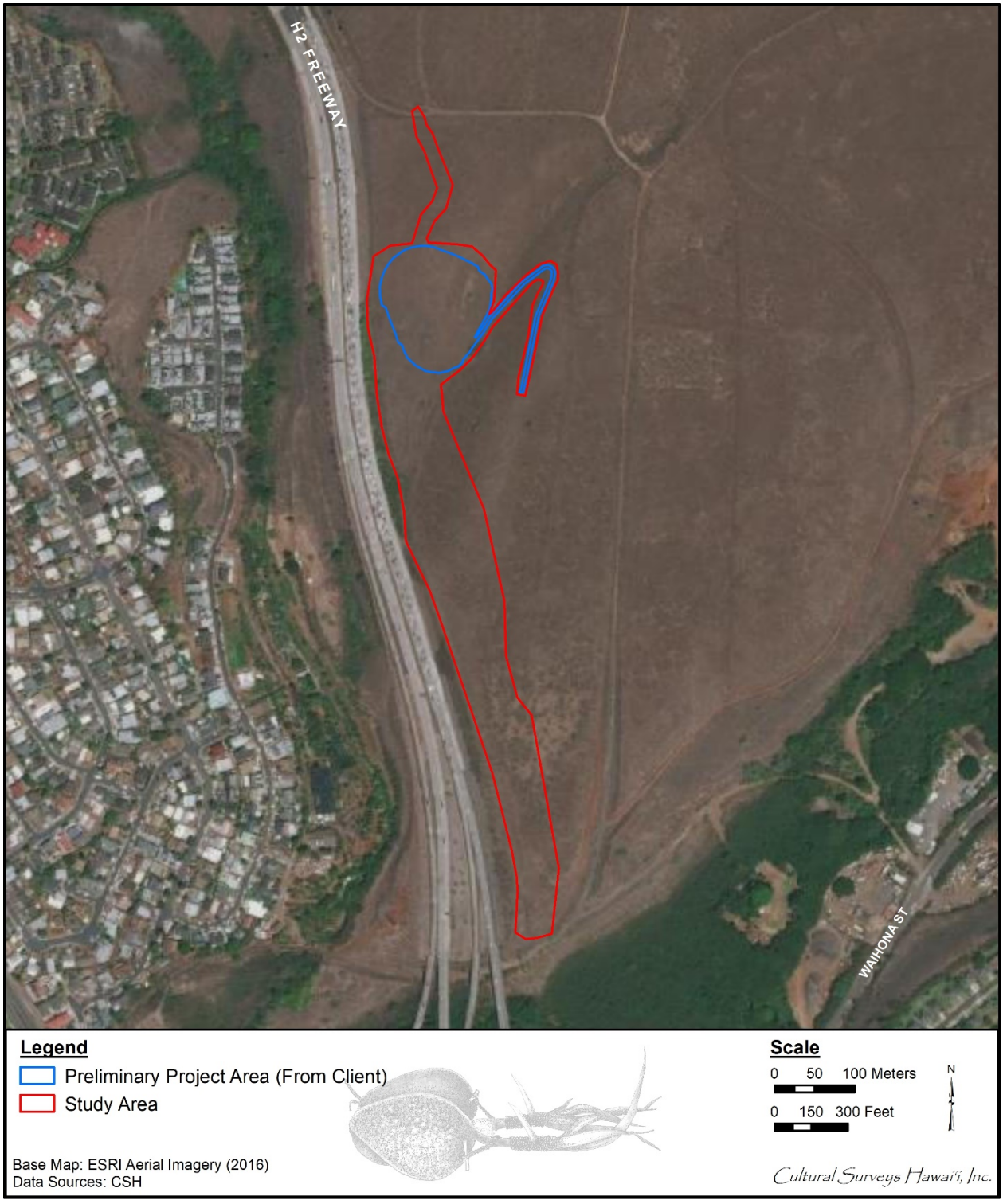

Figure 3. 2016 aerial photograph showing the study area (H-2 Freeway at left) (ESRI 2016)

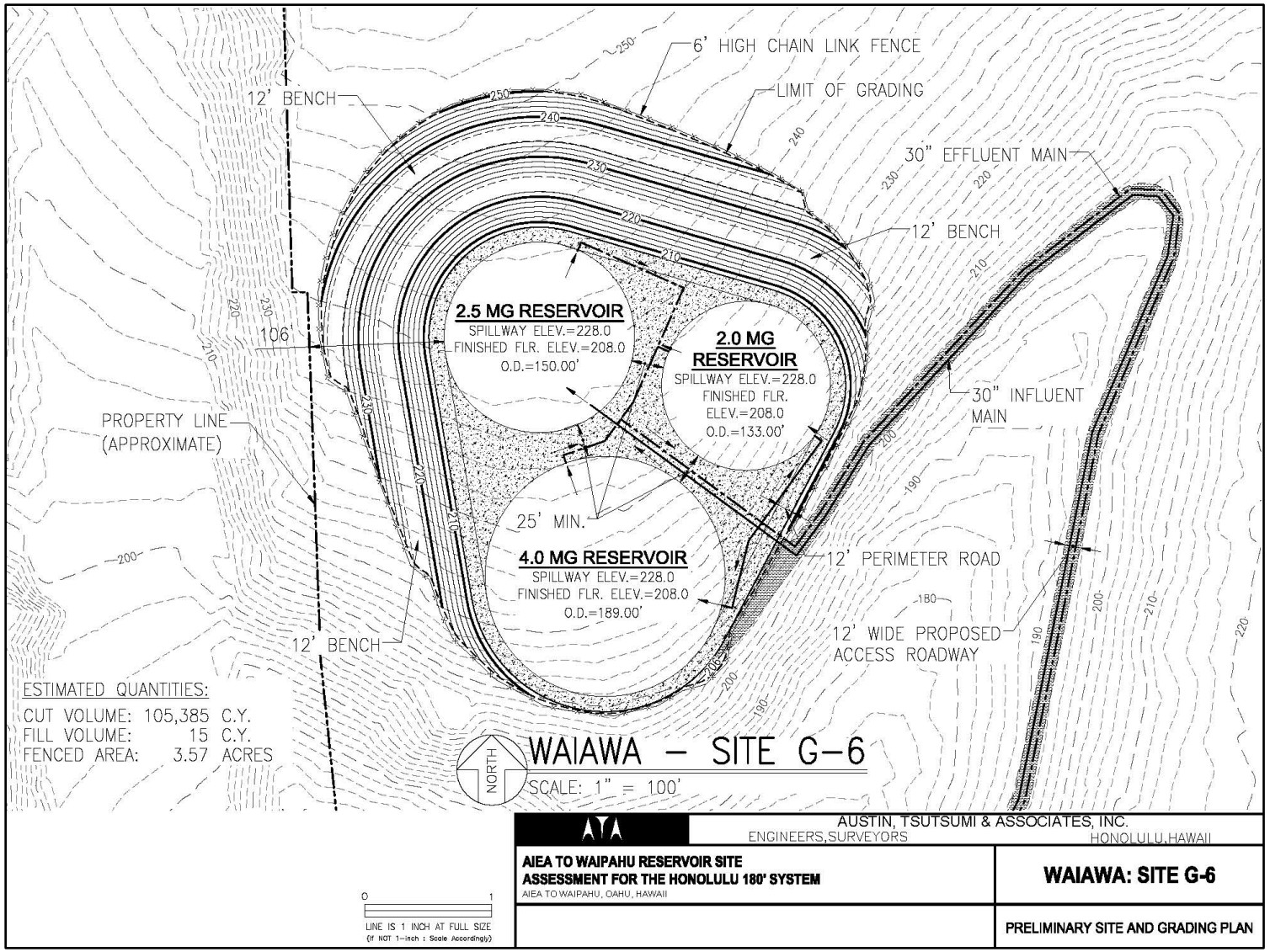

Figure 4. Preliminary site and grading plan for the Waiawa 228 Reservoir (courtesy of client)

Figure 5. Mock-up view of the Waiawa 228 Reservoir on the east side of the H-2 Freeway, as would be seen from the H-2 Freeway (courtesy of client)

1.2 **Document Purpose**

This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the study area—to determine the likelihood that historic properties may be affected by the project and, based on findings, consider cultural resource management recommendations. This document is intended to facilitate the project's planning and support the project's historic preservation and environmental review compliance. This study was specifically intended to support a Hawai‘i Administrative Rules (HAR) §13-275-3 request for a determination letter.

1.3 **Environmental Setting**

1.3.1 Natural Environment

The study area is located on gently sloping table land near the 228-ft elevation (hence the name of the reservoir project) with the proposed tank location at a distance of approximately 2.5 km north of the Middle Loch of Pearl Harbor and located immediately east of the H-2 Freeway.

According to the U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) database (2001) and soil survey data gathered by Foote et al. (1972), the study area's soils consist of Helemano silty clay, 30 to 90% slope (HLMG) soils, Lahaina silty clay, 7 to 15% slopes (LaC) soils, and Molokai silty clay loam, 3 to 7% slope (MuB) soils and 15 to 25%slope (MuD) soils (Figure 6).

Helemano series soils are described as follows:

> […] well-drained soils on alluvial fans and colluvial slopes on the sides of gulches [...] They developed in alluvium and colluvium derived from basic igneous rock. They are steep to extremely steep. Elevations range from 500 to 1,200 feet […] These soils are used for pasture, woodland, and wildlife habitat. The natural vegetation consists of bermudagrass, Christmas berry, eucalyptus, Formosa koa, guava, Japanese tea,· Java plum, and koa haole. [Foote et al. 1972:40]

Helemano silty clay, 30 to 90% slope (HLMG) soils are further described as follows:

> This soil is on the sides of V-shaped gulches. [...] Also included were small areas of rock outcrop, steep stony land, and eroded spots. Permeability is moderately rapid. Runoff is medium to very rapid, and the erosion hazard is severe to very severe. [Foote et al. 1972:40]

Lahaina series soils are described as follows:

> […] consists of well-drained soils on uplands […] These soils developed in material weathered from basic igneous rock. They are nearly level to steep. Elevations range from 10 to 1,500 feet […] These soils are used for sugarcane and pineapple. Small acreages are used for truck crops, pasture, homesites, and wildlife habitat. The natural vegetation consists of bermudagrass, feather fingergrass, ilima, kiawe, lantana, oi, and uhaloa. [Foote et al. 1972:78]

Lahaina silty clay, 7 to 15% slopes (LaC) soils are further described as "On this soil, runoff is medium and the erosion hazard is moderate. Included in mapping were small,

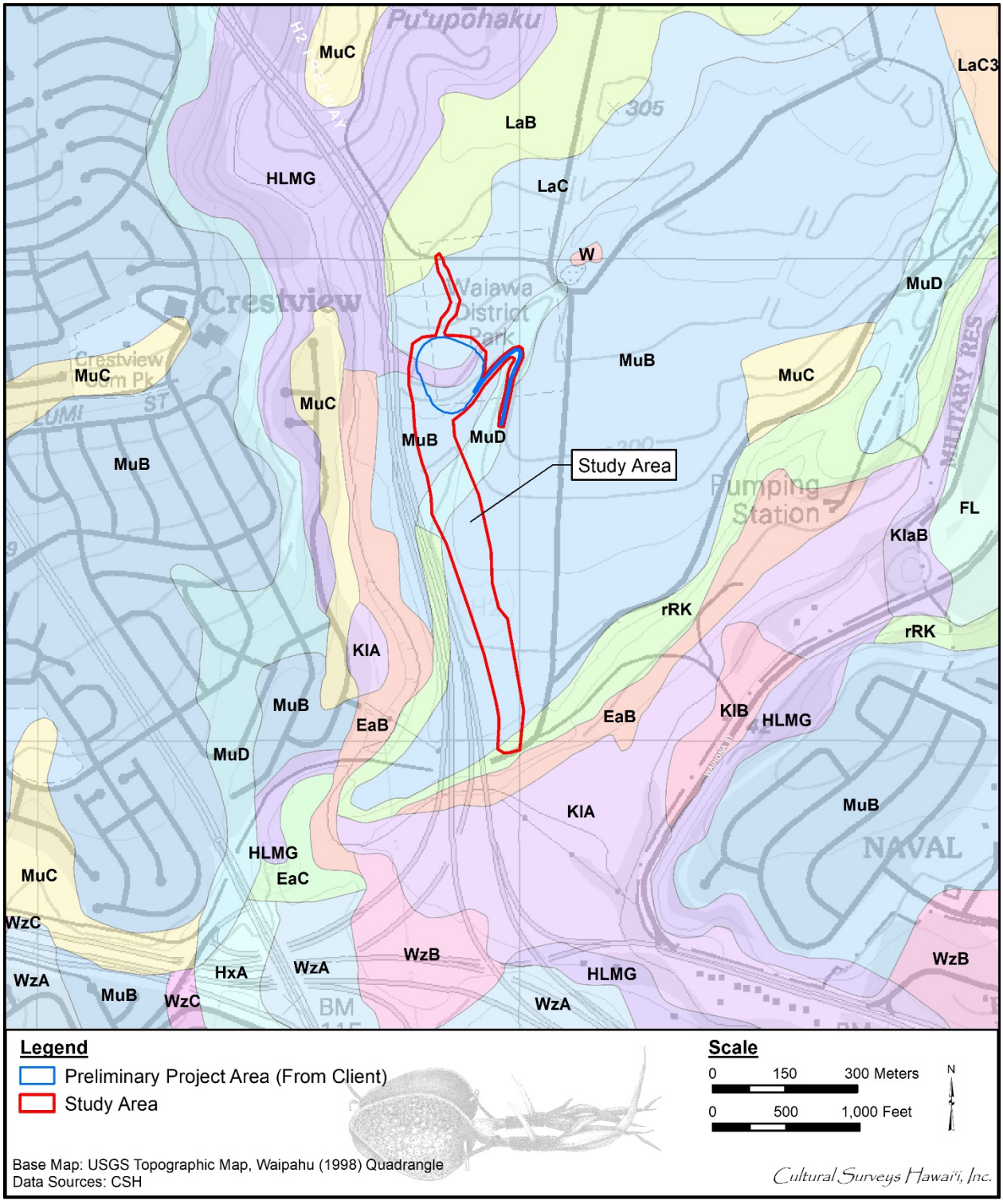

Figure 6. Overlay of *Soil Survey of the State of Hawaii* (Foote et al. 1972), indicating soil types within and surrounding the study area (USDA SSURGO 2001) (base map: portion of the 1998 Waipahu USGS 7.5-minute topographic quadrangle)

steep areas and areas where a few cobblestones and stones are on the surface" (Foote et al. 1972:79).

Molokai series soils are described as follows:

> […] consists of well-drained soils on uplands […] These soils formed in material weathered from basic igneous rock. They are nearly level to moderately steep. Elevations range mainly from nearly sea level to 1,000 feet […] These soils are used for sugarcane, pineapple, pasture, wildlife habitat, and homesites. The natural vegetation consists of kiawe, ilima, uhaloa, feather fingergrass, and buffelgrass. [Foote et al. 1972:96]

Molokai silty clay loam, 3 to 7% slope (MuB) soils are further described as "runoff is slow to medium and the erosion hazard is slight to moderate" (Foote et al. 1972:96).

Molokai silty clay loam, 15 to 25% slope (MuD) soils are further described as "Runoff is medium, and the erosion hazard is severe. Workability is slightly difficult because of the slope" (Foote et al. 1972:96).

Rainfall in the vicinity of the study area (at "Field 500 Station," Giambelluca et al. 2013) is estimated at approximately 761 mm (30.0 inches) which is suggested to be marginal at best for non-irrigated agriculture.

Waiawa Stream located approximately 800 m to the southeast of the proposed reservoir area is understood to have been a perennial stream prior to modern water diversions.

The study area was under commercial sugarcane cultivation for nearly a century from shortly after the establishment of the Oahu Sugar Company in 1897 until approximately 1996. Since the end of sugarcane cultivation the lands of the study area vicinity have been fallow and are now overwhelmingly dominated by tall *haole koa* (*Leucaena glauca*) trees.

1.3.2 Built Environment

The H-2 freeway located just to the west of the study area is a major vehicular artery connecting Honolulu and the south shore of O‘ahu to the central O‘ahu communities of Mililani and Wahiawa and on to O‘ahu's North Shore. Otherwise development in the vicinity of the study area is limited to a network of roads developed by the Oahu Sugar Company to service their sugarcane fields.

Section 2 Methods

2.1 Field Methods

CSH completed the fieldwork component of this study under archaeological fieldwork permit numbers 20-07 and 21-10, issued by the SHPD pursuant to HAR §13-282. Fieldwork within the study area was conducted on 23 April 2020 and 3 August 2020 by CSH archaeologist David W. Shideler, M.A., and on 23 February 2021 by CSH archaeologists David Shideler, Thomas Martel III, B.A., and Spencer Fry, B.A. This work required approximately 4 person-days to complete.

In general, fieldwork included 100% pedestrian inspection of the study area, GPS data collection, and the taking of representative photographs and photographing finds.

A 100%-coverage pedestrian inspection of the study area was undertaken for the purpose of cultural resource identification and documentation. The pedestrian survey was accomplished through systematic sweeps typically spaced 10 m apart.

2.2 Research Methods

Background research included a review of previous archaeological studies on file at the SHPD; review of documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Bishop Museum Archives; study of historic photographs at the Hawai‘i State Archives and the Bishop Museum Archives; and study of historic maps at the Survey Office of the Department of Land and Natural Resources. Historic maps and photographs from the CSH library were also consulted. In addition, Māhele records were examined from the Waihona ‘Aina database (Waihona ‘Aina 2021).

This research provided the environmental, cultural, historic, and archaeological background for the study area. The sources studied were used to formulate a predictive model regarding the expected types and locations of cultural resources in the project area.

2.3 Consultation Methods

CSH previously carried out *A Cultural Impact Assessment for 3,600 acres in Waiawa and Waipi‘o Ahupua‘a in O‘ahu (TMK 9-4-06:11, 9-6-04:4 and 9-6-5:3)* (Bushnell et al. 2003) that included the entirety of the present study area but that was not specific to the present project.

A companion cultural impact assessment for the project has been contracted for and is presently (April 2021) in progress.

Section 3 Traditional Background

Hawaiians recognize several land divisions in varying scales, including the *moku*, the *kalana* (smaller land division than a *moku*), the *ahupua‘a*, and the *‘ili* (Malo 1951:16). S.K. Kuhano wrote in 1873 (cited in Kame‘eleihiwa 1992:330) that O‘ahu was divided into six *kalana* (although later scholars refer to these same divisions as *moku*)—Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olau Loa and Ko‘olau Poko—that were further divided into 86 *ahupua‘a*. Within ‘Ewa, there were 12 *ahupua‘a* including (from west to east) Honouliuli, Hō‘ae‘ae, Waikele, Waipi‘o, Waiawa, Mānana, Waimano, Waiau, Waimalu, Kalauao, ‘Aiea, and Hālawa (Kame‘eleihiwa 1992:330). The present study area is in Waiawa Ahupua‘a located between Waipi‘o Ahupua‘a to the west and Mānana Ahupua‘a to the east (Figure 7 and Figure 8). Modern maps and land divisions still generally follow the ancient system and use the same land divisions.

Mo‘olelo (stories, tales, histories) of the *ahupua‘a* of Waiawa and the broader *moku* of ‘Ewa illuminate the central importance of the waters of Pu‘uloa (the Hawaiian name for Pearl Harbor) and the surrounding land to Hawaiians. The land was fertile and well-fed by mountain streams, and the lochs of Pu‘uloa were abundant in marine resources. This agricultural base supported chiefs of distinguished lineages. The significance of water in ‘Ewa is embedded in the names of *wahi pana*. For example, six of the 12 *ahupua‘a* names in the *moku* of ‘Ewa—Waikele, Waipi‘o, Waiawa, Waimano, Waiau, and Waimalu— begin with *wai*, the Hawaiian word for fresh water. Further, the *moku* of ‘Ewa once contained more *loko i‘a* (fishponds) than any other district on O‘ahu, and vast *lo‘i kalo* (irrigated taro terraces) formerly filled the wetlands. This suggests that agricultural and aquacultural intensification were a direct link to the chiefs who resided there and to the increasing needs of the population. Further, *mo‘olelo* associated with specific *wahi pana* connect Pu‘uloa to the ancestral homeland of Hawaiians in central Polynesia, describe the marine and freshwater resources of Pu‘uloa, and detail the feats and journeys of legendary heroes, gods, and *‘aumākua* (deified ancestors).

3.1 *Wahi Pana* of Eastern ‘Ewa

A Hawaiian *wahi pana*, also referred to as a place name, “physically and poetically describes an area while revealing its historical or legendary significance” (Landgraf 1994:v). *Wahi pana* can refer to natural geographic locations, such as streams, peaks, rock formations, ridges, and offshore islands and reefs, or they can refer to Hawaiian divisions, such as *ahupua‘a* and *‘ili*, and man-made structures, such as *loko i‘a* and *heiau* (ceremonial structures). In this way, the *wahi pana* tangibly link the *kama‘āina* (residents) of eastern ‘Ewa to their past. Place name meanings are taken from Pukui et al. (1974) unless otherwise noted. Other sources include historic maps, the database of Hawaiian names mentioned in mid-nineteenth century land documents and maps compiled by Soehren (2009), and information in Land Commission Awards (LCAs) on the Waihona ‘Aina Corporation’s database (Waihona ‘Aina 2021).

3.1.1 Main Trails in the Vicinity of the Study Area

John Papa ‘Ī‘ī (1959:96–98) described a network of leeward O‘ahu *ala hele* (trails) (Figure 8) that in historic times encircled and crossed the Wai‘anae Range by three different paths. The coastal trail ran along the inward boundary of the Pearl Harbor floodplain and irrigated taro fields. ‘Ī‘ī described this coastal trail as if traveling from the Honolulu District west through the ‘Ewa

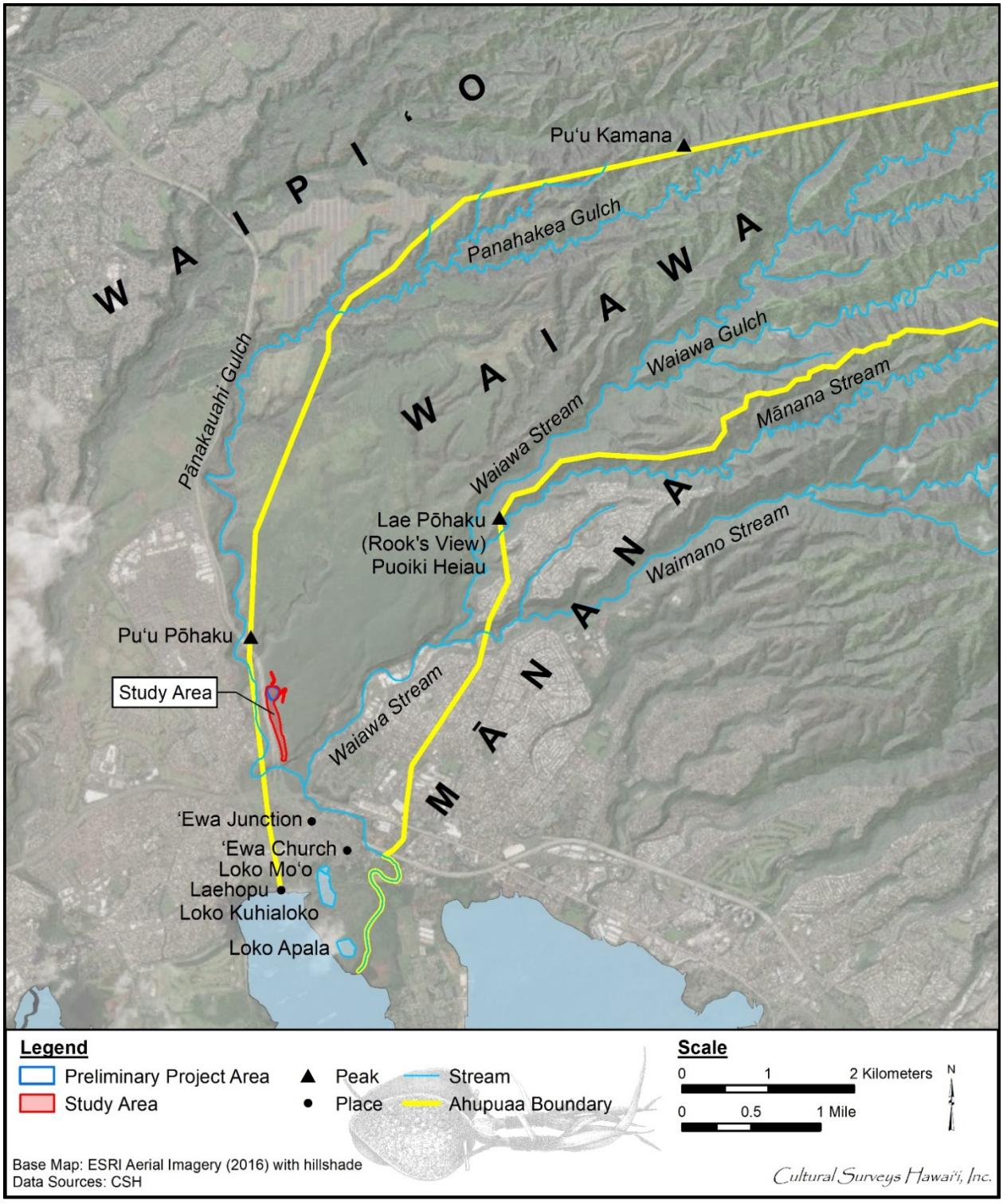

Figure 7. Topographic place names of Waiawa (base map: ESRI 2016 with hillshade)

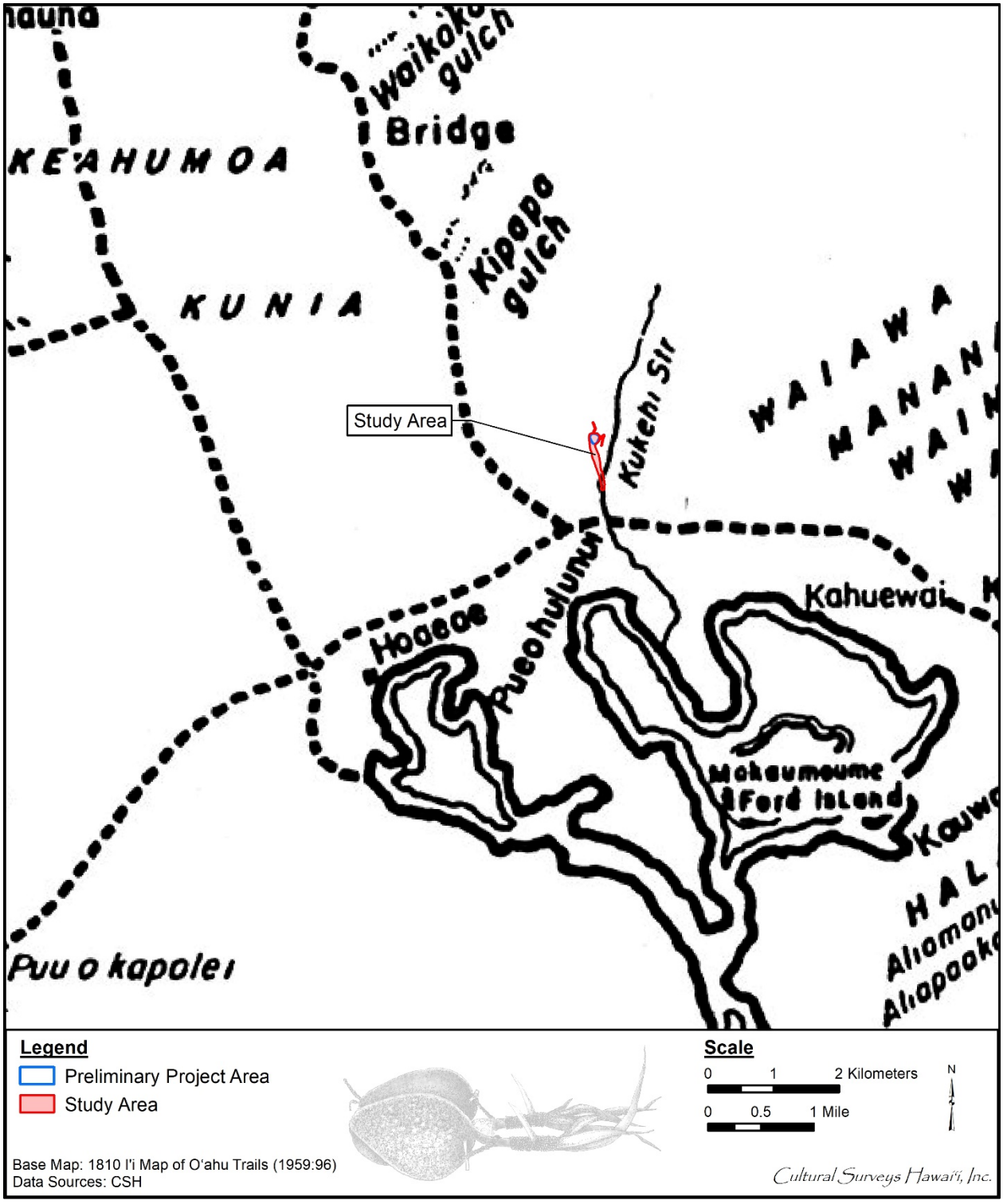

Figure 8. Portion of a map by Paul Rockwood showing O‘ahu trails and place names ca. 1810, as described by John Papa ‘Ī‘ī (1959:96) in relation to the study area

District and to the Wai‘anae District: fields through Hālawa, ‘Aiea, Kalauao, Waimalu, Waiau, Waimano, Mānana, and Waiawa, Waipi‘o, Waikele, Ho‘ae‘ae, and Honouliuli:

> The trail went down to the stream and up again, then went above the taro patches of Waiau, up to a *maika* [game with rolling stones] field, to Waimano, to Manana, and to Waiawa; then to the stream of Kukehi [now typically called “Waimano Stream”] and up to two other *maika* fields, Pueohulunui and Haupuu [in Waiawa]. At Pueohulunui [on the border of Waiawa and Waipi‘o] was the place where a trail branched off to go to Waialua and down to Honouliuli and on to Waianae. […]
>
> From Kunia [in Ho‘ae‘ae] the trail went to [Honouliuli] the plain of Keahumoa, on to Maunauna [peak], and along Paupauewla [‘*ili*], which met with the trails from Wahiawa and Waialua [Districts]. [‘Ī‘ī 1959:95, 97]

The coastal cross-*ahupua‘a* trail was close to the present H1 alignment approximately 500 m south of the south end of the present study area and the eastern trail heading north up the central valley is understood to have approximated the present Kamehameha Hwy (Hwy 99) alignment approximately 800 m west of the present study area.

3.1.2 *Wahi Pana* of Waiawa

The meaning and correct pronunciation of Waiawa is in dispute. It is variously spelled Waiawa or Wai‘awa, which leads to different interpretations. *Awa* is both the word for milk fish or a harbor, cove, channel or passage (Pukui and Elbert 1986:33). In a portion of the chant for Kūali‘i, Fornander (1917:394–400) notes the *awa* fish of Waiawa: *E ku‘u kaua i ka loko awa—o Waiawa*, or “Let us cast the net in the *awa*-pond—of Waiawa.” This would be no surprise, as there were numerous fishponds in Waiawa. With an alternate spelling, *‘awa* (kava) is the word for the native plant used to make a soporific and muscle relaxant drink by the Hawaiians. Traditional accounts suggest that Waiawa may have been acknowledged in early times as the site of a special variety of the *‘awa* plant:

> *I ka wa i hiki mai ai ua eueu nei a ku ma ka puka o kahi e komo ai i loko o ua kuahiwi nei o Konahuanui, aia noi na makana a pau ma ka lima o Keanuenue, oia hoi ka puaa-pukoa, he puaa ehu keia o ka hulu, a he pu awa popolo, aole i laha nui keia awa ma keia pae aina, aia nae keia awa e ulu nei i keai wa ma uka o Waiawa ma Ewa ae nei*.
>
> […] When the wondrous maiden [Keaomelemele] arrived at the entrance to the mountain of Konahuanui, all the offerings were in charge of Ke-anuenue, a puko‘a or reddish brown pig, a clump of dark ‘awa [*pu ‘awa pōpolo*] which was not common in these islands. This variety of ‘awa now grows in the upland of Waiawa, down here in ‘Ewa. [Manu 2002:50, 138]

Waiawa Ahupua‘a extends from Pearl Harbor (Middle Loch) to the Ko‘olau Mountains. In the lower section, it is watered by Waiawa Stream, which John Papa ‘Ī‘ī (1959:95, 97) called “Kukehi,” and which splits into Waiawa and Mānana streams in the uplands. Near this junction was a long ridge. The point of the ridge was called Lae Pōhaku (stone point) (Bishop 1853), which marked a boundary point between Waiawa and Mānana. At this junction, McAllister (1933:105) recorded a *heiau* called Puoiki, which was built on a knoll.

Along the western Waiawa/Waipi‘o boundary were three marked boundary points, Pu‘u Kamana (hill of the supernatural power), Pu‘u Pōhaku (stone hill) (Brown 1877a, 1877b), and Laehopu (Brown 1877b). Panahakea Gulch extends from the summit of Pu‘u Kamana *makai* (seaward) toward Waipi‘o, and the east ridge of Pānakauahi Gulch (touched by the smoke) in Waipi‘o defines the *makai* western border of Waiawa. Laehopu marks the coastal point (*lae*) that divides Waiawa and Waipi‘o on the Middle Loch shore.

The mid-nineteenth century Māhele documents concerning Land Commission Awards (LCA) indicate there were at least 15 *‘ili* in Waiawa. A map by S. Bishop (1887) of Waiawa and Mānana (see Figure 11) shows all of the awarded LCA lots in Waiawa were clustered along Waiawa Stream and on the Mānana Peninsula. A few were *mauka* (inland, toward the mountains) and adjacent to the government road in the *‘ili* of Holoipiapia, Kahō‘ai‘ai, and Piliaumoa. Most are clustered around the fishponds Kuhialoko and Loko Mo‘o (lizard or water spirit) on the west and Waiawa Stream to the east in the *‘ili* of Kuhiawaho (outer Kuhia), Kuhialoko (inner Kuhia), Kapopou (the cigar wrasse fish), Pānaio, Kapuaihalulu, Hanakehau (mist bay), Kionaole, Kulaokamakau, and Kāpaloa (the long fence or the long enclosure). The Māhele documents also mention Kalimukele (the watery seaweed), an *‘ili* on the *mauka* border of LCA 9384 near Kapopou ‘Ili, Kalona, an *‘ili* near LCA 10561:1 near Kapuaihaluhalu ‘Ili, and Hale‘aha (meeting house), an *‘ili* on the western border of LCA 9372 in Kapaloa ‘Ili. These *‘ili* are not labeled on available maps. An isolated LCA (LCA 5646) was west of Loko Apala near the *makai* tip of Waiawa, in the *‘ili* of Pānaio, possibly indicating Pānaio had a type of non-contiguous land unit called *lele*.

Nineteenth century land documents mention numerous *loko i‘a* (Soehren 2009). These include the following: Loko Apalakai, Apalawai (Loko Apala), and Kuakuanui at the *makai* tip of Waiawa (Kuhialoko ‘Ili); Ho‘opililoko on the west side of LCA 9361:2 (Kuhiawaho ‘Ili); Loko Kuhialoko (Inner Kuhia Pond), the large pond on the western boundary of the *ahupua‘a* named after Kuhia, one of the servants to Ka‘ahupahau, the shark queen of ‘Ewa (*Saturday Press* 1884, cited in Sterling and Summers 1978:17); Loko Mo‘o (land parcel or lizard; Soehren 2009), a smaller pond connected to the *makai* side of Loko Kuhialoko; Kalokohanahou (the repaired pond) on the west side of LCA 1715 (Kuhialoko ‘Ili); Kama‘ihi (the dwarf; Pukui and Elbert 1986:222) on the *mauka* side of LCA 1715; Kepoelalo, on the east side of LCA 1715; Kepoeluna, east of LCA 5644:3 (Kuhialoko ‘Ili); Loko Mōkōlea (cut plover or plover island; Soehren 2009), on the west side of LCA 9374:3 (Pānaio ‘Ili; exact location of lot 3 unknown); and Mōkōlea pond was surrounded on one or more sides by two *pu‘uone* (sand dunes) called Kalokoloa (the long pond) and Ninauwale.

There are several other topographic points listed in mid-nineteenth century documents (Soehren 2009), but these could not be found on any available historic maps. A hill called Kanukumanu (the bird’s beak) served as a boundary point for a Māhele award (LCA 9372, *‘āpana* [lot] 2; near the intersection of Waiawa Stream and the Government Road). In his discussion of trails through Waiawa, ‘Ī‘ī (1959) mentions the stream Kukehi (another name for the *makai* end of Waiawa Stream) and the *maika* fields of Haupu‘u and Pueohulunui. Pueohulunui was on the border between Waiawa and Waipi‘o at the “crossroads, where one leads to Waialua and the other branches off to Honouliuli” (Hawaiian Ethnological Notes Ms. I:2705, cited in Sterling and Summers 1978:18). Haupu‘u was the small hill on which the first Protestant Ewa Church was built (*Ka Loea Kālai‘āina* 1899b, translated in Sterling and Summers 1978:18). Up behind the church, at the home of the missionaries, was a small cave that served as the residence for Kahi‘ukā, the brother of the shark

protector of ‘Ewa called Ka‘ahupahau (*Ke Au Hou* 1910, translated in Sterling and Summers 1978:18). According to Sterling and Summers (1978:18), there were two places along the shore, Polea and Kuhia, named for two local *konohiki* (headman of an *ahupua‘a* land division under the chief), but neither of these could be found on any available historic maps.

3.2 Agriculture and Aquaculture

Many *mo‘olelo* describe the traditional agriculture and aquaculture in ‘Ewa, including *loko i‘a* around the lochs of Pu‘uloa, wetland *lo‘i kalo*, and other resources. These forms of subsistence supported the households of the chiefs (Handy and Handy 1972:470) and ‘Ewa was once the political center for O‘ahu. An endearing name for ‘Ewa was *‘Ewa, ka ‘āina o nā ali‘i* (‘Ewa, land of chiefs) because it was a favorite residence of theirs (Sterling and Summers 1978:1). Handy and Handy provide a detailed description of the forms of agriculture and aquaculture in the region.

> The salient feature of ‘Ewa, and perhaps its most notable difference, is its spacious coastal plain, surrounding the deep bays (‘lochs’) of Pearl Harbor, which are actually the drowned seaward valleys of ‘Ewa’s main streams, Waikele and Waipi‘o […] The lowlands, bisected by ample streams, were ideal terrain for the cultivation of irrigated taro. The hinterland consisted of deep valleys running far back into the Ko‘olau range. Between the valleys were ridges, with steep sides, but a very gradual increase of altitude. The lower parts of the valley sides were excellent for the culture of yams and bananas. Farther inland grew the *‘awa* [kava] for which the area was famous. The length or depth of the valleys and the gradual slope of the ridges made the inhabited lowlands much more distant from the *wao*, or upland jungle, than was the case on the windward coast. Yet the *wao* here was more extensive, giving greater opportunity to forage for wild foods in famine time. [Handy and Handy 1972:469]

Except for the numerous varieties of shellfish and abundance of mullet, Handy and Handy describe ‘Ewa as being like the rest of O‘ahu.

> In the interior was the same avifauna, including the birds whose feathers were prized for feather capes, helmets, and *lei* making. In fact this, with its spacious *wao* inland, was the region where these birds were most numerous. There were more extensive areas also where *wauke* [paper mulberry] and *mamaki* [small native tree], which supplied bast for the making of *tapa* [cloth], grew in abundance. In fact, ‘Ewa was famous for its *mamaki*. There was, too, much *olona* [native shrub used for cordage] grown in the interior, and wild bananas and yams flourished. [Handy and Handy 1972:470]

‘Ewa was also known for a special and tasty variety of *kalo* called *kāī* that was native to the district. Handy collected four varieties; the *kāī ‘ula‘ula* (red *kāī*), *kāī koi* (*kāī* that pierces), *kāī kea* or *kāī ke‘oke‘o* (white *kāī*), and *kāī uliuli* (dark *kāī*) (Handy 1940:81). A *kama‘āina* of ‘Ewa described the *kāī kea* as being very fragrant. The *kāī ke‘oke‘o* made exceptionally good *poi* and was said to be reserved for the *ali‘i* (chiefs). An 1899 newspaper account says of the *kāī koi*, “That is the taro that visitors gnaw on and find it so good that they want to live until they die in ‘Ewa. The *poi* of *kāī koi* is so delicious” (*Ka Loea Kālai‘āina* 1899a, translated in Sterling and Summers

1978:8). So famous was the *kāī* variety that ‘Ewa was sometimes affectionately called Kāī o ‘Ewa (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the saying:

> *Ua ‘ai i ke kāī-koi o ‘Ewa*. He has eaten the Kāī-koi taro of ‘Ewa.
>
> *Kāī* is O‘ahu’s best eating taro; one who has eaten it will always like it. Said of youth or a maiden of ‘Ewa, who, like the Kāī taro, is not easily forgotten. [Pukui 1983:305]

In addition, breadfruit, coconuts, *wauke*, bananas, and *olonā*, and other plants were grown in the interior. ‘Ewa was known as one of the best areas to grow gourds and was famous for its *māmaki* (Handy and Handy 1972:471).

Section 4 Historical Background Research

Numerous *mo‘olelo* chronicle the reigns of *ali‘i* in ‘Ewa District (or Moku) from the eleventh century through the eighteenth century. These oral traditions highlight the central importance of the ‘Ewa *ali‘i* on O‘ahu, a monarchy that ended in 1795 with the Battle of Nu‘uanu at the precipice of the sheer *pali* (cliffs) in the Ko‘olau mountains. The recorded observations of early foreign visitors to Pu‘uloa and the broader region of ‘Ewa detail the numerous *loko i‘a*, *lo‘i kalo* and other resources, such as the cultivation of bananas and sweet potatoes. The first missionaries stationed themselves in ‘Ewa Moku in the 1820s and their detailed reports reveal the massive impact introduced diseases were having on the ‘Ewa residents. During this time, the removal of the sandalwood forest and the introduction of domesticated animals and new vegetation species severely affected the plains and slopes of the ‘Ewa landscape. In 1848, Kamehameha III introduced the concept of private property into Hawaiian society through the Māhele and subsequently the Kuleana Act, dividing the land between *ali‘i* and commoners. In the 1880s, Bernice Pauahi Bishop inherited numerous parcels of land in Waiawa, which Kamehamaha Schools and the Bishop Estate presently retain.

‘Ewa residents witnessed tremendous changes to the land in the late nineteenth century, including ranching and pineapple cultivation in the *mauka* regions and rice and sugar cultivation in the *makai* regions. The sugar industry sparked the construction of a network of railroad lines and a vast tunnel and ditch system that irrigated the ‘Ewa sugar fields with water from the distant Waiāhole Ahupua‘a in the *moku* of Ko‘olaupoko. With the annexation of the Hawaiian Islands as the Territory of Hawaii in 1901 by the United States of America, the U.S. Navy began to dredge Pearl Harbor to stage their growing Pacific fleet. The Japanese attack on Pearl Harbor in 1941 greatly accelerated the military’s use of both the *makai* and *mauka* regions of the area, from Waiawa to Hālawa Ahupua‘a, for bases, training areas, storage facilities, and housing. By the 1970s, residential neighborhoods and commercial centers filled the *makai* region of Waiawa Ahupua‘a. In contrast, very little development has been undertaken in the *mauka* region of this *ahupua‘a.*

4.1 Observations of Early Explorers and Visitors

Captain James Cook landed in the Hawaiian Islands in 1778, and ten years later the first published description of Pearl Harbor appeared. Captain Nathaniel Portlock, observing the coast of Honolulu for Great Britain, recorded the investigation of a “fine, deep bay running well to the northward” around the west point of “King George’s Bay” in his journal (Portlock 1789:74). Portlock’s description matches the entire crescent-shaped shoreline from Barber’s Point to Diamond Head.

Captain George Vancouver made three voyages to the Hawaiian Islands between 1792 and 1794. In 1793, the British captain recorded the name of the harbor opening as “O-poo-ro-ah” and sent several boats across the sand bar to venture into the harbor proper (Vancouver 1798:884). The area known as “Pu‘u-loa” was comprised of the western bank at the entrance to Pearl River. George Vancouver anchored off the entrance to West Loch in 1793, and the Hawaiians told him of the area at “a little distance from the sea, [where] the soil is rich and all the necessaries of life are abundantly produced” (Vancouver 1798, cited in Sterling and Summers 1978:36). Mr. Whitbey, one of Vancouver’s crew, observed, “from the number of houses within the harbor it should seem

to be very populous; but the very few inhabitants who made their appearance were an indication of the contrary" (Vancouver 1798, cited in Sterling and Summers 1978:36).

The waters of Pearl Harbor were first used for warfare when a sea captain named John Kendrick used his ship to bombard the Chief Ka‘eo of Kaua‘i and his invading warriors on behalf of O‘ahu's Chief Kalanikūpule during the Battle for Kuki‘iahu. On 6 December 1794, both Kendrick and a British sea captain named Brown, who was commanding two additional ships named *Jackal* and *Prince Le Boo*, landed troops ashore and stood off to bombard those opposed to Kalanikūpule. The battle lasted for two days, with fighting recorded in various areas of ‘Ewa, including ‘Aiea (Fornander 1996:264).

During the first decades of the nineteenth century, several western visitors described the ‘Ewa landscape near Pearl Harbor. Archibald Campbell, an English sailor, spent some time in Hawai‘i between 1809-1810. He had endured a shipwreck off the Island of Sannack on the northwest coast of America. As a result, both his feet became frost-bitten and were amputated. He spent over a year recuperating in the Hawaiian Islands. His narrative is considered noteworthy because it describes life before the missionaries arrived. During part of his stay, he resided with King Kamehameha I, who granted him 60 acres in Waimano Ahupua‘a in 1809. Campbell described his land:

> In the month of November the king was pleased to grant me about sixty acres of land, situated upon the Wymummee [Wai Momi, traditional Hawaiian name for Pearl River], or Pearl-water, an inlet of the sea about twelve miles to the west of Hanaroora [Honolulu]. I immediately removed thither; and it being Macaheite time [Makahiki], during which canoes are tabooed, I was carried on men's shoulders. We passed by footpaths winding through an extensive and fertile plain, the whole of which is in the highest state of cultivation. Every stream was carefully embanked, to supply water for taro beds. Where there was no water, the land was under crops of yams and sweet potatoes. The roads and numerous houses are shaded by cocoa-nut trees, and the sides of the mountains are covered with wood to a great height. We halted two or three times, and were treated by the natives with the utmost hospitality. My farm, called Wymannoo [Waimano], was upon the east side of the river, four or five miles from its mouth. Fifteen people with their families resided upon it, who cultivated the ground as my servants. There were three houses upon the property; but I found it most agreeable to live with one of my neighbours, and get what I wanted from my own land. This person's name was William Stevenson a native of Borrowstouness. [Campbell 1967:103–104]

Of the Pearl River area, Campbell wrote,

> Wymumme, or Pearl River, lies about seven miles farther to the westward. This inlet extends ten or twelve miles up the country. The entrance is not more than a quarter of a mile wide, and is only navigable for small craft; the depth of water on the bar, at the highest tides, not exceeding seven feet; farther up it is nearly two miles across. There is an isle in it, belonging to Manina, the king's interpreter, in which he keeps a numerous flock of sheep and goats. [Campbell 1967:114]
>
> The flat land along shore is highly cultivated; taro root, yams, and sweet potatoes, are the most common crops; but taro forms the chief object of their husbandry,

> being the principal article of food amongst every class of inhabitants. [Campbell 1967:115]

The botanist F.J.F. Meyen, visiting in 1831, confirms the abundant vegetation described by Campbell in the vicinity of Pearl Harbor:

> At the mouth of the Pearl River the ground has such a slight elevation, that at high tide the ocean encroaches far into the river, helping to form small lakes which are so deep, that the long boats from the ocean can penetrate far upstream. All around these water basins the land is extraordinarily low but also exceedingly fertile and nowhere else on the whole island of Oahu are such large and continuous stretches of land cultivated. The taro fields, the banana plantations, the plantations of sugar cane are immeasurable. [Meyen 1981:63]

A contrasting picture of ‘Ewa is recorded in the missionary William Ellis’ description from 1823-24 of the ‘Ewa lands away from the coast:

> The plain of Eva is nearly twenty miles in length, from the Pearl River to Waiarua, and in some parts nine or ten miles across. The soil is fertile, and watered by a number of rivulets, which wind their way along the deep water-courses that intersect its surface, and empty themselves into the sea. Though capable of a high state of improvement, a very small portion of it is enclosed or under any kind of culture, and in travelling across it, scarce a habitation is to be seen. [Ellis 1963:7]

4.2 **Missionary Stations and the Population Census**

The first company of Protestant missionaries from America, part of the American Board of Commissioners of Foreign Missions (ABCFM), arrived in Honolulu in 1820. They quickly established churches in Kona on Hawai‘i Island, Waimea on Kaua‘i, and Honolulu on O‘ahu. Although the O‘ahu missionaries were based in Honolulu, they traveled around the islands intermittently to preach to the rural Hawaiians and to check on the progress of English and Bible instruction schools set up by local converts.

In 1828, the missionary Levi Chamberlain (1956:39-40) made a circuit of O‘ahu, stopping wherever there was a large enough population to warrant a sermon or to visit a school. In his trek through the ‘Ewa District from Wai‘anae, he stopped at Waimānalo ‘Ili in Honouliuli, on the western border of ‘Ewa. At around 11 o‘clock the next day, on a Saturday, Chamberlain and his companions set out toward the east, reaching Waikele at 3 or 4 o‘clock. The group did not stop in Hō‘ae‘ae, suggesting that the population was too small for a school, but Waikele had two schools, an obviously larger population than Hō‘ae‘ae. In fact, Chamberlain decided to stay in Waikele until the next day, on the Sabbath, and preach to the Hawaiians who lived there. A crowd of 150 to 200 gathered for the sermon. The next day at 6 o’clock they set out for the village of Waipi‘o, which had one school. They left Waipi‘o at about 8:30, and walked to Waiawa, where there were two schools. Around ten o’clock, they began their circuit again, stopping only in the *ahupua‘a* of Kalauao in the ‘Ewa District before they reached Moanalua Ahupua‘a in the Kona District. The account does not give much information on the surroundings, but does indicate the relatively populated areas of ‘Ewa, in western Honouliuli, Waikele, Waipi‘o, Waiawa, and Kalauao, and the time it took to travel by foot along the trail across the ‘Ewa District.

In the following years, the Protestant missionaries established smaller churches in outlying areas, sometimes presided over by a foreign missionary or led by a Hawaiian convert, with periodical visits by a pastor from one of the main churches. The first mission in ‘Ewa was established in 1834 in Waiawa. Two missionaries, Lowell and Abigail Smith, were assigned to the station and were in charge of building a church and a house for themselves (Hawaiian Mission Children’s Society 1969:3–9). The *ali‘i,* Kīna‘u, daughter of Kamehameha I and an early Christian convert, offered the missionaries to “settle upon her land, will build us a house and do anything to promote our happiness” (letter from Lowell Smith 1833, cited in Frear 1934:69). Citing his wife’s poor health, the Smiths went to Moloka‘i instead. But at the General Meeting of the missionaries in June and July 1834, the board decided the Smiths should be transferred to ‘Ewa to a place 3 miles from the king‘s favorite country seat (Frear 1934:93). Lowell selected the site for the new church on a hill called Haupu‘u (built-up hill) that was elevated 200 ft above the ‘Ewa plain. This church is depicted as it looked in 1851 in Figure 9 and the location of this church approximately 1.5 km southeast of the south end of the present study area is shown on an 1881 map of O‘ahu (Figure 10). This ‘Ewa Church on the hill Haupu‘u was probably situated near the demographic center of Waiawa Ahupua‘a from time immemorial and would dominate the geographic and social landscape of Waiawa for decades.

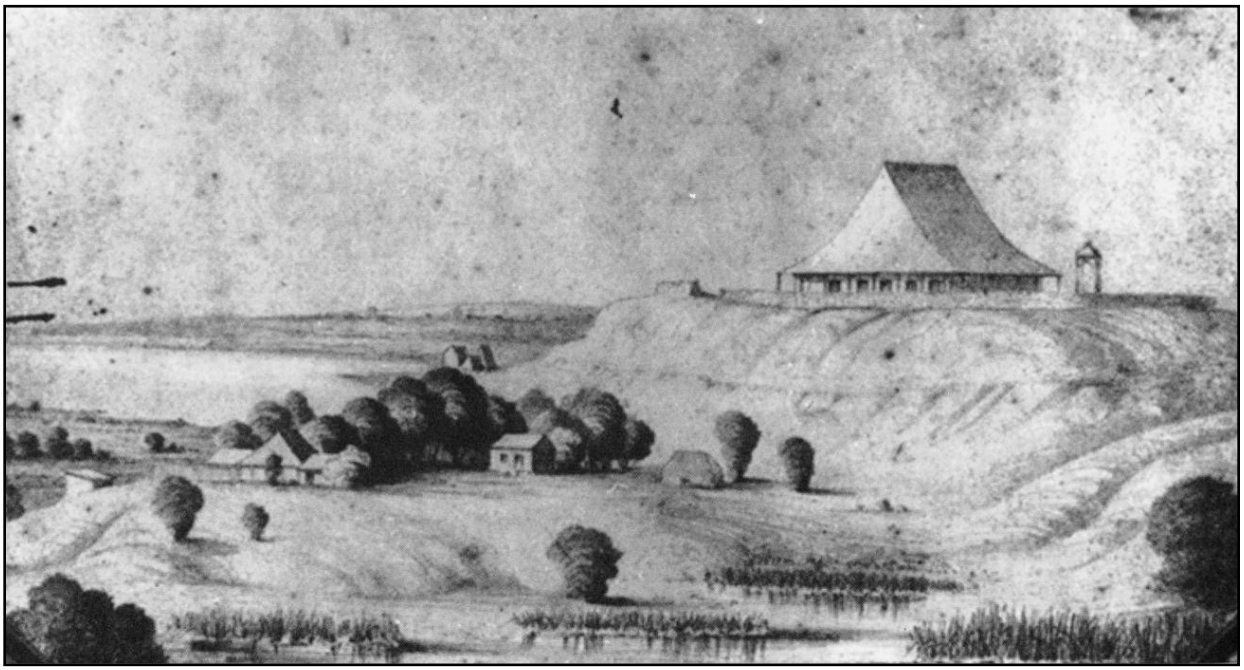

Figure 9. 1851 sketch of ‘Ewa Church on the hill Haupu‘u in Waiawa (original sketch by Paul Emmert in the Mission Houses Museum Library; reprinted in Gowans 1993:10)

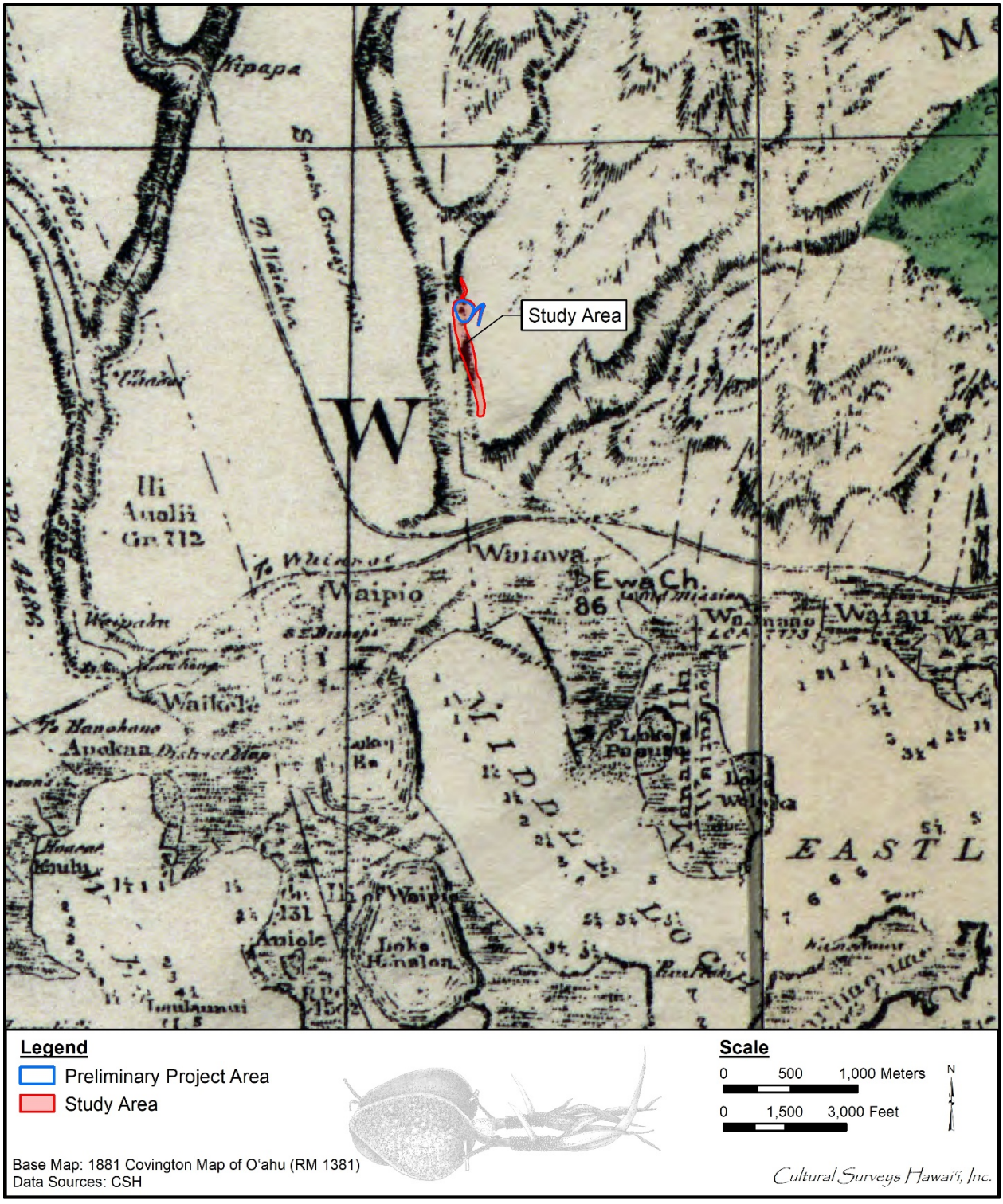

Figure 10. 1881 map of O‘ahu (portion) by R. Covington (RM 1381); the new roads follow the old trails; the main taro / rice wetlands and the Ewa Church are *makai* of the main coastal road

Lowell Smith’s congregation was spread out over an area of 20 miles, and he traveled to different areas to preach to crowds. He also established two schools, one for boys and one for girls, and treated the sick, especially inoculating his parishioners against smallpox. In 1836, Abigail’s health deteriorated, and the mission decided that the two should live in Honolulu instead. To carry on the work at the mission, the Reverend Artemas Bishop and his family were transferred to ‘Ewa. Sereno Bishop, the son of Artemas Bishop, remembered the move:

> Our predecessors at Ewa were Rev. and Mrs. Lowell Smith, specially capable and devoted missionaries who had been only two years in the field. Mr. Smith had built a comfortable house of adobe bricks, thatched with grass and well plastered inside and out. He had also erected the adobe walls of a church, capable of holding an audience of about one thousand people […] The adobe walls fifteen feet high were covered by a steeply pitched roof, which extended out in a verandah on all four sides, in order to protect the base of the mud walls from being destroyed by raindrip. The timbers of the roof were long beams dragged from the mountains entirely by human strength, the labor being secured by volunteering, under the leadership of the chiefs.
>
> The mission house was located on the west bank of the Waiawa creek, about one-fourth mile northwest of the present railway station at Pearl City. There was nearly an acre of ground enclosed in an adobe wall. Some distance seaward was a glebe of a couple of acres of taro swamp, a little below where the railway bridge now crosses the creek. A small cattle pen was enclosed about twenty rods north. An old wall of the natives separated the upland from the planted lands and kept out the pigs and afterward the cattle. Copious springs of most delicious water abounded throughout the district of Ewa, a small one being in our own grounds. [Bishop 1916:41–42]

The church, shown on an 1851 sketch (see Figure 9), was finally completed in early 1837 (Frear 1934:137) on a lot that is now a portion of the Leeward Community College (LCC) and the adjacent College Gardens Condominiums. It was described as follows:

> An elegant church building, ninety feet long, forty two feet wide with a veranda all around it,--plastered inside and out, a good pulpit, etc., etc. The house will contain from ten to twelve hundred people. [letter from Lowell Smith 1857, cited in Frear 1934:115]

During the U.S. Exploring Expedition of 1839-1841, a member of Captain Wilkes’ crew visited ‘Ewa and noted the church and thriving village at Waiawa:

> At Ewa, Mr. Bishop has a large congregation. The village comprises about fifty houses, and the country around is dotted with them. The village presents an appearance of health and cleanliness, clearly indicating the influence Mr. Bishop has exerted over his flock, in managing which he is much aided by his lady.
>
> The church is a large adobe building, situated on the top of a small hill, and will accommodate a great number of persons. Mr. Bishop sometimes preaches to two thousand persons.

> The natives had made some advance in the arts of civilized life; there is a sugar-mill, which, in the season, makes two hundred pounds of sugar a day. They have been taught, and many of them are now able to make their own clothes, after the European pattern. There is a native blacksmith and several native carpenters and masons, how are able to work well.
>
> In 1840, the church contained nine hundred members, seven hundred and sixty of whom belonged to Ewa, the remainder to Waianae; but the Catholics have now established themselves at both these places, and it is understood are drawing off many from their attendance on Mr. Bishop's church. […]
>
> This is the best part of the island of Oahu for raising cattle and sheep, which are seen here in greater numbers than elsewhere. [Wilkes 1845:80–81]

The reports left by Artemas Bishop of the Ewa Protestant Station in Waiawa shed light on the massive impact disease was having on the Hawaiian people in the ‘Ewa district. The 1831–1832 census of O‘ahu recorded a population of 4,015 within the ‘Ewa district. Four years later, in 1836, the ‘Ewa population had dropped to 3,423 (Schmitt 1973:9, 36), “a decrease of 592 in 4 years” (‘Ewa Station Report 1836). Reverend Lowell Smith noted,

> The people of Ewa are a dying people. I have not been able to obtain an exact count of all the deaths & births since the last general meeting. But my impression is that there have been as many as 8 or 10 deaths to one birth. I have heard of but 4 births on Waiawa during the year, & all of these children are dead. I have attended about 20 funerals on that one land, & 16 of these were adults. [‘Ewa Station Report 1836]

The population stabilized in the 1830s and early 1840s. In January 1849, the population was 2,386 people, but the population dropped with a measles epidemic in October 1849. Although Bishop attempted to vaccinate as many individuals as possible, the smallpox epidemic of 1853-1854 killed upwards of 400 people in the ‘Ewa District. The comments of Artemas Bishop reflect the destitution people were suffering district wide:

> It is not necessary that I go into detail of that season of sorrow and trial which we passed through, and from which I did not myself escape without feeling its influence in my own person. Let it suffice here, that not a house or family in Ewa escaped. In many cases, whole families were cut off. Husbands and wives parents and children were separated by death. The whole state of society became disorganized; almost every family was broken up. In the whole district between July and October inclusive, upwards of half of the people died and of those who escaped, many are still enfeebled in consequence. In the church we have lost upwards of 400 members, including several of my best men. We feel ourselves very much crippled in consequence. Many sad and affected feelings, mingled with discouragement have followed my labors through the year, and that to a degree far beyond what I ever before suffered. [‘Ewa Station Report 1854]

Sereno Bishop also remembered his father's efforts to save his congregation, but with limited success in ‘Ewa:

> The greatest destruction of Hawaiian population took place in the summer of 1853, by an invasion of small-pox. This broke out in Honolulu. Rev. A. Bishop

> immediately procured a supply of vaccine matter, which proved to be spurious. He then proceeded to inoculate the people with small-pox, thus saving hundreds of lives, and himself coming down with varioloid, having formerly been vaccinated. But more than half of the population of Ewa perished in a few weeks. The earliest cases were pathetic. A young woman in Kalauao was visiting in Honolulu, and contracted the malady. She hastened home in terror and summoned her friends and kindred from all the villages of Ewa to bid her farewell. They all came and kissed her, then returned to their homes and all died. The young woman herself recovered. [Bishop 1916:46]

In 1860, Artemas Bishop reported,

> The people of the district are rapidly diminishing, and whole neighborhoods where in former years were numerous families and cultivated lands, there are now no inhabitants, and the land is left to run to waste. The fathers have died off, and the children wander into other parts, and there are none to fill their places. [‘Ewa Station Report 1860]

Sereno Bishop, recollecting his life at the mission station in ‘Ewa in the mid-eighteenth century, commented on the population decline: “Throughout the district of Ewa the common people were generally well fed. Owing to the decay of population great breadths of taro marsh had fallen into disuse, and there was a surplus of soil and water for raising food” (Bishop 1916:44).

The consequences of the great numbers of deaths were far reaching, one of which was the large displacement of people from traditionally settled lands. When Reverend Bishop no longer preached at the church, various short-term pastors and deacons took his place, but the attendance dropped off and the pastors often were not paid. ‘Ewa Church, long neglected both physically and spiritually, fell into a state of despair (Ellis 1995:20). A new adobe church building was begun by the minister Samuel Nawaa in 1882, which was built 20 ft west of the old church. Nawaa had trouble paying for the construction and petitioned the help of King Kalākaua, the seventh in the line of Hawaiian monarchs. Kalākaua paid the debt and Nawaa honored him at the dedication in 1884 by calling the church Kahikuonālani (the seventh of the kings). The church was moved east into Mānana Ahupua‘a in 1906 as the population shifted to the new residential sections of Pearl City. The church moved once again in 1957 to Pearl City Highlands (Ching 1992:28–29).

4.2.1 The Sandalwood Trade and the Introduction of Domesticated Animals

Subsequent to Western Contact in the area, the landscape of the ‘Ewa plains and Wai‘anae slopes was adversely affected by the removal of the sandalwood forest, and the introduction of domesticated animals and new vegetation species. Domesticated animals, including goats, sheep, and cattle, were brought to the Hawaiian Islands by Vancouver in the early 1790s, and allowed to graze freely about the land for some time after. It is unclear when the domesticated animals were brought to O‘ahu; however, L.A. Henke reports the existence of a longhorn cattle ranch in Wai‘anae by at least 1840 (Frierson 1972:10). During this same time, perhaps as early as 1790, exotic vegetation species were introduced to the area. These typically included vegetation best suited to a terrain disturbed by the logging of sandalwood forest and eroded by animal grazing.

Sereno Bishop stated that his father was the first to bring cows to ‘Ewa:

> Waiawa valley above us lay knee deep with the richest of grass, where our cows rioted. Out goats took to the higher ground, where they flourished, being driven in and penned at night. […] The herd gradually multiplied and in a few years became large. [Bishop 1916:42]

These herds contributed to the deforestation of the upper valley, as noted by Bishop:

> There was a very passable road down Ewa and Waianae way. Once while making the trip down to Waialua, to which there was a good horse trial, I discovered that even at that early day [ca. 1858] that cattle had made great inroads into the forests of ti plants which had theretofore clad the foothills and upland pasturages, even to the highest tracts. [Bishop 1916:60]

4.3 **Mid-Nineteenth Century 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). The Māhele, the division of lands among the *ali‘i*, and subsequently the Kuleana Act, the awarding of lands to the common people, introduced the concept of private property into Hawaiian society. In 1848, Kamehameha III divided the land into four categories: King/Crown Lands to be reserved for himself and the royal house; Government Lands set aside to generate revenue for the government; Konohiki Lands set aside for *ali‘i* and their *konohiki* (stewards); and *kuleana* (Native Hawaiian land rights), habitation and agricultural plots claimed by the common people (Chinen 1958:15–16).

During the Māhele land division of Hawai‘i in 1848, Waiawa Ahupua‘a was awarded to Princess Victoria Kamāmalu (sister of Kamehameha IV and V) as part of land claim 7713. During the second half of the nineteenth century, Waiawa was passed on to successive members of the *ali‘i*. Victoria Kamāmalu died in 1866 at the age of 27. Her entire estate was inherited by her father, Mataio Kekūanao‘a, who died two years later. The estate went to Kekūanao‘a’s son Lot Kapuāiwa, who by that time reigned as Kamehameha V. Kapuāiwa died in 1872, whereupon Ruth Ke‘elikōlani, Kapuāiwa’s half-sister, petitioned for and received in 1873 the entire estate. By 1883, Ruth Ke‘elikōlani died, leaving all of her estate to her cousin Bernice Pauahi Bishop (Kame‘eleihiwa 1992:309–310). Kamehameha Schools and the Bernice Pauahi Bishop Estate presently retain ownership of most of the *ahupua‘a*. The present study area is entirely within the award to Victoria Kamāmalu and *mauka* of all the smaller *kuleana* awards to individuals. There were no *kuleana* awarded within the study area.

A total of 33 awards were made in Waiawa, including the award of Waiawa to Victoria Kamāmalu (Table 1). One large award, LCA 387, was to the ABCFM. It comprised 4.13 acres in the *makai* portion of Waiawa and included a salt pond, a *mo‘o* (land strip) for the church, and a house lot. Artemas Bishop, the Protestant missionary stationed at ‘Ewa from 1836–1856, made the application and drew a map of the Waiawa *kuleana* awards in 1887 (Figure 11). This map shows the location of topographic features, trails, LCA awards, and *‘ili.* The remaining 31 awards in Waiawa were for *kuleana*. The claims included 28 house lots, 176 taro *lo‘i*, 20 *loko i‘a*, 23 *kula* (dryland agriculture), eight *paukū ‘auwai* (section of ditch), and seven banana *kula* (Cordy

Table 1. LCAs and *‘Ili* in Waiawa Ahupua‘a

LCA	Awardee	Acres	*‘Ili*
387	ABCFM	4.13	Pānaio
879	Puakai	0.619	Pānaio, Kapuaihalulu (*‘āpana* [lot] 1), Kionaole (*‘āpana* 2, 3)
882	Poonui	0.78	Kuhialoko
904	Naheana, Noa	1.608	Pānaio (*‘āpana.* 1); Kuhiawaho (*‘āpana.* 2); Kahō‘ai‘ai (*‘āpana.* 3)
1696	Namomoku	3.91	Kuhialoko (*‘āpana.* 3)
1715	Haa	2.4	Kuhialoko (*‘āpana* 1 and *‘āpana* 2)
2146	Paahana	0.372	Kapuaihalulu
2448	Kikane	0.844	Pānaio (*‘āpana* 1), Kapuaihalulu (*‘āpana* 2, 3, 4)
2685, 4529	Ohia	1.227	Holoipiapia (*‘āpana* 3), Kapuaihalulu (*‘āpana* 3)
4213	Kauhi	1.285	Holoipiapia (*‘āpana* 2), Kahō‘ai‘ai (*‘āpana* 1)
5591; 9357	Kekua	1.24	Kahō‘ai‘ai
5644; 9362	Kamalii	3.196	Kuhialoko
7713:46	Kamāmalu, Victoria	entire *ahupua‘a*	Waiawa Ahupua‘a
9294	Kekeni	0.67	Piliaumoa
9320	Keoho	1.47	Kapaloa (two *‘āpana*)
9357-B	Opunui	1.628	Pānaio (*‘āpana* 1 and 2)
9358	Kaanuu	1.155	Kapuaihalulu
9360; 5847	Kapaa	0.9	Hanakehau
9361; 1711	Hanamaulu	1.54	Kuhiawaho
9362-B	Naone	0.595	Kapuaihalulu
9364; 6086	Makanui	0.61	Hanakehau
9366; 1594	Keawe	0.687	Hanakehau
9368; 1604	Kakoo	0.43	Kuhiawaho
9372	Keiki	1.38	Kapaloa (two *‘āpana*)
9373	Kamoku	0.52	Kapaloa
9374; 5646	Kaionio	1.214	Pānaio (*‘āpana* 1); Kulaokamakau (*‘āpana* 2)
9375; 1683	Peahi	1.176	Pānaio (one *‘āpana*); Kulaokamakau (one *‘āpana*)
9376	Kupihea	1.306	Kapaloa (two *‘āpana*)
9377	Lio	1.21	Kapaloa, Hale‘aha
9384	Nahalepili	1.58	Kapopou (*‘āpana* 1 and 2)

LCA	Awardee	Acres	*‘Ili*
9409	Puhiki	0.937	
10567	Ohulenui	1.264	Kapuaihalulu (three *‘āpana*) , Kalona
10942	Wallace, William	3.651	Kahō‘ai‘ai (*‘āpana* 1–4)

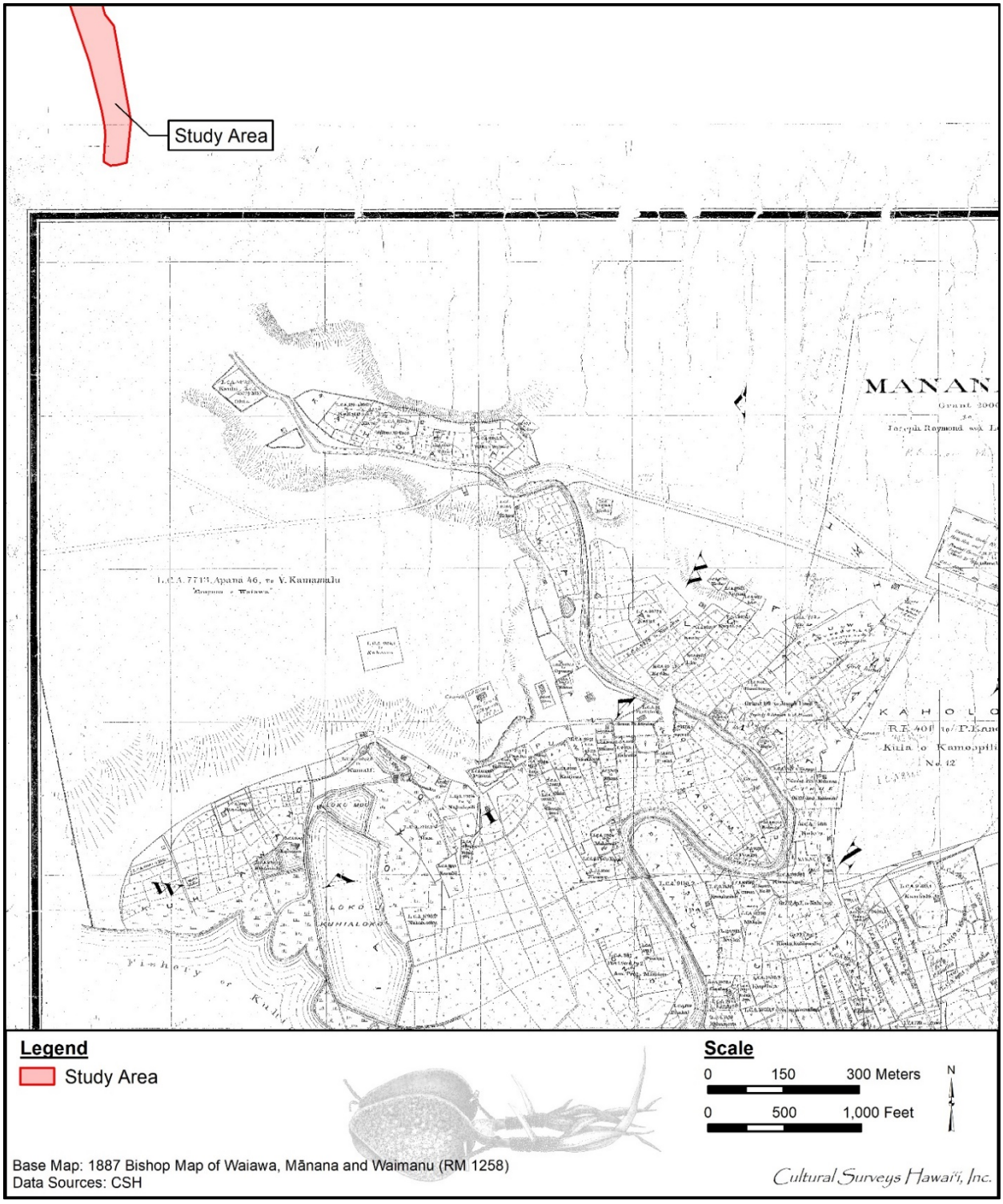

Figure 11. 1887 map of Waiawa, Mānana, and a part of Waimano by S. Bishop (RM 1258), depicting the area of *Kuleana* Awards; the south end of the present study area is *mauka* of these smaller awards and within LCA 7713 Apana 46 to V. Kamāmalu, who was granted the entire *ahupua‘a* of Waiawa

1996:5). All historic maps show the 31 claims adjacent or *makai* of the Government Road, which later became Kamehameha Highway.

As documented in the above LCA claims, much of the land during the mid- to late 1800s was being utilized for dryland crops, wetland crops, and pond fields. Waiawa Stream was the logical means of irrigation, although there were also freshwater springs about the area. In marsh areas, the Hawaiians made earth mounds for *kalo* crops. A majority of these LCA parcels were in the lower, wetter elevations where wetland agriculture was propagated. Areas *mauka* of the highway may have had scattered fields of dryland crops, such as sweet potatoes. While the uplands of Waiawa were probably used for the procurement of resources, there is no evidence of permanent settlements in traditional Hawaiian times.

4.4 **Late Nineteenth Century**

4.4.1 Ranching

Both John Young and Kamehameha I brought the first cattle to O‘ahu from Kaua‘i in 1809 (Kamakau 1992:268). It is probable that Young had cattle at his Hālawa lands as well.

> Several individuals had large flocks of them. The queen had one [*sic*], consisting of about one hundred and fifty; and Manina had several hundreds on the island [Moku‘ume‘ume or Ford Island] in Pearl river. The cattle lately introduced are pastured upon the hills, and those parts of the country not under cultivation, the fences not being sufficient to confine them. [Campbell 1967:117–118]

As previously noted, the missionaries assigned to the ‘Ewa Church in Waiawa allowed their cattle to roam on the Waiawa uplands as early as the late 1830s. In 1868, a 50-year lease and leaseholds in Waiawa were granted to James Robinson, an early shipbuilder in Hawai‘i. After James Robinson’s death in 1890, his son, Mark P. Robinson, acquired a 25-year lease and ran cattle on the Waiawa lands. Robinson had expanded his father’s business, and was part owner in a large lumber yard business and in operating several inter-island steamers. He was also one of the three largest landowners in the ‘Ewa District, along with James Campbell, who had a large cattle ranch in Honouliuli and Charles ‘Ī‘ī Brown, who owned lands from the Waipi‘o Peninsula to the uplands. The Robinson homestead was between Ho‘ae‘ae and Waikele (west of the study area), but he had fee simple lands in Mānana and Waimano, and a number of leased lands in Waiau, Waiawa and Waimano Uka (Yardley 1981:131).

As late as the 1894 Kanakanui map (Figure 12) virtually no human modification of the vicinity of the study area is indicated other than the pre-Contact coastal cross-*ahupua‘a* trail (“Road to Honolulu”) and the ‘Ewa Church. It is understood that the land north of the coastal cross-*ahupua‘a* trail was quite undeveloped Robinson family ranch land to that time.

4.4.2 The Origins of the OR&L

Mark Robinson was one of the early supporters of B.F. Dillingham’s Oahu Railway and Land (OR&L) Company, and later became one of the managers. Robinson initially agreed to put his lands and cattle into the new corporation, in exchange for cash and stock and bonds. He and Dillingham planned to use the sale of bonds of the new company to build and equip the first

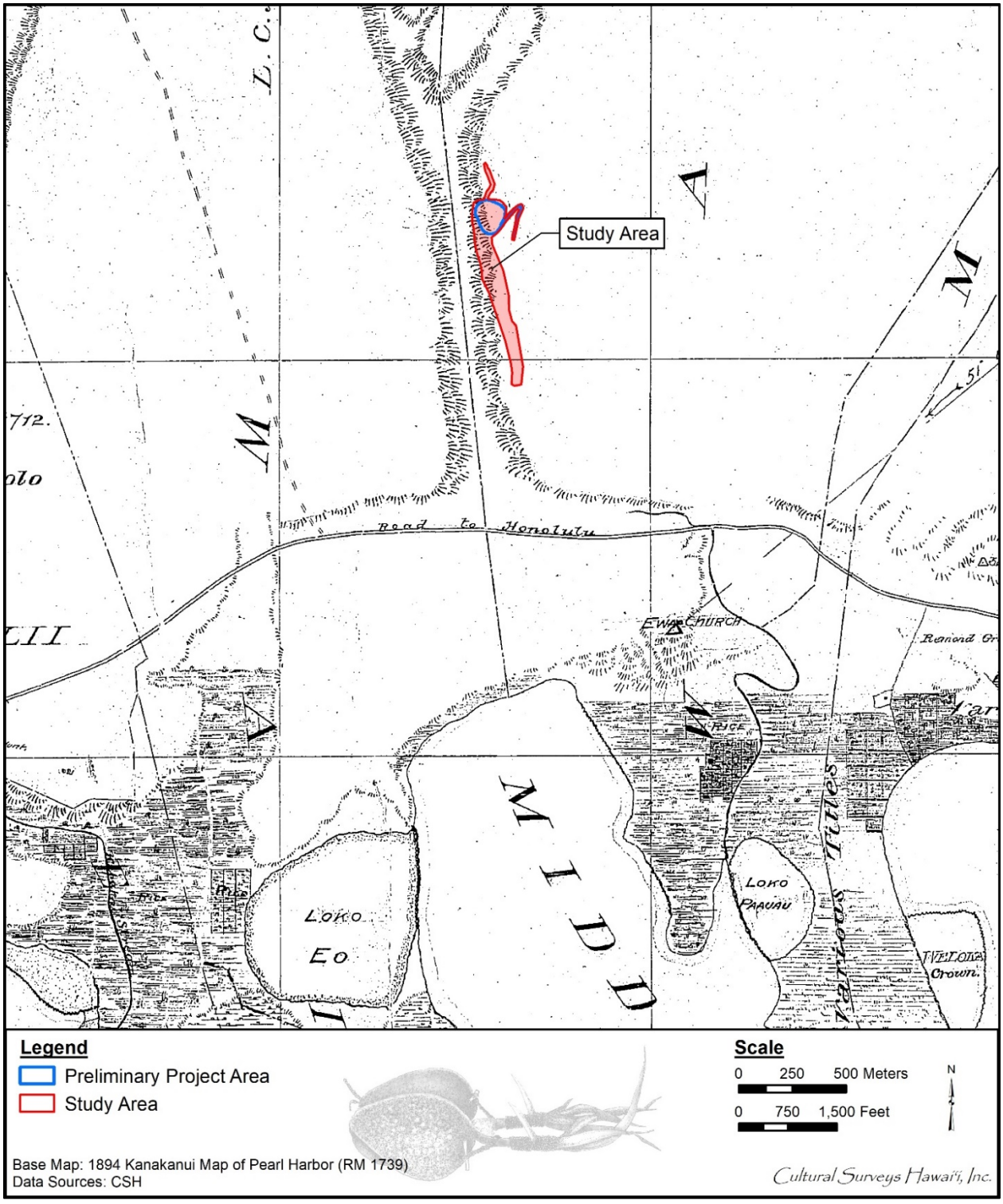

Figure 12. Portion of 1894 map of Pearl Harbor by S.M. Kanakanui (RM 1739) showing the study area

15 miles of the railroad (Yardley 1981:131). From the agreement, we learn the extent of the ‘Ewa ranch lands owned by Robinson.

> Mark [Robinson] had committed himself to put into the railway company, in exchange for stock and bonds, 2,010 acres in fee simple at $25 an acre, a paid-up lease from the Bishop Estate for twenty years on 18,000 acres, one thousand head of cattle and fifty horses, 45,000 *‘ohi‘a* railroad ties [from his lumber yards], and the steamer *Ewa.* [Yardley 1981:135–136]

By 1889, the OR&L had completed its first 9 miles of railway. It connected the wharves at the Honolulu Harbor to Hālawa and the agricultural coastline of Pearl Harbor. O‘ahu’s Ewa Plantation was incorporated in 1889 and the growing railroad of B.F. Dillingham was leveling the Waipahu-to-‘Ewa Junction in anticipation of service to the ‘Ewa plains and beyond. Due to this increased construction, harbor commissioners for the new Territory planned for extensive terminal construction and harbor development to accommodate the steady growth of O‘ahu’s sugar industry (U.S. War Department, Army Corps of Engineers 1935). The railroad extended from Honolulu to Pearl City in 1890, to Wai‘anae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:100). This railroad line eventually ran across the center of the ‘Ewa Plain at the lower boundary of the sugar fields (Frierson 1972:15). The OR&L tracks extended along the margin of Pearl Harbor. The 1899 Beasley map (Figure 13) shows the OR&L track quite close to the northern margin of Middle Loch south of the present study area.

4.4.3 The Sugar Industry

Although sugarcane was already being grown as a cash crop as far back as the early 1800s, the industry revealed its economic potential in 1879 when the first artesian well was drilled in ‘Ewa (Ellis 1995:22). The availability of subsurface water resources enabled greater irrigation possibilities for expanding plantations besides the use of water diversions from the surrounding stream systems. This prompted the drilling of many other wells throughout the Hawaiian Islands, thereby commencing the Hawai‘i sugar plantation era. By the early 1900s, all the main Hawaiian Islands had land devoted to the production of sugarcane.

Agricultural field systems, railroads, and residential areas in ‘Ewa were developed by three sugarcane companies: the Ewa Plantation, located largely in the *ahupua‘a* of Honouliuli and Hō‘ae‘ae in the western section of the ‘Ewa; the Oahu Sugar Company, extending in the areas upland of the Ewa Plantation in central ‘Ewa, including a portion of the uplands of Waiawa; and the Honolulu Plantation Company, with fields extending through Mānana to Hālawa in the eastern section of the ‘Ewa.

In 1886, Campbell and B.F. Dillingham put together the “Great Land Colonization Scheme,” which was an attempt to sell Honouliuli land to homesteaders (Thrum 1887:74). This homestead idea failed; two factors for the failure were the lack of water and the distance from ‘Ewa to Honolulu. The water problem was solved by drilling artesian wells, and Dillingham decided the area could be used instead for large-scale cultivation (Pagliaro 1987:4). The transportation problem was solved by constructing a railroad, which B.F. Dillingham soon began to finance as OR&L.

The Ewa Plantation Company was incorporated in 1890 for sugarcane cultivation. The first crop of 2,849 tons of sugar was harvested in 1892. ‘Ewa was the first all-artesian plantation, and

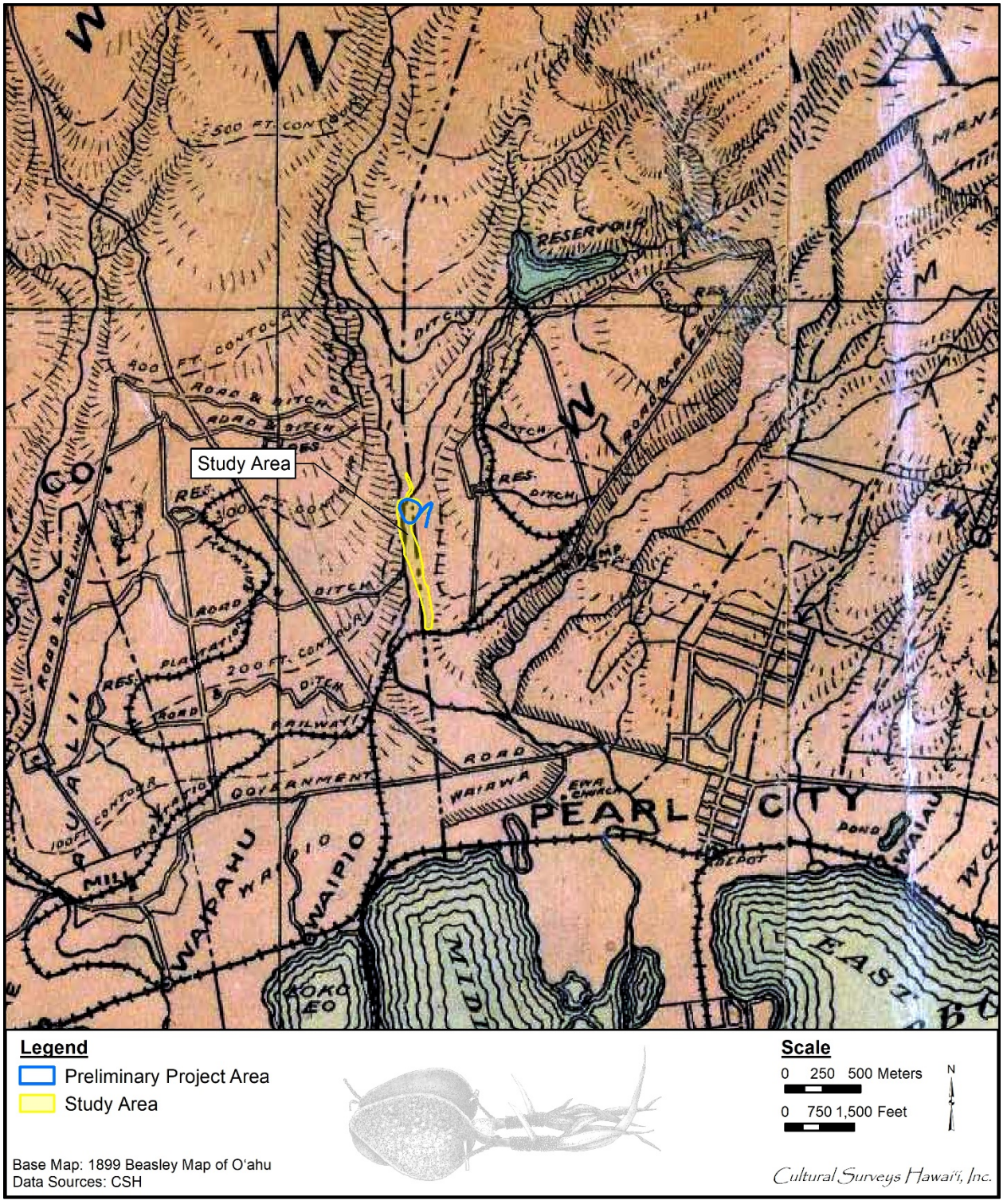

Figure 13. 1899 Beasley map of Oahu (portion) showing the study area

it gave an impressive demonstration of the role artesian wells were to play in the later history of the Hawaiian sugar industry (Kuykendall 1967:69).

In 1897, B.F. Dillingham established the Oahu Sugar Company on 12,000 acres leased from the estates of John Papa ‘Ī‘ī, Bishop, and Robinson. The OR&L subleased Waiawa lands to the Oahu Sugar Company for 43 years on 1 January 1897. It describes the property as “All that part of the Ahupua‘a of Waiawa lying west of Waiawa Gulch and below the contour line of 650 feet elevation […] area of about twelve hundred acres” (Bureau of Land Conveyances 169:181–183 as quoted by Gwen Hurst in Appendix B, Goodman and Nees 1991:152) This included the present study area. The 1899 Beasley map (see Figure 13) shows how quickly plantation infrastructure was developed depicting an extensive networks of roads, railroads, a large reservoir, and ditches on the Waiawa table lands to the east and northeast of the present study area.

The Oahu Sugar Company had over 900 field workers, composed of 44 Hawaiians, 473 Japanese, 399 Chinese, and 57 Portuguese. The first sugar crop was harvested in 1899, ushering in the sugar plantation era in central and eastern ‘Ewa (Ohira 1997).

Prior to commercial sugar cultivation, these lands were described as being “of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project” (Condé and Best 1973:313). Dillingham had successfully promoted the Ewa Plantation Company in 1890; the sprawling sugar company was just south of and adjacent to the Oahu Sugar Company. Artesian wells had converted the arid ‘Ewa lands into a thriving plantation, and Dillingham recognized the same potential in the northern area.

A Donn 1906 land use map (Figure 14) shows the extent of the Oahu Plantation sugarcane lands clearly including the entirety of the present study area. The 1919 U.S. War Department map (Figure 15) shows the entire surrounding area as a sea of sugarcane.

Water to irrigate the upper cane fields was initially pumped to levels of 150 m (500 ft) by some of the “largest steam pumps ever manufactured” (Dorrance and Morgan 2000:49). The expense of pumping water to the high elevations of the plantation led to the proposal to transport water from the windward side of the Ko‘olau Mountains. The Waiahole Water Company was formally incorporated in 1913 and was originally a subsidiary of the Oahu Sugar Company. The Waiāhole Ditch was designed by engineer Jorgen Jorgensen, with recommendations by engineer J.B. Lippencott and assisted by W.A. Wall. When completed, 27 tunnels connected 37 stream intakes on the north side of the Ko‘olau with the main bore through Waiāhole Valley. This connected to 14 tunnels on the southern side of the Ko‘olau at Waiawa and then by ditch westward to Honouliuli. Overall, the tunnel and ditch system covered a total of 13.6 km (Condé and Best 1973:37). Upon its completion in 1916, the Waiāhole Ditch was 21.9 miles long (35 km) and cost $2.3 million. The 32 million gallons of daily water enabled the Oahu Sugar Company to grow to “some 20 square miles […] ranging in elevation from 10 feet at the Waipio Peninsula […] to 700 feet at the Waiahole Ditch” (Condé and Best 1973:313). The Waiāhole ditch system, with some modifications, is still in use (SIHP # 50-80-09-2268).

The Waiahole Ditch greatly opened up *mauka* lands to irrigation and sugarcane production.

> The Waiahole Water Co. has taken over from the Oahu Sugar Co. the Ahrens Ditch in Waiawa, the Kipapa Ditch, the Waikakalaua Ditch in Waipio, and the Hoaeae Ditch. Two redwood pipes having a total length of 1,223 feet have been laid across

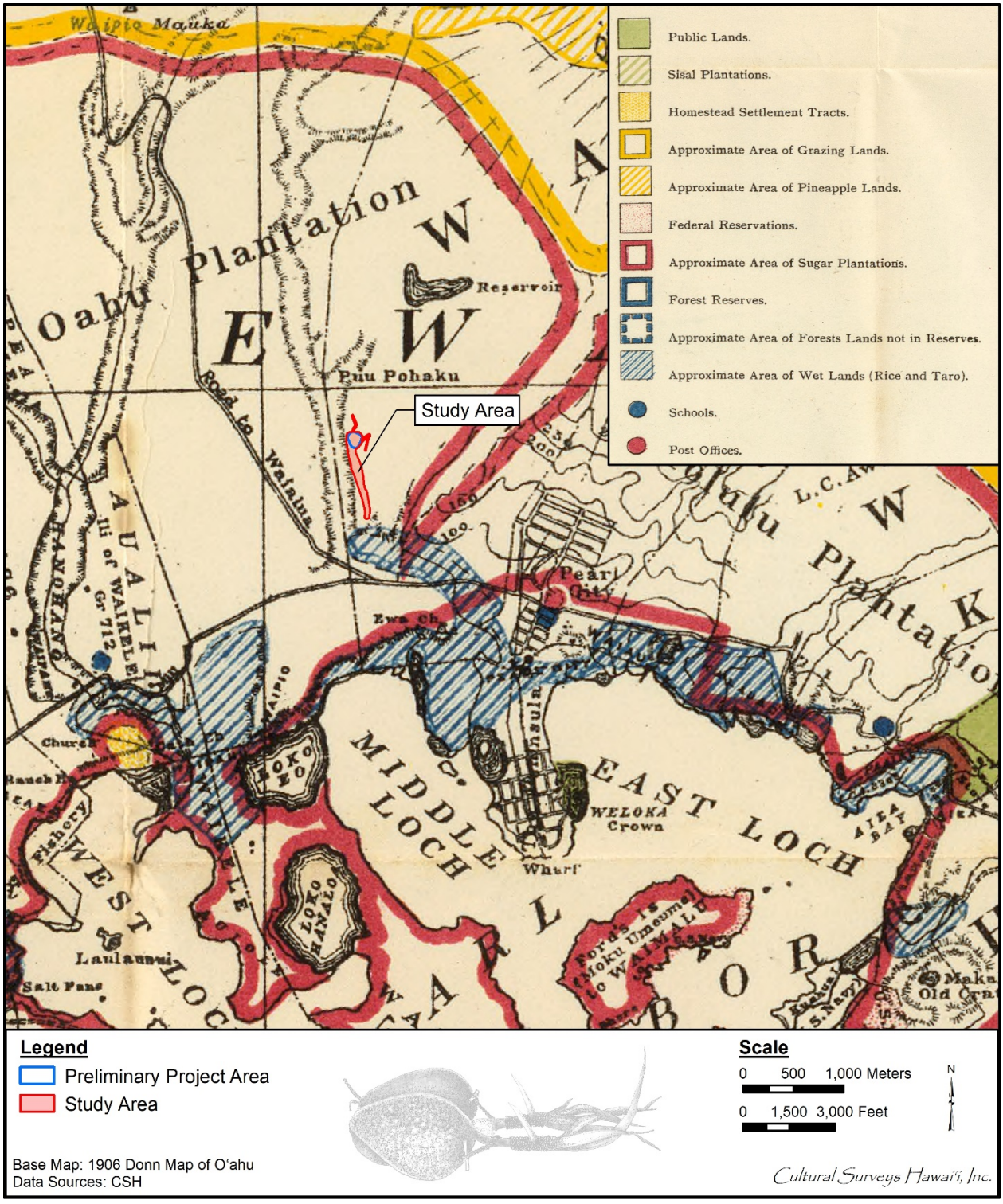

Figure 14. Portion of the 1906 Donn map of O‘ahu showing land use showing the study area

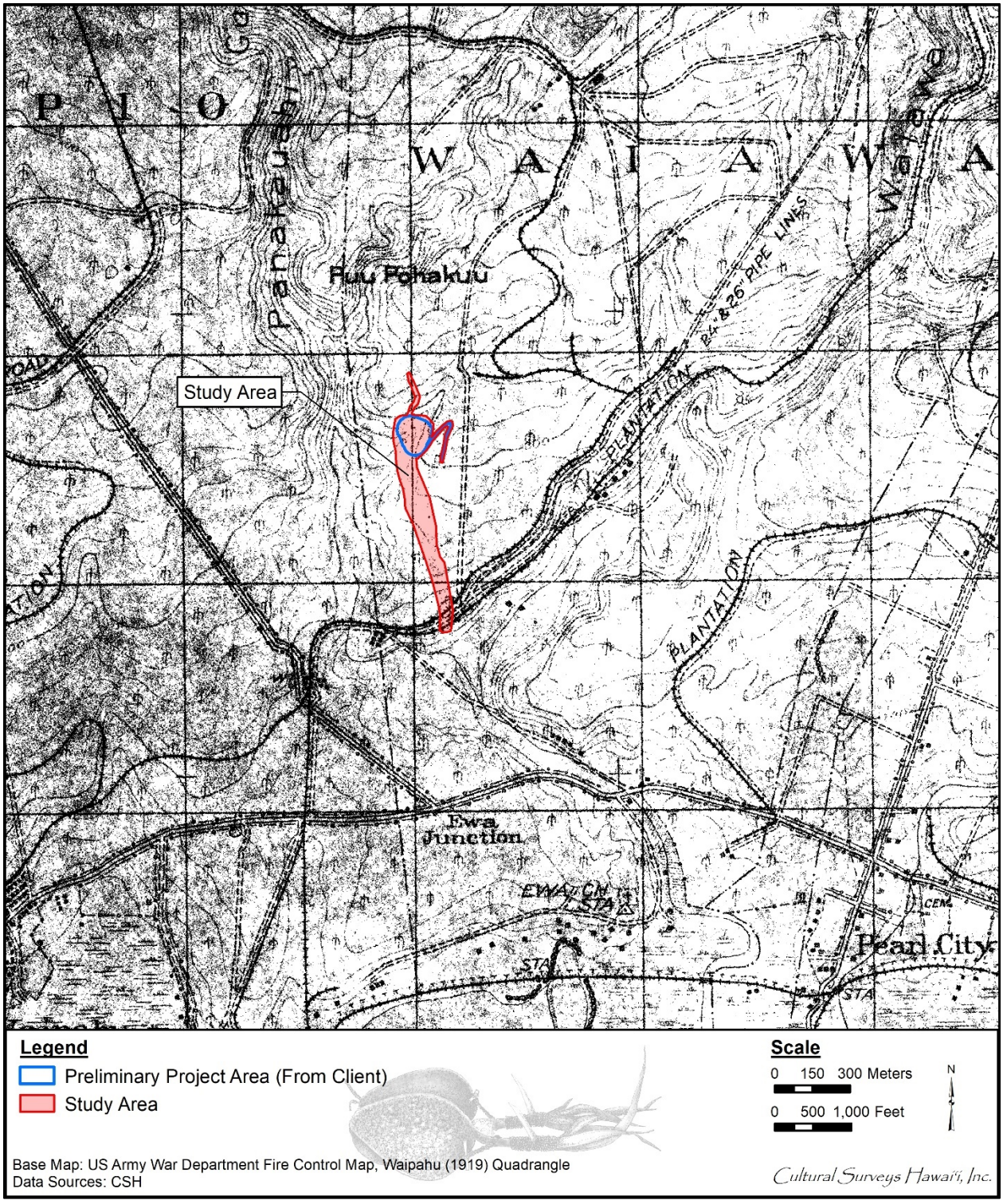

Figure 15. Portion of the 1919 U.S. Army War Department fire control map, Waipahu quadrangle, showing the study area

> two gulches on the line of Hoaeae Ditch, cutting out 21 miles of ditch. The water delivered by the Waiahole System is chiefly used on newly planted cane on land above the lift of the pumps. [Kluegel 1916:107]

Oahu Sugar Plantation railroad lines were quickly developed to access these *mauka* fields (see Figure 15 and Figure 16).

A 1925 map (Figure 17) of the Oahu Sugar Company sugarcane fields indicate the study area lands were situated in sugarcane Field 4.

The eastern section of ‘Ewa was largely developed by the Honolulu Plantation Company. Mr. J.R. Williams first developed sugarcane in the 1850s and then leased land and built a sugar mill in ‘Aiea in 1899 with the Honolulu Sugar Company (Condé and Best 1973:327). It then became the Honolulu Plantation Company in 1900. Originally in ‘Aiea, the plantation expanded along the northern inshore and upland areas of Pearl Harbor. The expanse of the Honolulu Plantation Company lands seems to extend from ‘Aiea westward as far as Mānana and Waiawa streams. Additionally, several land sections lay southeast of Pearl Harbor where the present Honolulu International Airport and Hickam Air Force Base are located. In 1914, the company harvested 19,000 tons of sugar. It was taken over by the Oahu Sugar Company in 1947 (Condé and Best 1973:313).

4.5 Twentieth Century and Modern Land Use

4.5.1 Oahu Railway and Land Company in the Twentieth Century

Operations at the OR&L began to slow down in the 1920s when electric streetcars were built for public transportation within the city of Honolulu and automobiles began to be used by families for transportation outside the city (Chiddix and Simpson 2004:185). The build-up to World War II turned this decline around as the U.S. military utilized the OR&L lines to transport materials to build defense projects around the island. Historians have noted one of the most serious mistakes made by the Japanese in their 1941 attack on Pearl Harbor was their decision not to bomb the railway infrastructure. Soon after the attack, the OR&L operated 24 hours a day, transporting war materials and troops from Honolulu to the new and expanded army, naval, and air bases. The huge navy base at Pearl Harbor had its own rail lines that connected to the OR& L rail lines.

With the end of the war in August 1945, the use of the OR&L railway lines for military transport came to an abrupt halt:

> She had served her country well and proudly during the war, but operating round-the-clock on what little maintenance could be squeezed in, had taken a prodigious hit on the locomotives and track. Traffic stayed steady for a short time, but soon dropped precipitously as soldiers and sailors went home, military posts were shrunk or razed, and civilians could again get tires, gasoline and new cars. [Chiddix and Simpson 2004:257]

There was no choice but to abandon the OR&L main line, and in 1946 Water F. Dillingham, son of B.F. Dillingham, wrote the following:

> The sudden termination of the war with Japan changed not only the character of our transportation, but cut the freight tonnage to a third and the passenger business to a little above the pre-war level. With the increased cost of labor and material and

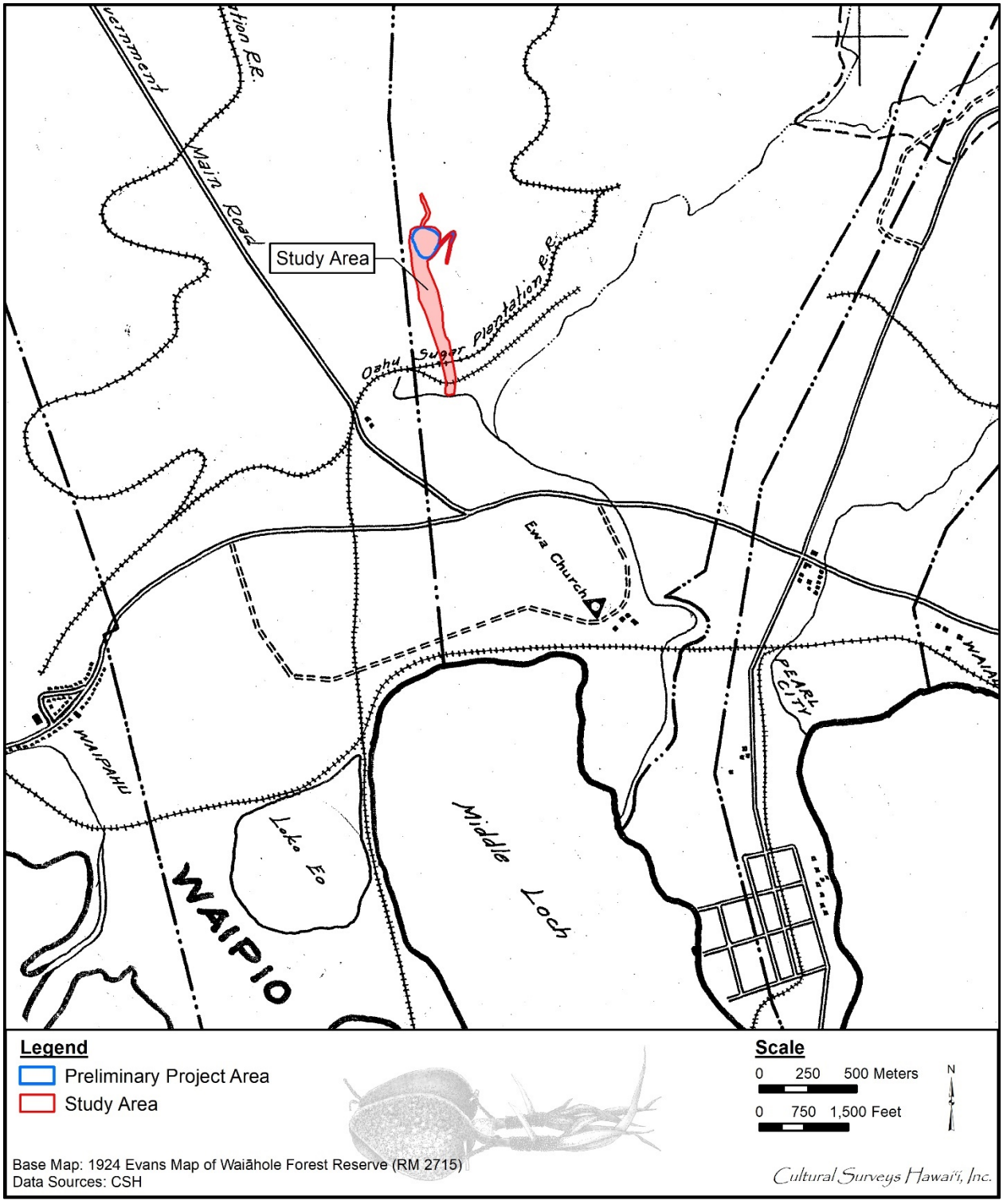

Figure 16. Portion of the 1924 Evans map of Waiahole Forest Reserve (RM 2715) showing the study area (the two railroad lines are believed to have actually been slightly further south than indicated in this sketch, at the southern tip of the present study area)

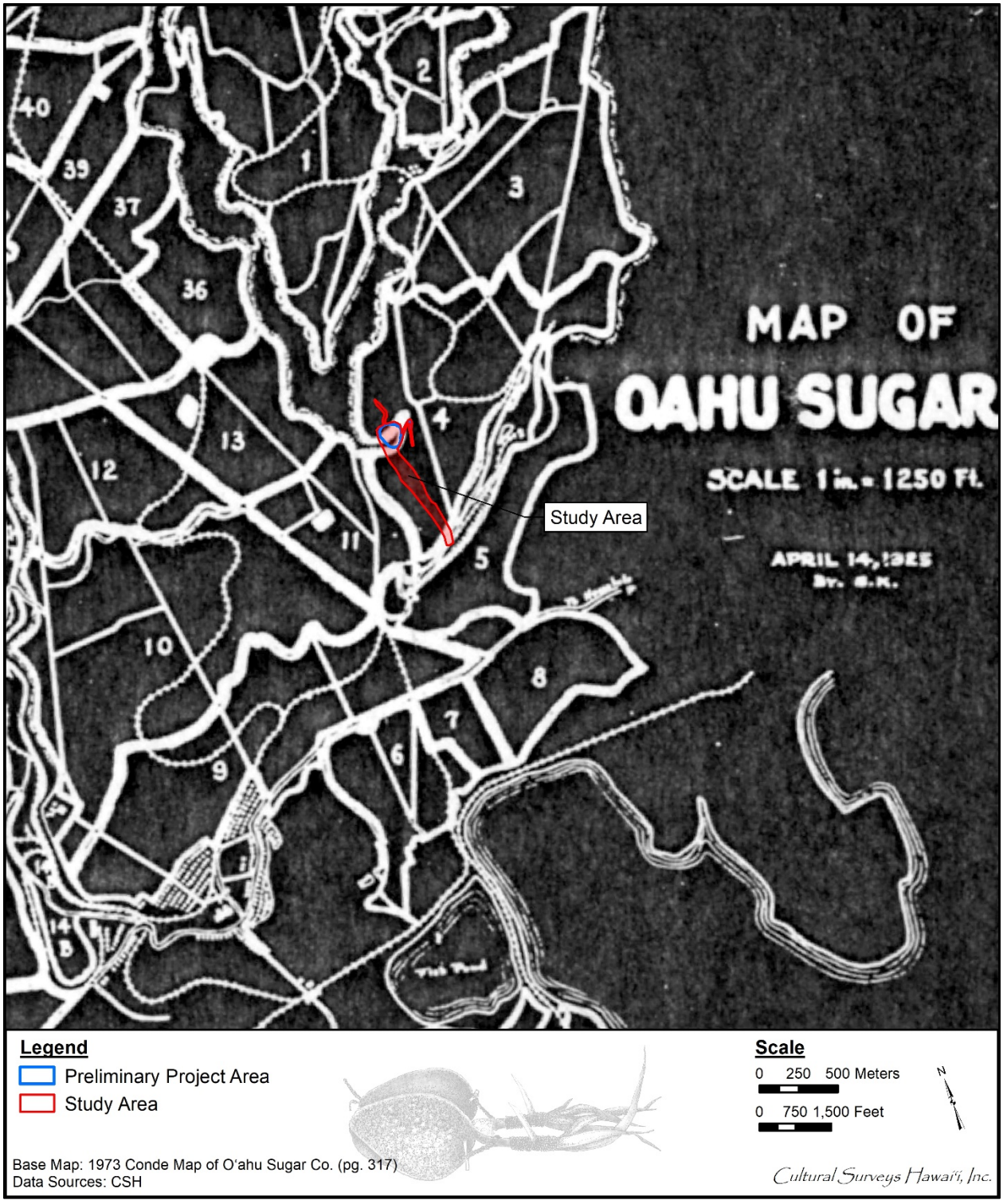

Figure 17. Portion of the 1925 Oahu Sugar Company map of numbered sugarcane fields in Honouliuli to Waiawa (reprinted in Condé and Best 1973:317) showing the study area

> the shrinkage in freight tonnage and passenger travel, it was definite that the road could not be operated as a common carrier. With no prospect of increased tonnage, and the impossibility of increasing rates against truck competition, your management has applied to the Interstate Commerce for authority to abandon its mainline. [Chiddix and Simpson 2004:257]

After the war, most of the 150 miles of OR&L track were pried up, locomotives were sold to businesses on the U.S. mainland, and railway cars were scrapped. In 1947, the U.S. Navy took over a section of the OR&L track to transport bombs, ammunition, and torpedoes from the ammunition magazines at Lualualei in the West Loch of Pearl Harbor and Waikele on OR&L's Wahiawā Branch to Pearl Harbor Naval Base (Treiber 2005:25–26). The track to Waipahu was abandoned in the 1950s, but the line from the magazines in Lualualei to the wharves in West Loch at Pearl Harbor remained open until 1968 (Chiddix and Simpson 2004).

At its height, the OR&L connected the lines of the Koolau Railway, the private lines of the sugar plantations in Waialua, Waianae, ‘Ewa, Kahuku, Waimānalo, and Honolulu, and the private city trolley lines of Desky and Honolulu Rapid Transit. As aforementioned, the OR&L lines also serviced the Honolulu Plantation Company in transporting goods and workers from the sugarcane fields. The Lualualei Naval Ammunition Storage Depot, the West Loch Munitions Loading Station, and the Nānākuli Navy Rest Camp were serviced by their own railroad equipment using OR&L track. The Wahiawā branch of the railroad connected the James Drummond Dole Pineapple plantation to Waipahu, which also linked the U.S. Army Base at Schofield Barracks with Pearl Harbor via the Waipahu Junction. The Pearl Harbor Navy Yard train and the Barber's Point Naval Air Station train were commuter specials timed to deliver workers to each shift (Chiddix and Simpson 2004).

4.5.2 Pineapple Cultivation

In the early decades of the twentieth century, lands in the *mauka* portion of the central and eastern sections of ‘Ewa were being acquired for pineapple cultivation. The Donn 1906 land use map (see Figure 14) shows extensive pineapple cultivation approximately 2.7 km northeast of the present study area.

There is a record of attempted pineapple irrigation utilizing water from shallow wells in Waiawa Gulch in 1893 and prior to 1913 most of the plateaus in Waiawa were planted in pineapple (Goodman and Nees 1991:59). In 1899, the Hawaiian Pineapple Company leased 1,000 acres in Waiawa for pineapple cultivation from the OR&L. In 1901, they obtained an additional 61 acres in Waiawa through public auction. The extent of the upland pineapple fields in Waiawa is shown in the 1906 land use map (see Figure 14). These fields were *mauka* of the present study area. Initially, most pineapple was shipped to California for packing. In an attempt to speed up processing, save money, and produce a fresher product, the Pearl City Fruit Company constructed a cannery in Waiawa in 1905, but it became a part of the Hawaiian Pineapple Company operations after it went bankrupt. The cannery was in operation from 1905 to 1935.

Pineapples were handpicked, graded, boxed, and loaded into trucks before the introduction of machinery into the harvesting process. The introduction of the mechanical field fruit harvester in 1947 eliminated the labor-intensive process of grading, boxing, and loading. The pineapple industry employed both male and female Japanese and Filipino workers in the fields and in the cannery. Camps were set up throughout Waiawa to be used as housing for the workers and their

families. There was also a small cemetery associated with the workers camp (Goodman and Ness 1991:165). Japanese and Filipino camps were established next to the cannery from roughly 1905 to 1935 (Goodman and Ness 1991:154–155). In the 1920s, pineapple was abandoned and by 1935, much of the present Kamehameha Schools parcels in Waiawa were planted in sugarcane. The cannery and its camp in Waiawa were connected by rail to the OR&L line along the coast. This Camp Complex is designated on the SIHP # 50-80-09-1470/171.

4.5.3 The Military Development of Pearl Harbor

In 1891, Russian explorer Otto von Kotzebue tried to observe Pearl River, but his group could not obtain a canoe. What he was told led him to speculate on the possible importance of Pearl Harbor in the future.

> In the mouth of this river are several islands; it is so deep, that the greatest ship of the line can lie at anchor a few fathoms from the shore; and so broad, that a hundred vessels can conveniently find room in it. The entrance into the Pearl Rivers is in the same situation as the harbor of Hana-rura; but the windings between the reefs are, however, said to render a passage more difficult. If this place were in the hands of the Europeans, they would certainly employ means to make this harbour the finest in the world. [Kotzebue 1821:338-348]

The early missionary Levi Chamberlain was able to take an outrigger canoe trip to Pearl River, and noted the difficulty of access for larger ships.

> Kawaa took passage in our canoe to go down the harbor to a place where oysters are abundant to give orders to his people to gather a mess. The sail down the harbor was delightful […] The passage down the creek for a number of miles was very pleasant till we got down near the reef and our course altered. We then could sail no longer as the wind was against us. The sail was lowered the mast taken down and secured across the outrigger and the rowers plied their paddles. [Journal of Levi Chamberlain 1822-1849, Hawaiian Mission Children’s Society Library, cited in Sterling and Summers 1978:51]

The first foreign attempt to survey Pearl Harbor was made in 1840 during the U.S. Exploring Expedition led by Charles Wilkes.

> In this district is a large inlet of the sea, into which the river Ewa empties; at the entrance of this inlet is the village of Laeloa (at Kalaeloa Pont): the shore is known by the name of Pearl River or harbour, from the circumstance that the pearl oyster is found here; and it is the only place in these islands where it occurs.
>
> The inlet has somewhat the appearance of a lagoon that has been partly filled up by alluvial deposits. At the request of the king, we made a survey of it: the depth of water at its mouth was found to be only fifteen feet; but after passing this coral bar, which is four hundred feet wide, the depth of water becomes ample for large ships, and the basin is sufficiently extensive to accommodate any number of vessels. If the water upon the bar should be deepened, which I doubt not can be effected, it would afford the best and most capacious harbour in the Pacific. [Wilkes 1845:79]

Although Wilkes was impressed by the harbor, he was not at this time thinking of how this survey could benefit the American government in the future. In fact, Wilkes (1845:79) concluded, “As yet there is no necessity for such an operation, for the port of Honolulu is sufficient for all the present wants of the islands, and the trade that frequents them.”

The low impression of Wilkes for the use of Pearl Harbor had changed in less than 30 years. The U.S. military had tried to make a coaling station on Midway Island in 1869 by blasting through the coral reef to make a harbor, but the plan failed. In 1873, General Schofield presented a confidential report to the U.S Secretary of War, recommending that Pearl Harbor should be available to the U.S. Navy. Schofield wrote,

> In case it should become the policy of the Government of the United States to obtain the possession of this harbor for naval purposes, jurisdiction over all the waters of Pearl River with the adjacent shores to the distance of 4 miles from any anchorage should be ceded to the United States by the Hawaiian Government. […]
>
> The cession of Pearl River could probably be obtained by the United States in consideration of the repeal of the duty of Sandwich Island sugar. Indeed, the sugar –planters are so anxious for a reciprocity treaty, or so anxious rather for free trade in sugar with the United States, that many of them openly proclaim themselves in favor of annexation of these islands of the United States. [Sen. Ex. Docs, 52nd Cong. 2nd Sess. No. 77:150–154, reproduced in Judd 1971:Appendix 3]

This reciprocity treaty was concluded in 1876 with the provision that Hawai‘i would not “lease or relinquish sovereignty to another country or any harbor, etc.” (Judd 1971:128). In 1887, the treaty was renewed and amended, and this allowed the United States the “exclusive right to enter the harbor of Pearl River, in the Island of Oahu, at to establish and to maintain there a coaling and repair station for the use of vessels of the United States” (Judd 1971:128).

The most dramatic change affecting both the use of Pearl Harbor and the growth of the sugar industry in Hawai‘i occurred 7 July 1898. Following years of diplomatic pressure from delegates to Washington, the Congress of the United States approved a joint resolution of annexation that established the Republic of Hawaii as a Territory of the United States. On 30 April 1900, President William McKinley signed the Organic Act for the Territory of Hawaii, which provided a government whose leaders were appointed by the United States and otherwise defined the political structure and powers of the newly established government (U.S. Department of the Interior 1900).

After annexation of the Islands to the United States in 1899, development began in order to make a Pacific base that could be used as a staging area for the Spanish-American war (Coletta 1985:433). In 1901, the U.S. Congress formally ratified the annexation of the Territory of Hawaii, and the first 1,356.01 acres of Pearl Harbor land were transferred to U.S. ownership. The U.S. Navy began a preliminary dredging program, which created a 30-ft deep entrance channel measuring 200 ft wide and 3,085 ft long. Additional dredging to deepen and widen the channel was conducted in 1908 and again in the 1920s. Money for the funding of the construction of dry docks and other support facilities was approved in 1908. In 1931, the Navy built an ammunition depot at West Loch on a 213-acre parcel that it had bought from the Campbell Estate. Construction of a new depot in Lualualei Valley and at West Loch Harbor began in 1931 (Downes 1953).

As American ground forces fought to stabilize the Philippine government between 1898 and 1904, military transport ships took on coal, oil, and livestock feed at Honolulu Harbor's military docks. Troops in transit to various military bases in the Pacific were also in need of temporary barracks while awaiting deployment. Concurrent with the military modernization of its Honolulu Harbor facilities, the first land purchases at Pearl Harbor were made in 1901, including the site of the Pearl Harbor Shipyard (Naval Historical Center Archives 1995). The U.S. Government began acquiring additional coastal lands of ‘Ewa for the development of its naval base at Pearl Harbor.

Between 1903 and 1911, civilian contractor Walter Dillingham dredged Pearl Harbor deep enough to receive the largest warships of the fleet. In 1914, the United States Marine Corps barracks were moved from Honolulu to the ‘Ewa end of Pearl Harbor in order to accommodate and maintain airship (dirigible) mooring masts. Throughout the 1920s, American trade with India, Australia, and the East Indies grew to over two thousand million dollars. Protection of the Pacific trade routes required the U.S. Navy to develop Pearl Harbor as an advanced forward base. By the 1930s, a gradual expansion of facilities at Pearl Harbor kept pace with increasing levels of instability in the Pacific region. The original purchase for the Pearl Harbor Naval Yard consisted of:

Original Owner		
Bishop Estate	693.47 acres	$ 52,737.50
John Ii Estate (Ford's Island)	25.83 acres	$ 3,000.00
J.J. Dowsett Estate (Leasehold)	48.88 acres	$ 2,400.00
Oahu Sugar Company (Leasehold)	25.83 acres	$ 1.00
Honolulu Plantation Company (Leasehold)	562.00 acres	$ 75,000.00
Other expenses		$ 500.00
Total	1,356.01 acres	$133,640.50

[Knox 1936]

When the U.S.S. *California* docked at the Pearl Harbor Navy Yard on 16 December 1911, Hawai‘i's last monarch, Queen Lili‘uokalani, and the Territory's first president, Sanford B. Dole, attended the event. They were both guests aboard the battleship as she sailed through the entrance channel and berthed at the new deep-draft docks. The event marked the beginning of increased facility construction within the Navy Yard (Naval Historical Center Archives 1995).

By 1913, the first dry dock had been under construction for two years at Pearl Harbor when the enormous structure designed to complete the Navy's ship repair yard exploded. The entire framework was blown out of its foundation by hydrostatic forces greater than Navy engineers predicted. After blessings to appease the angry shark goddess Ka‘ahupāhau, the dry dock was finally completed in 1919 (Beckwith 1940:163).

The development of the service and supply depot facilities continued. Three additional dry docks were designed, and the Navy Yard was diversified to accommodate separate submarine and aircraft squadrons. By the mid-1930s, over 42 million dollars had been spent in development and modernization. The pace of spending at Pearl Harbor increased with the disintegration of diplomatic relations between Japan and the United States. Japan's denial of access to the "Mandate Islands" in 1932, coupled with Japan's invasion of Nanking in 1937, caused the United States military to accelerate construction of defensive facilities in the Philippines, on islands such as

Wake, Howland, Jarvis, Midway, and Johnson, and throughout the Hawaiian Islands (Downes 1953).

Prior to the bombing of Pearl Harbor by the armed forces of Japan on 7 December 1941, there existed a high degree of coordination between civilian interests and the military. On 17 February 1941, the Oahu Sugar Company granted blanket permission to the Sixty-fourth Coast Artillery (Anti-Aircraft) to occupy positions from time to time on the property owned and controlled by the plantation. Similar authorizations had previously been given to the same artillery unit by the Honolulu Plantation Company in 1939. Troop maneuvers involving thousands of men using plantation roads and lands occurred throughout 1940 and 1941 (Spalding 1945).

Expenditures for new Pearl Harbor construction measured in the hundreds of millions of dollars at the end of 1941. With the Japanese surprise attack on Pearl Harbor, 7 December 1941, much of the new construction had been damaged, and in some cases, destroyed. A furious pace of reconstruction was instituted to double the war capacity of Pearl Harbor. Military planners approved a new ammunition depot in the mountainside of Waipahu, a huge new hospital in ‘Aiea, and thousands of additional changes to the Navy Yard to accommodate the new aircraft carrier task forces (Woodbury 1946:342–343).

By 1943, over 24,000 people were working at Pearl Harbor. Navy Housing Areas 1 and 2 and Civilian Housing Area 3 had grown large enough to be considered separate cities. Barracks and temporary housing for workers filled every available piece of land for miles between Pearl Harbor and the outskirts of Honolulu. A ring of huge barrage balloons was set up for the protection of the once-quiet waters of Wai-momi, which had since become one of the greatest Navy bases in the world (Downes 1953).

Before the war, the main Pearl Harbor Naval yard was sufficient for a staging and storage area for the Pacific fleet, but after the Japanese attack and the beginning of World War II, additional areas were needed for supply depots and warehouses. The government procured additional land after the beginning of World War II to expand the functionality of the military bases. The Navy took all of the coastline area in eastern ‘Ewa District from the coast inland of the OR&L railroad tracks (Ching 1996:24). Iroquois Point in Hālawa, Pearl City (Mānana) Peninsula, Waipi‘o Point, Waiawa Gulch, and small areas in Honolulu were taken over as supply depots and storage areas. By 1944, the Navy had claimed close to 2,400-acres of land in the Pearl Harbor and Pearl City areas within Mānana, Waiawa, and Hālawa for use as military staging areas in the war effort (Allen 1999:234).

Four main portions of Waiawa were used by the military—the Pearl City Peninsula *makai* of Kamehameha Highway, a diesel drum storage area at Ewa Junction, also *makai* of the highway, an aviation supply depot along Waiawa Stream *mauka* of the highway and adjacent to the eastern boundary of the study area, and a military reservation in upland Waiawa, approximately 0.75 km northeast of the study area, used for communications and training (Allen 1999).

On the Pearl City Peninsula in Mānana, three large warehouses were built for a storage area. Other sections of the peninsula, including the Waiawa portion, were used for supply depot warehouses and spare part distribution centers. One of these was the U.S. Navy Mānana Supply Center, now known as the U.S. Navy Mānana Storage Area. A 25-acre portion of the former Supply Center on the Waiawa side of Mānana Peninsula was set aside in 1972 as a portion of the Pearl Harbor National Wildlife Refuge. This refuge for endangered wetland water birds was set

up in the former area of Loko Kuhialoko and Loko Mo‘o. A non-contiguous section of the U.S. Navy Mānana Storage Area was *mauka* of Kamehameha Highway. It began as an aviation supply depot on the border between Waiawa and Mānana. The Navy built 50 wood-frame structures and spaced open-storage areas along the banks of Waiawa Stream for 2 miles (Allen 1999).

The Ewa Junction Fuel Drumming Facility was built on a 44-acre site in 1943 as a fuel drumming and transportation terminal at the site of the old OR&L railroad junction. Thus, it had railroad lines to the Pearl Harbor Shipyard and Hickam Air Field to the east, to Barbers Point Naval Air Station and other bases in Waianae to the west, and to Schofield Barracks and Wheeler Air Field Base to the north. The facilities consist of two 585,000-gallon fuel storage tanks, a fuel drumming building, and associated piping. The site has been inactive since the 1970s (Allen 1999).

The aviation supply depot of the Naval Reservation adjacent to Waiawa Gulch consisted of 50 wood-frame structures and open storage areas along the banks of the Waiawa Stream for two miles, connected by paved roads (U.S. Department Navy 1947:132).

Waiawa is one of many supply depots built by the Navy before and after entering World War II (one of only two on O‘ahu specifically designated for aviation supplies) (north of the study area) (Mason Architects, Inc. and Hawaii Army National Guard 2002:4). The reservation is 650.0 acres consisting of both gulch and plateau lands. From 1941 to 1945, the reservation was used as a training area for tanks and personnel and as an artillery impact area. The area was also used for the storage of munitions and supplies. The primary structure built by the military was a communications center, including a radio tower. This center consists of four buildings and a tunnel system. The communications center was subsequently used by the State of Hawai‘i as a minimum-security prison called the Waiawa Correctional Facility. The transfer of the 198-acre site to the State of Hawai‘i was completed in 1985 (Goodman and Ness 1991:158).

Following World War II, much of the lower lands of Waiawa and Mānana remained part of the Naval Reservation and were used mainly as housing for military families and also sites for military warehousing. To this day, much of the Pearl City peninsula remains in the custody of the U.S. Navy; however, in the late 1990s, much of the rest of the previous Pearl City regions were released to the state for public use (Allen 1999).

A supply depot for fuel drums was also set up along the coast called the Waiau Drum Storage. This site is actually in Waimalu Ahupua‘a. It was built on land the U.S. Navy purchased from the OR&L in 1942, and it was used to clean and store empty fuel drums. Between 1943 and 1963, waste oils were destroyed at the site (Dega and O’Rourke 2003:15). In 1963, the U.S. Navy gave the land to the City and County of Honolulu, which created the Neal Blaisdell Park on the property.

4.5.4 Twentieth Century Developments as Reflected in Maps and Aerial Photographs

A series of historic maps and aerial photographs (see Figure 14 through Figure 25) visually demonstrate the development of Waiawa and the ‘Ewa District in the twentieth century.

The 1881 and 1906 maps of O‘ahu (see Figure 10 and Figure 14) show little development of Waiawa except for agricultural purposes. The only settlement in the vicinity is that around Ewa Church, *makai* of the main road (later Farrington Highway) and the study area. A 1919 U.S. War Department map (see Figure 15) shows the early twentieth century changes in the area. Although the Ewa Church moved to Mānana in 1906, the site of the old church, labeled on the map, was still a notable feature. The OR&L railroad line parallels the coast with a major station in Waiawa at the

Ewa Junction. The Ewa Junction became a focal point for rail activity on the OR&L line. According to Thrum (1900, not paginated), tourist travel on the railroad afforded “good views of Pearl Harbor,” and trips could be arranged three times a day to the Ewa Plantation and back. The junction eventually allowed trains to travel east to Honolulu, west toward Wai‘anae, and north to Wahiawā, Wheeler Field, and Schofield Barracks. Railroads from the OR&L and the Honolulu Plantation Company snake upward into the extensive inland sugarcane fields. Unimproved roads lead from the rails upward through sugarcane fields to the site of the pineapple cannery at an elevation of 600 ft AMS, *mauka* of the study area. This cannery operated between 1905 and 1935. The 1919 map shows an unimproved north-south trending road just east of the study area but no other plantation infrastructure in the vicinity.

The 1927/1928 map (Figure 18) depicts several new reservoirs, both *mauka* and *makai* of the study area, with the nearest being a large reservoir established by 1927/1928 just east of the study area at 240-ft elevation. The pineapple cannery called out on the 1919 map is not labeled.

The 1935 U.S. Army War Department map (Figure 19) depicts more clearly the reservoir at 240-ft elevation just east of the study area, and just east of the unimproved north/south trending road. No other infrastructure development in the immediate vicinity is indicated.

A 1943 U.S. Army War Department map (Figure 20) shows the same pattern of railroad infrastructure in the Waiawa uplands as shown on the 1919 map (see Figure 15). The area around the old Ewa Church (still labeled on the map) is not densely inhabited, while Pearl City to the east continues to grow in size and density. The fishponds along the shore appear to be filled. The military filled in many of the ponds along Pearl Harbor when it took over the coastal land in ‘Ewa at the beginning of World War II. The *mauka* old pineapple cannery is deserted with no structures shown standing. A new military complex is depicted on the map by clusters of large rectangular warehouse buildings near Waiawa Stream east of the study area. This military reservation was rapidly built after the 1941 Japanese attack on Pearl Harbor. The railroad system within the Oahu Sugar Company fields is depicted for the last time.

A 1952 USGS aerial photograph (Figure 21) clearly shows sugarcane cultivation in the study area and extensive pineapple cultivation just to the north and east. It appears the gulch on the south side of the reservoir area was not in cane production at that time.

A 1954 Army Mapping Service map (Figure 22) depicts the railroad alignments as having been converted to roads. The north/south trending plantation road east of the study area is indicated as having been improved. A new unimproved road is indicated north of the study area at Pu‘u Pōhaku. Naval reservations have been expanded along Waiawa Stream southeast of the study area. The immediate vicinity of the study area still lacks any infrastructure or indicated improvements.

A 1978 aerial photograph (Figure 23) shows the lack of residential and commercial development at Waiawa. The early campus of the Leeward Community College can be seen *makai* of the H-1 highway.

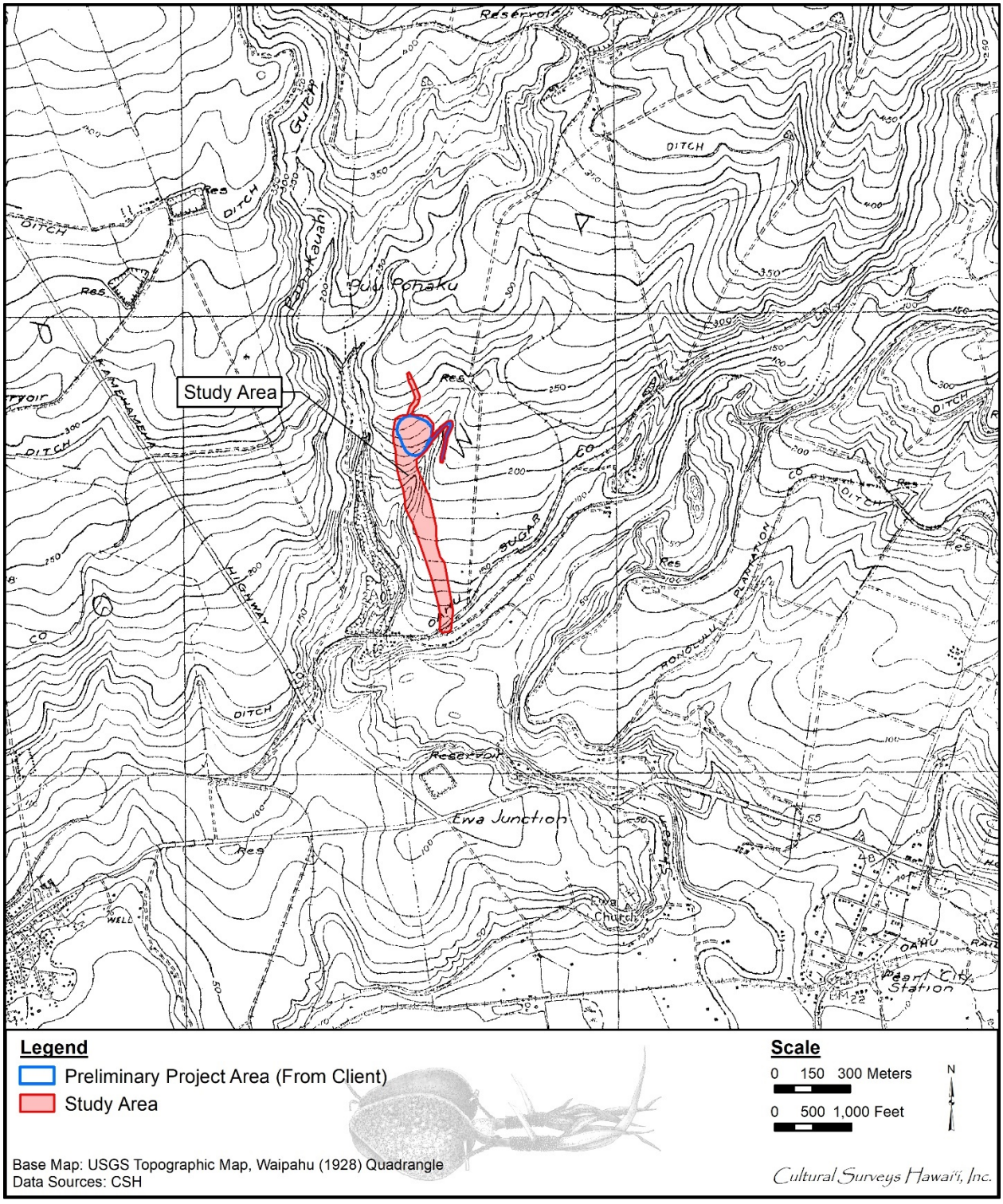

Figure 18. Portion of the 1928 USGS topographic map, Waipahu Quadrangle, showing the study area

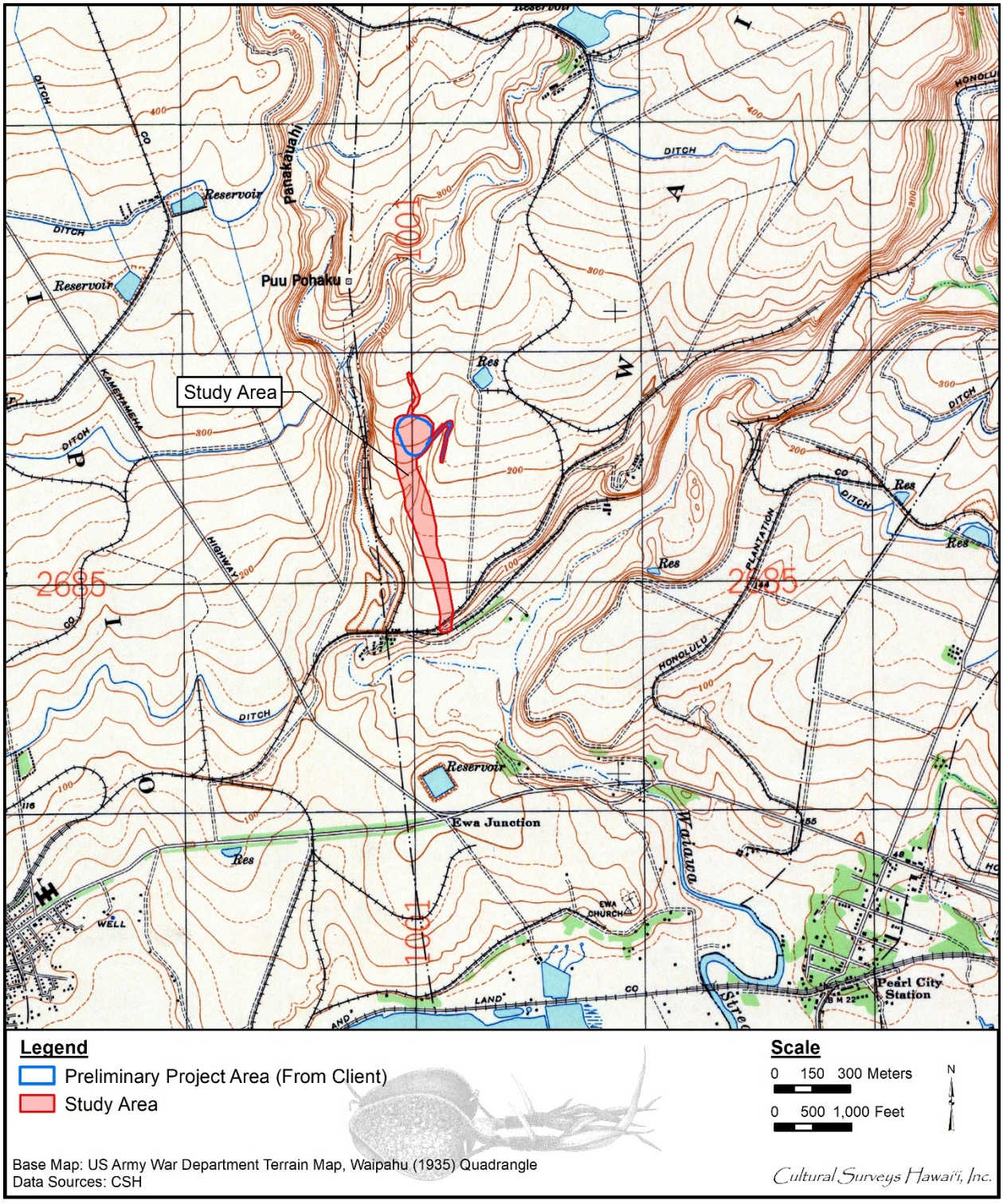

Figure 19. Portion of the 1935 U.S. Army War Department terrain map, Waipahu Quadrangle, showing the study area

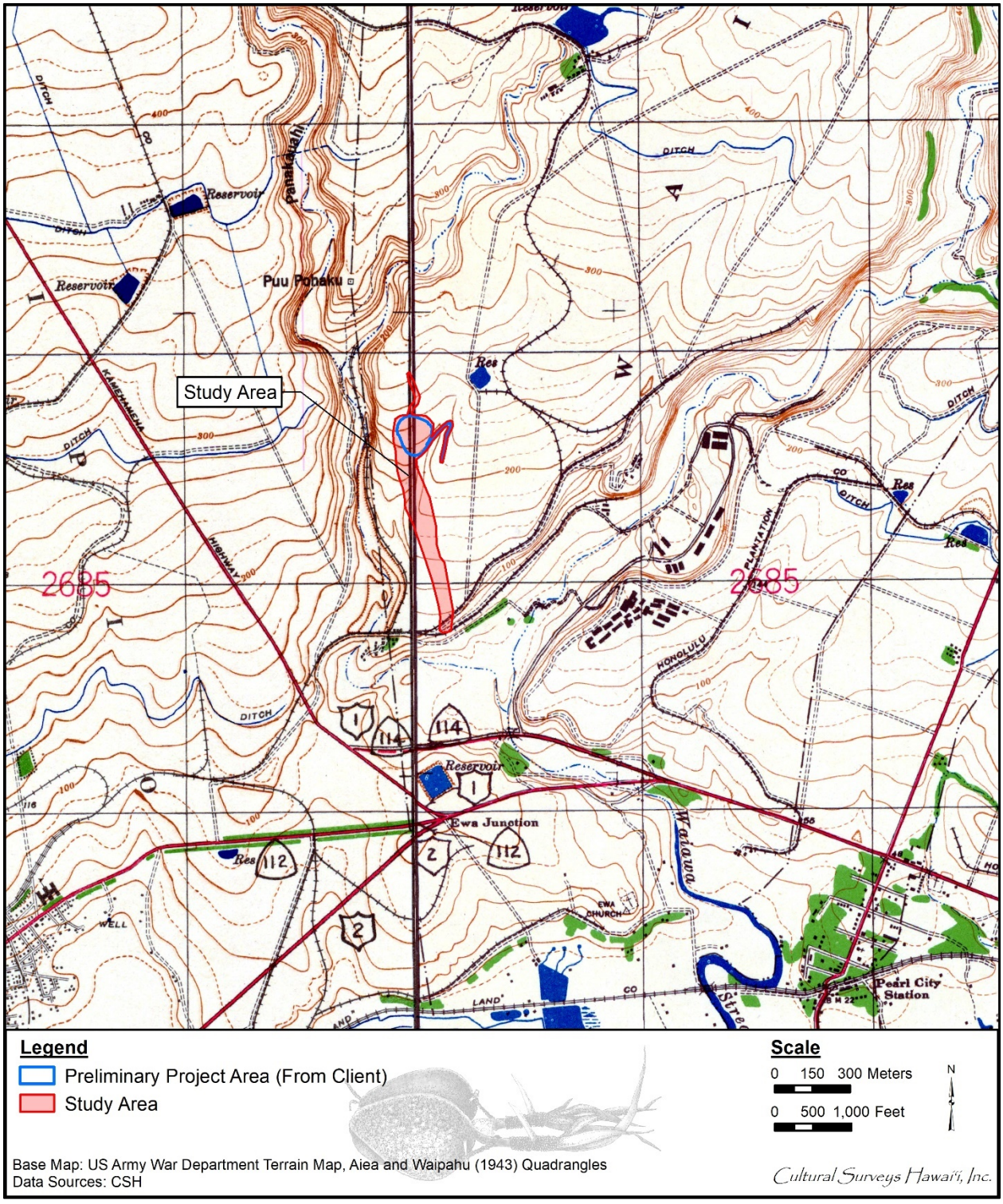

Figure 20. Portion of the 1943 U.S. Army War Department terrain map, Aiea and Waipahu quadrangles, showing the study area

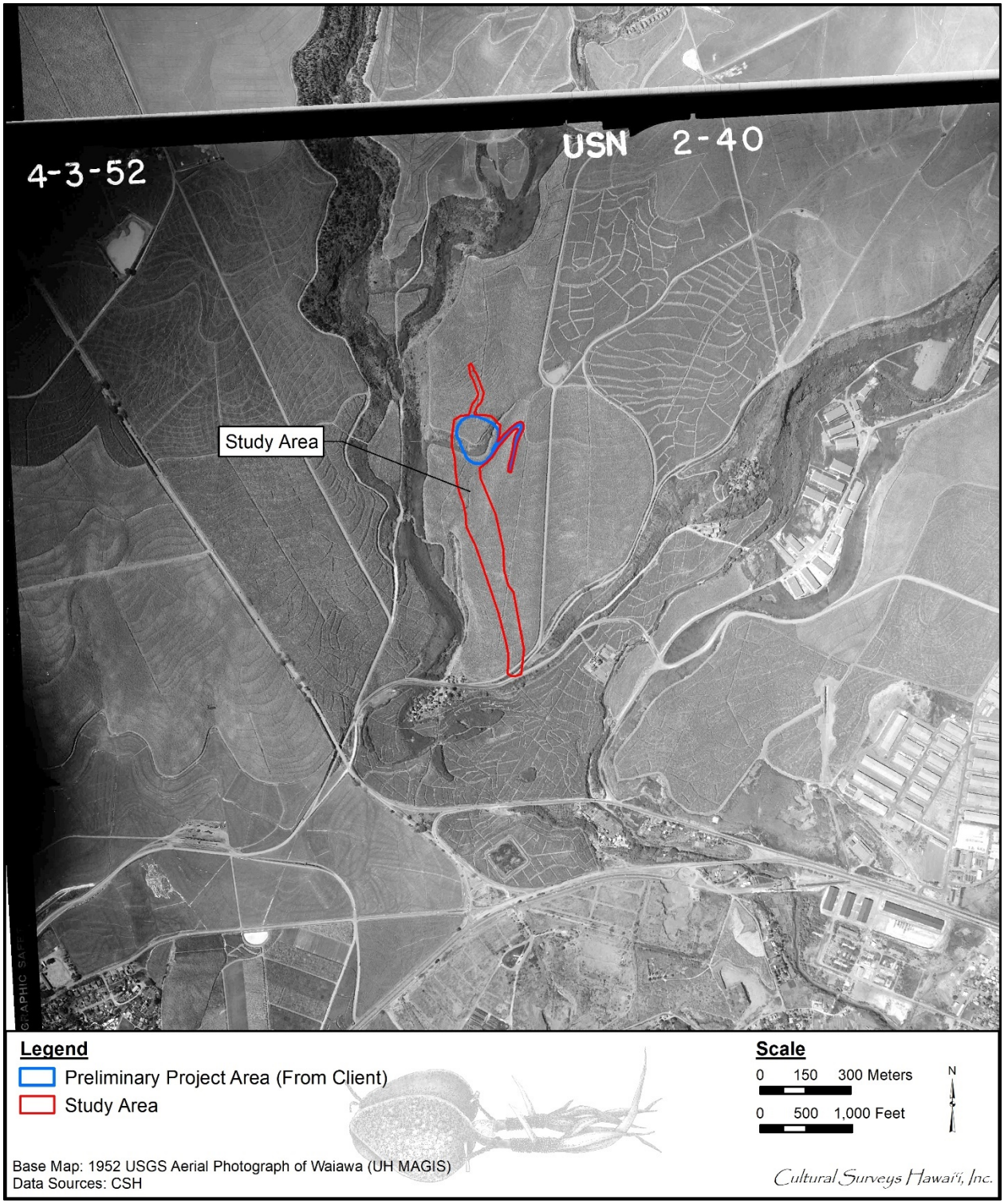

Figure 21. 1952 USGS aerial photograph of Waiawa (UH MAGIS) showing the study area

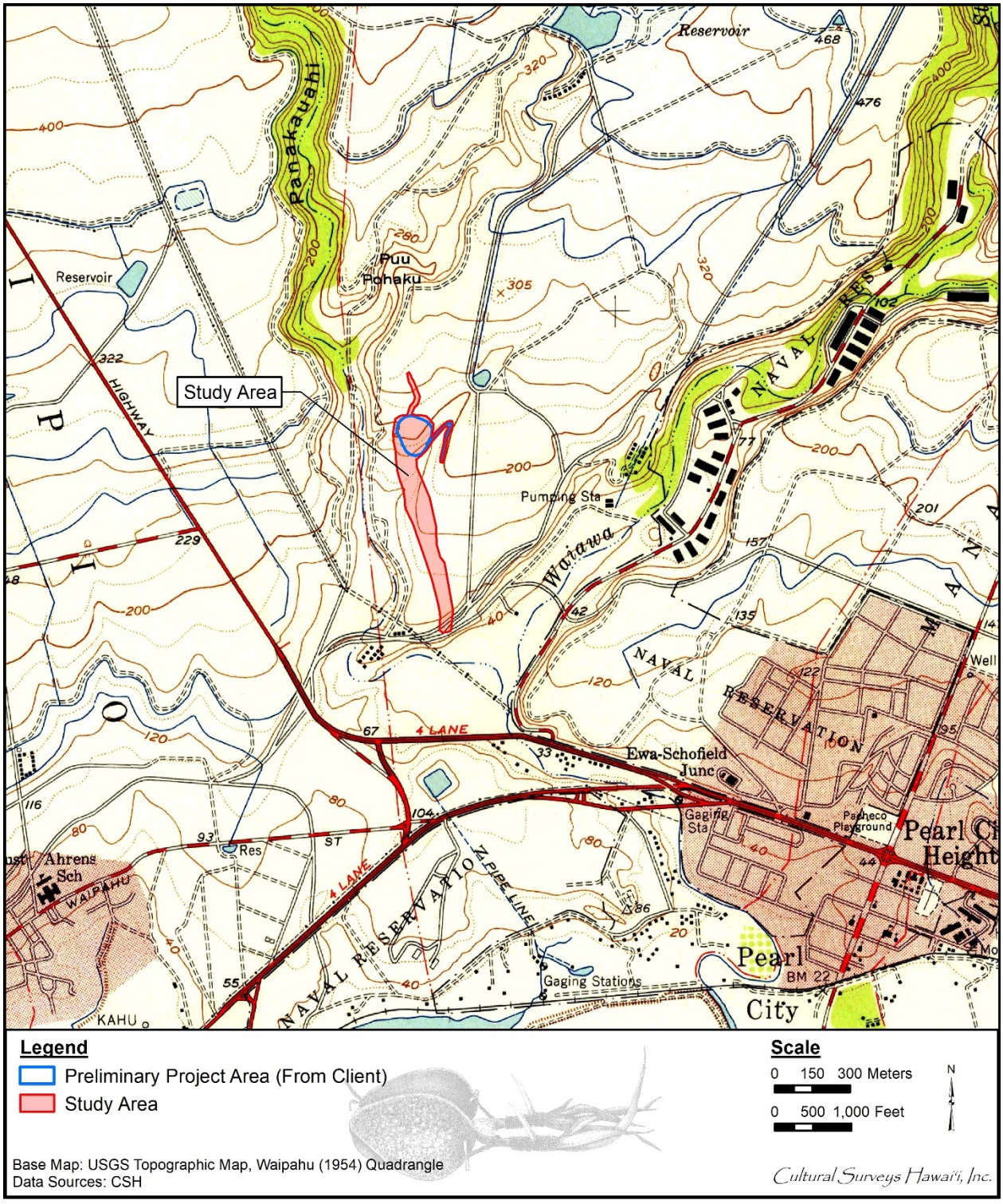

Figure 22. Portion of the 1954 Waipahu USGS topographic quadrangle, showing the study area

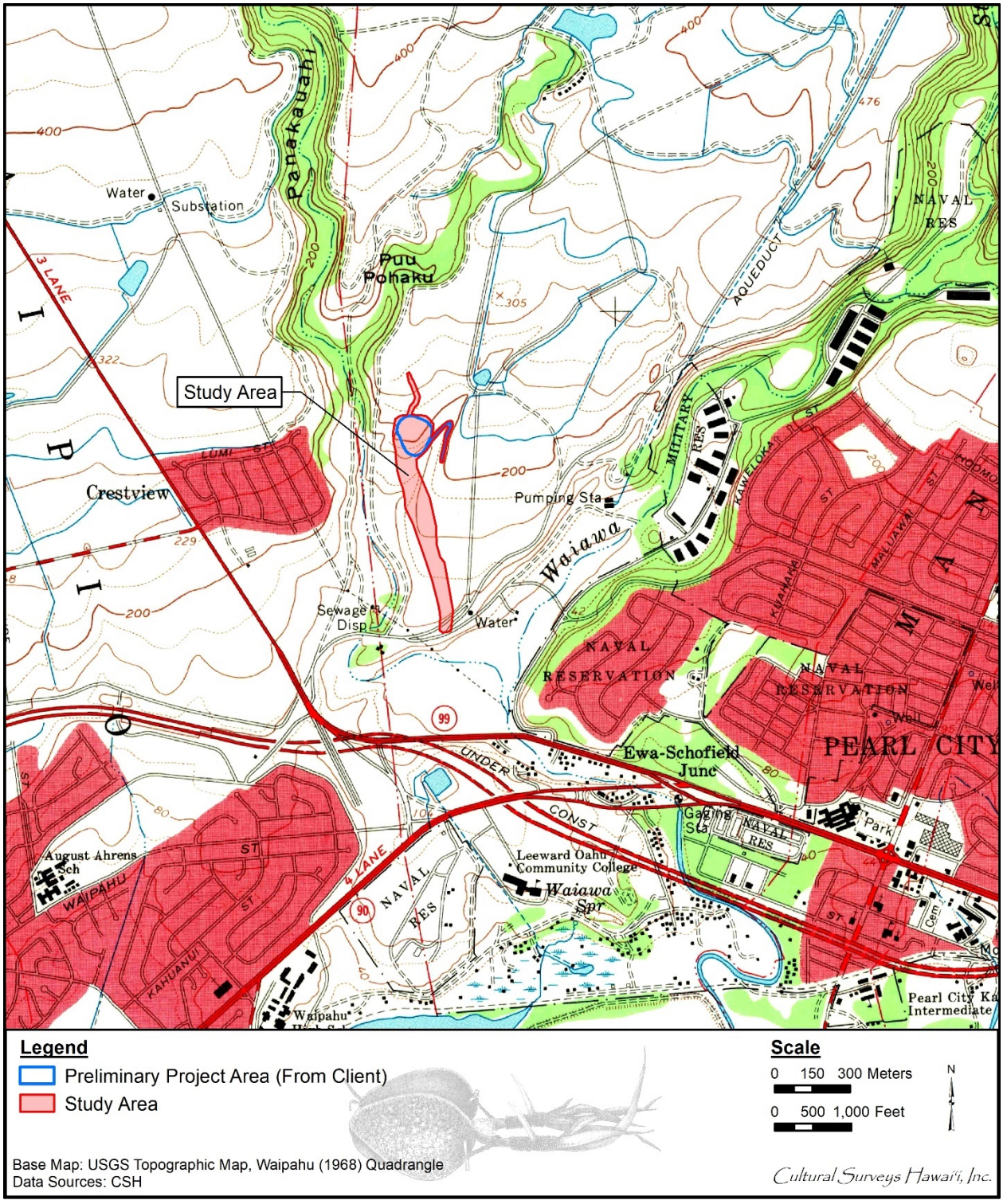

Figure 23. Portion of the 1968 Waipahu USGS topographic quadrangle, showing the study area

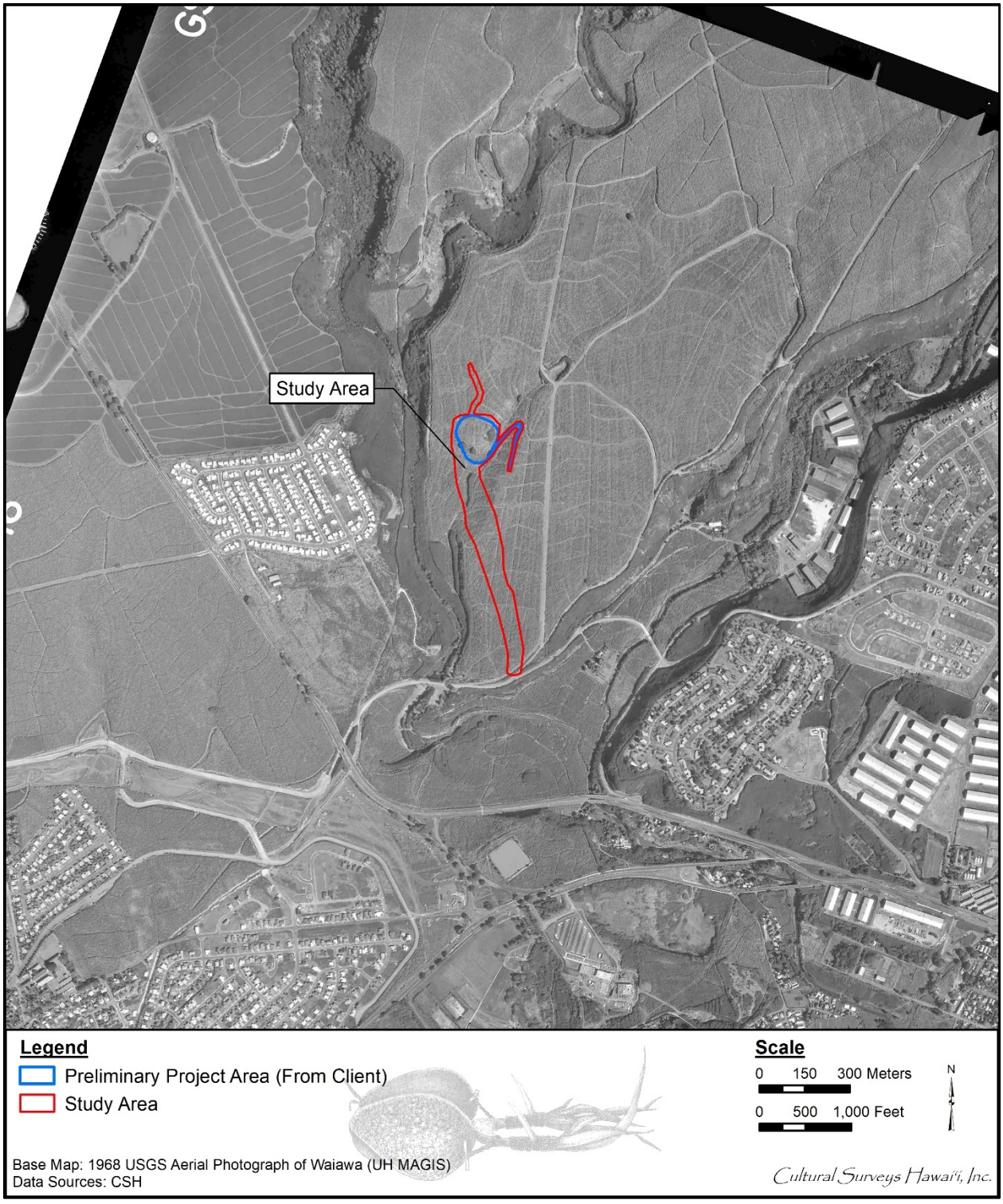

Figure 24. 1968 USGS aerial photograph of Waiawa (UH MAGIS) showing the study area

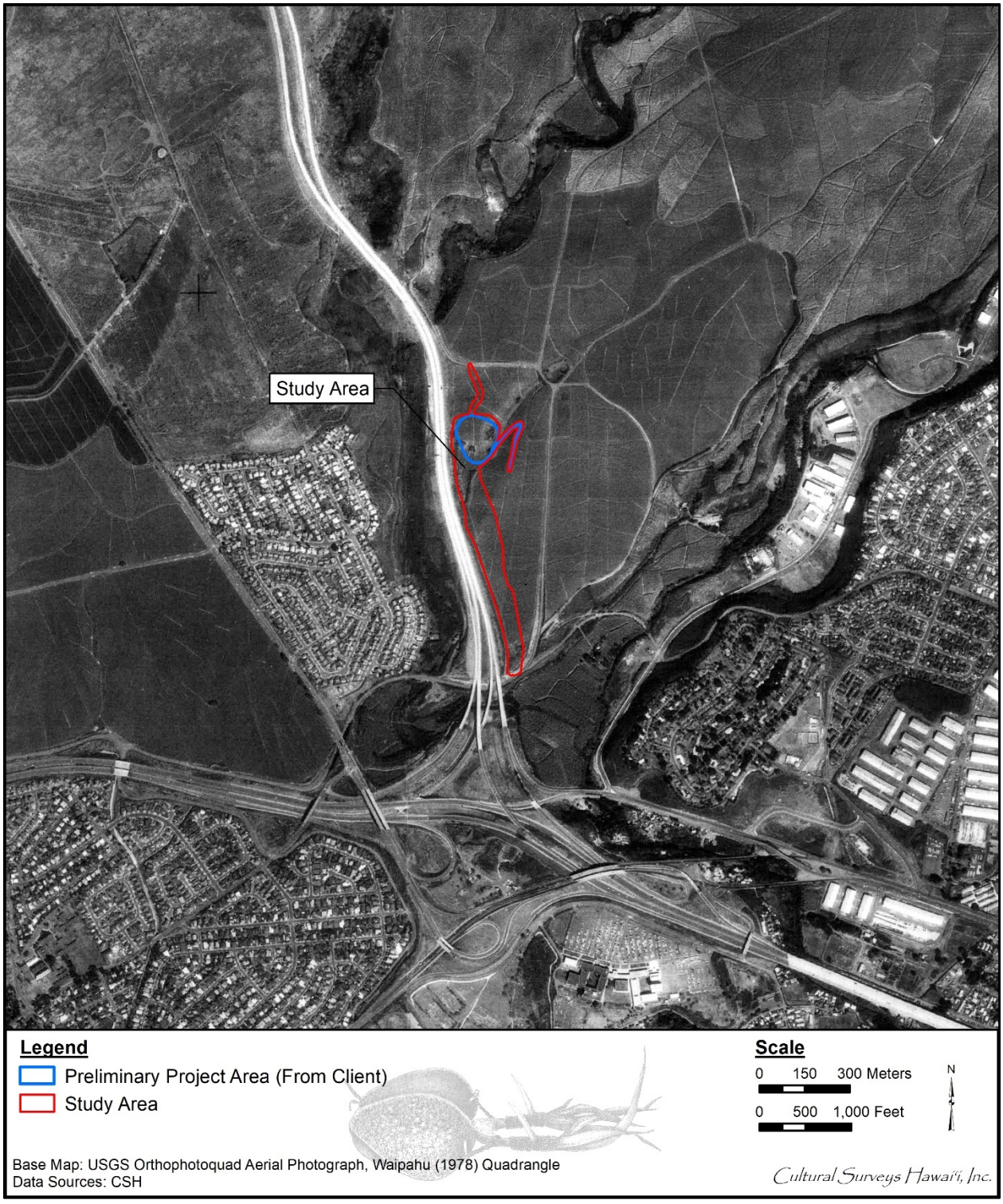

Figure 25. 1978 USGS orthophotoquad aerial photograph, Waipahu quadrangle, showing the study area

Section 5 Previous Archaeological Research

This section presents an overview of previous archaeological research in and near the current study area. Previous archaeological studies in the vicinity of the study area are depicted in Figure 26 and are summarized in Table 2. Previously identified historic properties in the vicinity of the study area are depicted in Figure 27 and are summarized in Table 4. Section 5.1 summarizes research in the *ahupua‘a* of Waiawa, in general. Section 5.2 summarizes research in the current study area, specifically.

5.1 General Findings in Waiawa – Outside the Current Study Area

Overall, the *makai* lands surrounding Pearl Harbor and extending into the gulches of the *mauka* lands were continuously used in pre- and early post-Contact times for ceremonies (*heiau*), aquaculture (*loko i‘a*), and agriculture (terraces and ponded fields). Post-Contact sugar and pineapple cultivation, dredging and land reclamation, and military use of the land significantly impacted pre- and early post-Contact historic properties as may have been present previously.

In his 1931 surface survey of the island of O‘ahu, Bernice Pauahi Bishop Museum archaeologist J. Gilbert McAllister (1933) recorded the specific locations of important archaeological and cultural sites, and the general locations of some sites of lesser importance. A single site (SIHP # 50-80-09-121) was recorded in the inland portion of Waiawa Ahupua‘a. According to McAllister’s data, this site was once located *mauka* of the current study area. The following description was provided for Site 121:

> Site 121 Puoiki heiau, at the juncture of Manana and Waiawa gulches. The heiau crowned the top of a small oval knoll that is about 50 feet high by 100 feet wide and 200 feet long. The sides of the knoll are perpendicular except for a steep and narrow neck on the mountainside. During the ceremonies, the people are said to have been at the foot of the knoll and surrounding the heiau. There are no remains. [McAllister 1933:105]

There was a second *heiau* in Waiawa Ahupua‘a, near the “maika playing field of Haupu‘u” (Waialeale 1834:23). It was demolished in 1834 and the Protestant Ewa Church was built directly over the *heiau*. Thrum and McAllister do not mention this *heiau*, probably because it was long gone by the early twentieth century. McAllister recorded three fishponds adjacent to Pearl Harbor in Waiawa Ahupua‘a—Loko Apala (SIHP # -118), Loko Kuhialoko (SIHP # -119), and Loko Mo‘o (SIHP # -120). All three of these ponds are shown on the S. Bishop map (1887) (see Figure 11) but they were coastal far from the present study area.

In the 1970s, the Bishop Museum conducted a reconnaissance survey of all lands owned or controlled by the Army (Rosendahl 1977). This survey included 6.18 acres of the total 13 acres comprising the Waiawa Gulch National Guard Storage Area, as well as 4.94 acres within the total 9-acre Waiawa Military Reservation. The archaeologists did not inventory any sites in Waiawa, though they did note these areas were “probably used for food crop cultivation” and that an old trail was known to exist though the area (Rosendahl 1977:1-54 and 1-55).

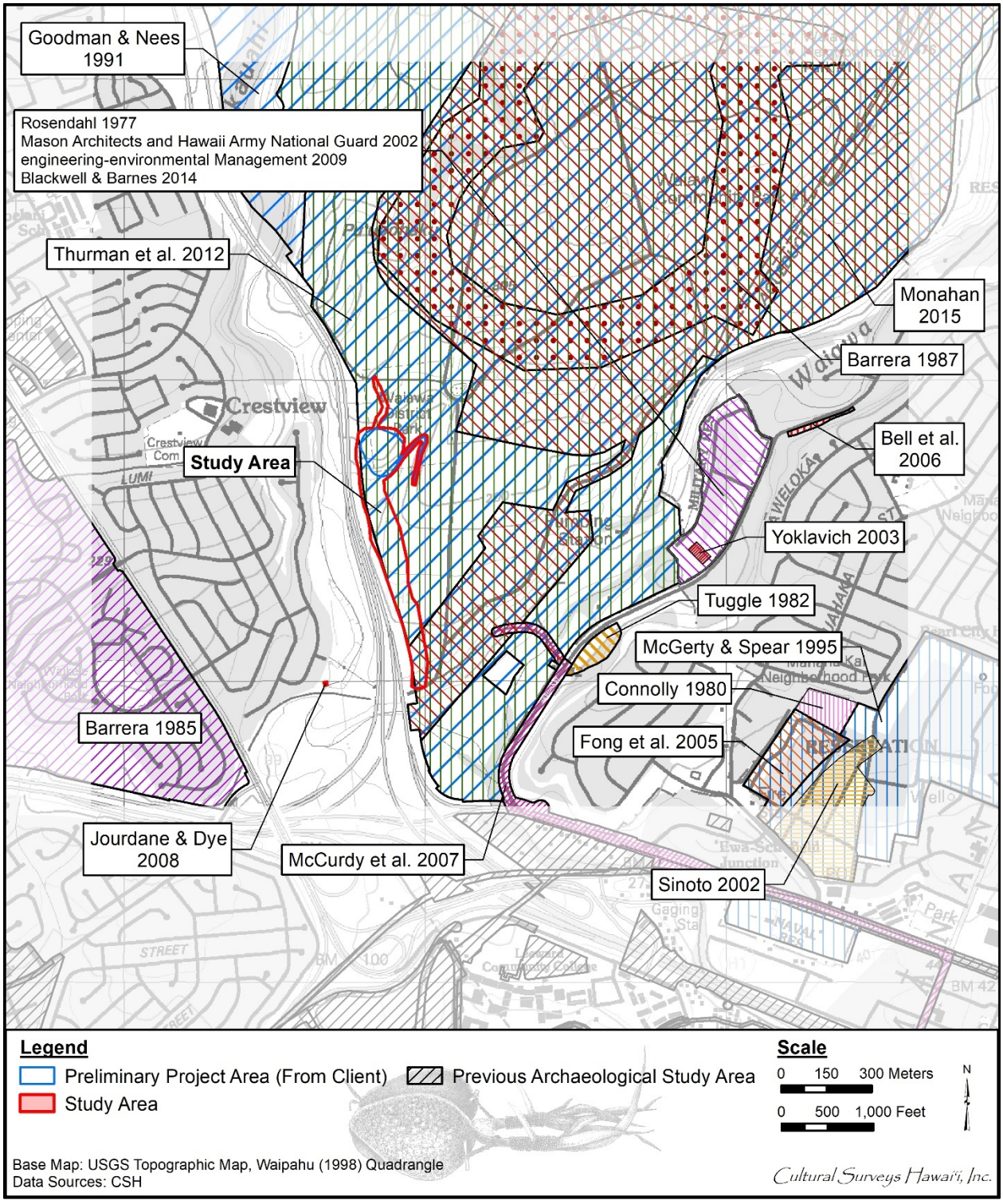

Figure 26. Previous cultural resource management studies in the vicinity of the study area (base map: portion of the 1998 Waipahu USGS topographic quadrangle)

Table 2. Previous cultural resource management studies in the vicinity of the study area (all SIHP #s are prefixed “50-80-09” unless otherwise noted)

Source	Type of Investigation	General Location	Findings (SIHP # 50-80-09, unless otherwise noted)
McAllister 1933	Reconnaissance survey	Island-wide	Four historic properties described, including Puoiki Heiau (SIHP # -121), Loko Apala (SIHP # -118), Loko Kuhialoko (SIHP # -199) and Loko Mo‘o (SIHP # -120)
Rosendahl 1977	Archaeological reconnaissance survey	Included Waiawa Gulch National Guard Storage Area and Waiawa Military Reservation	No historic properties found in Waiawa study areas
Connolly 1980	Archaeological reconnaissance survey	Manana Kai Neighborhood Park, TMK: [1] 9-7-024:040	No historic properties identified
Tuggle 1982	Archaeological inventory survey	Waihona St, Waiawa	Possible agricultural canal documented
Barrera 1985	Archaeological reconnaissance	Kilohana, Waipi‘o, (Waiola Estates Subdivision)	Two-page memo addresses 270 acres in pineapple cultivation at the time; no historic properties reported
Barrera 1987	Archaeological survey	Waiawa Ridge	Four sites recorded, including a boulder alignment (SIHP # -1469), a dump site (SIHP # -1470), a pineapple cannery (SIHP # -1471), and a former camp area (SIHP # -1472)
Goodman and Nees 1991	Archaeological inventory and reconnaissance survey(s)	3,600 acres bounded by H-1, H-2, and Waiawa Stream, Waiawa (includes entirety of current study area)	17 historic properties, historic and pre-contact; found previously recorded sites (SIHP #s -1469 through -1472); new sites designated (SIHP #s -2261 through -2273)
McGerty and Spear 1995	Field inspection literature review	“Manana and Pearl City Junction Sites” Manana and Waiawa Ahupua‘a, TMKs: [1] 9-7-024: Por. 006, 9-7-023:001; 138.5 acres	No historic properties identified

Source	Type of Investigation	General Location	Findings (SIHP # 50-80-09, unless otherwise noted)
Mason Architects, Inc. and Hawaii Army National Guard 2002	Assessment of buildings	Waiawa Unit Training Equipment Site	Discusses six buildings (Buildings 13, 22, 25, 27, 28, and 65)
Sinoto 2002	Field inspection literature review	Proposed Wal-Mart Development Pearl City, Manana	No historic properties identified; monitoring of construction related excavations that exceed 1m (3 ft) recommended
Yoklavich 2003	Written historical descriptive data and photographs	Hawaii Army National Guard, Waiawa Unit Training Equipment Site 96-1176 Waihona St, TMK: [1] 9-6-004:015	Documents WWII Building 22 at former Navy Aviation Supply Depot
Fong et al. 2005	Archaeological literature review and field inspection	Manana Parcel B (approx. 13 acres), TMK: [1] 9-7-024:057	No historic properties identified
Bell et al. 2006	Archaeological field check and literature review	Rockfall remediation project Waihona St, TMKs: [1] 9-6-007: por. 012 and 013	Observed one historic property (designated “CSH 1”), a small terrace structure likely of post-Contact construction but unknown function
McCurdy et al. 2007	Archaeological literature review and field inspection	Waiawa Off-Site Sewer Line Alignment No. 2, Waiawa and Manana Ahupua‘a, TMKs: [1] 9-6-003, 004; 9-7-016, 020–024	Portions of two historic properties identified, a plantation-era railroad berm and associated retaining wall (SIHP # -2270) and irrigation ditch (SIHP # -2273) are features of previously identified site complexes (Goodman and Nees 1991); southern portion of their project corridor also parallels OR&L Right-of-Way (SIHP # 50-80-12-9714)
Jourdane and Dye 2008	Historic properties assessment	Proposed T-Mobile Cell Site at 94-977 Lumipolu St, TMK: [1] 9-4-056:109 por.	No historic properties identified (no field inspection conducted)

Source	Type of Investigation	General Location	Findings (SIHP # 50-80-09, unless otherwise noted)
engineering-environmental Management, Inc. 2009	Historic building survey and evaluation report	Waiawa Gulch Hawaii Army National Guard facility	Presents survey results for WWII-era buildings: Buildings 13, 25, and 65
Thurman et al. 2012	Archaeological reconnaissance survey	1,680 scres of KS Lands in Waiawa, TMKs: [1] 9-4-006:034, 036, 037; 9-6-004:024 and 025	Three new sites documented: CSH 1, a traditional Hawaiian petroglyph site consisting of three images; CSH 2, a possible rock shelter recommended for subsurface testing; and CSH 3, a traditional Hawaiian lithic quarry; ten previously documented historic properties in and adjacent to their project area revisited, including SIHP #s -1470, -1471, -1472, -2262, -2263, -2264, -2270, -2271, -2272 and -2273
Blackwell and Barnes 2014	Historic building survey and evaluation	Waiawa Gulch Unit Training Equipment Site (UTES) and Regional Training Site Maintenance (RTSM)	Building 22A (UTES FMS) surveyed and photographed
Monahan 2015	Archaeological inventory survey	1,395 acres of Kamehameha Schools' lands in Waiawa and Waipi‘o Ahupua‘a, TMKs: [1 9-4-006:034 por., 035 por., 036, 037 por.; 9-6-004:024 por., 025, 026; 9-6-005:001 por.	Documented three historic properties, all plantation-era sites dating from early to middle 20th century, consisting of 55 component features: 1) SIHP # -2270, a network of roads and railroad rights-of-way consisting of 28 features; 2) SIHP # -2273, an irrigation system consisting of 25 features; and 3) SIHP # -2271, remains of workers' camps consisting of two features
Shideler 2020	Archaeological reconnaissance for geotechnical testing	Present study area	Notes presence of temporary ditch segments

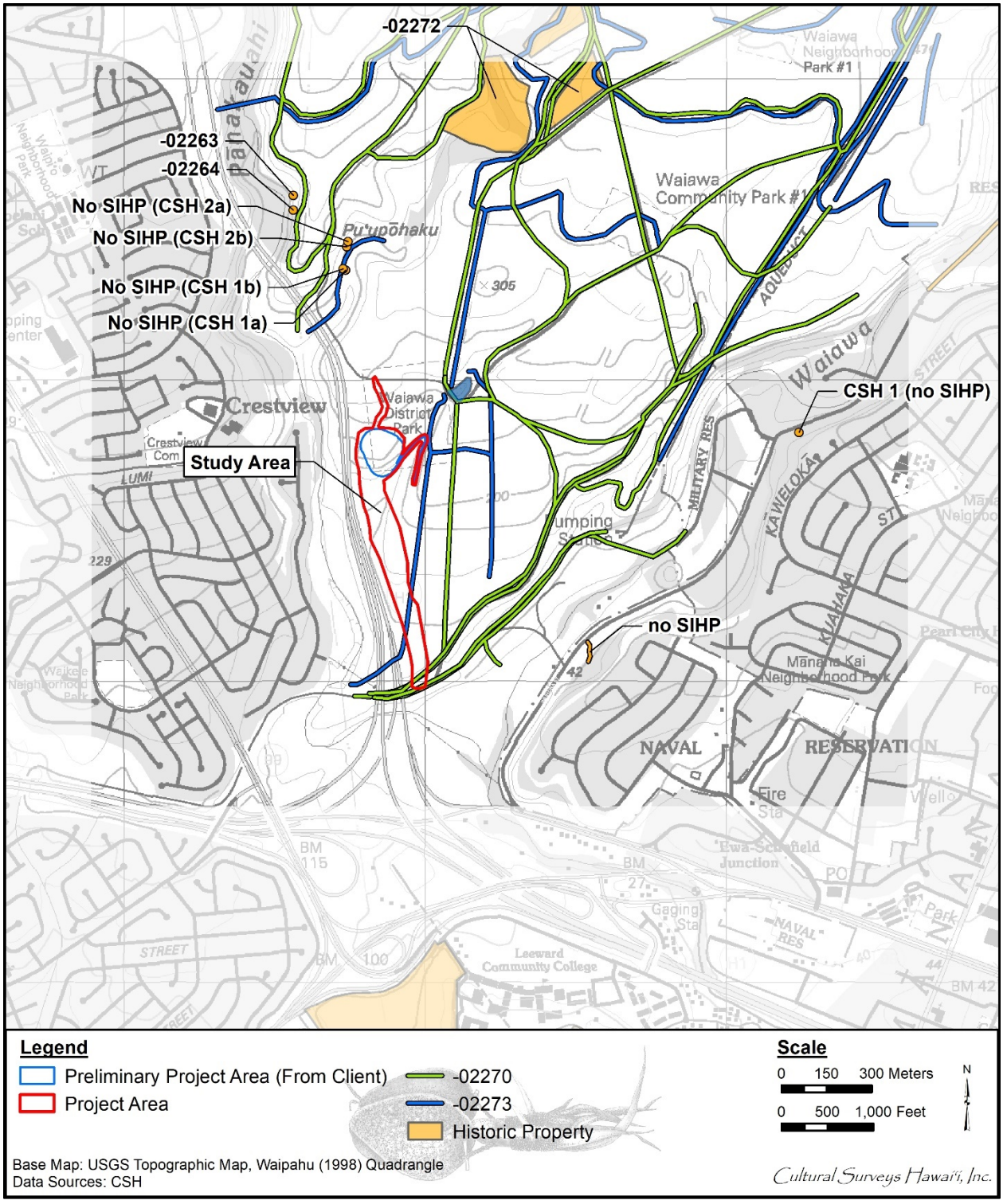

Figure 27. Previously identified historic properties in the vicinity of the study area (base map: portion of 1998 Waipahu USGS topographic quadrangle)

Table 3. Previously identified historic properties in the vicinity of the study area

SIHP #	Nature of Site	Comments	Source
2263	Rock shelters with associated petroglyphs	A complex of rock shelters with associated petroglyphs and terracing	Goodman and Nees 1991, Thurman et al. 2012
2264	Trail	Runs along base of Gulch D, oriented north/south; trail crosses over a dry stream bed in base of Gulch D	Goodman and Nees 1991, Thurman et al. 2012
2270	Roads and railroad rights-of-way	Goodman and Nees (1991) identified 44 features; Monahan (2015) identified 28 features in his project area	Goodman and Nees 1991, Thurman et al. 2012, Monahan 2015
2272	Military utilization areas	Military structures built from 1941 to 1983; primary structure is a communications center currently used by State of Hawai‘i as a minimum security prison	Thurman et al. 2012
2273	Irrigation infrastructure	Goodman and Nees (1991) identified 35 features; Monahan (2015) identified 25 features in his project area	Goodman and Nees 1991, Thurman et al. 2012, Monahan 2015
CSH 1a (No SIHP #)	Petroglyphs	The southernmost petroglyph consists of a pair of human images.	Thurman et al. 2012
CSH 1b (No SIHP #)	Petroglyph	One human image	Thurman et al. 2012
CSH 2a (No SIHP #)	Possible rock shelter	A 1-m deep 3-m tall overhang appears to be filled with eroded soil deposits from the western upslope side of the gulch. Basalt stones surrounding the overhang may be manuports or may have been deposited through erosion.	Thurman et al. 2012
CSH 2b (No SIHP #)	Concentrated scratching or etching on rock outcrop	Possibly related to tool sharpening	Thurman et al. 2012
CSH 1 (east) (No SIHP #)	Terrace	A small terrace structure likely constructed historically, but of unknown function	Bell et al. 2006
No SIHP # (Southeast)	Ditch	Possible agricultural canal	Tuggle 1982

Tuggle (1982) conducted an archaeological survey of a 3.18-acre parcel east of Waihona Street at the Mānana Marine Housing in Waiawa Ahupua‘a, east of the present study area (see Figure 26). The remains of a possible agricultural canal associated with two natural terraces were discovered. Tuggle reports the canal water source was probably a spring, although another possibility was the nearby Waiawa Stream.

Barrera (1987) conducted a reconnaissance survey along a proposed golf course on Waiawa Ridge northeast of the present study area (see Figure 26). Four historic sites were identified, including parallel boulder alignments (SIHP # -1469), a historic dump site by a pineapple cannery (SIHP # -1470), the remains of the cannery itself (SIHP # -1471), and a former camp area associated with the Oahu Sugar Company (SIHP # -1472).

In 1991, Applied Research Group of the Bishop Museum conducted reconnaissance and inventory surveys of a 3,600-acre parcel within Waiawa bounded by the H-2 Freeway (Goodman and Nees 1991). Their study area included the entire current study area (see Figure 26). In all, they recorded 13 sites (discussed further below).

CSH conducted a cultural impact assessment for a 3,600-acre parcel within Waiawa bounded by the H-2 Freeway, Waiawa Gulch, Dole pineapple fields, and Kīpapa Gulch (Bushnell et. al. 2003, same project area as studied by Goodman and Nees 1991) and including the entire present project area.

CSH (Thurman et al. 2011) undertook a reconnaissance survey of 1,680 acres in Waiawa for Kamehameha Schools including the current study area (see Figure 26). Three new sites were documented during this study: CSH 1, a traditional Hawaiian petroglyph site consisting of three images; CSH 2, a possible rock shelter that requires additional investigation (subsurface testing); and CSH 3, a traditional Hawaiian lithic quarry. In addition, historic properties previously documented by Barrera (1987) and Goodman and Nees (1991) in and adjacent to their project area were revisited, including SIHP #s -1470, -1471, -1472, -2262, -2263, -2264, -2270, -2271, -2272, and -2273. Of these revisited sites, SIHP # -2263—a very impressive petroglyph complex consisting of at least 65 images, first identified in 1991 (Goodman and Nees 1991)—is the most significant. This site is unique on the island of O‘ahu, and although it is located outside their project area boundary (to the west), it was recommended as a primary focus of collaborative preservation and conservation efforts between Kamehameha Schools and the adjacent landowner.

5.2 **Findings Near the Current Study Area**

5.2.1 Goodman and Nees 1991

The Goodman and Nees (1991) study focused on “significant historical and pre-Contact sites” (of which there were none near the present study area) (Figure 28, Figure 29, and Figure 30) and provides little data on sites regarded as of no further significance such as a plantation irrigation historic property and a road/railroad system historic property.

Features of two historic properties were identified in the vicinity of the presently proposed Waiawa 228 Reservoir study area including features 19 and 20 of SIHP # -2273 designated as “the irrigation complex” (Goodman and Nees 1991:59, Figure 29) and features 33, 35, and 36 of SIHP # -2270 designated as the “Road/railroad system” (Figure 30).

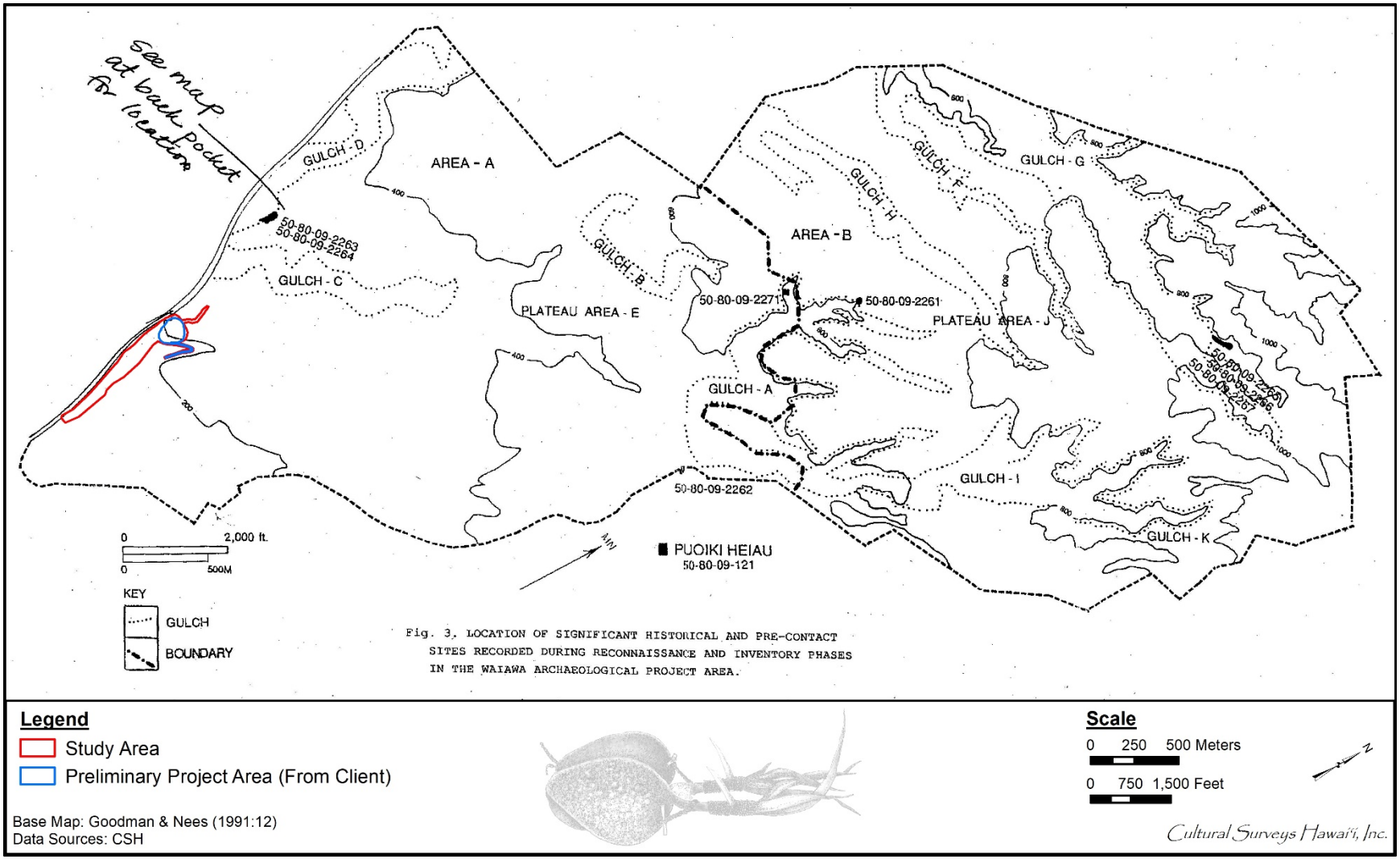

Figure 28. Map showing the “Location of Significant Historical and Pre-Contact Sites” recorded by Goodman and Nees (1991:12) in relation to the present study area (none are depicted near the present study area)

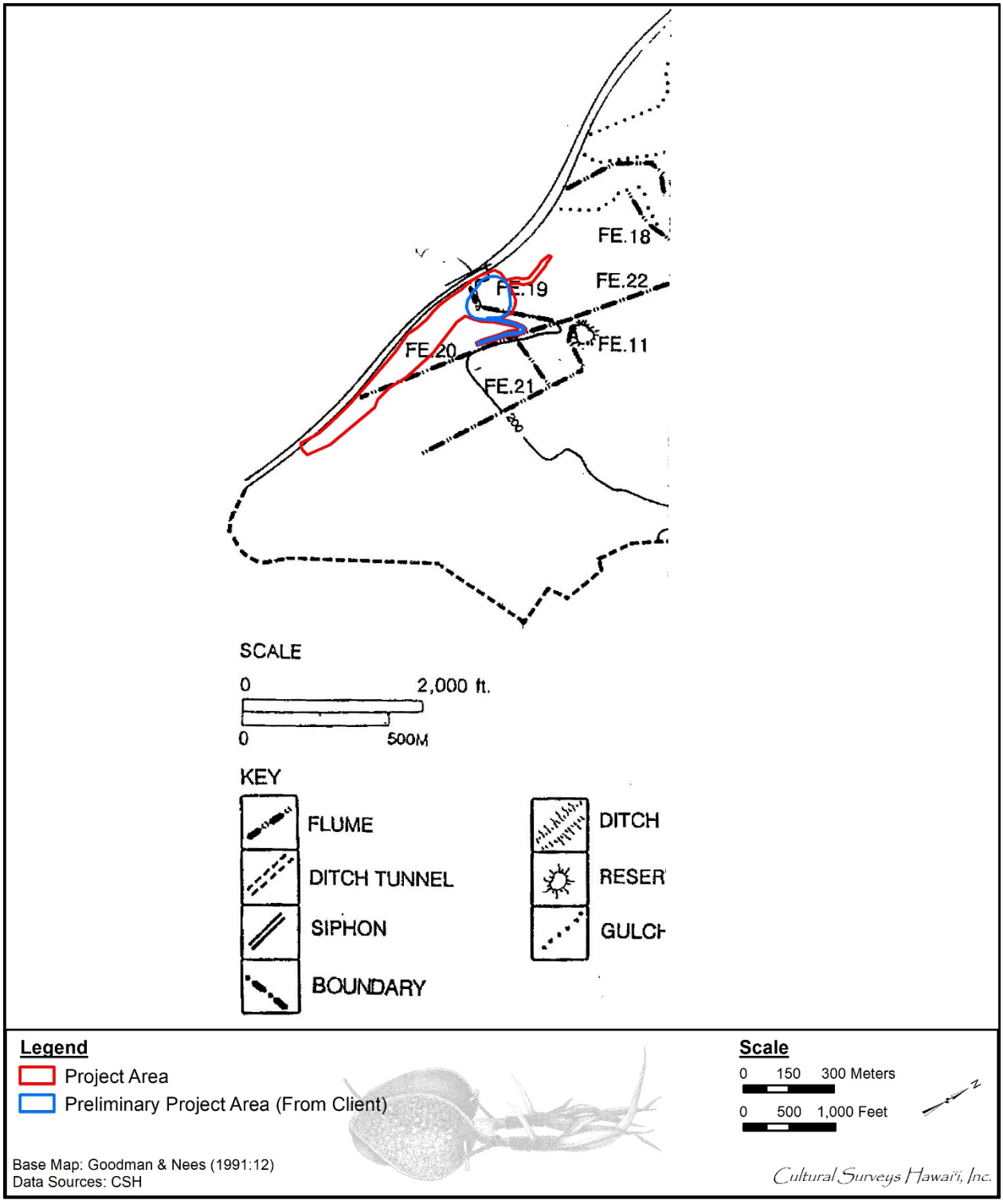

Figure 29. Goodman and Nees (1991:60) map of features of SIHP # -2273 designated as “the irrigation complex” (portions of Features 19 and 20 approximate a 12-ft wide proposed access roadway)

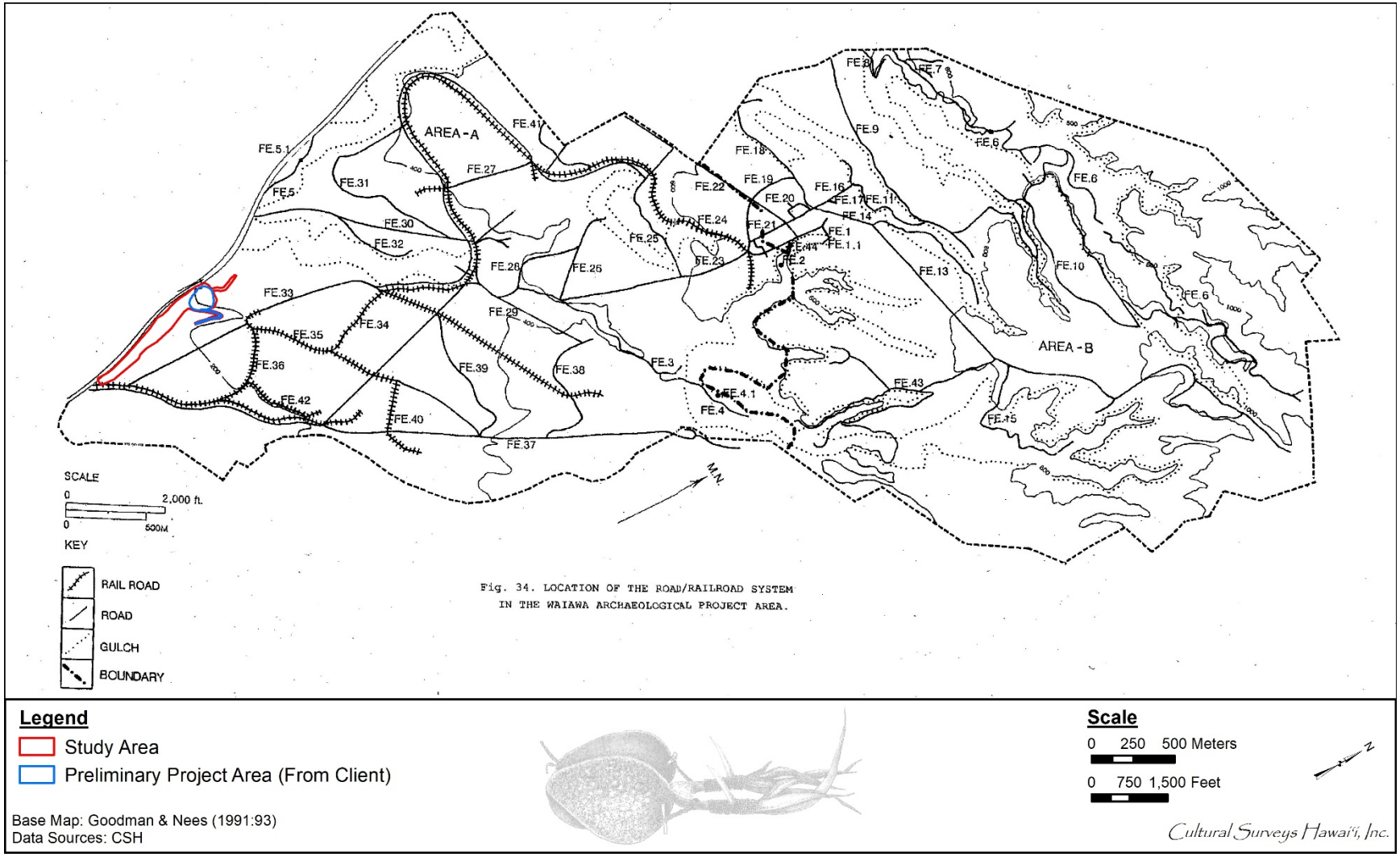

Figure 30. Goodman and Nees (1991:93) map of the location of the road/railroad system (SIHP # -2270) showing three designated features (Features 33, 35, and 36) converging near the head of a small valley near a hairpin turn of a 12-ft wide proposed access roadway

Ditches and flumes, siphons, reservoirs, pumping stations, and wells within their study area were assigned feature and sub-feature designations of SIHP # -2273. Their master "Table 1 Sites and Features Recorded […]" (Goodman and Nees (1991:19) lists 40 features and sub-features of SIHP # -2273 (Features 1 through 35 and sub-features 14.1 through 14.6) but many of these are lumped, as in Features 16–29 being simply described as "Straight Ditches." The location of approximately eight of these designated features is depicted on one figure (see present Figure 29) but the location of the majority of the features is not depicted.

It appears the only data specific to Features 19 and 20 near the present study area is in their Table 1 that lumps features 16–29 as "historical" "straight ditches" in their designated Areas A/B (Goodman and Nees 1991:20). There is a summary discussion of "Straight Ditches":

> Straight ditches are supply ditches that branch from a main water supply, such as a reservoir or the Waiahole Ditch. There are approximately 13 of these features (Features 16 through 29) in the project area [reference to the figure presented in present Figure 29]. They generally tend to be located: 1) along the gulch rims, 2) adjacent to roads, and 3) in the bottom of some of the gulches. They often bisect fields in order to connect reservoirs. These ditches generally are perpendicular to the contour of the field and deliver the majority of the water to separate fields in a distributary fashion.
>
> The most common technique used in the construction of straight ditches utilizes cement and fractured basalt. These were used to line a trench that in cross section appears as a boxed C-shape with well-defined corners and straight sides [a photographic example is supplied, shown in the present Figure 31]. Another construction technique for this type of ditch is that of cement plaster reinforced with chicken-wire netting. This technique involves plastering a chicken-wire base with cement plaster and stapling the whole base with heavy wire staples into the ditch sides. The bottom of the ditch is also constructed of concrete. These ditches have a wide, U-shaped cross section and are flat on the bottom.
>
> Another technique utilizes the Penhollow pre-cast concrete slab and is commonly seen in modern irrigation ditches (Penhollow 1914). Cement is poured in a mold constructed along the sides of an excavated trench. This ditch appears as a very explicit U-shape in cross section, with straight edges and sharp corners. [Goodman and Nees 1991:64, 66, 68]

Their map of features of SIHP # -2273 (see present Figure 29) indicate Feature 19 approximated the 200-ft contour on the northwest side of a small gulch on the east side of the proposed reservoir approximating the alignment of a 12-ft wide proposed access roadway to the reservoir (and then exiting the study area to the northwest, effectively cut by the H-2 freeway). This seemingly connects with the linear Feature 20 that approximated the east side of the small gulch extending to the south. It is unclear why a few of the irrigation features of SIHP # -2273 were depicted but most were not. This makes it impossible to determine the location of most of the designated features of SIHP # -2273 (and next to impossible to determine if there is anywhere in their project area where these features were not present). Whether the indicated locations were actually determined as a result of archaeological fieldwork, or were effectively traced from a map, is unclear.

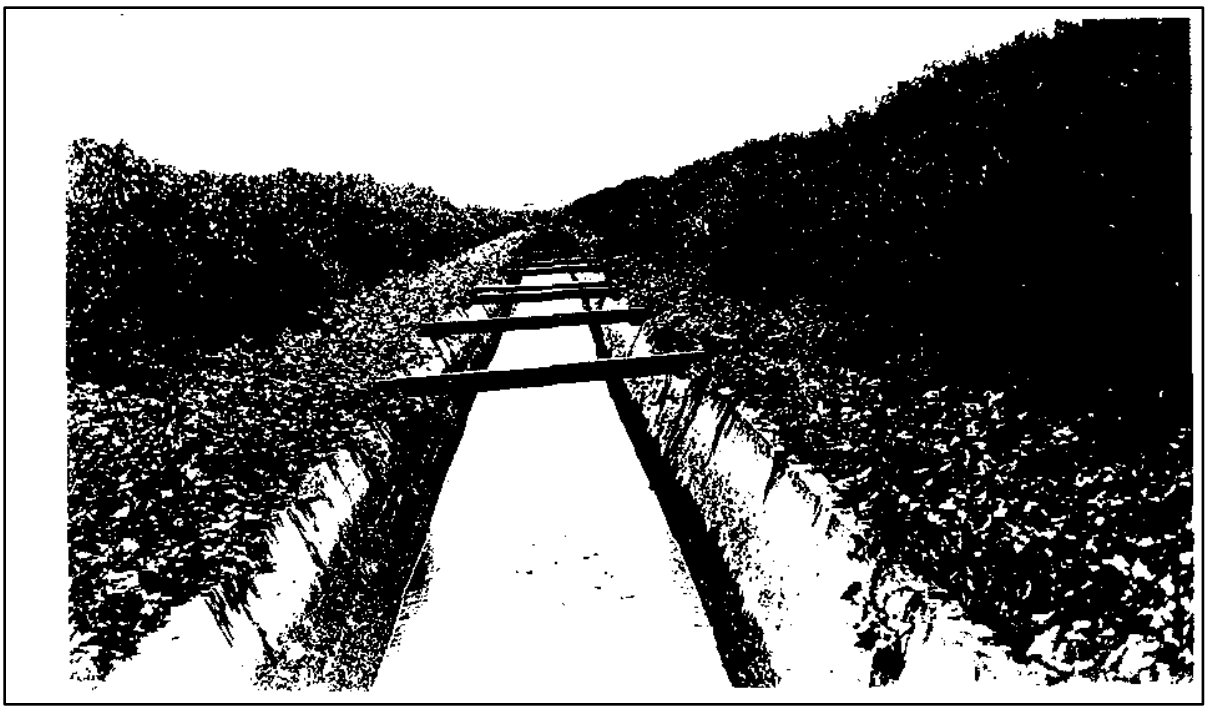

Figure 31. Photograph of a (presumably representative) "Straight Ditch" (BM Neg. No. CP93828, no date from Goodman and Nees 1991:67)

Goodman and Nees (1991) describe SIHP # -2270 as a "Road/Railroad System" with a summary description as follows:

> This site consists of all paved and unpaved roads used by the plantation and military concerns in the area and associated structures, such as retaining walls and roadbeds. The right-of-way for a temporary railroad that serviced the area early in the 20th century (now non-existent) is also included. [Goodman and Nees 1991:18]

Their master "Table 1 Sites and Features Recorded […]" (Goodman and Nees (1991:19) lists only two features:

- Feature 1.1 Retaining wall for roadbed; and
- Feature 2 Parallel rock alignment for road

They assert that SIHP # -2270 included 43 features (Goodman and Nees 1991:i). Their map (Goodman and Nees 1991:93, reproduced here as Figure 30) appears to list features numbered 1 to 11, 13 to 44 and sub-features 1.1, 4.1, and 5.1. The main point here is that "The information on this map was derived from Bishop Estate maps (1933-1936)" (Goodman and Nees 1991:92). The Bishop Estate maps indicated as the source of the data are not presented.

While descriptions of some of the features (features 1 through 9) are provided, there appear to be no descriptions at all of features 10 through 44 and it is unclear whether these numbered features were ever identified on the ground. A cryptic assertion is that "Because there are no remains of the railroad system still present in Waiawa, no feature numbers were assigned" (Goodman and Nees 1991:92) whereas quite a number of feature designations in the south or *makai* portion of their

project area are indicated to have been segments of railroad lines (see figure reproduced in present Figure 30).

It appears that no description of the indicated Features 33, 35, and 36 of SIHP # -2270 near the present study area is provided beyond the provided map (reproduced in present Figure 30). The map indicates Features 35 and 36 were railroad alignments as was the southernmost portion of Feature 33 but much of Feature 33 is depicted as a road.

The Goodman and Nees study (1991:137, 138) evaluates historic properties' significance in terms of National Register of Historic Places criteria finding six sites as significant but does not find either SIHP # -2270 or SIHP # -2273 as so significant. The study concludes the significance of these sites "has been realized through field and archival research and no further work is recommended" (Goodman and Nees 1991:137).

5.2.2 Thurman et al. 2012

In 2011 CSH carried out fieldwork for an archaeological reconnaissance survey of 1,680 acres of Kamehameha School lands in Waiawa Ahupua‘a (Thurman et al. 2012). Like the Goodman and Nees (1991) study, the fieldwork focused on gulches and rock outcrops that were more likely to contain previously undocumented historic properties and also focused on revisiting previously recorded historic properties. The Thurman et al. (2012) study did not identify any additional historic properties in the vicinity of the present study area.

Section 6 Summary of Previous Cultural Consultation that Includes the Present Study Area

A companion cultural impact assessment (Tanaka and Hammatt 2021) for the project has been contracted for and is presently (April 2021) moving forward. A summary of previous community consultation that includes the present study area is provided here.

As a complimentary part of the Goodman and Nees (1991) archaeological assessment for the Waiawa study area (that included the entirety of the present study area) carried out in the 1980s and 1990s, two informants were consulted regarding the history of pineapple and sugarcane in their project area (Goodman and Nees 1991: Appendix C). The purpose of consulting informants was to "elicit information on lifeways, events, and structures within the project area in order to assist the archaeological team in the location and interpretation of historical period structures." One of the informants, Mr. Masao "Crankey" Watanabe, was a long time employee of Oahu Sugar Company who had knowledge of the irrigator camps in their project area. He also provided information on the war time use of their project area when 3,500 acres was taken out of cane production and placed into potato production. The second informant, Mrs. Masae Miyashiro, grew up in the Hawaiian Pineapple Cannery Camp located in the Goodman and Nees (1991) project area. In 1905, Pearl City Fruit Company opened up a pineapple cannery in the Waiawa project area along with a Filipino and Japanese pineapple workers camp (Goodman and Nees 1991:85). The cannery was taken over by Hawaiian Fruit Company when Pearl City Fruit Company went bankrupt. The cannery shut down ca. 1935 and the workers' camps were abandoned. Mrs. Miyashiro's family operated a small dry goods store withing the cannery complex and although Mrs. Miyashiro's family left the camp when she was a young girl, she was able to provide general information of the pineapple camp including details about the camp layout and the types of structures in the Japanese camp. She describes a cemetery associated with the camp with multiple graves, one of which had belonged to her deceased, infant sister.

Further consultation was completed as part of the data recovery efforts for the historic-period Japanese cemetery (SIHP # -2271: Feature 3) associated with the Japanese pineapple workers' camp of the Hawaiian Fruit Company Pineapple Cannery (Sinoto and Pantaleo 1995). Three interviews were conducted with individuals who grew up in the Hawaiian Pineapple Cannery Camp, however, the interviews focused more on the cemetery than on Waiawa in general. These individuals included Mrs. Masae Miyashiro, Mr. Eddie Tamanaha, and Mrs. Doris (Miyahara) Higa.

CSH previously carried out *A Cultural Impact Assessment for 3,600 acres in Waiawa and Waipi‘o Ahupua‘a in O‘ahu (TMK 9-4-06:11, 9-6-04:4 and 9-6-5:3)* (Bushnell et al. 2003) that included the entirety of the present study area but that was not specific to the present project. Outreach was undertaken with approximately 83 people. An interview is presented with Mr. Tin Hu Young who was born in 1927 to a Chinese father and a Hawaiian mother, who grew up in Waiawa and lived there most of his life.

No information particularly pertinent to the present study area appears to be presented in these previous studies.

Section 7 Results of Fieldwork

7.1 Fieldwork in Support of Geotechnical Testing

On 3 August 2020, CSH archaeologist David W. Shideler, M.A., joined members of Yogi Kwong Engineers, LLC for the purpose of flagging a route for a small drill rig to access points on the north and south perimeter of the proposed reservoir. It was understood that clearing of *koa haole* (*Leucaena glauca)* was needed for the drill rig to gain access. An archaeologist's track log of a flagged route from an access road to proposed geotechnical testing sites (north boring location, south boring location, and alternate south boring location) is shown on Figure 32.

Access was from the south side of an east/west trending cane haul road approximately 170 m north of the proposed reservoir (see Figure 32). Throughout the access route and within the project area the traverse was dominated by mature, tall *koa haole* and dry exotic grasses; ground visibility was generally very good to excellent.

Sections of portable plantation ditch were observed. Some of these were deliberately piled, some were displaced and broken up as if by deliberate field clearing activities, and some appeared to be arrayed in such a manner as to provide irrigation water to the former sugarcane fields. The portable ditch segments were regarded as a potential component of the SIHP # -2273: Irrigation Complex discussed by Goodman and Nees (1991) but neither the location, orientation, or nature of construction appeared consonant with the indicated features (SIHP # -2273, Features 19 and 20) in the vicinity as indicated in the Goodman and Nees (1991) study. It was surmised that such portable ditch alignments were not regarded as a major component of the designated historic property but an access route was flagged to avoid the ditch segments that appeared to have been deliberately placed. The flagged traverse south to the proposed south boring location and the proposed alternate south boring location encountered no other potential historic properties. No construction associated with SIHP # -2273, Feature 19 (as indicated on the Goodman and Nees [1991:60] map, Figure 29) was observed.

The results of this fieldwork were included in a *Letter Report in Support of Consultation with the SHPD for Geotechnical Testing for the BWS Waiawa 228 Reservoir Project, Waiawa Ahupua‘a, ‘Ewa District, O‘ahu TMK: [1] 9-6-004:024 por.* (Shideler 2020) received by the SHPD 28 September 2020 and assigned Log No. 2020.02235.

7.2 Fieldwork Specifically for the BWS Waiawa 228 Reservoir Project

Fieldwork was conducted by three CSH archaeologists, David W. Shideler, M.A., Tom Martel III, B.A., and Spencer Fry, B.A., on 23 February 2021. A track log of three archaeologists' fieldwork and photograph key showing the general location and direction of the following photographs from the fieldwork is provided in Figure 33. Access to the study area was again from the south side of an east/west trending cane haul road approximately 170 m north of the proposed reservoir via the newly created access for the drill rig. Access was down a newly created access for the geotechnical testing drill rig to the proposed reservoir project area (Figure 35). The access route and the recently cleared areas for geotechnical testing (Figure 36) were examined but no evidence of historic properties was observed. The mature *haole koa* forest generally minimized any understory of vegetation and ground visibility ranged from fair to very good (Figure 37 is

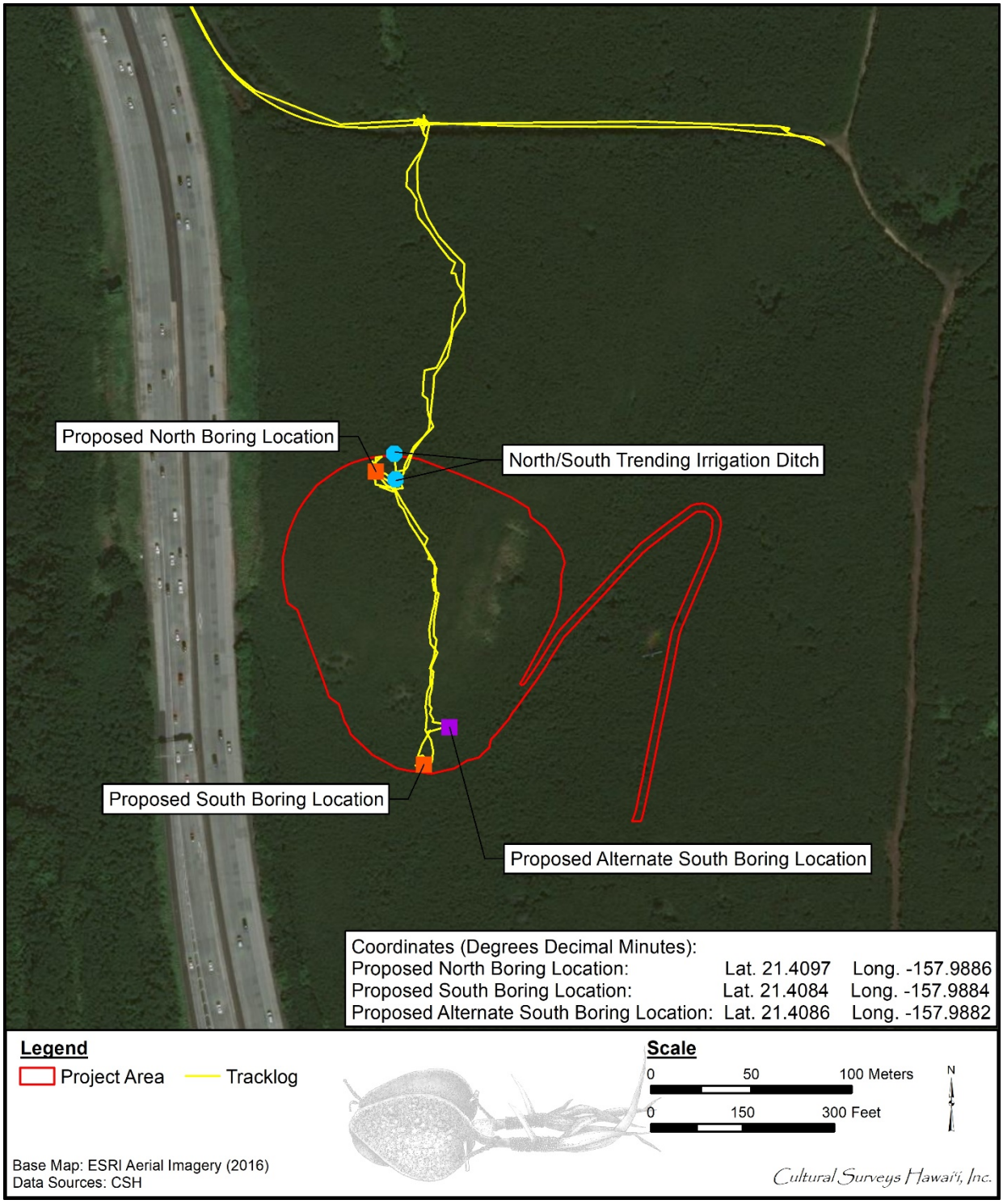

Figure 32. Archaeologist’s track log of a flagged route from an access road to proposed geotechnical testing sites (north boring location, south boring location, and alternate south boring location) (base map: ESRI 2016, from Shideler 2020)

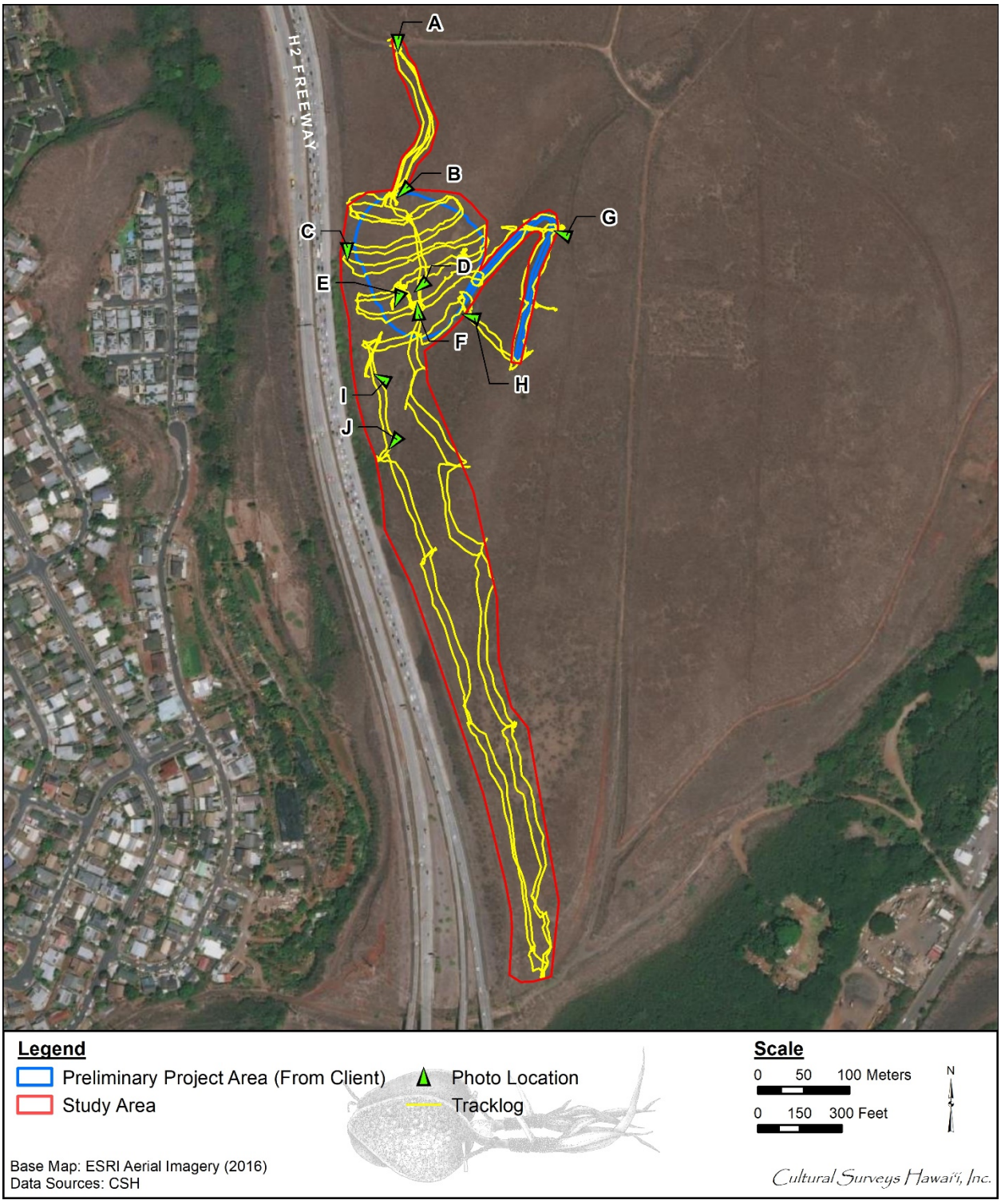

Figure 33. Track log of three archaeologists and photograph key showing the general location and direction of the following photographs from the fieldwork (base map: ESRI 2016)

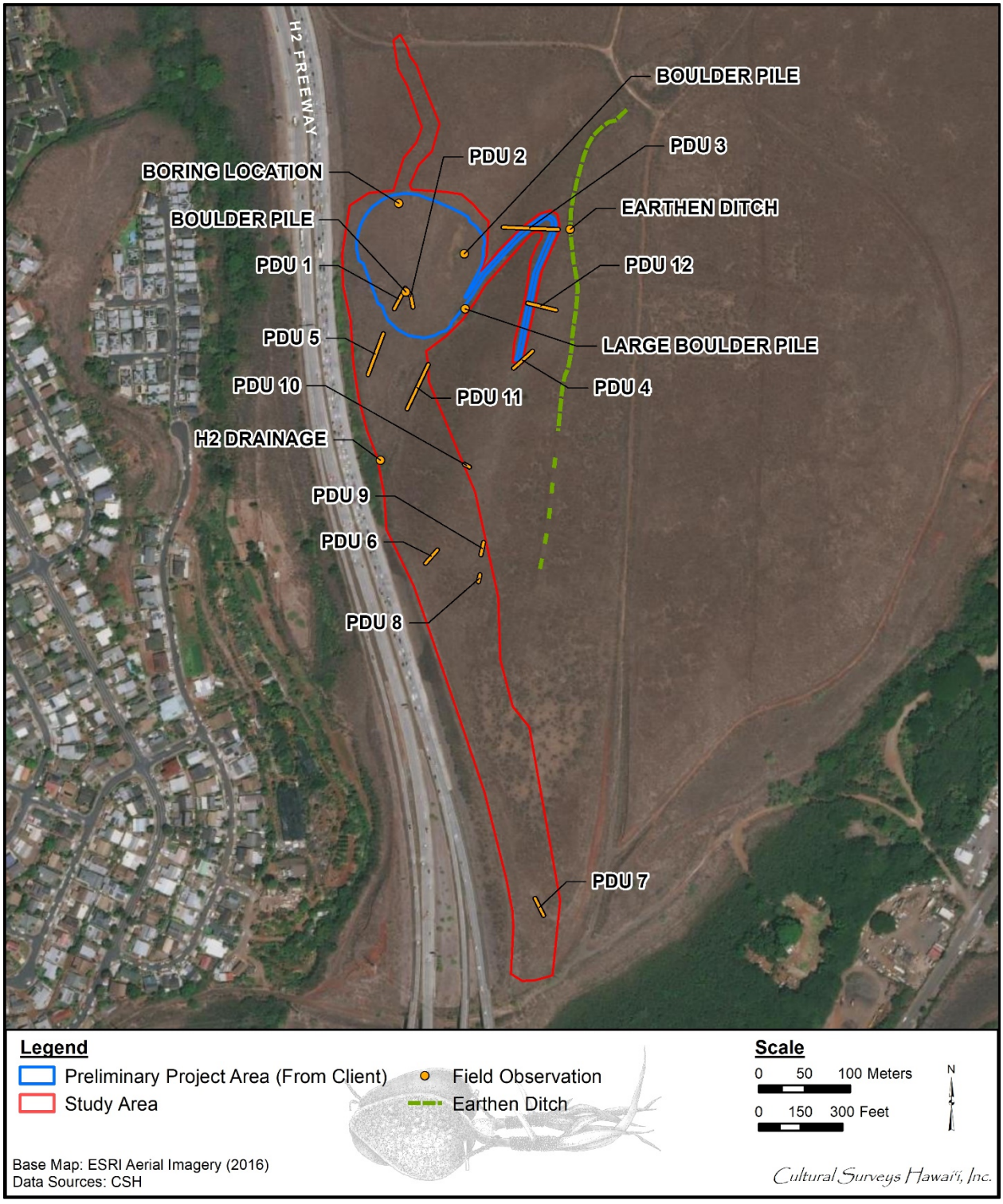

Figure 34. Observations from fieldwork in the study area (base map: ESRI 2016)

Figure 35. Photo A: Access route down a newly created access for the geotechnical testing drill rig to the proposed reservoir project area, view to south

Figure 36. Photo B: North boring location drill rig in action, view to southwest

Figure 37. Photo C: General view of wire fence along west (H-2) side of the study area, H-2 at right, view to south

Figure 38. Photo D: Boulder pile in the south portion of the preliminary site and grading plan area, view to southwest

representative). Two boulder pile areas were observed (see Figure 34, see Figure 38, and Figure 42) but the lack of sorting, the presence of bulldozer scars, and the presence of concrete fragments were felt to conclusively prove these were the result of mechanical clearing of sugarcane fields.

The main observation was the identification of alignments of portable ditch units (PDU). Some 12 of these alignments were observed (designated PDU 1 through PDU 12 on Figure 34). In appearance they were all very much the same, as the mass-produced PDU were meant to be interchangeable. These tended to extend in a northeast/southwest direction but there were a couple of exceptions (see PDU 3 and PDU 12 on Figure 34). The density of these former irrigation ditch alignments of PDU was higher in the north portion of the study area than the south (see Figure 34) but that may have been an artifact of differential destruction. Typically these alignments of former irrigation ditches were broken at both ends by bulldozing understood as dating to the demise of commercial sugarcane cultivation by the Oahu Sugar Company ca. 1996. Representative photographs of these PDU irrigation alignments are shown in Figure 39 through Figure 41 and Figure 43.

A substantial earthen north/south trending ditch was observed just east of the study area (see Figure 34).

A substantial H-2 drainage feature (Figure 44) was noted that may extend east of the H-2 corridor.

The south end of the study area was at the top of a 10 m+ high cliff or *pali* descending down to an access road. Two roughly parallel but converging railroad alignments are indicated in this area on historic maps (see the 1935 map, Figure 19 and the 1943 map Figure 20). It was thought that the northern railroad was on a northeast/southwest trending terrace just slightly below the summit of this *pali* and that the southern railroad alignment was at the base of the *pali* (approximating an unimproved northeast/southwest trending road). No railroad infrastructure was observed (other than the indicated terrace cut).

No evidence of historic properties or traditional Hawaiian or early historic land use other than the sugarcane plantation irrigation infrastructure (and possibly portions of the H-2 drainage) was observed within the study area.

Figure 39. Photo E: Portable Ditch Unit (PDU) alignment 1, view to south

Figure 40. Photo F: PDU alignment 2, south portion, view to northeast

Figure 41. Photo G: PDU alignment 3, east end showing sluice gate, view to northwest

Figure 42. Photo H: View of large boulder pile in the southeast portion of the preliminary site and grading plan area, view to west

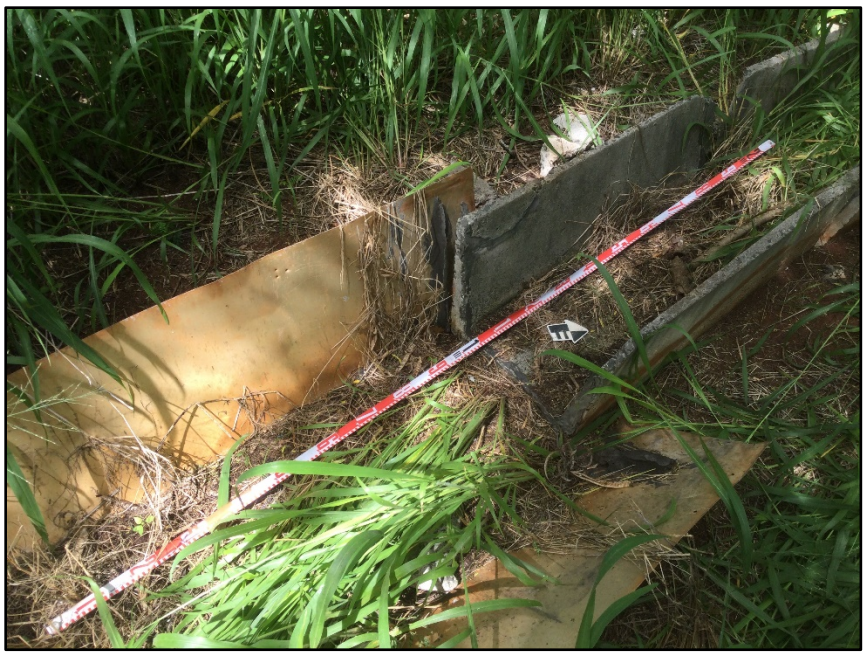

Figure 43. Photo I: View of PDU 5, southwest end, view to west

Figure 44. Photo J: View of H-2 drainage in the west edge of the study area, view to southwest

Section 8 Site Description

The assemblages of temporary irrigation ditch units observed in the BWS Waiawa 228 Reservoir study area relate to the designated SIHP # -2273: Irrigation Complex discussed by Goodman and Nees (1991) and Monahan (2015). This historic property is discussed below.

8.1 SIHP # 50-80-09-2273: Irrigation Complex

FORMAL TYPE:	Irrigation Infrastructure
FUNCTION:	Agriculture (irrigation)
NUMBER OF FEATURES:	35 identified by Goodman and Nees 1991, 25 identified in the Monahan 2015 project area
AGE:	Historic Period—Early to Middle 20th Century
TEST EXCAVATIONS:	Subsurface testing (hand excavation) was conducted at one feature: a small, dry-stacked terrace in Gulch C designated Feature 21, Site 2273 (Monahan 2015:9)
TAX MAP KEY:	TMK: [1] 9-6-004:024
LAND JURISDICTION:	Kamehameha Schools
PREVIOUS DOCUMENTATION:	Goodman and Nees (1991) Monahan (2015)

As this is a somewhat complicated historic property in terms of number of features, geographic extent, and history of documentation, we are presenting a large portion of the most recent (Monahan 2015) summary verbatim below:

> Site 2273 is an extensive system of infrastructure built, maintained and used by plantation workers to manage, store, transport and distribute water for commercial sugarcane. According to Goodman and Nees (1991), Site 2273 was initially built in the early 1900s by the Oahu Sugar Company as a network of ditches, flumes, siphons, reservoirs, pumping stations and a well. Based on our observations during the current [Monahan 2015] AIS fieldwork, the major components of Site 2273 were built after 1916, when completion of the Waiāhole Ditch made available large quantities of water from the Ko‘olau Mountains. We documented inscribed dates as early as 1925 on some features of this system. Operation of this system may have been interrupted altogether or simply altered by World War II, when parts of the current project area and its environs were used for military training. After the war, sugarcane agriculture continued up to the 1970s.
>
> Goodman and Nees (1991) identified a total of 35 features distributed over a larger (3,600-acre) project area compared with the current [Monahan 2015] (1,395-acre) project area. Our survey resulted in the identification of 25 features, which extend all throughout the current project area; many of these features also continue outside of the project area to the north, west and south. We observed the following types of features: a concrete-lined retention basin; a large, dam-like feature associated with a retention basin; ferrous-metal siphons (80-cm diameter); cut basalt and mortar

> ditches; earthen ditches; prefabricated flumes; industrial-sized (hand-operated) valves; small culverts; and large, formally-constructed cut basalt and mortar water-distribution basins.
>
> Because Goodman and Nees (1991:59, Figure 20) provided numbers for 35 features at Site 2273, but since it is not always clear which of these they actually observed in the field or which numbers correspond exactly to which features, we assigned new feature numbers. Wherever possible, we have also included what we believe the corresponding Goodman and Nees feature number is. Table 3 is a summary of Site 2273 features identified by TCP Hawai‘i in the current project area.
>
> Significance Assessment
>
> As described in the Conclusion to this report, Site 2273 is assessed as significant under criteria C and D for eligibility on the Hawai‘i Register of Historic Places. [Monahan 2015:32]

Monahan's summary listing of features is presented below in Table 4. Monahan's rationale for assigning new feature numbers ("that it is not always clear which of these [features] they [Goodman and Nees] actually observed in the field or which numbers correspond exactly to which features") is understandable. The result of this is, however, that the same site/feature designation now often designates two quite different features separated by hundreds of meters. Monahan's use of "sub-feature" designations for features of SIHP # -2273 creates another layer of complexity.

Goodman and Nees (1991:138) make a formal significance evaluation under National Register of Historic Places criteria for six specific sites but not for the SIHP # -2273: Irrigation Complex which is lumped with ten sites for which the summation is, "The significance of the following sites has been realized through field and archival research and no further work is recommended […] 2273; [Bishop Museum Site No.] B4-20 (irrigation system)" (Goodman and Nees 1991:137).

While the Monahan study found the SIHP # -2273: Irrigation Complex significant under criteria C and D for eligibility for listing on the Hawai‘i Register of Historic Places (Monahan 2015:32), it also concluded:

> SIHP # 50-80-09-2273 is evaluated as significant under criteria c and d [in accordance with HAR §13-284-6], for its intrinsic informational value to research on Hawaiian history (d) and as exemplars of a distinctive construction method (c) using skillfully-shaped basalt blocks and mortar [see present Table 4]. We documented 25 component features of this site. In particular, it provides important data on the geospatial location, extent and character of the plantation irrigation infrastructure in Waiawa Uka built around or shortly after 1916 by the Oahu Sugar Company; and, excluding the interruption of World War II, continued to be used into the 1970s. In the context of the nearby Waiāhole Ditch System (upslope and mauka of the current project area), Site 2273 played an important role in the early 20th century commercial development of O‘ahu and the Hawaiian Islands. [Monahan 2015:141]

The resolution of mitigation for the SIHP # -2273: Irrigation Complex in the Monahan study area was preservation of two specific features (his designated Features 19 and 22) and portions of two additional specific features (his designated Feature 14 Sub-feature 3 and Feature 23) that

included both more formal examples and representative examples of the historic property, with preservation measures to be described in a formal preservation plan (Monahan 2015:142).

While some of the designated features (Features 4, 5, 9, 12, and 20, see Table 4) of SIHP # -2273: Irrigation Complex in the Monahan study seem to be virtually identical to the sections of prefabricated concrete ditch segments observed in the present study area, the four features recommended for preservation were clearly much more formal.

8.2 A Note on SIHP # 50-80-09-2273: Irrigation Complex Feature Designation

Goodman and Nees (1991) identified 35 features of the SIHP # -2273: Irrigation Complex distributed over their 3,600-acre project area. As Monahan (2015:32) notes, “it is not always clear which of these they actually observed in the field or which numbers correspond exactly to which features [in the field].” Thus it is perhaps understandable that Monahan simply assigned new feature numbers noting the corresponding Goodman and Nees feature number where possible. This unfortunately leads to a situation where, at present, the same feature designation in these two studies refers to different features located hundreds of meters apart.

The Goodman and Nees (1991) study was carried out preparatory to Kamehameha Schools’ development of these extensive Waiawa lands. Given the passage of time, the Monahan (2015) study was meant as an update preparatory to land development. CSH is aware that Kamehameha Schools does indeed appear to be moving forward with development of certain Waiawa lands including much of the present study area and CSH is under the impression that much of the present study area will be included in a new archaeological inventory survey (AIS) of a large land area soon. This anticipated new AIS will need to deal with designations of additional features of the SIHP # -2273: Irrigation Complex and it is anticipated that these to-be-designated features will be designated in consideration of Monahan’s 25 feature designations and their geographic distribution. CSH did not want to further complicate SIHP # -2273 feature designations and is thus using a temporary system of portable ditch unit segment designation (PDU 1 through PDU 12) leaving it up to the anticipated AIS to integrate such designations into a larger framework of feature designations.

Table 4. Summary table of SIHP # 50-80-09-2273: Irrigation Complex features (from Monahan 2015:33)

Fea.	Other #[1]	Description	Dimensions (Area)	Comments
1	n.a.	Cut basalt and mortar water-distribution basin	10 m (NE/SW) by 7.5 m (NW/SE)	This is one of the most complex formal structures in the [Monahan 2015] project area.
2	32	Siphon (80-cm diameter pipe) oriented *mauka-makai*	2.0 km long (in Monahan 2015 project area)	Pipe continues a short distance out of Monahan 2015 project area to the south
3	?32	Siphon (80-cm diameter pipe) oriented *mauka-makai*	600 m long	Portions of this siphon were (by design) buried under an earthen road.
4	n.a.	Prefabricated concrete flume (caulked sections)	800 m long	Runs east, upslope, and parallel to main earthen road (Feature 1, Site 2270)
5	n.a.	Prefabricated concrete flume (caulked sections)	20.5 m long	Feature is complete on its west end but broken on its east end.
6	n.a.	Metal pole w. marker on concrete footing	5-m tall 3-inch diameter pipe	Possibly marking location of earthen ditch (see text)
7	34	Cut basalt and mortar ditch	970 m long	Partially filled in with sediment
8	?33	Cut basalt and mortar ditch	330 m long	Partially filled in with sediment
9	n.a.	Prefabricated concrete flume (caulked sections)	5.0 m long	Feature is complete on its west end but broken on its east end.
10	n.a.	Earthen ditch	530 m long	Heavily overgrown with vegetation
11	33	Earthen ditch	500 m long	Heavily overgrown with vegetation
12	n.a.	Prefabricated concrete flume (caulked sections)	420 m long	Runs parallel up slope just east of main earthen road (Feature 1, Site 2270)
13	28/31	Cut basalt and mortar ditch	1.5 km (in Monahan 2015 project area)	Ditch continues out of Monahan 2015 project area to the west-northwest
14	27	Cut basalt and mortar ditch	3.4 km long	Ditch disappears in heavy ground cover, possibly buried by sedimentary deposition at its west end

Fea.	Other #[1]	Description	Dimensions (Area)	Comments
15	n.a.	Earthen ditch ending in a 4-way sluice gate intersection	50 m long	Earthen ditches around 3 sides of the 4-way sluice gate are difficult to identify due to soil erosion and deposition.
16	2	Combination cut basalt and mortar ditch and siphon	1.2 km long (ditch is 920 m long, siphon is 300 m long)	Feature traverses east half of Monahan 2015 project area from just below Gulch A to east end of Gulch B.
17	?	Cut basalt and mortar ditch	1.3 km long	Connects Reservoir 1-A w. Reservoir 3
18	n.a.	Ditch-builders' lithic processing area	26 m (N/S) by 14 m (E/W)	Abundant large flakes and debitage created with metal (presumably iron) tools
19	6	Massive slope-retaining feature in Gulch B	38.0 m (E/W) by 33.0 m (N/S)	Part of a dam-like structure at the south end of Reservoir 1-B
20	n.a.	Prefabricated concrete flume (caulked sections)	25 m long	Upper end truncated by a modern (non-historic-age) road
21	8	Cut basalt and mortar lined reservoir	110 m (N/S) by 30 m (E/W)	According to historic maps from the 1930s, this is Reservoir 2-B.
22	Part of 2 or 32?	Cut basalt and mortar water-distribution basin	16.0 m (N/S) by 13.0 m (E/W)	One of the most complex formal structures in the Monahan 2015 project area
23	Part of 32?	Cut basalt and mortar ditch	360 m long	Connects with Feature 22 and damaged on its south end
24	Part of 31	Basalt and mortar ditch	550 m long	Ditch uses natural (sub-rounded), rather than cut and dressed, boulders
25	35, 22	Cut basalt and mortar ditch	2.6 km long (includes three sections)	Ditch begins as a cut basalt and mortar ditch, changes into two earthen ditches

[1] Other # – Goodman and Nees (1991) feature number; n.a. = newly-identified feature (not mapped or described in Goodman and Nees); ? = we were unable to determine Goodman and Nees number

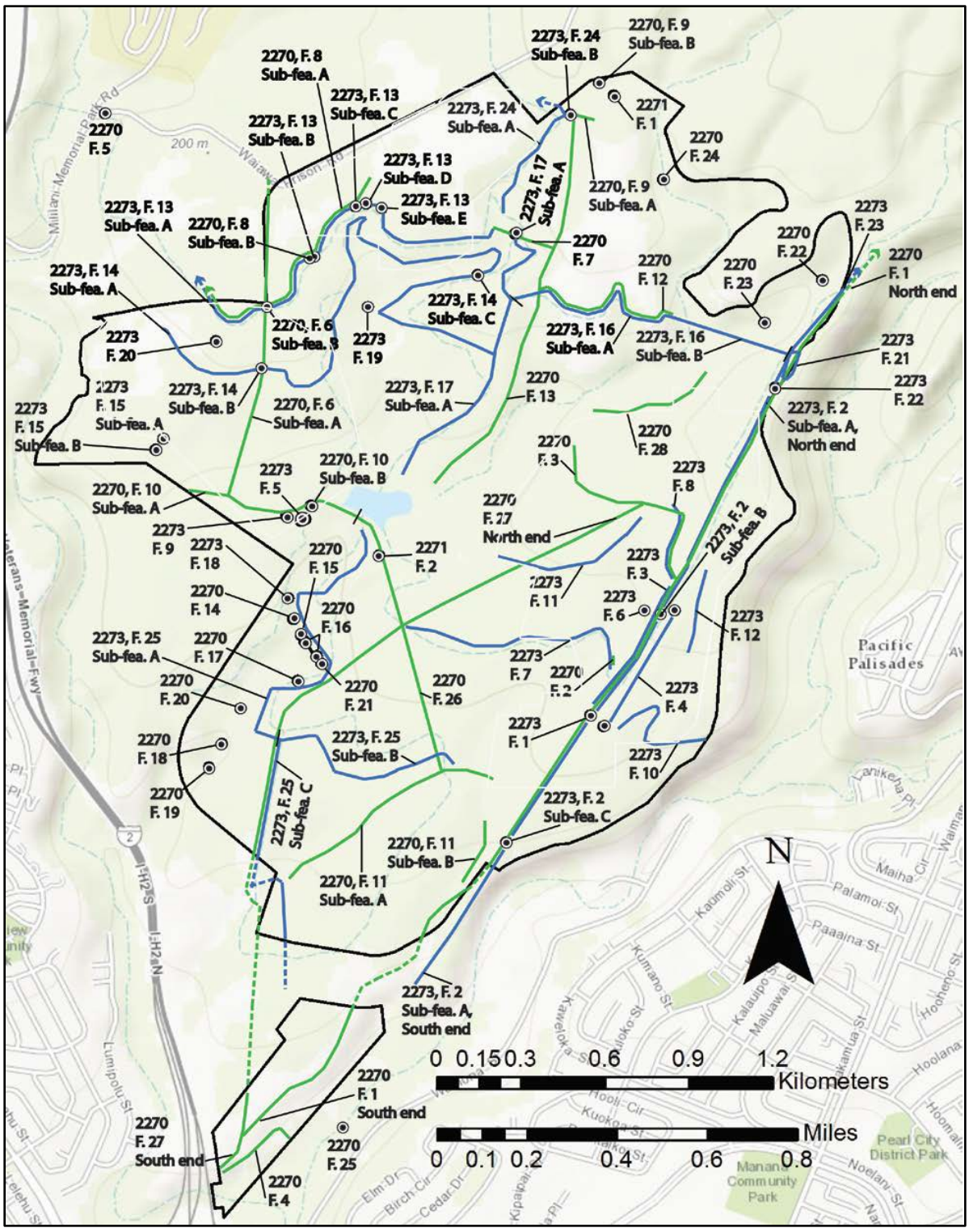

Figure 45. Historic properties and features identified by TCP Hawai‘i on a topographic map (base map from ESRI in ArcMap); LUC project area in black; SunEdison project area in light pink; roads in green; linear irrigation features in blue; dashed lines indicate feature continues out of project area (adapted from Monahan 2015:25)

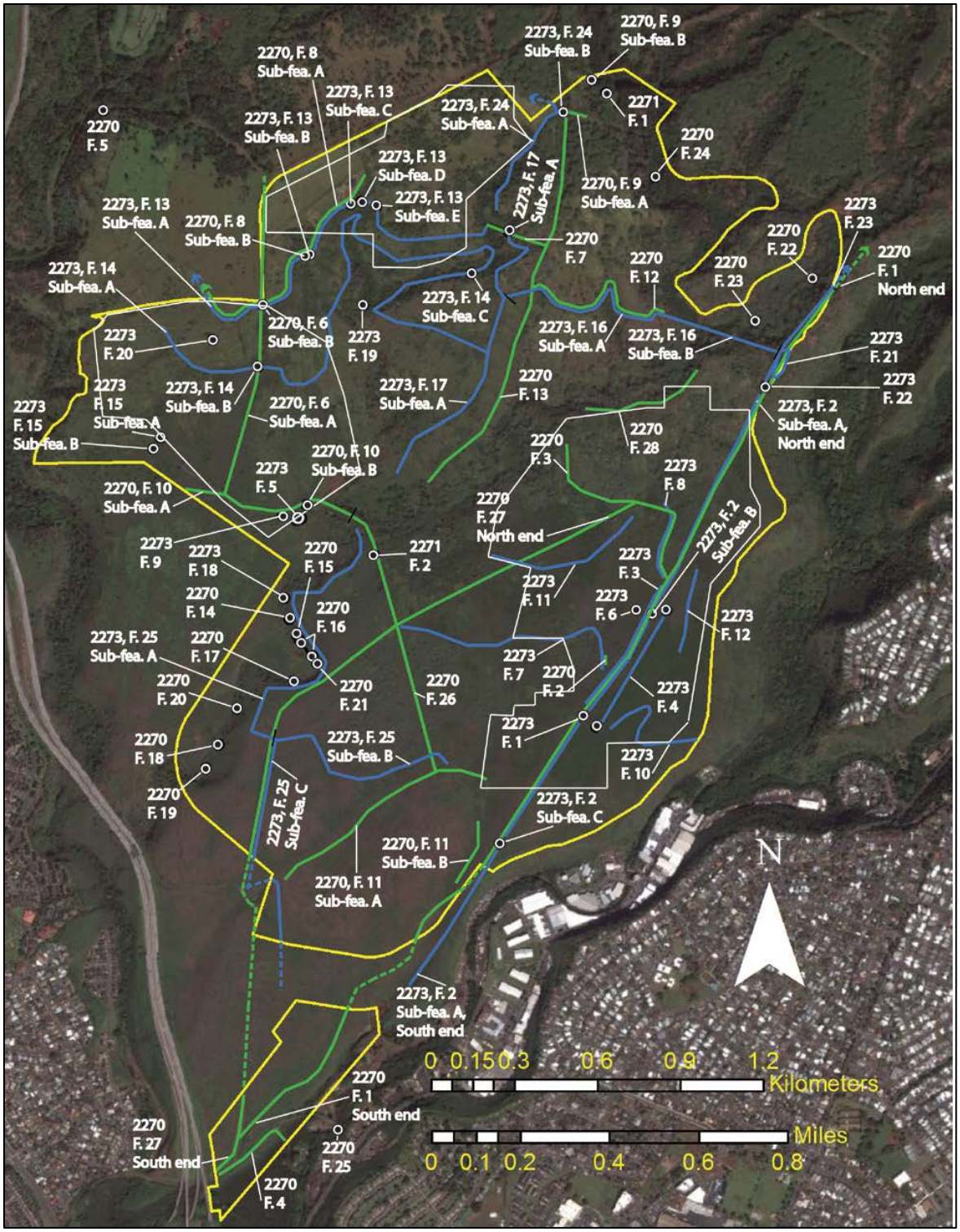

Figure 46. Historic properties and features identified by TCP Hawai‘i on aerial image (base map from ESRI in ArcMap); LUC project area in yellow; SunEdison project area in light pink; roads in green; linear irrigation features in blue; dashed lines indicate feature continues out of project area (adapted from Monahan 2015:26)

Section 9 Summary and Recommendations

At this point in time (April 2021) CSH has been provided with a “Preliminary Project Area” supplied by client that includes the area of the reservoirs and a hairpin configuration of a possible road segment of 1.72 ha (4.26 acres). This is anticipated to be the area of the vast majority of project-related ground disturbance—particularly for the excavation of a bench to support the three reservoir tanks. It appears likely, however, that certain appurtenances, including the access road and influent and effluent mains alignments, will extend outside this “Preliminary Project Area.” Thus this study addresses a larger “study area” of 8.19 ha (20.23 acres) thought likely to include the access road and influent and effluent mains alignments.

The background research on cultural history of the area and previous archaeological studies of the area reported on in this study is intended to address likely project area configurations. The purpose of the fieldwork component of this study is to develop data on the nature, density, and distribution of historic properties as might be present.

No traditional Hawaiian or early historic period historic properties have been reported from the likely project area or were observed during the fieldwork for this project. The probability of traditional Hawaiian or early historic period historic properties in the likely project area is evaluated as low.

9.1 The Case of SIHP # 50-80-09-2273: Irrigation Complex

The only historic properties reported from the vicinity are related to plantation infrastructure. It is understood that the study area was developed starting in the early 1900s by the Oahu Sugar Company for commercial sugarcane fields and this included the development of a network of ditches, flumes, siphons, reservoirs, pumping stations, and access roads. It is understood that much of the irrigation infrastructure was rapidly developed after 1916, when the completion of the Waiāhole Ditch made available large quantities of water from windward O‘ahu.

The irrigation infrastructure of the Kamehameha Schools Waiawa lands has been extensively documented in prior studies (particularly Goodman and Nees 1991 and Monahan 2015). Goodman and Nees (1991) identified a historic property, SIHP # -2273: Irrigation Complex, as including a total of 35 features distributed over a larger (3,600-acre) project area and Monahan documents 25 features associated with this historic property in greater detail (the extent of overlap of these designated features is uncertain).

The Goodman and Nees (1991) study made no formal assessment of significance for the SIHP # -2273: Irrigation Complex and no further work was recommended (Goodman and Nees 1991:137).

The Monahan study (2015:32 and 141) found the irrigation complex significant under Criteria C and D for eligibility for listing on the Hawai‘i Register of Historic Places and significant under HAR §13-284-6 historic property significance Criteria c and d. The resolution of mitigation was preservation of two specific features (Monahan’s designated Features 19 and 22) and portions of two additional specific features (Monahan’s designated Feature 14 Sub-feature 3 and Feature 23) that included both more formal examples and representative examples of the historic

property, with preservation measures to be described in a formal preservation plan (Monahan 2015:142).

With the SHPD acceptance of the Monahan (2015) study, the significance of the SIHP # -2273: Irrigation Complex has arguably been determined; the irrigation complex is assessed as significant under Criteria C and D for eligibility for listing on the Hawai‘i Register of Historic Places and significant under HAR §13-284-6 historic property significance Criteria c and d.

Some of the designated features (Features 4,5, 9, 12, and 20, see Table 4) of SIHP # -2273: Irrigation Complex in the Monahan study area seem to be virtually identical to the sections of prefabricated concrete ditch segments observed in the present study area. Thus it would seem disingenuous to suggest the features documented in this study are anything other than additional features of the SIHP # -2273: Irrigation Complex.

However, it should be noted that there may well be over a hundred similar portable ditch section alignments within the Kamehameha Schools Waiawa lands and that these may be, by and large, virtually identical to the sections documented by Monahan and in the present study. The four features recommended for preservation were clearly much more formal and are not only the most formal examples but are understood as representative.

Thus the argument is that additional findings of features of the SIHP # -2273: Irrigation Complex should be evaluated on a case by case basis. If they are “more of the same” mundane portable ditch segment alignments then the mitigation is accomplished in the documentation of their location and orientation and mitigation has been effectively accomplished by preservation of better and representative examples elsewhere on the KS property. It may be the case that some additional features of this site merit

preservation in consideration of their workmanship, but that does not fit the ubiquitous, mass-produced portable ditch units of the present study area.

In light of this recommendation, the results of this study would be consistent with and support a determination of “No historic properties affected” and no further archaeological work within the study area.

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APPENDIX E

Cultural Literature Review for the BWS Waiawa 228 Reservoir Project
Waiawa Ahupuaa, Ewa District, Oahu

DRAFT

Cultural Literature Review for the BWS Waiawa 228 Reservoir Project, Waiawa Ahupua‘a, ‘Ewa District, O‘ahu

TMK: (1) 9-6-004:024 por.

Prepared for
The Limtiaco Consulting Group
on behalf of the
City and County of Honolulu Board of Water Supply (BWS)

Prepared by
Kellen Tanaka, B.A.,
and
Hallett H. Hammatt, Ph.D.

Cultural Surveys Hawai‘i, Inc.
Kailua, Hawai‘i
(Job Code: WAIAWA 15)

February 2023

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Management Summary

Reference	Cultural Literature Review (CLR) for the BWS Waiawa 228 Reservoir Project, Waiawa Ahupua‘a, ‘Ewa District, O‘ahu, TMK: (1) 9-6-004:024 por. (Tanaka and Hammatt 2023)
Date	February 2023
Project Number	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: WAIAWA 15
Agencies	State Office of Planning and Sustainable Development (OPSD), Environmental Review Program (ERP)
Land Jurisdiction	Kamehameha Schools
Project Proponent	City and County of Honolulu Board of Water Supply (BWS)
Project Location	The study area is owned by Kamehameha Schools and is located on gently sloping table land near the 228-foot (ft) elevation (hence the name of the reservoir project) at a distance of approximately 2.5 km north of the Middle Loch of Pearl Harbor immediately east of the H-2 freeway. The study area is depicted on a portion of the 1998 Waipahu U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle, tax map plat, and a 2016 aerial photograph.
Project Description	The BWS Waiawa 228 Reservoir project will likely involve grading an approximately 3.57-acre area for the foundation of three closely sited tank reservoirs (of 2.0, 2.5, and 4.0 million gallon capacity) east of the H-2 Freeway. This may involve cutting into the northwest slope with a cut volume estimated at 105,385 cubic yards (and a fill volume of 15 cubic yards). The project may also include the construction of a 12-ft wide access road, a 30-inch influent main, and a 30-inch effluent main, plans for which are still under development. Specific alignments for the access roads, water mains, and other associated infrastructure is unknown at this time, but is anticipated to be within the study area.
Project Acreage	This cultural literature review (CLR) report analyzes the project in terms of 1) a “Preliminary Reservoir Location” supplied by the client that includes the area of the reservoirs and a hairpin configuration of a possible road segment of 4.26 acres (1.72 hectares) and 2) a larger “study area” of 59.48 acres (24.07 hectares) thought likely to include the access road and influent and effluent mains alignments.
Document Purpose	This cultural literature review was prepared to assist in identifying past and ongoing cultural resources and practices within and surrounding the proposed project area. Cultural resources and practices include but are not limited to habitation sites, areas of gathering and cultivation, sacred sites, burial practices, and trails. Historical and archaeological background research was conducted to clarify land use within and surrounding the proposed project area from

	the earliest records to present-day usage. Such findings were used to identify recognized cultural resources and practices, and if present and still performed, to assess the potential impact of the proposed project and to determine whether their preservation is justified.
Results of Background Research	Background research for the proposed project yielded the following information: 1. The study area is located in the *ahupua‘a* (traditional land division usually extending from the mountains to the sea) of Waiawa which extends from the Middle Loch of Pearl Harbor up to the summit of the Ko‘olau Range, and is bounded by the *ahupua‘a* of Waipi‘o on the west and the *ahupua‘a* of Manana to the east. 2. The meaning and correct pronunciation of Waiawa is in dispute. It is variously spelled Waiawa or Wai‘awa, which leads to different interpretations. *Awa* is both the word for milk fish or a harbor, cove, channel or passage (Pukui and Elbert 1986:33). With an alternate spelling, *‘awa* (kava; *Piper methysticum*) is the word for the native plant used to make a soporific and muscle relaxant drunk by the Hawaiians. Traditional accounts suggest Waiawa may have been acknowledged in early times as the site of a special variety of the *‘awa* plant. 3. Other traditional accounts concerning Waiawa include the *mo‘olelo* (stories) of Kawelo (Fornander 1919:700–701), Keakua‘ōlelo (*Ka Loea Kālai‘āina* 1899, translated in Sterling and Summers 1978:22) and Maihea (Handy and Handy 1972:472; *Ka Loea Kālai‘āina*, 1 July 1899, translated in Sterling and Summers 1978:5; Maly and Maly 2003:95). 4. The *moku* (district) of ‘Ewa had more *loko i‘a* (fishponds) than any other district on O‘ahu, indicating that agricultural and aquacultural intensification was a direct link to the chiefs who resided there and to the increasing needs of the population (McAllister 1933:28; Handy and Handy 1972:270,470). 5. Archaeologist Gilbert McAllister recorded three *loko i‘a* adjacent to Pearl Harbor in Waiawa Ahupua‘a—Loko Apala (State Inventory of Historic Places [SIHP] # 50-80-09-118), Loko Kuhialoko (SIHP # -119), and Loko Mo‘o (SIHP # -120). Mid-nineteenth century Māhele documents also mention numerous *loko i‘a* including Loko Apalakai, Apalawai (Loko Apala), Kuakuanui, Ho‘opililoko, Loko Kuhialoko, Loko Mo‘o, Kalokohanahou, Kama‘ihi, Kepoelalo, Kepoeluna, Loko Mōkōlea, and Mōkōlea (Soehren 2009). 6. There were numerous *heiau* (pre-Christian place of worship) within the *moku* of ‘Ewa. McAllister (1933:105) recorded a *heiau* called Puoiki located on the point of the ridge called Lae

	Pōhaku, the boundary point between Waiawa and Mānana Ahupua‘a. A second *heiau* in Waiawa Ahupua‘a was located near the “maika [Ancient Hawaiian game suggesting bowling] playing field of Haupu‘u” (Waialeale 1834:23). It was demolished in 1834 and the Protestant Ewa Church was built directly over the *heiau*. 7. There were several pre-Contact/early historic trails across the *moku* of ‘Ewa including a cross-*ahupua‘a* trail which passed through ‘Ewa connecting Honolulu to Wai‘anae. The coastal trail ran along the inward boundary of the Pearl Harbor floodplain and irrigated taro fields (‘Ī‘ī 1959:96–98). The coastal cross-*ahupua‘a* trail was close to the present H-1 alignment approximately 500 m south of the south end of the present study area; the eastern trail heading north up the central valley is understood to have approximated the present Kamehameha Highway (Highway 99) alignment approximately 800 m west of the present study area. 8. Beginning with the time of Western Contact, Hawaiian populations were introduced to many virulent western diseases which began to decimate the native populations. The 1831–1832 census of O‘ahu recorded a population of 4,015 within the ‘Ewa District. Four years later, in 1836, the ‘Ewa population had dropped to 3,423 (Schmitt 1973:9, 36), “a decrease of 592 in 4 years” (‘Ewa Station Report 1836). The population stabilized in the 1830s and early 1840s. In January 1849, the population was 2,386 people, but the population dropped with a measles epidemic in October 1849 (Ewa Station Report 1849:3, 4). 9. The first mission in ‘Ewa was established in 1834 in Waiawa. Two missionaries, Lowell and Abigail Smith, were assigned to the station and were in charge of building a church and a house for themselves (Hawaiian Mission Children’s Society 1969:3–9). Lowell selected the site for the new church on a hill called Haupu‘u (built-up hill) elevated 200 ft above the ‘Ewa plain. This ‘Ewa Church on the hill Haupu‘u was probably situated near the demographic center of Waiawa Ahupua‘a from time immemorial and would dominate the geographic and social landscape of Waiawa for decades. 10. During the Māhele in 1848, Waiawa Ahupua‘a was awarded to Princess Victoria Kamāmalu (sister of Kamehameha IV and V) as part of land claim 7713. During the second half of the nineteenth century, Waiawa was passed on to successive members of the *ali‘i* (royalty). In 1883, Bernice Pauahi Bishop received Waiawa following the death of her cousin Ruth Ke‘elikōlani (Kame‘eleihiwa 1992:309–310). The Bernice Pauahi Bishop Estate and Kamehameha Schools presently retain

	ownership of most of the *ahupua‘a*. The present study area is entirely within the award to Victoria Kamāmalu and *mauka* (toward the mountains) of all the smaller *kuleana* (Native Hawaiian land rights) awards to individuals. 11. In 1868, a 50-year lease and leaseholds in Waiawa were granted to James Robinson, an early shipbuilder in Hawai‘i. After James Robinson’s death in 1890, his son, Mark P. Robinson, acquired a 25-year lease and ran cattle on the Waiawa lands. The Robinson homestead was between Ho‘ae‘ae and Waikele (west of the study area), but he had fee simple lands in Mānana and Waimano, and a number of leased lands in Waiau, Waiawa, and Waimano Uka (Yardley 1981:131). 12. In 1897, B.F. Dillingham established the Oahu Sugar Company on 12,000 acres leased from the estates of John Papa ‘Ī‘ī, Bishop, and Robinson. The Oahu Sugar Company had over 900 field workers, composed of 44 Hawaiians, 473 Japanese, 399 Chinese, and 57 Portuguese. The first sugar crop was harvested in 1899, ushering in the sugar plantation era in central and eastern ‘Ewa (Ohira 1997). 13. By 1889, the Oahu Railway and Land (OR&L) Company connected the wharves at Honolulu Harbor to Hālawa and the agricultural coastline of Pearl Harbor. O‘ahu’s Ewa Plantation was incorporated in 1889 and the growing railroad of B.F. Dillingham was leveling the Waipahu-to-‘Ewa Junction in anticipation of service to the ‘Ewa plains and beyond. The railroad extended from Honolulu to Pearl City in 1890, to Wai‘anae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:100). This railroad line eventually ran across the center of the ‘Ewa Plain at the lower boundary of the sugar fields (Frierson 1972:15). The OR&L tracks extended along the margin of Pearl Harbor close to the northern margin of Middle Loch south of the present study area. 14. In the early decades of the twentieth century, lands in the *mauka* portion of the central and eastern sections of ‘Ewa were being acquired for pineapple cultivation. There is a record of attempted pineapple irrigation utilizing water from shallow wells in Waiawa Gulch in 1893 and prior to 1913 most of the plateaus in Waiawa were planted in pineapple (Goodman and Nees 1991:59). In 1899, the Hawaiian Pineapple Company leased 1,000 acres in Waiawa for pineapple cultivation from the OR&L. In 1901, they obtained an additional 61 acres in Waiawa through public auction. These fields were *mauka* of the present study area. In the 1920s, pineapple was abandoned and by 1935, many of the present Kamehameha Schools parcels in Waiawa were planted in sugarcane.

	15. The early twentieth century saw the U.S. Government begin acquiring the coastal lands of ‘Ewa for development of a naval base at Pearl Harbor. In 1901, the U.S. Congress formally ratified annexation of the Territory of Hawaii, and the first 1,356.01 acres of Pearl Harbor land were transferred to U.S. ownership (Knox 1936). 16. Four main portions of Waiawa were used by the military—the Pearl City Peninsula *makai* (toward the sea) of Kamehameha Highway, a diesel drum storage area at Ewa Junction, also *makai* of the highway, an aviation supply depot along Waiawa Stream *mauka* of the highway and adjacent to the eastern boundary of the study area, and a military reservation in upland Waiawa, approximately 0.75 km northeast of the study area, used for communications and training (Allen 1999).
Impacts and Recommendations	Based on the information gathered from the cultural and historic background detailed in this cultural assessment, the proposed project should not have any impacts on cultural resources and practices. Although highly unlikely, in the event that any cultural resources are encountered during construction, we recommend the following: 1. In the event that *iwi kūpuna* (Native Hawaiian skeletal remains) are identified, all earth moving activities in the area will stop, the area will be cordoned off, and the SHPD and Police Department will be notified pursuant to Hawai‘i Administrative Rules (HAR) §13-300-40. In addition, in the event of an inadvertent discovery of human remains, the completion of a burial treatment plan, in compliance with HAR §13-300 and Hawai‘i Revised Statutes (HRS) §6E-43, is recommended. 2. In the event that *iwi kūpuna* and/or cultural finds are encountered during construction, project proponents should consult with cultural and lineal descendants of the area to develop a reinternment plan and/or preservation plan.

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Section 1 Introduction

1.1 Project Background

At the request of The Limtiaco Consulting Group on behalf of the City and County of Honolulu Board of Water Supply (BWS), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this cultural literature review (CLR) for a BWS Waiawa 228 Reservoir project, Waiawa Ahupua‘a, ‘Ewa District, O‘ahu, TMK: (1) 9-6-004:024 por. The study area is owned by Kamehameha Schools and is located on gently sloping table land near the 228-foot (ft) elevation (hence the name of the reservoir project) at a distance of approximately 2.5 km north of the Middle Loch of Pearl Harbor immediately east of the H-2 freeway. The study area is depicted on a portion of the 1998 U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), tax map plat (Figure 2), and a 2016 aerial photograph (Figure 3).

A preliminary site and grading plan for the Waiawa 228 Reservoir is provided in Figure 4 and a mock-up of how the project would appear from the H-2 Freeway, providing a feeling for the area, is provided in Figure 5. The study area was under commercial sugarcane cultivation for nearly a century (ca. 1897 to 1996) and since the end of sugarcane cultivation, the lands of the study area vicinity have been fallow and are now overwhelmingly dominated by tall *haole koa* (*Leucaena glauca*) trees.

The BWS Waiawa 228 Reservoir project will likely involve grading of an approximately 3.57-acre area for the foundation of three closely sited tank reservoirs (of 2.0, 2.5, and 4.0 million gallon capacity, see Figure 4) east of the H-2 Freeway (see Figure 5). This may involve cutting into the northwest slope with a cut volume estimated at 105,385 cubic yards (and a fill volume of 15 cubic yards). The project may also include the construction of a 12-ft wide access road, a 30-inch influent main, and a 30-inch effluent main, plans for which are still under development. Specific alignments for the access roads, water mains, and other associated infrastructure is unknown at this time, but is anticipated to be within the study area.

1.2 Document Purpose

This cultural literature review was prepared to assist in identifying past and ongoing cultural resources and practices within and surrounding the proposed project area. Cultural resources and practices include but are not limited to habitation sites, areas of gathering and cultivation, sacred sites, burial practices, and trails.

Historical and archaeological background research was conducted to clarify land use within and surrounding the proposed project area from the earliest records to present-day usage. Such findings were used to identify recognized cultural resources and practices, and if present and still performed, to assess the potential impact of the proposed project and to determine whether their preservation is justified.

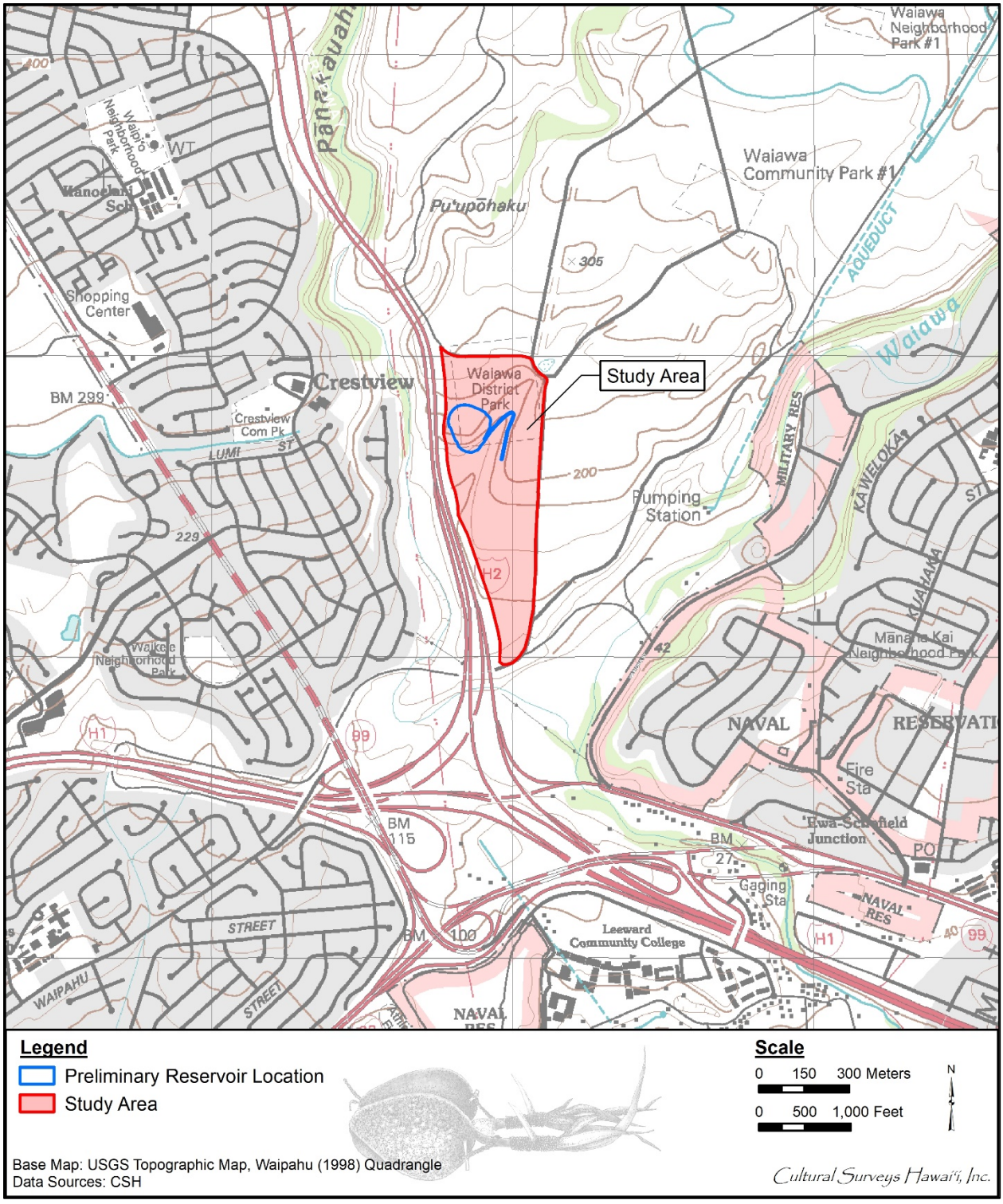

Figure 1. Portion of the 1998 Waipahu USGS 7.5-minute topographic quadrangle, showing the study area

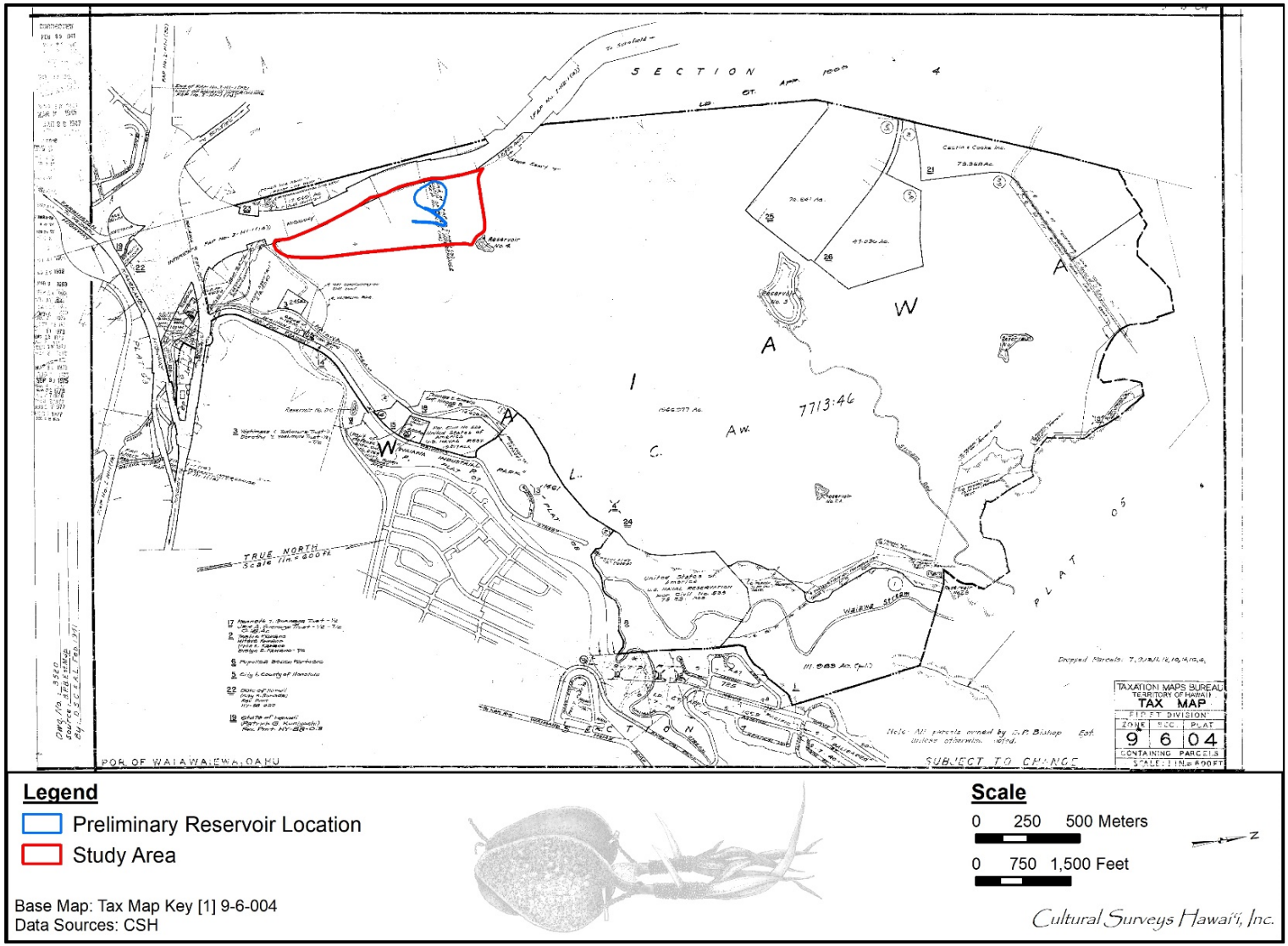

Figure 2. TMK: (1) 9-6-004 showing the study area (Hawai‘i TMK Service 2022)

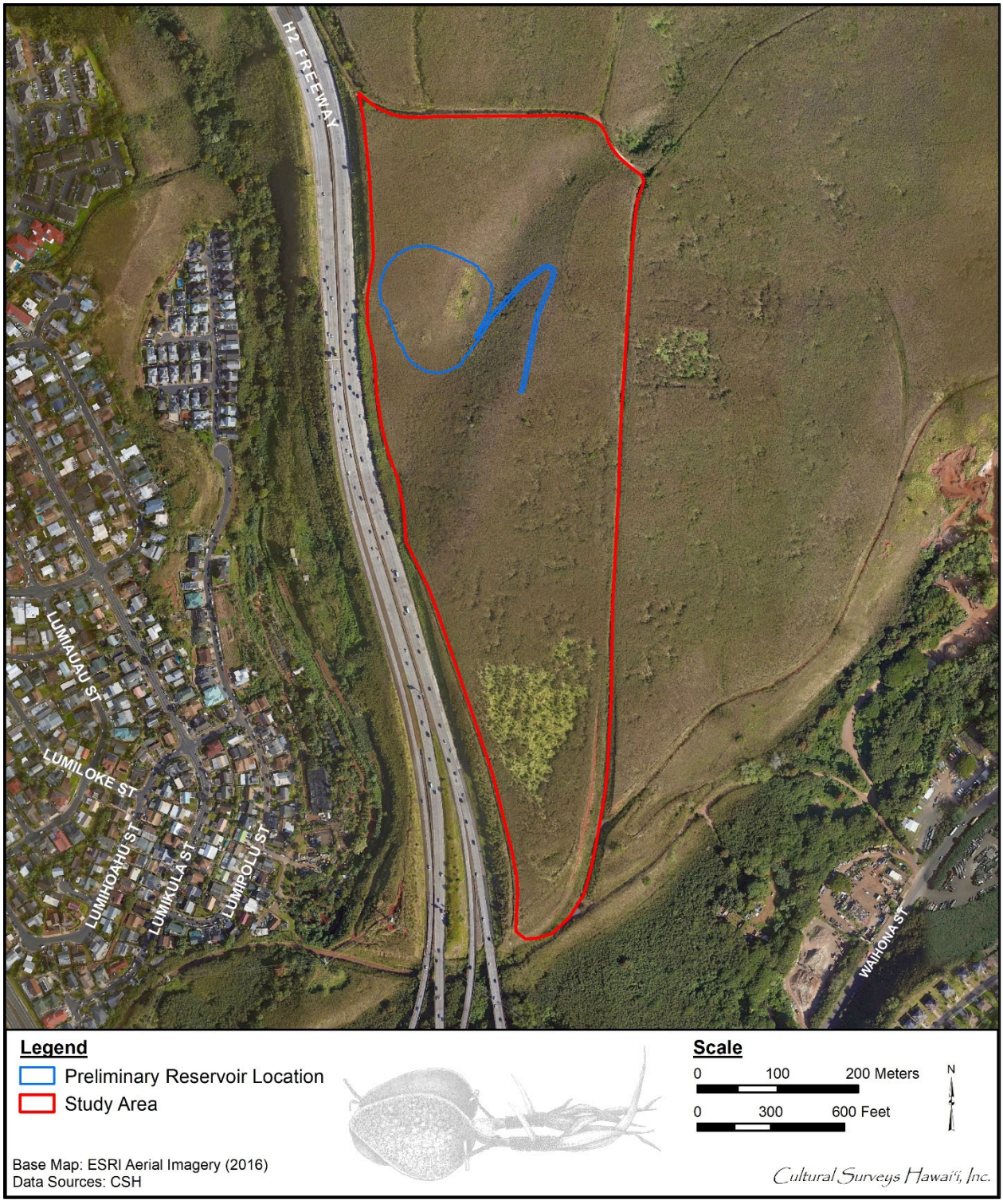

Figure 3. 2016 aerial photograph showing the study area (H-2 Freeway at left) (ESRI 2016)

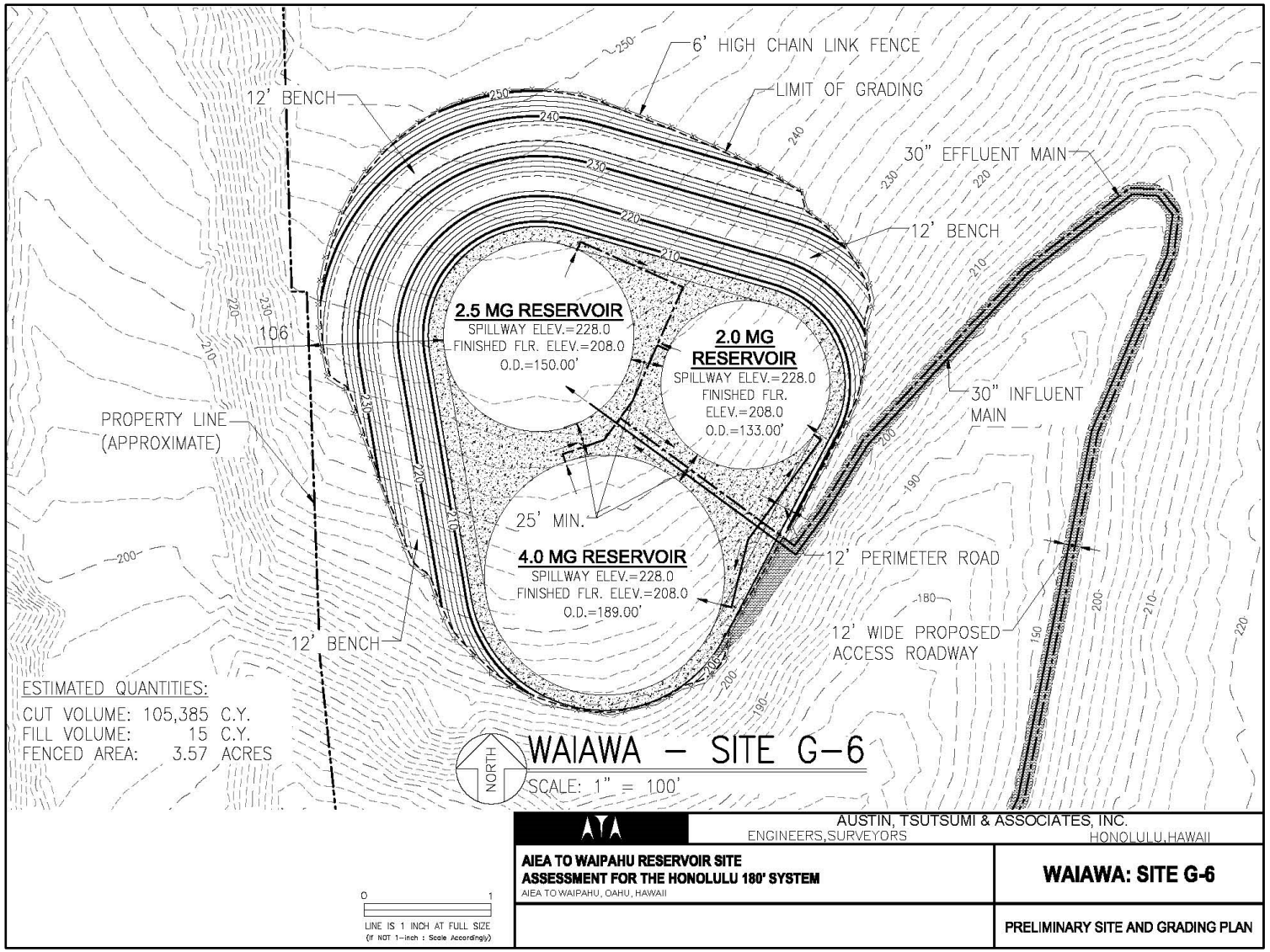

Figure 4. Preliminary site and grading plan for the Waiawa 228 Reservoir (courtesy of client)

Figure 5. Mock-up view of the Waiawa 228 Reservoir on the east side of the H-2 Freeway, as it would be seen from the H-2 Freeway (courtesy of client)

1.3 Scope of Work

The scope of work for this cultural component includes the following:

1. Examination of cultural and historical resources including Land Commission documents, historic maps, and previous research reports for the specific purpose of identifying traditional Hawaiian activities including gathering of plant, animal, and other resources or agricultural pursuits as may be indicated in the historic record.
2. Review of previous archaeological work within and near the subject parcel that may be relevant to reconstructing traditional land use activities and to the identification and description of cultural resources, practices, and beliefs associated with the parcel.
3. Preparation of a report that summarizes the results of these research activities and provides recommendations based on findings.

1.4 Environmental Setting

1.4.1 Natural Environment

The study area is located on gently sloping table land near the 228-ft elevation (hence the name of the reservoir project) with the proposed tank location at a distance of approximately 2.5 km north of the Middle Loch of Pearl Harbor and located immediately east of the H-2 Freeway.

The study area was under commercial sugarcane cultivation for nearly a century from shortly after the establishment of the Oahu Sugar Company in 1897 until approximately 1996. Since the end of sugarcane cultivation the lands of the study area vicinity have been fallow and are now overwhelmingly dominated by tall *haole koa* trees.

1.4.2 *Ka Lepo* (Soils)

According to the U.S. Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) database (2001) and soil survey data gathered by Foote et al. (1972), the study area's soils consist of Helemano silty clay, 30 to 90% slope (HLMG) soils, Lahaina silty clay, 3 to 7% slopes (LaB) soils and 7 to 15% slopes (LaC) soils, and Molokai silty clay loam, 3 to 7% slope (MuB) soils and 15 to 25% slope (MuD) soils, and rock land (rRK) (Figure 6).

Helemano series soils are described as follows:

> […] well-drained soils on alluvial fans and colluvial slopes on the sides of gulches [...] They developed in alluvium and colluvium derived from basic igneous rock. They are steep to extremely steep. Elevations range from 500 to 1,200 feet […] These soils are used for pasture, woodland, and wildlife habitat. The natural vegetation consists of bermudagrass, Christmas berry, eucalyptus, Formosa koa, guava, Japanese tea, Java plum, and koa haole. [Foote et al. 1972:40]

Helemano silty clay, 30 to 90% slope (HLMG) soils are further described as follows:

> This soil is on the sides of V-shaped gulches. [...] Also included were small areas of rock outcrop, steep stony land, and eroded spots. Permeability is moderately rapid. Runoff is medium to very rapid, and the erosion hazard is severe to very severe. [Foote et al. 1972:40]

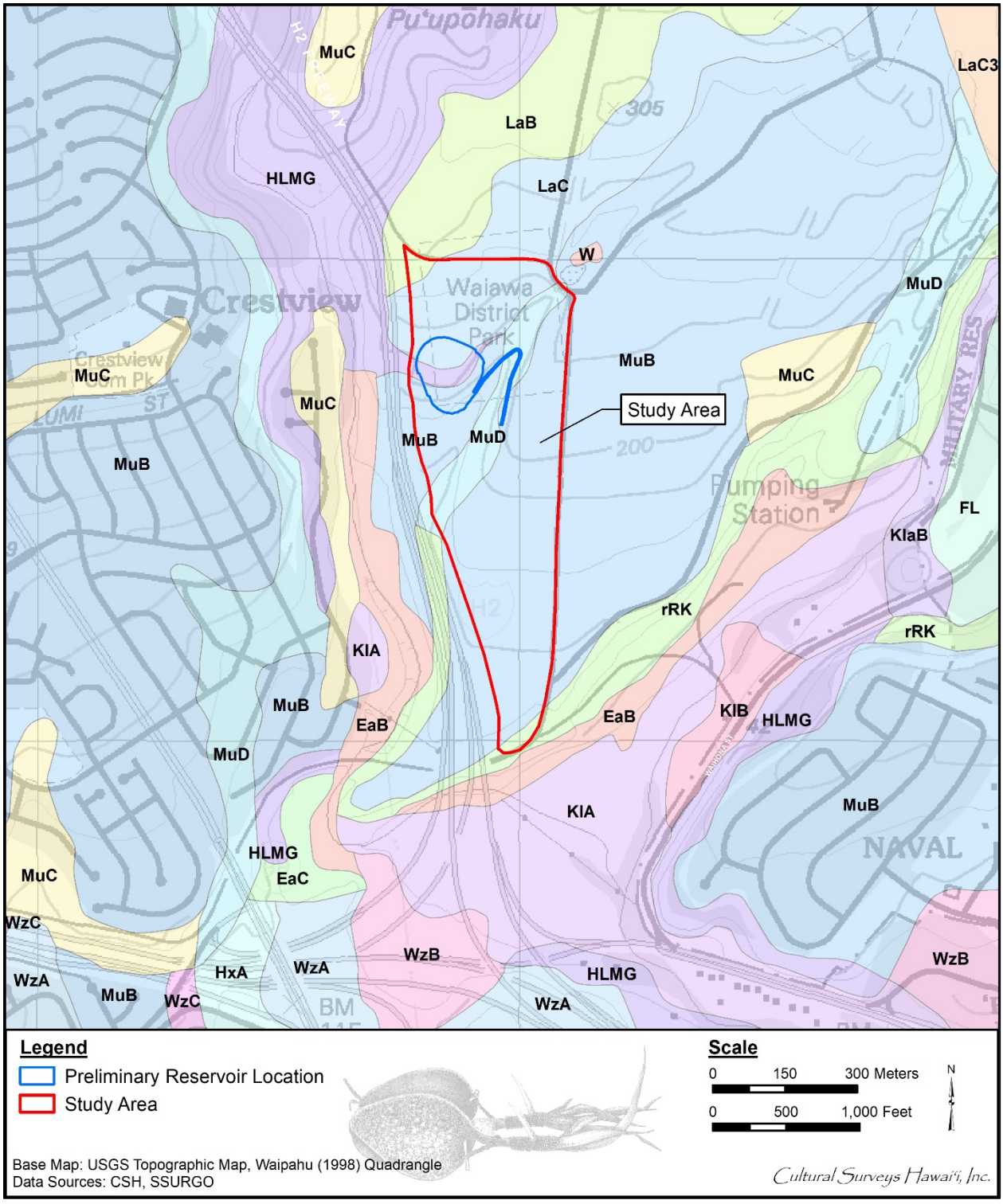

Figure 6. Overlay of *Soil Survey of Islands of Kauai, Oahu, Maui, Molokai and Lanai, State of Hawaii* (Foote et al. 1972), indicating soil types within and surrounding the study area (USDA SSURGO 2001) (base map: portion of the 1998 Waipahu USGS 7.5-minute topographic quadrangle)

Lahaina series soils are described as follows:

> […] consists of well-drained soils on uplands […] These soils developed in material weathered from basic igneous rock. They are nearly level to steep. Elevations range from 10 to 1,500 feet […] These soils are used for sugarcane and pineapple. Small acreages are used for truck crops, pasture, homesites, and wildlife habitat. The natural vegetation consists of bermudagrass, feather fingergrass, ilima, kiawe, lantana, oi, and uhaloa. [Foote et al. 1972:78]

Lahaina silty clay, 3 to 7% slopes (LaB) soils are further described as "runoff is slow, and the erosion hazard is slight" (Foote et al. 1972:78).

Lahaina silty clay, 7 to 15% slopes (LaC) soils are further described as "On this soil, runoff is medium and the erosion hazard is moderate. Included in mapping were small, steep areas and areas where a few cobblestones and stones are on the surface" (Foote et al. 1972:79).

Molokai series soils are described as follows:

> […] consists of well-drained soils on uplands […] These soils formed in material weathered from basic igneous rock. They are nearly level to moderately steep. Elevations range mainly from nearly sea level to 1,000 feet […] These soils are used for sugarcane, pineapple, pasture, wildlife habitat, and homesites. The natural vegetation consists of kiawe, ilima, uhaloa, feather fingergrass, and buffelgrass. [Foote et al. 1972:96]

Molokai silty clay loam, 3 to 7% slope (MuB) soils are further described as "runoff is slow to medium and the erosion hazard is slight to moderate" (Foote et al. 1972:96).

Molokai silty clay loam, 15 to 25% slope (MuD) soils are further described as "Runoff is medium, and the erosion hazard is severe. Workability is slightly difficult because of the slope" (Foote et al. 1972:96).

Rock land are described as follows:

> […] made up of areas where exposed rock covers 25 to 90 percent of the surface. […] The rock outcrops and very shallow soils are the main characteristics. The rock outcrops are mainly basalt and andesite. This land type is nearly level to very steep. Elevations range from nearly sea level to more than 6,000 feet. The annual rainfall amounts to 15 to 60 inches.
>
> Rock land is used for pasture, wildlife habitat, and water supply. The natural vegetation at the lower elevations consists mainly of kiawe, klu, piligrass, Japanese tea, and koa haole. Lantana, guava, Natal redtop, and molassesgrass are dominant at the higher elevations. This land type is also used for urban development. […] [Foote el al. 1972:119]

1.4.3 *Ka Ua* (Rains)

Precipitation is a major component of the water cycle accountable for depositing fresh water on local flora. Pre-Contact *kānaka ʻōiwi* (Native Hawaiians) recognized two distinct annual seasons. The first, known as *kau* (period of time, especially summer) lasts typically from May to October and is a season marked by a high-sun period corresponding to warmer temperatures and steady

trade winds. The second season, *ho‘oilo* (winter, rainy season) continues through the end of the year from November to April and is a much cooler period when trade winds are less frequent, and widespread storms and rainfall become more common (Giambelluca et al. 1986:17). Typically, the maximum rainfall occurs in January and the minimum in June (Giambelluca et al. 1986:17).

It was a customary tradition to grant a name for each type of rain. Rains were named to show their action toward plants or the supposed effects on people or their possessions (Pukui and Elbert 1986:361). There are different rains associated with the *moku* (district) of ‘Ewa including the Kuahine, Nāulu, and Wa‘ahila rain (Akana and Gonzalez 2015:114, 195, 272).

1.4.4 *Ka Makani* (Winds)

Similar to rain, *makani* (wind) were named for various reasons such as describing the intensity or direction of the wind, relating the wind to a story, or even relating the wind to the landscape. David Malo, a Native Hawaiian historian, explains some general terms related to wind:

> […] There was the *kona*, a wind from the south, of great violence and of wide extent. It affected all sides of an island, east, west, north, and south, and continued for many days […] The *kona* wind often brings rain, though sometimes it is rainless […] The *hoolua*, a wind that blows from the north, sometimes brings rain and sometimes is rainless […] The *hau* is a wind from the mountains, and they are thought to be the cause of it, because this wind invariably blows from the mountains outwards towards the circumference of the island. [Malo 1951:14]

The Wind Gourd of La‘amaomao tells the story of Pāka‘a and his son Kuāpāka‘a, descendants of the wind goddess La‘amaomao. They are able to control the winds of Hawai‘i which are contained in a gourd and may be called forth by chanting their names. Pāka‘a’s chant traces the winds of O‘ahu in the *moku* of ‘Ewa. Five winds are identified throughout this *moku* and are presented in Pāka‘a’s chant as follows:

He Moae-ku ko Ewaloa,	Moa‘e-ku is of Ewaloa,
He Kehau ko Waiopua,	Kēhau is of Waiopua,
He Waikoloa ko Lihue,	Waikōloa is of Līhu‘e,
He Kona ko Puukapolei,	Kona is of Pu‘ukapolei,
He Maunuunu ko Puuloa. . .	Māunuunu is of Pu‘uloa. . .
[Nakuina 1902:57]	[Nakuina 1992:51]

1.4.5 *Nā Kahawai* (Streams and Freshwater)

In the lower section, Waiawa Ahupua‘a is watered by Waiawa Stream, which in the upper portion splits into Waiawa and Mānana streams. In his discussion of trails through Waiawa, John Papa ‘Ī‘ī (1959:97) mentions the stream Kukehi (another name for the *makai* end of Waiawa Stream). Agricultural and aquacultural intensification in the well-watered area along Waiawa Stream would have supported substantial food production and human population. In his survey of existing and remnant agricultural areas on O‘ahu, E.S. Craighill Handy noted a few seaward terraces for taro cultivation, irrigated by Waiawa Stream (Handy 1940:81). Waiawa Stream is located approximately 800 m to the southeast of the project area and is understood to have been a perennial stream prior to modern water diversions.

1.4.6 *Ka Lihiwai a me Ka Moana* (the Coast and Ocean)

Both seashore and ocean provided physical and spiritual sustenance (NOAA 2017) for the people of ‘Ewa. According to Malo, the ocean was divided into smaller divisions, stretching from *‘ae kai* (water’s edge) to *moana* (pelagic zone) (Malo 1951:25–26). Outside the coastal areas was the belt known as *kua au*, where the shoal water ended (Malo 1951:26). Further out was the *kai au*, deeper waters designated for surfing, swimming, or spearing squid (Malo 1951:26).

Traditionally, the seashore and ocean areas were vitally important for resource extraction in the early days of settlement. Fishermen along the coast maintained a respected status within traditional Hawaiian society; Kanahele asserts that “early Hawaiians regarded fishing as the oldest, and hence the most prestigious of professions” (Kanahele 1995:17).

According to Charles Howard Edmondson (1946:5), the coastal waters of Pearl Harbor were “a natural aquarium for many varieties of marine animals.” Titcomb (1952:7) identifies the Pearl Harbor area as the only large natural inland lagoon, famous for its fish and fishponds. The *nehu* (anchovy; *Anchoviella purpurea*) was said to fill the lochs of Pearl Harbor. Citing Kamakau, Margaret Titcomb writes that the *nehu*, “filled the lochs from the channel of Pu‘uloa (Pearl Harbor) inland to the Ewas” (Titcomb 1952:97). Due to the presence of the *nehu*, the *kama‘āina* (native born) of ‘Ewa developed this saying,

> *He kai puhi nehu, puhi lala ke kai o ‘Ewa e, e noho i ka la‘i o ‘Ewa nui a La‘akona*
> (‘A sea that blows up nehu, blows them up in rows, is ‘Ewa, until they rest in the calm of great ‘Ewa-a-La‘akona’). [Kamakau 1991a:84]

1.4.7 Built Environment

The H-2 freeway located just to the west of the study area is a major vehicular artery connecting Honolulu and the south shore of O‘ahu to the central O‘ahu communities of Mililani and Wahiawa and on to O‘ahu’s North Shore. Otherwise development in the vicinity of the study area is limited to a network of roads developed by the Oahu Sugar Company to service their sugarcane fields.

Section 2 Methods

2.1 Archival Research

Research centers on Hawaiian activities including *ka‘ao* (legends), *wahi pana* (storied places), *‘ōlelo no‘eau* (proverbs), *oli* (chants), *mele* (songs), traditional *mo‘olelo* (stories), traditional subsistence and gathering methods, ritual and ceremonial practices, and more. Background research focuses on land transformation, development, and population changes beginning with the early post-Contact era to the present day.

Cultural documents, primary and secondary cultural and historical sources, previous archaeological reports, historic maps, and photographs were reviewed for information pertaining to the study area. Research was primarily conducted at the CSH library. Other archives and libraries including the Hawai‘i State Archives, the Bishop Museum Archives, the University of Hawai‘i at Mānoa’s Hamilton Library, Ulukau, The Hawaiian Electronic Library (Ulukau.org 2014), the State Historic Preservation Division (SHPD) library, the State of Hawai‘i Land Survey Division, the Hawaiian Historical Society, and the Hawaiian Mission Houses Historic Site and Archives are also repositories where CSH cultural researchers gather information. Information on Land Commission Awards (LCAs) were accessed via Waihona ‘Aina Corporation’s Māhele database (Waihona ‘Aina 2022), the Office of Hawaiian Affairs (OHA) Papakilo Database (Office of Hawaiian Affairs 2015), and the Ava Konohiki Ancestral Visions of ‘Āina website (Ava Konohiki 2022).

Section 3 Traditional Background

3.1 *Ka‘ao* and *Mo‘olelo* (Legends and Stories)

Hawaiian storytellers of old were greatly honored; they were a major source of entertainment and their stories contained teachings while interweaving elements of Hawaiian lifestyles, genealogy, history, relationships, arts, and the natural environment (Pukui and Green 1995:IX). According to Pukui and Green (1995), storytelling is better heard rather than read for much becomes lost in the transfer from the spoken to the written word and *ka‘ao* are often full of *kaona* or “double meanings.”

Ka‘ao are defined by Pukui and Elbert as a “legend, tale [...], romance, [and/or], fiction” (Pukui and Elbert 1986:108). *Ka‘ao* may be thought of as oral literature or legends, often fictional or mythic in origin, and have been “consciously composed to tickle the fancy rather than to inform the mind as to supposed events” (Beckwith 1970:1). Conversely, Pukui and Elbert define *mo‘olelo* as a “story, tale, myth, history, [and/or] tradition” (Pukui and Elbert 1986:254). The *mo‘olelo* are generally traditional stories about the gods, historic figures or stories that cover historic events and locate the events with known places. *Mo‘olelo* are often intimately connected to a tangible place or space.

In differentiating *ka‘ao* and *mo‘olelo* it may be useful to think of *ka‘ao* as expressly delving into the *wao akua* (realm of the gods), discussing the exploits of *akua* (gods) in a primordial time. However, it is also necessary to note there are exceptions, and not all *ka‘ao* discuss gods of an ancient past. *Mo‘olelo* on the other hand, reference a host of characters from *ali‘i* (chiefs), to *akua* and *kupua* (supernatural beings), to finally *maka‘āinana* (commoners), and discuss their varied and complex interactions within the *wao kānaka* (realm of man). Beckwith elaborates, “In reality, the distinction between ka‘ao as fiction and mo‘olelo as fact cannot be pressed too closely. It is rather in the intention than in the fact” (Beckwith 1970:1). Thus, a so-called *mo‘olelo*, which may be enlivened by fantastic adventures of *kupua*, “nevertheless corresponds with the Hawaiian view of the relation between nature and man” (Beckwith 1970:1).

Both *ka‘ao* and *mo‘olelo* provide important insight into a specific geographical area, adding to a rich fabric of traditional knowledge. The preservation and passing on of these stories through oration remains a highly valued tradition. Additionally, oral traditions associated with the study area communicate the intrinsic value and meaning of a place, specifically its meaning to both *kama‘āina* as well as others who also value that place.

The following section presents traditional accounts of ancient Hawaiians living in the vicinity of the BWS Waiawa 228 Reservoir project area. Many relate an age of mythical characters whose epic adventures inadvertently lead to the Hawaiian race of *ali‘i* and *maka‘āinana*. The *ka‘ao* in and around the project area shared below are some of the oldest Hawaiian stories that have survived. They still speak to the characteristics and environment of the area and its people.

3.1.1 The Hero Kawelo

Kawelo, called “The Roving Chief,” lived for a time at Waiawa in ‘Ewa.

> *O kahi nae a lakou e noho nei, aia no ma Waiawa, Oahu. O ko ianei hele aku la no ia e halawai me ka lawaia a ianei, a o ko laua nei holo aku la no ia, a hiki no ma*

> *kahi, a laua nei i lana mua ai. O ko laua nei kuu iho la no ia i ka upena, ahiu aku la ua i‘a nei aohe kokoke mai i ka upena. Pane aku o Kawelo: ‘Aole e loaa ana ka i‘a ia kaua. Ina e loaa kekahi uhu okoa ia kaua, alaila, loaa ka pakali nana e hoowalewale.’ Oia kekahi mea i olelo ia e ka poe haku-mele, penei: ‘I laka no ka i‘a i ka pakali,’ a pela aku.*
>
> Now the place they were then residing was at Waiawa, Oahu. He [Kawelo] immediately set out to join his fishing companion [Makuakeke], and both sailed out and arrived at the place where they had formerly floated. They lowered the net, but the fish became shy and kept away from the net. Kawelo remarked: ‘We shall not be able to catch the fish. If we can secure an uhu [parrotfish], then, we can have a bait that will tempt it.’ This is a fact that has found expression among the composers of chants, in this manner: ‘The fish are tamed by the tempting bait,’ etc. [Fornander 1919:5(3):700–701]

Fornander (1919:5[3]:700) explains this is in reference to the Hawaiian practice of using a tame *uhu* (parrotfish) as a decoy to lure other *uhu* to an area for netting. This netting method and other fishing practices were described by a Lāhainā resident, Daniel Kahā‘ulelio, in a series of articles on traditional Hawaiian fishing practices written for the Hawaiian language newspaper, *Ka Nūpepa Kū‘oko‘a* in 1902.

> *O kekahi upena o ka uhu kaka, he wahi upena poepoe, a he makolu a malua ka upena* […] *a me na hanai kaula aho eha e hoopaa ana i ka pu e paa iho ai ke aho e huki ae ai ka lawaia, a laila, o ka hana koe, o kou imi i lehu maunu hoowalewale, a hoohaehae i mea e laka mai ai na uhu okoa, a ua kapa ia kona inoa he pula a he pakahi, a he uhu pakahi, a ua puana hula ia no hoi, pakalikali ka loaa, a o ka maunu ekaeka. I ka loaa ana o ka uhu pakahi .*
>
> […] *akahi no hoi e lawaia ai,* […]. *A laila hooku‘u no i ua uhu pakahi ala, ina e ike ana ka lawaia ua hae ka uhu, a laila, hooku‘u ka upena, me ka hoopaa i ua uhu pakahi ala ma ka pu o ka upena. A i ka manawa i komo ai ka uhu hou e pili me kela uhu pakahi, o ka manawa ia e huki ai ka lawaia i ka upena me ka cquir, o ka paa ihola no ia .* […]
>
> One of the nets used was rounded and compact, having meshes of two or three fingers width. […] Four cords were tied to the corners and fastened together in the center. There a drawing cord was attached for the fisherman to pull it up. Then the next thing was to seek a living decoy to lure other *uhu* in. It is called a *pula*, a *pākahi* or an *uhu pākahi*.
>
> When a decoy was secured, the fisherman sailed out to the fishing spot he had selected […] then the decoy was lowered. As soon as the fisherman saw that the other *uhu* had rushed to the spot, then he lowered the net with the fish decoy tied where the four cords met on the net. When the new *uhu* came in to be close to the decoy then the fisherman pulled in the net as hard as he could. It was then caught fast. [*Ka Nūpepa Kū‘oko‘a* 1902 in Kahā‘ulelio 2006:150–153]

Kawelo was famous for catching the supernatural parrotfish called *Uhu‘maka‘ika‘a*, the father of all fish. One day, when fishing off the Wai‘anae coast, the following occurred:

> At dawn Kawelo awakened his teacher with these words: ‘Makuakeke, awake! The sun is high. Bring the fishhooks and the nets. Let us fish.’ […]
>
> Then with one mighty stroke of the paddle the canoe lay off Honolulu harbor, with two strokes it neared Puuloa, and with three it reached Waianae. There Kawelo chewed some *kukui* nuts and blew the oil over the sea so that the water became calm and they could see the bottom. The canoe drifted from the shallow water into the deep as the men fished for *ulua* [crevalle, jack, or pompano].
>
> As it grew late Makuakeke urged Kawelo to return home, for he knew that it was time for Uhumakaikai, the fish god, to appear and he greatly feared this fish. So the tired fishermen went home. […]
>
> Early the next morning Kawelo called the fishermen and paddled out to their fishing waters. Soon Makuakeke saw the storm clouds gather in the sky and knew that the fish god was coming. As the huge fish swam toward them Kawelo threw his net and caught him. Then the fish, pulling the canoe with him, swam out to sea until the men could no longer see their homes or the surf beating on the shore. They went so rapidly that they soon came to Kauai, where the fish turned and swam back with them to Waikiki. There at last the men were able to kill him. [Rice 1977:68, 70]

3.1.2 Keakua‘ōlelo

Keakua‘ōlelo is described as a local god of Pānakauahi Gulch (in Waiawa), who was watching from his *heiau* in Pānakauahi one day. He spotted a woman of high rank from Hawai‘i as she hid her *lei niho palaoa* (special ornament, usually bone or ivory, worn by the *ali‘i*) in a hole of a rock, a rock named Pōhaku Huna Palaoa*,* on the plain of Punahawele in Waipi‘o. Keakua‘ōlelo assured the woman that when the time came for her descendants to find the necklace, he would guide them (*Ka Loea Kālai‘āina* 1899, translated in Sterling and Summers 1978:22).

Keakua‘ōlelo also appears in another *mo‘olelo* of children and a secret eating place called Ka‘aimalu. A boy named Pūpūkanioe and a girl named Nāuluahōkū grew up at Pana‘iahakea, a tributary gulch on the boundary of Waipi‘o and Waiawa. They traveled frequently down to the coast at the village of Kualaka‘i in Honouliuli to fish. Usually they caught plenty of fish; however, on one particular day, they only caught one fish, a *palani* (surgeonfish), which was a fish *kapu* (taboo) to men but free to eat by females. As they were on their long journey home, they were both caught up in hunger, and the girl insisted they both eat the *palani* secretly. However, Keakua‘ōlelo was watching and announced their sharing of the females’ fish. This was considered the first time the eating *kapu* was broken, and the spot where they ate is called Ka‘aimalu, the secret eating place (*Ka Loea Kālai‘āina* 1899, translated in Sterling and Summers, 1978:7).

3.1.3 Maihea

One *mo‘olelo,* the legend of Maihea, suggests Waiawa was named for the *‘awa* plant.

> […] it was here in ‘Ewa that Kāne and Kanaloa were invoked by a planter of sweet potatoes, taros, and *‘awa* named Maihea. This man, living in the upland of Wai‘awa, [Handy and Handy use the glottal stop] when he had prepared his meal and his ‘*awa*, would pray:
>
> O unknown gods of mine,

> Here are *‘awa*, taro greens and sweet potatoes
> Raised by me, Maihea, the great farmer.
> Grant health to me, to my wife and to my son.
> Grant us *mana*, knowledge and skill.
> *Amama*. It is freed.
> [Handy and Handy 1972:472]

Another version of the *mo‘olelo* of Maihea is published in *Ka Loea Kālai‘āina* (1899, translated in Hawaiian Ethnological Notes). In this rendition, Maihea lived at Waimalu, where he cultivated sweet potatoes and taro. However, it was on a hill in the upland of Waiawa where he planted his *‘awa*. He prayed daily to the unknown gods with his offering of *‘awa*, taro greens, and sweet potatoes. In answer to his prayer, the gods Kāne and Kanaloa sent a whale to Waimalu. All the people of the area came to marvel at the sight. The beached whale waited almost four weeks until the son of Maihea, Ula-a-Maihea, could resist no longer. Against the wishes of his parents, he went down to the shore to see the spectacle. Once there, he followed the children climbing on to the whale. The whale began to move and Ula-a-Maihea was taken to Kahiki, where he was trained in the *kahuna* (priest) arts under Kāne and Kanaloa. The parents grieved for the boy until two strangers came to the door. Maihea invited them into his house and offered them *‘awa*, saying his usual prayer to the unknown gods. At this time, Kāne and Kanaloa revealed that they were the unknown gods and that they had answered his prayer by sending their son to Kahiki to learn the arts of the *kahuna*.

> This was the beginning of the travels of these gods on earth and this was also the time when the boundaries of Ewa were made as I told you when I mentioned Pohaku-pili. On their return after dividing the land, they came to the top of Haupuu, (that is the present site of the Kahikuonuolani Church at Waiawa) [old Ewa Protestant Church in Waiawa] they turned to look at ‘Ewa and when they saw the fish ponds at Waiawa, they said, ‘May the fish ponds down at Waiawa be as the stars in the sky above. May there be mullets at Kuhia-*loko* [fishpond and *‘ili* (traditional land division smaller than an *ahupua‘a*) of Waiawa], fine sea weed at Kuhia-waho [*‘ili* of Waiawa], salt at Ninauele, the single fruited coconut at Hapenui, the taro greens at Mokaalika and the water of Kaaimalu [garden area in Waiawa], to remove the bitterness of the ‘awa of Kalahikuola.’ [*Ka Loea Kālai‘āina,* 1 July 1899, translated in Sterling and Summers 1978:5]

In a different version of the *mo‘olelo*, translated by Maly, Kāne and Kanaloa tell Maihea that his wife will have a son who must come to Kahiki to learn the practices of the priests. When Kāne and Kanaloa send a whale to fetch Maihea’s son, Nauluaamaihea, and take him to Kahiki, Maihea forbids his son from going, however, after three weeks, Nauluaamaihea disobeys his father and gets on the back of the whale.

> When Naulaamaihea was born, he lived with his parents until he was fifteen years old, and then Naulaamaihea was taken to Kahiki. It was a whale that fetched him and took him to Kahiki. The whale came near the shore of Waimalu, just outside of the walled fishpond called Paakea. For three weeks the whale lay outside, but Naulaamaihea did not go to the shore because Maihea forbade him from going. This was because of Maihea’s great love for his son. But in the fourth week,

> Naulaamaihea went down to the shore and got on the back of the whale. Thus, he was taken to Kahiki where he learned the practices of the priests. He is still remembered in the genealogies of the priests to this day. [Maly and Maly 2003:95]

Maihea sent his two sons down to the spring at Punanaloa to fill their water gourds. The necks of the gourds were very narrow and it took a long time to fill them. In frustration, the boys dashed the gourds to the ground and broke them, so the place was called Huewaipi (stingy-water-bottle). The boys ran over the plain and were turned into two stones, called Na-keiki-pōhaku-a Maihea (the stone sons of Maihea). Later, the stones were called Napōhaku-kū-loloa (the long standing stones) and the spring's name was contracted to Kawaipi. There is an *‘ili* called Kauhihau on the east edge of Waiau, so the gulch may have been located there. Sterling and Summers (1978:15) place the spot called Punanaloa and the Huewaipi Spring in Waimalu, the *ahupua‘a* to the east of Waiau.

Author Moses Manu also notes a dark *‘awa* (*pu‘awa popolo*) which was grown in the uplands of Waiawa:

> […] When the wondrous maiden Ke-ao-melemele arrived at the entrance to the mountain of Konahuanui, all the offerings were in charge of Ke-anuenue, a puko‘a or reddish brown pig, a clump of dark ‘awa (pu‘awa popolo) which was not common in these islands. This variety of ‘awa now grows in the uplands of Waiawa, down here in Ewa. [Sterling and Summers 1978:19]

3.2 Wahi Pana (Storied Places)

Wahi pana are legendary or storied places in a landscape. These legendary or storied places can be a variety of natural or human-constructed features. Oftentimes dating to the pre-Contact period, many but not all *wahi pana* are connected to particular *mo‘olelo*. Dr. Davianna McGregor outlines the types of natural and human-made structures that may constitute *wahi pana*:

> Natural places have mana or spiritual power, and are sacred because of the presence of the gods, the akua, and the ancestral guardian spirits, the ‘aumakua. Human-made structures for the Hawaiian religion and family religious practices are also sacred. These structures and places include temples, and shrines, or heiau, for war, peace, agriculture, fishing, healing, and the like; pu‘uhonua, places of refuge and sanctuaries for healing and rebirth; agricultural sites and sites of food production such as the lo‘i pond fields and terraces slopes, ‘auwai irrigation ditches, and the fishponds; and special function sites such as trails, salt pans, hōlua slides, quarries, petroglyphs, gaming sites, and canoe landings. [McGregor 1996:22]

As McGregor makes clear, *wahi pana* can refer to natural geographic locations such as streams, peaks, rock formations, ridges, offshore islands and reefs, or they can refer to Hawaiian land divisions such as *ahupua‘a* or *‘ili*, and man-made structures such as fishponds. In this way, the *wahi pana* of Waiawa tangibly link the *kama‘āina* of Waiawa to their past. It is common for places and landscape features to have multiple names, some of which may only be known to certain *‘ohana* (family) or even certain individuals within an *‘ohana*, and many have been lost, forgotten, or kept secret through time. Place names also convey *kaona* and *huna* (secret) information that may even have political or subversive undertones. Before the introduction of writing to the Hawaiian Islands, cultural information was exclusively preserved and perpetuated orally.

Hawaiians gave names to literally everything in their environment, including individual garden plots and *‘auwai* (water courses), house sites, intangible phenomena such as meteorological and atmospheric effects, *pōhaku* (stone), *pūnāwai* (freshwater springs), and many others. According to Landgraf (1994), Hawaiian *wahi pana* "physically and poetically describes an area while revealing its historical or legendary significance" (Landgraf 1994:v).

3.2.1 *Nā Inoa ‘Āina* (Place Names)

The meaning and correct pronunciation of Waiawa is in dispute. It is variously spelled Waiawa or Wai‘awa, which leads to different interpretations. *Awa* is both the word for milk fish or a harbor, cove, channel, or passage (Pukui and Elbert 1986:33). In a portion of the chant for Kūali‘i, Fornander (1917:4[2]:394–400) notes the *awa* fish of Waiawa: *E ku‘u kaua i ka loko awa—o Waiawa*, or "Let us cast the net in the *awa*-pond—of Waiawa." This would be no surprise, as there were numerous fishponds in Waiawa. With an alternate spelling, *‘awa* is the word for the native plant used to make a soporific and muscle relaxant drunk by the Hawaiians. Traditional accounts suggest Waiawa may have been acknowledged in early times as the site of a special variety of the *‘awa* plant:

> *I ka wa i hiki mai ai ua eueu nei a ku ma ka puka o kahi e komo ai i loko o ua kuahiwi nei o Konahuanui, aia noi na makana a pau ma ka lima o Keanuenue, oia hoi ka puaa-pukoa, he puaa ehu keia o ka hulu, a he pu awa popolo, aole i laha nui keia awa ma keia pae aina, aia nae keia awa e ulu nei i keai wa ma uka o Waiawa ma Ewa ae nei*.
>
> […] When the wondrous maiden [Keaomelemele] arrived at the entrance to the mountain of Konahuanui, all the offerings were in charge of Ke-anuenue, a puko‘a or reddish brown pig, a clump of dark ‘awa [*pu ‘awa pōpolo*] which was not common in these islands. This variety of ‘awa now grows in the upland of Waiawa, down here in ‘Ewa. [Manu 2002:50, 138]

Waiawa Ahupua‘a extends from Pearl Harbor (Middle Loch) to the Ko‘olau Mountains, and is bounded on the west by Waipi‘o Ahupua‘a and to the east by Manana Ahupua‘a (Figure 7). In the lower section, it is watered by Waiawa Stream, which John Papa ‘Ī‘ī (1959:95, 97) called "Kukehi," and which splits into Waiawa and Mānana streams in the uplands. Near this junction was a long ridge. The point of the ridge was called Lae Pōhaku (stone point) (Bishop 1853), which marked a boundary point between Waiawa and Mānana. At this junction, McAllister (1933:105) recorded a *heiau* called Puoiki, which was built on a knoll.

Along the western Waiawa/Waipi‘o boundary were three marked boundary points, Pu‘u Kamana (hill of the supernatural power), Pu‘u Pōhaku (stone hill) (Brown 1877a, 1877b), and Laehopu (Brown 1877b). Panahakea Gulch extends from the summit of Pu‘u Kamana *makai* toward Waipi‘o, and the east ridge of Pānakauahi Gulch (touched by the smoke) in Waipi‘o defines the *makai* western border of Waiawa. Laehopu marks the coastal point (*lae*) that divides Waiawa and Waipi‘o on the Middle Loch shore.

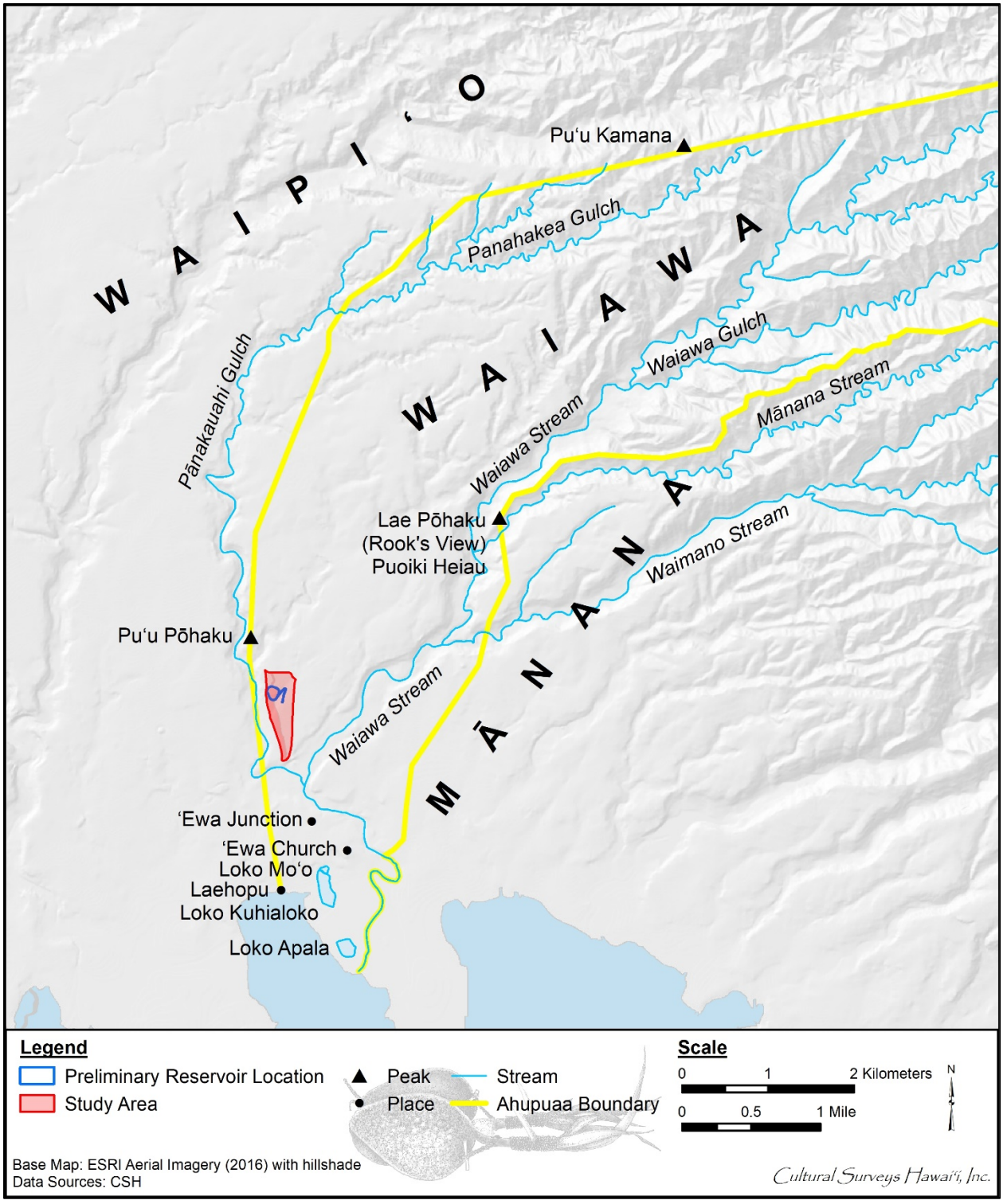

Figure 7. Topographic place names of Waiawa (base map: ESRI 2016 with hillshade)

The mid-nineteenth century Māhele documents concerning Land Commission Awards (LCA) indicate there were at least 15 *‘ili* in Waiawa. A map by S. Bishop (1887) of Waiawa and Mānana (Figure 8) shows all of the awarded LCA lots in Waiawa were clustered along Waiawa Stream and on the Mānana Peninsula. A few were *mauka* and adjacent to the government road in the *‘ili* of Holoipiapia, Kahō‘ai‘ai, and Piliaumoa. Most are clustered around the fishponds Kuhialoko and Loko Mo‘o (lizard or water spirit) on the west and Waiawa Stream to the east in the *‘ili* of Kuhiawaho (outer Kuhia), Kuhialoko (inner Kuhia), Kapopou (the cigar wrasse fish), Pānaio, Kapuaihalulu, Hanakehau (mist bay), Kionaole, Kulaokamakau, and Kāpaloa (the long fence or the long enclosure). The Māhele documents also mention Kalimukele (the watery seaweed), an *‘ili* on the *mauka* border of LCA 9384 near Kapopou ‘Ili, Kalona, an *‘ili* near LCA 10561:1 near Kapuaihaluhalu ‘Ili, and Hale‘aha (meeting house), an *‘ili* on the western border of LCA 9372 in Kapaloa ‘Ili. These *‘ili* are not labeled on available maps. An isolated LCA (LCA 5646) was west of Loko Apala near the *makai* tip of Waiawa, in the *‘ili* of Pānaio, possibly indicating Pānaio had a type of non-contiguous land unit called *lele*.

Nineteenth century land documents mention numerous *loko i‘a* (Soehren 2009). These include the following: Loko Apalakai, Apalawai (Loko Apala), and Kuakuanui at the *makai* tip of Waiawa (Kuhialoko ‘Ili); Ho‘opililoko on the west side of LCA 9361:2 (Kuhiawaho ‘Ili); Loko Kuhialoko (Inner Kuhia Pond), the large pond on the western boundary of the *ahupua‘a* named after Kuhia, one of the servants to Ka‘ahupāhau, the shark queen of ‘Ewa (*Saturday Press* 1884, cited in Sterling and Summers 1978:17); Loko Mo‘o (land parcel or lizard; Soehren 2009), a smaller pond connected to the *makai* side of Loko Kuhialoko; Kalokohanahou (the repaired pond) on the west side of LCA 1715 (Kuhialoko ‘Ili); Kama‘ihi (the dwarf; Pukui and Elbert 1986:222) on the *mauka* side of LCA 1715; Kepoelalo, on the east side of LCA 1715; Kepoeluna, east of LCA 5644:3 (Kuhialoko ‘Ili); Loko Mōkōlea (cut plover or plover island; Soehren 2009), on the west side of LCA 9374:3 (Pānaio ‘Ili; exact location of lot 3 unknown); and Mōkōlea pond was surrounded on one or more sides by two *pu‘uone* (sand dunes) called Kalokoloa (the long pond) and Ninauwale.

There are several other topographic points listed in mid-nineteenth century documents (Soehren 2009), but these could not be found on any available historic maps. A hill called Kanukumanu (the bird’s beak) served as a boundary point for a Māhele award (LCA 9372, *‘āpana* [lot] 2; near the intersection of Waiawa Stream and the Government Road). In his discussion of trails through Waiawa, ‘Ī‘ī (1959) mentions the stream Kukehi (another name for the *makai* end of Waiawa Stream) and the *maika* (game similar to bowling) fields of Haupu‘u and Pueohulunui. Pueohulunui was on the border between Waiawa and Waipi‘o at the “crossroads, where one leads to Waialua and the other branches off to Honouliuli” (Hawaiian Ethnological Notes Ms. I:2705, cited in Sterling and Summers 1978:18). Haupu‘u was the small hill on which the first Protestant Ewa Church was built (*Ka Loea Kālai‘āina* 1899b, translated in Sterling and Summers 1978:18). Up behind the church, at the home of the missionaries, was a small cave that served as the residence for Kahi‘ukā, the brother of the shark protector of ‘Ewa called Ka‘ahupāhau (*Ke Au Hou* 1910, translated in Sterling and Summers 1978:18). According to Sterling and Summers (1978:18), there were two places along the shore, Polea and Kuhia, named for two local *konohiki* (headman of an *ahupua‘a* land division under the chief), but neither of these could be found on any available historic maps.

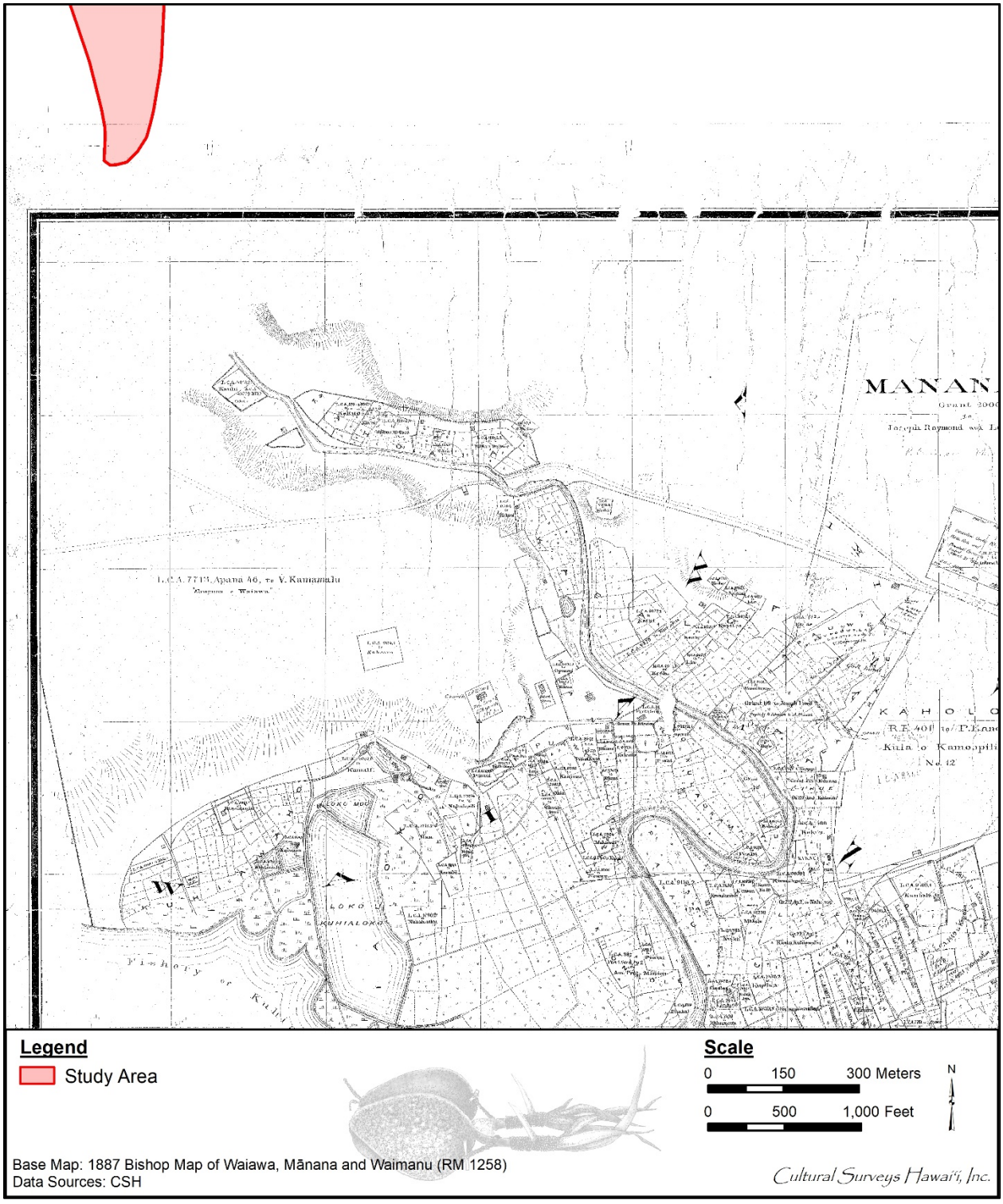

Figure 8. 1887 map of Waiawa, Mānana, and a part of Waimano by S. Bishop (RM 1258), depicting the area of Kuleana Awards; the south end of the present study area is *mauka* of these smaller awards and within LCA 7713 Apana 46 to V. Kamāmalu, who was granted the entire *ahupua‘a* of Waiawa

3.2.2 Pu‘uloa

The Hawaiian name for Pearl Harbor is Pu‘uloa or Keawalau‘opu‘uloa, “the many harbored-sea of Pu‘uloa” (Pukui 1983:182). An alternate name is Awawalei, or “garland (lei) of harbors” (Handy and Handy 1972:469). Pukui (1983:120) uses the name Awalau for Pearl Harbor, as in the saying “*Huhui na ‘ōpua i Awalau*” (“The clouds met at Pearl Harbor,” said of the mating of two people). Emerson (1993:167) interpreted Awalau as “leaf-shaped lagoon.” Clark (1977:70) says that its English name came from the name Waimomi (water of the pearl). The harbor was later named Pearl Harbor after the *pipi*, or pearl oysters, which were once abundant on the harbor reefs but were later decimated by over-harvesting.

A *mo‘o* (water spirit) named Kānekua‘ana supposedly brought these oysters from Kahiki (Handy and Handy 1972:470). Kānekua‘ana was the *kia‘i* (food guardian) of ‘Ewa. When food was scarce, the descendants of Kānekua‘ana built Waihau Heiau (a *heiau* for *mo‘o*) for her and lit fires to plead for her blessings. For ‘Ewa, the main *i‘a* (marine food) blessing involved the famous *pipi*. Samuel Kamakau describes the *pipi* of Pu‘uloa as follows:

> That was the oyster that came in from deep water to the mussel beds near shore, from the channel entrance of Pu‘uloa to the rocks along the edges of the fishponds. They grew right on the nahawele mussels and thus was this i‘a obtained. Not six months after the hau branches were set up, the pipi were found in abundance-enough for all ‘Ewa—and fat with flesh. Within the oyster was a jewel (cquire) called a pearl (momi), beautiful as the eyeball of a fish, white and shining; white as the cuttle fish, and shining with the colors of the rainbow-reds and yellow and blues, and some pinkish white, ranging in size from small to large. They were of great bargaining value (he waiwai kumuku‘ai nui) in the ancient days, but were just “rubbish” (‘opala) in ‘Ewa. [Kamakau 1991b:83]

This pearl oyster, the *pipi*, was “the silent fish,” or *i‘a hamau leo o ‘Ewa*, ‘Ewa’s silent sea creature (Handy and Handy 1972:471). This refers to the fact that the collectors were supposed to stay quiet while harvesting the shells, as in the following sayings:

Ka i‘a hāmau leo o ‘Ewa. The fish of ‘Ewa that silences the voice.

> The pearl oyster, which has to be gathered in silence. [Pukui 1983:144]

Haunāele ‘Ewa i ka Moa‘e. ‘Ewa is disturbed by the Moa‘e wind.

> Used about something disturbing, like a violent argument. When the people of ‘Ewa went to gather the *pipi* (pearl oyster), they did so in silence, for if they spoke, a Moa‘e breeze would suddenly blow across the water, rippling it, and the oysters would disappear. [Pukui 1983:59]

E hāmau o makani mai auane‘i. Hush, lest the wind rise.

> Hold your silence or trouble will come to us. When the people went to gather pearl oysters at Pu‘uloa, they did so in silence, for they believed that if they spoke, a gust of wind would ripple the water and the oysters would vanish. [Pukui 1983:34]

Ka i‘a kuhi lima o ‘Ewa. The gesturing fish of ‘Ewa.

> The *pipi*, or pearl oyster. Fishermen did not speak when fishing for them but gestured to each other like deaf-mutes. [Pukui 1983:148]

Sereno Bishop (1901) wrote of the *pipi* and another edible clam present during the 1830s:

> The lochs or lagoons of Pearl River were not then as shoal as now. The subsequent occupation of the uplands by cattle denuded the country of herbage, and caused vast quantities of earth to be washed down by storms into the lagoons, shoaling the water for a long distance seaward. No doubt, the area of deep water and anchorage has been greatly diminished. In the thirties, the small oyster was quite abundant, and common on our table. Small pearls were frequently found in them. No doubt the copious inflow of fresh water favored their presence. I think they have become almost entirely extinct, drowned out by the mud. There was also at Pearl River a handsome speckled clam, of a delicate flavor which contained milk white pearls of exquisite luster and perfectly spherical. I think the clam is still found in the Ewa Lochs. [Bishop 1901:87]

Older Hawaiians believed the *pipi* disappeared around the time of the smallpox epidemic of 1850-1853, because Kānekua‘ana became displeased at the greed of some *konohiki*.

> The people of the place believe that the lizard was angry because the konohikis imposed kapus [restrictions], were cross with the women and seized their catch of oysters. So this ‘fish’ was removed to Tahiti and other lands. When it vanished a white, toothed thing grew everywhere in the sea, of Ewa, which the natives of Ewa had named the pahikaua (sword). It is sharp edged and had come from Kauai-helanai, according to this legend. [Manu 1885 in Sterling and Summers 1978:50]

In a clarification of the story of Kānekua‘ana and the pearl oysters of Pearl Harbor, an overseer seems to have set a ban on the *pipi* for several months a year so that they could increase. A poor widow, a relation of the *mo‘o*, took some of the *pipi* and hid them in a basket. The *konohiki* found the hidden shells and took them from her, emptying them back into the sea, which was proper. However, after this action, he followed the woman home and demanded that she pay a stiff fine in cash, which she did not have. The *mo‘o* thought this was unjust, and the next night, she took possession of a neighbor, who was a medium, and the following occurred:

> After the overseer had gone back to Palea the lizard goddess possessed her aged keeper [a woman of Ewa] and said to those in the house, ‘I am taking the pipi back to Kahiki and they will not return until all the descendants of this man are dead. I go to sleep. Do not awaken my medium until she wakes of her own accord.’ The command was obeyed and she slept four days and four nights before she awoke. During the time that she slept the pearl oysters vanished from the places where they were found in great numbers, as far as the shore. The few found today are merely nothing […] [*Ka Loea Kālai‘āina* 1899, translated in Sterling and Summers 1978:49–50]

Pu‘uloa is closely associated with shark *‘aumākua* (family gods). Pukui (1943:56) and others (e.g., Sheldon 1883) claim the sharks of Pu‘uloa were so tame that people used to ride on their backs, and that their human relatives would feed them with *‘awa*. The most famous guardian shark was Ka‘ahupāhau, the queen shark of O‘ahu, who lived in Pu‘uloa. One meaning of her name is

“cloak well cared for” (Pukui 1943:56). Ka‘ahupāhau and her brother Kahi‘ukā had been born as humans and were turned into sharks (Told by Mary Kawena Pukui 1954 in Sterling and Summers 1978:56).

> The mother, who was a chiefess, of Ka‘ahupahau was gathering limu [seaweed] in the waters of Pearl Harbor when she had a miscarriage. Thinking the baby dead she left it in the water to be washed away. Later she went again to gather limu and was bitten by a shark. She went to a kahuna [priest] who told her that the shark was Ka‘ahupahau who was her own daughter, the baby she thought was dead. The kahuna advised her to go to the place and build an ahu (heap) of hau a sort of landing from which she could feed the shark and care for it. It was from that time by command of the mother that all people of Ewa were to be always be protected from sharks whether in Pearl Harbor or outside. [Told to E. Sterling by Simeon Nawaa, 22 March 1954 in Sterling and Summers 1978:56]

The grandmother of Ka‘ahupāhau and her brother, Koihala, lived in Honouliuli. One day she was making *lei* for her shark grandchildren. A young girl named Pāpio rudely begged for a *lei*, but Koihala refused. On her way to her favorite surfing spot at Keahi Point, Pāpio snatched up one of the *lei* and laughingly went surfing. Koihala angrily told Ka‘ahupāhau about the stolen *lei*, and the shark killed the girl after grabbing her from a rock in the sea where she was resting.

> Ka‘ahupahau soon recovered from her anger and became very sorry. She declared that from hence forth all sharks in her domain should not destroy, but protect the people round about. As flowers were the cause of the trouble she forbade their being carried or worn on the water of Pu‘uloa. From that time all the people of that locality and the sharks in the lochs were the best of friends. [Pukui 1943:56]

In a second version of this story, the shark gods Kānehunamoku and Kamohoali‘i were the ones that had placed a *kanawai* (decree) against the attack on men by all sharks around O‘ahu. As the result of the attack on the chiefess Pāpio, Ka‘ahupāhau was put on trial at Uluka‘a (the realm of the gods). She escaped the punishment of death but was placed in confinement.

> After her confinement ended several years later Ka‘ahupahau was very weak. She went on a sightseeing trip, got into trouble, and was almost killed. But she received great help from Kupiapia and Laukahi‘u, sons of Kuhaimoana, when their enemies were all slain the *kanawai* was firmly established. This law—that no shark must bite or attempt to eat a person in Oahu waters—is well known from Pu‘uloa to the Ewa. Anyone who doubts my work must be a *malihini* [recent resident] there. Only in recent times have sharks been known to bite people in Oahu waters or to have devoured them; it was not so in old times. [Kamakau 1991b:73]

This information on the protective nature of Ka‘ahupāhau is somewhat contradicted by the writings of the Russian explorer Otto Von Kotzebue, who walked to Pu‘uloa in 1821 but was unable to sail on the waters. He was told that people were thrown into the water as sacrifices to the sharks; however, it is uncertain if the person who told him this was a resident of ‘Ewa.

> In the Pearl River there are sharks of remarkable size, and there have made on the banks an artificial pond of coral stones, in which a large shark is kept, to which, I

> was told, they often threw grown-up people, but more frequently children, as victims. [Kotzebue 1821:338–348]

The protection of Ka‘ahupāhau is emphasized in many other Hawaiian traditions. One time, a man-eating shark called Mikololou from the Ka‘ū district of the island of Hawai‘i came visiting at Pu‘uloa with other sharks. Mikololou remarked, “What fine, fat crabs you have here,” from which Ka‘ahupāhau knew that some of the sharks were man-eaters, since sharks referred to fishermen as “fat crabs.” She directed the fishermen to place a barrier of nets across the entrance to the harbor, and when the sharks left her home, they could not get back out to the ocean.

> The sharks of the lochs attacked the man-eaters from outside and beat them unmercifully. A shark from Ka‘u, Hawaii, who was not a man-eater, threw his weight over the nets and pressed them down. His sons changed themselves into pao‘o [blennies] fishes and leaped where the net was forced down, thus escaping from the place where the battle of shark was raging. Mikololou was caught fast in the nets and dragged ashore where his head was cut off and his body burned. [Pukui 1943:56]

In another version of this story, Mikololou is accompanied to Pu‘uloa by his shark friends Kua, Keali‘ikauaoka‘ū, Pākaiea, and Kalani.

> [To escape a net,] Keali‘ikauaoka‘ū changed himself into a pao‘o fish, which lives among the rocks, and leapt out of the net. Kua changed into a lupe, as the spotted stingray is called, and weighted down the net on one side, helping his son Kalani and nephew Pākaiea, who were half human, to escape. [Pukui and Green 1995:40]

Only Mikololou was caught in the net, and his body was tossed on shore to rot until only the tongue was left. In some versions of this story, the tongue immediately jumps into the water and then becomes a shark again (Pukui and Green 1995:41). In other versions (Pukui 1943:56), a dog eats the tongue, jumps into the water, turns into a shark, and escapes. In both versions, Mikololou returns to Ka‘ū never to bother Ka‘ahupāhau again.

In a third version (Webb 1923:307–308), Mikololou went back to his home island of Hawai‘i and organized an army of sharks to return to Pu‘uloa. He was again defeated by the fishermen of ‘Ewa under the command of Ka‘ahupāhau, who slaughtered so many of the sharks that from then on, “the sea of Pu‘uloa is safe and peaceful through her law that sharks shall not attack man. That is why these waters are safe for people to swim from shore to shore without fear” (Webb 1923:308).

The watchful eye of Ka‘ahupāhau led to the following Hawaiian sayings:

Alahula Pu‘uloa, he alahele Ka‘ahupāhau	Everywhere in Pu‘uloa is the trail *na* of Ka‘ahupāhau.

> Said of a person who goes everywhere, looking, peering, seeing all, or of a person familiar with every nook and corner of a place. Ka‘ahupāhau is the shark goddess of Pu‘uloa (Pearl Harbor) who guarded the people from being molested by sharks. She moved about, constantly watching. [Pukui 1983:14]

Ho‘ahewa na niuhi ia Ka‘ahupāhau.	The man-eating sharks blamed Ka‘ahupāhau.

> Evil-doers blame the person who safeguards the rights of others. Ka‘ahupāhau was the guardian shark goddess of Pu‘uloa (Pearl Harbor) who drove out or destroyed all the man-eating sharks. [Pukui 1983:108]
>
> *Mehameha wale no o Pu‘uloa,* Pu‘uloa became lonely when
> *i ka hele a Ka‘ahupāhau.* Ka‘ahupāhau went away.
>
> The home is lonely when a loved one has gone. Ka‘ahupāhau, guardian shark of Pu‘uloa (Pearl Harbor), was dearly loved by the people. [Pukui 1983:234]
>
> *Make o Mikololou a ola i ke ale lo.* Mikololou died and came to life again through his tongue.
>
> Said of one who talks himself out of a predicament. [Pukui 1983:229]

Other guardian sharks were also in Pearl Harbor, including a brother of Ka‘ahupāhau’s named Kahi‘ukā (the smiting tail), and a son named Kūpīpī (Pukui 1943:57), or in some versions, twin sons named Kūpīpī and Kūmaninini (Pukui and Green 1995:41). In one version of the Story of Pāpio, recounted above, the Ka‘ahupāhau is said to have later turned into a stone, although the people of Pu‘uloa continued to feed her (Sterling and Summers 1978:56).

> Kahi‘uka was the brother of Ka‘ahupahau. The name means ‘smiting tail.’ This shark was called by this name because it was his duty to warn the people of Ewa of the presence of strange and unfriendly sharks in these waters and he did so by nudging them or striking at them with his tail. When ever anyone was fishing and felt a nudge they would know it was Kahi‘uka, warning them and they would leave the water immediately. [Told to E. Sterling by Simeon Nawaa 1954 in Sterling and Summers 1978:56]

Two different accounts of the home of this shark brother have been told. The above reference says that Kahi‘ukā lived at the site of the old dry dock. However, Mary Pukui disagrees, and says the site of the old dry dock was the home of the son of Ka‘ahupāhau rather than her brother. Mary Pukui (1954 in Sterling and Summers 1978:56) says Kahi‘ukā lived in a cavern underwater off Moku‘ume‘ume (Ford Island) near Keanapua‘a Point; he had a stone form in deep water some distance from the cave that one could see from the surface (Told by Mary Kawena Pukui 1954 in Sterling and Summers 1978:56). J.S. Emerson (1892:11) wrote that Kahi‘ukā’s keeper, Kimona, would often find fish nets missing and knew that Kahi‘ukā had carried them up shore to a place of safety. Pukui also relates that the shark was named “smiting tail” because one side of his tail was longer than the other, and the shark would use it to smite unfriendly sharks.

Others have placed a home for Kahi‘ukā at a cave below the home of Reverend Sereno Bishop of the old Ewa Protestant Church in Waiawa (*Ke Au Hou* 1910 in Sterling and Summers 1978:18). Kuhialoko, a fishpond on the Waiawa coastline, was named for Kuhia, a servant or retainer to Kahi‘ukā (*Saturday Press* 1884 in Sterling and Summers 1978:17).

One of the shark *‘aumākua* associated with Pu‘uloa was a little yellow shark called Ka‘ehu. This *‘aumakua* was born on the island of Hawai‘i, later traveled to O‘ahu, and finally settled at Pu‘uloa. His ancestor was Kama‘ili‘ili, a Hawaiian shark god who was the brother of the volcano goddess Pele. Ka‘ehu was a guardian of the Hawaiian people and once saved several surf riders at Waikīkī from a man-eating shark called Pehu (Knudsen 1946:9–13; Westervelt 1963:55–58).

In the Thomas Thrum (1923) translation of this *mo‘olelo*, the shark’s name is Ka‘ehuikimanō ‘o Pu‘uloa, or “the small, blonde shark of Pu‘uloa.” He was born in Puna, Hawai‘i, but soon left on a tour of all of the islands so that he could call on and pay respects to all of the shark kings of Hawai‘i.

> Puuloa, Oahu, was the next objective. Reaching its entrance they visited the pit of Komoawa, where Kaahupahau’s watcher lived. Here the young shark made himself known, as usual; the object of the journey, and the desire to meet the famous queen-shark protector of Oahu’s water. The watcher set off to give the message to the guard-chief then at Waiawa, and described the party of visitors as distinguished chiefs; five full-grown and one quite youthful. […] Welcome greetings were sent by the messenger, who was bid entertain the visitors in the outer cave, and on the morrow the party could come up the lochs to meet the queen. […] The strangers were all introduced to, and each made welcome by her, and after an agreeable reception the guests were invited to join in a bathing party of the waters of Waipahu, the bathing place of the Waikele section, as also at Waimano, Waiau, etc., which the strangers greatly enjoyed, and congratulated the queen on her refreshing provinces. The company then repaired to the royal cave at Honouliuli, where the visitors were supplied with soft coconut and awa, their home food and beverage. [Thrum 1923:301–302]

The cave of Komoawa may refer to the Hawaiian words for “channel” or “harbor” entrance (Pukui and Elbert 1986:164). In another version of this story, the shark watcher himself is named Komoawa, and the cave that he lives in is called Kea‘ali‘i. Kea‘ali‘i guards the entrance to Pu‘uloa, while the home of Ka‘ahupāhau is deeper in the lagoon of Honouliuli (Sheldon 1883).

In 1823, the missionary Hiram Bingham accompanied Liholiho (King Kamehameha II) and his company to the royal compound at Pu‘uloa, where he was shown a cave that was home to a shark god:

> I one day accompanied the king and others by boat to see the reputed habitation of an Hawaiian deity, on the bank of the lagoon of Ewa. It was a cavern or fissure in a rock, chiefly under water, where, as the traditions teach, and as some then affirmed, a god, once in human form, taking the form of a shark, had his subterraqueous abode. Sharks were regarded by the Hawaiians as gods capable of being influenced by prayers and sacrifices, either to kill those who hate and despise them, or to spare those who respect and worship them. [Bingham 1847:177]

In other versions of this story, the name of the shark is interpreted as “the little ruddy shark” (Emerson n.d.) or the “little reddish-haired shark,” named for the reddish (*‘ehu*) hair of Ka‘ehu. In this version, the cave of Ka‘ehu is called Pānau, and the human mother and father of the little shark are Kapukapu and Holei of Pānau, in Puna, Hawai‘i (Emory et al. 1959:63).

Although Bingham (1847) stated that no one any longer believed these stories, some residents kept the beliefs of the guardian sharks alive. Dredging in Pearl Harbor enabled the completion of a large dry dock in 1912, but it collapsed the next year. Native Hawaiians believed the dock collapsed because it was built over the home of Kūpīpī, the shark son of Ka‘ahupāhau, who lived in a cavern near the harbor entrance at Pu‘uloa. “Angered by the violation of his home, the shark

prince destroyed the imposing structure" (Clark 1977:69–70). Workers rebuilt the dock in the same year, but this time only after *cquir* led a blessing ceremony at the construction site.

3.2.3 Nāpōhaku-luahine

Along the coastal trail through ‘Ewa described by John Papa ‘Ī‘ī were several stone markers, called Nāpōhaku-luahine. These are described as old women who were changed into stones:

> The names of these royal stones were Kahoaiai (also the name of an *‘ili* in Waiawa), Waiawakalea, Piliaumoa, Kahe‘ekuluaikamoku, all chiefesses. Their four servants were Nohoana, Kikaeleke, Piliamo‘o, Nohoanakalai. These were the guardians of the trail. [*Ka Loea Kālai‘āina,* 29 June 1899, translation in Sterling and Summers 1978:6]

The writer describes the location of the stones:

> Here is how the traveler can locate them. When you leave the bridge of Waiawa, for Honolulu, go up and then down an incline. The hill standing on the seaward side is Nuku-o-ka-manu. The next incline is Waiawa. Go up the ascent till you reach the top and above that, about two chains from the road you will find the stones. [*Ka Loea Kālai‘āina,* 29 June 1899, translation in Sterling and Summers 1978:6]

3.2.4 *Heiau* (Pre-Contact Place of Worship)

Heiau were pre-Contact places of worship. Construction of some *heiau* were elaborate, consisting of large communal structures, while others were simple earth terraces or shrines (McAllister 1933:8). *Heiau* are most commonly associated with important religious ceremonies; large structures with platforms or altars of one or more terraces were indicative of such function (McAllister 1933:8).

McAllister (1933:105) recorded a *heiau* called Puoiki (State Inventory of Historic Places [SIHP] # 50-80-09-00121) located on the point of the ridge called Lae Pōhaku, the boundary point between Waiawa and Mānana Ahupua‘a. The *heiau* was built on a knoll. According to McAllister (1933:105), ceremonies were performed at the base of the knoll.

A second *heiau* in Waiawa Ahupua‘a was located near the "maika playing field of Haupu‘u" (Waialeale 1834:23). The *heiau* was demolished in 1834 and the Protestant Ewa Church was built directly over the *heiau*. Thrum and McAllister do not mention this *heiau*, probably because it was long gone by the early twentieth century.

3.2.5 *Loko I‘a* (Fishponds)

The *ahupua‘a* of Waiawa also had many *loko i‘a*. McAllister recorded three *loko i‘a* in Waiawa Ahupua‘a—Loko Apala (SIHP # -00118), Loko Kuhialoko (SIHP # -00119), and Loko Mo‘o (SIHP # -00120). These ponds were located adjacent to Pearl Harbor far from the present study area and are shown on the S. Bishop map (1887) (see Figure 8).

In mid-nineteenth century Māhele documents, numerous *loko i‘a* are mentioned (Soehren 2009). These include Loko Apalakai, Apalawai (Loko Apala), Kuakuanui, Ho‘opililoko, Loko Kuhialoko, Loko Mo‘o, Kalokohanahou, Kama‘ihi, Kepoelalo, Kepoeluna, Loko Mōkōlea, and Mōkōlea.

3.2.6 *Ala Hele* (Trails)

John Papa ‘Ī‘ī (1959:96–98) described a network of leeward O‘ahu *ala hele* (trails) (Figure 9) that in historic times encircled and crossed the Wai‘anae Range by three different paths. The coastal trail ran along the inward boundary of the Pearl Harbor floodplain and irrigated taro fields. ‘Ī‘ī described this coastal trail as if traveling from the Honolulu District west through the ‘Ewa District and to the Wai‘anae District: fields through Hālawa, ‘Aiea, Kalauao, Waimalu, Waiau, Waimano, Mānana, and Waiawa, Waipi‘o, Waikele, Ho‘ae‘ae, and Honouliuli:

> The trail went down to the stream and up again, then went above the taro patches of Waiau, up to a *maika* field, to Waimano, to Manana, and to Waiawa; then to the stream of Kukehi [now typically called “Waimano Stream”] and up to two other *maika* fields, Pueohulunui and Haupuu [in Waiawa]. At Pueohulunui [on the border of Waiawa and Waipi‘o] was the place where a trail branched off to go to Waialua and down to Honouliuli and on to Waianae. […]
>
> From Kunia [in Ho‘ae‘ae] the trail went to [Honouliuli] the plain of Keahumoa, on to Maunauna [peak], and along Paupauewla [‘*ili*], which met with the trails from Wahiawa and Waialua [Districts]. [‘Ī‘ī 1959:95, 97]

The coastal cross-*ahupua‘a* trail was close to the present H-1 alignment approximately 500 m south of the south end of the present study area and the eastern trail heading north up the central valley is understood to have approximated the present Kamehameha Highway (Highway 99) alignment approximately 800 m west of the present study area.

3.1 *‘Ōlelo No‘eau* (Hawaiian Proverbs)

Hawaiian knowledge was shared by way of oral histories. Indeed, one’s *leo* (voice) is oftentimes presented as *ho‘okupu* (“a tribute or gift” given to convey appreciation, to strengthen bonds, and to show honor and respect); the high valuation of the spoken word underscores the importance of the oral tradition (in this case, Hawaiian sayings or expressions), and its ability to impart traditional Hawaiian “aesthetic, historic, and educational values” (Pukui 1983:vii). Thus, in many ways these expressions may be understood as inspiring growth within reader or between speaker and listener:

> They reveal with each new reading ever deeper layers of meaning, giving understanding not only of Hawai‘i and its people but of all humanity. Since the sayings carry the immediacy of the spoken word, considered to be the highest form of cultural expression in old Hawai‘i, they bring us closer to the everyday thoughts and lives of the Hawaiians who created them. Taken together, the sayings offer a basis for an understanding of the essence and origins of traditional Hawaiian values.
>
> The sayings may be categorized, in Western terms, as proverbs, aphorisms, didactic adages, jokes, riddles, epithets, lines from chants, etc., and they present a variety of literary techniques such as metaphor, analogy, allegory, personification, irony, pun, and repetition. It is worth noting, however, that the sayings were spoken, and that their meanings and purposes should not be assessed by the Western concepts of literary types and techniques. [Pukui 1983:vii]

Figure 9. Portion of a map by Paul Rockwood showing O‘ahu trails and place names ca. 1810, as described by John Papa ‘Ī‘ī (1959:96) in relation to the study area

Simply, *‘ōlelo no‘eau* may be understood as proverbs. The Webster dictionary notes it as “a phrase which is often repeated; especially, a sentence which briefly and forcibly expresses some practical truth, or the result of experience and observation.” It is a pithy or short form of folk wisdom. Pukui equates proverbs as a treasury of Hawaiian expressions (Pukui 1995:xii). Oftentimes within these Hawaiian expressions or proverbs are references to places. This section draws from the collection of author and historian Mary Kawena Pukui and her knowledge of Hawaiian proverbs describing *‘āina* (land), chiefs, plants, and places relative to Waiawa Ahupua‘a.

3.1.1 Concerning Sharks

The *moku* of ‘Ewa lies adjacent to Pu‘uloa which has many *mo‘olelo* about sharks, particularly Ka‘ahupāhau, the queen shark of O‘ahu and the most famous guardian shark who lived in Pu‘uloa. Thus, ‘Ewa is closely associated with shark *‘aumakua* and *mo‘olelo* which say the people of ‘Ewa were protected by sharks. The following *‘ōlelo no‘eau* are associated with sharks.

3.1.1.1 *‘Ōlelo No‘eau* #105

Alahula Pu‘uloa he alahele na Ka‘ahupāhau.

Everywhere in Pu‘uloa is the trail of Ka‘ahupāhau.

Said of a person who goes everywhere, looking, peering, seeing all, or of a person familiar with every nook and corner of a place. Ka‘ahupāhau is the shark goddess of Pu‘uloa (Pearl Harbor) who guarded the people from being molested by sharks. She moved about, constantly watching. [Pukui 1983:14]

3.1.1.2 *‘Ōlelo No‘eau* #1014

Ho‘ahewa na niuhi ia Ka‘ahupāhau

The man-eating sharks blamed Ka‘ahupāhau

Evil-doers blame the person who safeguards the rights of others. Ka‘ahupāhau was the guardian shark goddess of Pu‘uloa (Pearl Harbor) who drove out or destroyed all the man-eating sharks. [Pukui 1983:108]

3.1.1.3 *‘Ōlelo No‘eau* #2111

Make o Mikololou a ola i ke ale lo

Mikololou died and came to life again through his tongue

Said of one who talks himself out of a predicament. [Pukui 1983:229]

3.1.1.4 *‘Ōlelo No‘eau* #2158

Mehameha wale no o Pu‘uloa i ka hele a Ka‘ahupāhau

Pu‘uloa became lonely when Ka‘ahupāhau went away

The home is lonely when a loved one has gone. Ka‘ahupāhau, guardian shark of Pu‘uloa (Pearl Harbor), was dearly loved by the people. [Pukui 1983:234]

3.1.2 Concerning Pipi

Pearl Harbor or Pu‘uloa, derived from the name Waimomi, or “water of the pearl,” an alternate name for the Pearl River. The harbor was thus named after pearl oysters of the family Pteriidae (mainly *Pinctada radiata*), which were once abundant on the harbor reefs and after which many *‘ōlelo no‘eau* were generated.

3.1.2.1 *‘Ōlelo No‘eau* #123

Anu O ‘Ewa i ka i‘a hamau leo e. E hāmau!

‘Ewa is made cold by the fish that silences the voice. Hush!

A warning to keep still. First uttered by Hi‘iaka to her friend Wahine‘oma‘o to warn her not to speak to Lohi‘au while they were in a canoe near ‘Ewa. [Pukui 1983:16]

3.1.2.2 *‘Ōlelo No‘eau* #274

E hāmau o makani mai auane‘i

Hush, lest the wind rise

Hold your silence or trouble will come to us. When the people went to gather pearl oysters at Pu‘uloa, they did so in silence, for they believed that if they spoke, a gust of wind would ripple the water and the oysters would vanish. [Pukui 1983:34]

3.1.2.3 *‘Ōlelo No‘eau* #493

Haunāele ‘Ewa i ka Moa‘e

‘Ewa is disturbed by the Moa‘e wind

Used about something disturbing, like a violent argument. When the people of ‘Ewa went to gather the pipi, they did so in silence, for if they spoke, a Moa‘e breeze would suddenly blow across the water, rippling it, and the oysters would disappear. [Pukui 1983:59]

3.1.2.4 *‘Ōlelo No‘eau* #1331

Ka i‘a hāmau leo o ‘Ewa

The fish of ‘Ewa that silences the voice

The pearl oyster, which has to be gathered in silence. [Pukui 1983:144]

Handy and Handy (1972:471) offer a different interpretation: “The pipi was sometimes called ‘the silent fish,’ or, *‘i‘a hamau leo o ‘Ewa*,’ ‘Ewa’s silent sea creature since the collectors were supposed to stay quiet while harvesting the shells.”

3.1.2.5 *‘Ōlelo No‘eau* #1357

Ka i‘a kuhi lima o ‘Ewa

The gesturing fish of ‘Ewa

The pipi, or pearl oyster. Fishermen did not speak when fishing for them but gestured to each other like deaf-mutes. [Pukui 1983:148]

3.1.3 Concerning *Nehu* of Pu‘uloa

The following *‘ōlelo no‘eau* discuss the *nehu* which was once abundant in the waters of Pu‘uloa.

3.1.3.1 *‘Ōlelo No‘eau* #661

He kai puhi nehu, phui lala ke kai o ‘Ewa.

A sea that blows up nehu fish, blows up a quantity of them, is the sea of ‘Ewa. [Pukui 1983:74]

3.1.3.2 *‘Ōlelo No‘eau* #1721

Ke kai he‘e nehu o ‘Ewa

The sea where the nehu come in schools to ‘Ewa.

Nehu (anchovy) come by the millions into Pearl Harbor. They are used as bait for fishing, or eaten dried or fresh. [Pukui 1983:185]

3.1.4 Concerning *Kalo* (taro; *Colocasia esculenta*)

3.1.4.1 *‘Ōlelo No‘eau* #2770

A rare taro called the *‘‘kāī o ‘Ewa*,” was grown in mounds in marshy locations in ‘Ewa (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the following saying:

Ua ‘ai i ke kāī-koi o ‘Ewa

He has eaten the kāī-koi taro of ‘Ewa

Kāī is O‘ahu’s best eating taro; one who has eaten it will always like it. Said of a youth of a maiden of ‘Ewa, who, like the Kāī taro, is not easily forgotten. [Pukui 1983:305]

3.2 *Oli* (Chants)

Oli, according to Mary Kawena Pukui (Pukui 1995:xvi–xvii) are often grouped according to content. Chants often were imbued with *mana* (spiritual power); such *mana* was made manifest through the use of themes and *kaona*. According to Pukui, chants for the gods (prayers) came first, and chants for the *ali‘i*, “the descendants of the gods,” came second in significance. Chants “concerning the activities of the earth peopled by common humans,” were last in this hierarchy (Pukui 1995:xvi–xvii). Emerson conversely states,

> In its most familiar form the Hawaiians—many of whom [were lyrical masters]—used the oli not only for the songful expression of joy and affection, but as the vehicle of humorous or sarcastic narrative in the entertainment of their comrades. The dividing line, then, between the oli and those other weightier forms of the mele, the inoa, the kanikau (threnody), the pule, and that unnamed variety of mele in which the poet dealt with historic or mythologic subjects, is to be found almost wholly in the mood of the singer. [Emerson 1965:254]

While *oli* may vary thematically, subject to the perspective of the *ho‘opa‘a* (chanter), it was undoubtedly a valued art form used to preserve oral histories, genealogies, and traditions, to recall special places and events, and to offer prayers to *akua* and *‘aumākua* alike. Perhaps most

importantly, as Alameida (1993:26) writes, “chants […] created a mystic beauty […] confirming the special feeling for the environment among Hawaiians: their *one hānau* (birthplace), their *kula iwi* (land of their ancestors).”

3.2.1 *Oli* for Kūali‘i

A chant for the chief Kūali‘i, an ancient chief of O‘ahu, mentions the *ahupua‘a* names of the ‘Ewa District. Each phrase usually contains a play on words, as the place name and one meaning of the word, or portion of the word, appears on each line, for example, *kele* in Waikele means “slippery.” However, these word plays are not necessarily related to the actual place name meanings of the *ahupua‘a*.

Uliuli ka poi e piha nei—o Honouliuli;	Blue is the *poi* [pounded taro] which appeases [the hunger] of Honouliuli;
Aeae ka paakai o Kahuaiki—Hoaeae;	Fine the salt of Kahuaike—Hoaeae;
Pikele ka ia e Waikele—o Waikele;	Slippery the fish of Waikele— of Waikele;
Ka hale pio i Kauamoa—o Waipio;	The arched house at Kauamoa— of Waipio;
E kuu kaua i ka loko awa—o Waiawa;	Let us cast the net in the *awa*-pond— of Waiawa;
Mai hoomanana ia oe—o Manana.	Do not stretch yourself at—Manana.
He kini kahawai,	Many are the ravines,
He lau kamano—o Waimano;	Numerous the sharks, at Waimano;
Ko ia kaua e ke au—o Waiau;	We are drawn by the current— of Waiau;
Kukui malumalu kaua—Waimalu;	In the *kukui* grove we are sheltered— in Waimalu;
E ala kaua ua ao-e—o Kalauao;	Let us arise, it is daylight— at Kalauao;
E kipi kaua e ai—o Aiea;	Let us enter and dine—at Aiea;
Mai hoohalawa ia oe—O Halawa.	Do not pass by—Halawa.

[Fornander 1917:4(2):400–401]

A chant for the Kaua‘i chief of Kaumuali‘i, a rival of Kamehameha I, also mentions place names of the ‘Ewa District. In a portion of this chant, the wind that blows from one end of ‘Ewa to the other is compared to love.

3.3 *Mele* (Songs)

The following section draws from the Hawaiian art of *mele*, poetic song.

> Words and word combinations were studied to see whether they were auspicious or not. There were always two things to consider the literal meaning and the *kaona*, or ‘inner meaning.’ The inner meaning was sometimes so veiled that only the people to whom the chant belonged understood it, and sometimes so obvious that anyone who knew the figurative speech of old Hawai‘i could see it very plainly. There are but two meanings: the literal and the *kaona*, or inner meaning. The literal is like the body and the inner meaning is like the spirit of the poem. [Pukui 1949:247]

> The Hawaiians were lovers of poetry and keen observers of nature. Every phase of nature was noted and expressions of this love and observation woven into poems of praise, of satire, of resentment, of love and of celebration for any occasion that might arise. The ancient poets carefully selected men worthy of carrying on their art. These young men were taught the old *meles* and the technique of fashioning new ones. [Pukui 1949:247]

A number of late nineteenth, twentieth, and twenty-first century *mele* concern or mention Waiawa Ahupua‘a and ‘Ewa Moku. These particular *mele* may also be classified as *mele wahi pana* (songs for legendary or historic places). *Mele wahi pana* such as those presented here may or may not be accompanied by *hula* (dance) or *hula wahi pana* (dance for legendary or historic places). As the Hula Preservation Society notes,

> Hula Wahi Pana comprise a large class of dances that honor places of such emotional, spiritual, historical, or cultural significance that chants were composed for them. Only the composers of the chants could know the deepest meanings, as they would be reflections of their feelings and experiences […] Since the subjects of Wahi Pana compositions are extremely varied, their implementation through hula are as well. Coupled with the differences from one hula style and tradition to the next, Hula Wahi Pana can be exceptionally diverse. They can be done sitting or standing, with limited body movement or wide free movement; with or without the use of implements or instruments; with the dancers themselves chanting and/or playing an implement or being accompanied by the *ho‘opa‘a* [drummer and *hula* chanter (memorizer)]. Beyond the particular hula tradition, what ultimately determines the manner in which a Hula Wahi Pana is performed are the specific place involved, why it is significant, the story being shared about it, and its importance in the composer’s view. [Hula Preservation Society 2014]

3.3.1 Pūpū a ‘o ‘Ewa

The following *mele* describes the different features of the ‘Ewa District. From the Moa‘e wind to the shark goddess, Ka‘ahupāhau, this *mele* covers all the beauty of ‘Ewa.

> *Nani Ka‘ala hemolele i ka mālie*
> *Kuahiwi kaulana a‘o ‘Ewa*
> *E ki‘i anai ka makani o ka ‘āina*
> *Hea ka Moa‘e, ‘Eia au e ke aloha’*

Hui:

Pūpū a‘o ‘Ewa
I ka nu‘a nā kānaka
E naue mai a e ‘ike
I ka mea hou o ka ‘āina
A he ‘āina ua kaulana
Mai nā kūpuna mai
Alahula Pu‘uloa ke ala hele no Ka‘ahupāhau
Alahula Pu‘uloa ke ala hele no Ka‘ahupāhau

Translation:

Beautiful is Ka‘ala, flawless in the calm
Renowned mountain of the ‘Ewa district
Fetching the wind of the land
The Moa‘e wind beckons, ‘Here I am my love’

Chorus:

Shells of ‘Ewa
Amid throngs of people
Hasten here and learn
The news of the land
A land renowned
From the ancient ones
Pu‘uloa is a famous pathway
The pathway for Ka‘ahupāhau

[Wilcox 2003:235]

3.3.2 Eia Mai Au ‘o Makalapua

This particular *mele* pays homage to the royal train called *Lanakila*. In paying homage to this train, the *mele* also pays homage to its most honored and well-known passenger, Queen Lili‘uokalani. This *mele* may also be understood as a protest song.

In analyzing this *mele*, cultural historian Kīhei de Silva notes “Eia mai Au ‘o Makalapua” is the second of three chants that make up *hō‘alo i ka ihu o ka Lanakila* (Three Train Chants for Lili‘uokalani). He adds that these songs, “when considered in chronological succession […] add a Hawaiian dimension to the story of Benjamin Franklin (B.F.) Dillingham’s Oahu Railway and Land Company (OR&L), a story that otherwise reads far too much like an early script of *How the West was Won*” (de Silva 2003). De Silva provides a chronology of B.F. Dillingham’s rise to influence within Hawaiian political spheres, and his eventual founding and construction of the OR&L line. Dillingham’s personal history is described by de Silva as follows:

- Arrived in Honolulu in 1865 as first mate of the *Whistler*.
- He promptly fell off a horse and broke his leg. When his ship left without him, he took a job as a clerk in a hardware store.

- 20 years later, in 1885, he had become Hawai‘i’s first big-time land speculator, buying and leasing vast tracts of property in West O‘ahu in hopes of reselling it to housing and ag. Interests.
- When no one, in fact, took interest in his largely inaccessible property, he decided to build a railroad through it.
- In 1888, Dillingham convinced Kalākaua to sign a franchise giving him three years to build a line running from Honolulu to the far end of Pearl River Lagoon. His critics called it ‘Dillingham’s Folly,’ but Dillingham boasted that he would put his railroad into operation by Sept. 4, 1889, his 45th birthday.
- Things did not go well in the early months of construction, and in order to fulfill this boast, Dillingham had to fire up a miniscule saddle-tank engine named *Kauila*, hitch it to a flatcar that carried his passengers on jury-rigged seats, and send it bucking, wheezing, and spewing greasy foam down a mile-and-a-half of track that ended in the rice paddies of Pālama.
- Despite this farcical beginning, the construction of Dillingham’s railroad then proceeded in rather impressive fashion: the line was opened to ‘Aiea in November 1889, to Mānana in January 1890, to Honouliuli and ‘Ewa Mill in June and July 1890, to Wai‘anae in July 1895, to Waialua in June, 1898, and to Kahuku in January 1899. [de Silva 2003]

In 1890, as construction of the railway moved forward, B.F. Dillingham bought and shipped to Hawai‘i a passenger coach named the *Pearl* and a locomotive named *General Valleho.* According to de Silva (2003), the *Pearl* was built in San Francisco and was “paneled in rich woods and outfitted with plush chairs, velvet drapes, electric lights, a kitchen, a lānai with a striped canvas awning, and a new-fangled contraption called a flush toilet.” The *General Valleho* was renamed the *Lanakila* by Dillingham:

> […] [He] gave it the number 45, a tribute to his 45th birthday boast and erstwhile victory in the rice paddies of Pālama. The Lanakila became Dillingham’s 4th locomotive—after the Kauila, Leahi, and Ka‘ala—and for many years it was regarded as the most attractive engine in the OR&L stable. Dillingham apparently wasted no time in hitching the Pearl to the Lanakila and using the pair as his wine-‘em and dine-‘em celebrity train, the vehicle in which he wooed financial and political support for his business ventures. [de Silva 2003]

As part of Dillingham’s plans to woo the influential, he invited King Kalākaua on the inaugural ride on the *Lanakila*. Dillingham also insisted the luxury coach *Pearl* serve as the king’s own royal car. De Silva (2003) notes it is “safe for us to assume that Queen Lili‘u[okalani] rode in the Pearl when the *Lanakila* took her on the train rides.” With the opening of the ‘Ewa Mill station, Queen Lili‘uokalani once again embarked on a journey on the *Lanakila*; this particular journey took her through “the lowlands of Honouliuli, and finally to the exposed coral plain of Pōlea on which the ‘Ewa Mill Station was located” (de Silva 2003).

Eia mai au ‘o Makalapua	Here I am, Makalapua
Hō‘alo i ka ihu o ka Lanakila.	Traveling where the *Lanakila* goes.

‘O ke ku‘e a ka hao a i Kūwili	The piston works at Kūwili
Ka hiona ‘olu a‘o Hālawa.	And down the pleasant descent of Hālawa.
Ua lawa ka ‘ikena i ke awalau	Satisfying is the view of the lochs
Iā ‘Ewa ka i‘a hāmau leo.	Of ‘Ewa, “land of the silent fish.”
Ua piha ka uahi a i Mānana	The smoke rises at Mānana
Aweawe i ke kula o Waipi‘o.	And streams along at Waipi‘o.
I kai ho‘i au a Honouliuli	Then I reached the lowlands of Honouliuli
Ahuwale ke ko‘a o Pōlea.	Where the corals of Pōlea lie exposed.
Ha‘ina ‘ia mai ana ka puana	This is the conclusion of the song
Hō‘alo i ka ihu a ka Lanakila.	Of traveling where the *Lanakila* goes.

[de Silva 2003]

De Silva (2003) provides a remarkable breakdown of this *mele*, delving into the subtext to reveal another layer of understanding, of *kaona*:

> ‘Makalapua’ shares […] the sense of awesome efficiency and harmony […] These are apparent in ‘Makalapua’s’ description of the working of the train’s piston at Kūwili, in the rising and billowing of steam at Mānana and Waipi‘o, and especially in the sense of speed with which the mele whisks us from Honolulu to Pōlea in the space of its six, two-line verses. Efficiency and harmony, however, are not at the heart of ‘Makalapua;’ it is inspired and driven, instead, by *aloha ‘āina*—love for the land—and by *kū‘ē ho‘ohui ‘āina*—resistance to annexation. In my reading of the mele, the dominant imagery is that of flower-stringing. The train and track serve as the contemporary equivalent of lei needle and thread; with them, Lili‘u sews a series of beloved place-names and place-associations into a lei of adornment and protection for Ke-awalau-o-Pu‘uloa. Keawalauopu‘uloa, the many-harbored sea of Pu‘uloa, is the old name for Pearl Harbor. The cession of Pearl Harbor to America in return for sugar reciprocity was one of the hottest political issues of ‘Makalapua’s’ day. Lili‘u was absolutely opposed to any Keawalau deals; her brother, on the other hand, had regularly waved this bait at the American nose; he was even rumored, on his Nov. 1890 departure to San Francisco, to have harbored a hidden Pearl Harbor agenda. The key lines of ‘Makalapua’ are ‘Ua lawa ka ‘ikena i ke awalau / Iā ‘Ewa ka i‘ā hāmau leo […] I kai ho‘i au a Honouliuli / Ahuwale ke ko‘a o Pōlea.’ In my reading, these lines say: ‘We hold to our knowledge of Keawalau, we are like its closed-mouthed pipi, its oysters; we will never give up the pearl that we contain; here at the shoreline of Honouliuli we normally silent fish reveal this deeply held conviction.’ [de Silva 2003]

Section 4 Historical Background

4.1 Pre-Contact and Early Historic Period

Hawaiians recognize several land divisions in varying scales, including the *moku*, the *kalana* (smaller land division than a *moku*), the *ahupua‘a*, and the *‘ili* (Malo 1951:16). S.K. Kuhano wrote in 1873 (cited in Kame‘eleihiwa 1992:330) that O‘ahu was divided into six *kalana* (although later scholars refer to these same divisions as *moku*)—Kona, ‘Ewa, Wai‘anae, Waialua, Ko‘olau Loa and Ko‘olau Poko—that were further divided into 86 *ahupua‘a*. Within ‘Ewa, there were 12 *ahupua‘a* including (from west to east) Honouliuli, Hō‘ae‘ae, Waikele, Waipi‘o, Waiawa, Mānana, Waimano, Waiau, Waimalu, Kalauao, ‘Aiea, and Hālawa (Kame‘eleihiwa 1992:330). The present study area is in Waiawa Ahupua‘a located between Waipi‘o Ahupua‘a to the west and Mānana Ahupua‘a to the east (see Figure 7 and Figure 9). Modern maps and land divisions still generally follow the ancient system and use the same land divisions.

Mo‘olelo of the *ahupua‘a* of Waiawa and the broader *moku* of ‘Ewa illuminate the central importance of the waters of Pu‘uloa (the Hawaiian name for Pearl Harbor) and the surrounding land to Hawaiians. The land was fertile and well-fed by mountain streams, and the lochs of Pu‘uloa were abundant in marine resources. This agricultural base supported chiefs of distinguished lineages. The significance of water in ‘Ewa is embedded in the names of *wahi pana*. For example, six of the 12 *ahupua‘a* names in the *moku* of ‘Ewa—Waikele, Waipi‘o, Waiawa, Waimano, Waiau, and Waimalu— begin with *wai*, the Hawaiian word for fresh water. Further, the *moku* of ‘Ewa once contained more *loko i‘a* than any other district on O‘ahu, and vast *lo‘i kalo* (irrigated taro terraces) formerly filled the wetlands. This suggests agricultural and aquacultural intensification were a direct link to the chiefs who resided there and to the increasing needs of the population. Further, *mo‘olelo* associated with specific *wahi pana* connect Pu‘uloa to the ancestral homeland of Hawaiians in central Polynesia, describe the marine and freshwater resources of Pu‘uloa, and detail the feats and journeys of legendary heroes, gods, and *‘aumākua*.

4.1.1 Agricultural and Aquaculture

Many *mo‘olelo* describe the traditional agriculture and aquaculture in ‘Ewa, including *loko i‘a* around the lochs of Pu‘uloa, wetland *lo‘i kalo*, and other resources. These forms of subsistence supported the households of the chiefs (Handy and Handy 1972:470) and ‘Ewa was once the political center for O‘ahu. An endearing name for ‘Ewa was *‘Ewa, ka ‘āina o nā ali‘i* (‘Ewa, land of chiefs) because it was a favorite residence of theirs (Sterling and Summers 1978:1). Handy and Handy provide a detailed description of the forms of agriculture and aquaculture in the region.

> The salient feature of ‘Ewa, and perhaps its most notable difference, is its spacious coastal plain, surrounding the deep bays (‘lochs’) of Pearl Harbor, which are actually the drowned seaward valleys of ‘Ewa’s main streams, Waikele and Waipi‘o […] The lowlands, bisected by ample streams, were ideal terrain for the cultivation of irrigated taro. The hinterland consisted of deep valleys running far back into the Ko‘olau range. Between the valleys were ridges, with steep sides, but a very gradual increase of altitude. The lower parts of the valley sides were excellent for the culture of yams and bananas. Farther inland grew the *‘awa* [kava] for which the area was famous. The length or depth of the valleys and the gradual

> slope of the ridges made the inhabited lowlands much more distant from the *wao*, or upland jungle, than was the case on the windward coast. Yet the *wao* here was more extensive, giving greater opportunity to forage for wild foods in famine time. [Handy and Handy 1972:469]

Except for the numerous varieties of shellfish and abundance of mullet, Handy and Handy describe ‘Ewa as being like the rest of O‘ahu.

> In the interior was the same avifauna, including the birds whose feathers were prized for feather capes, helmets, and *lei* making. In fact this, with its spacious *wao* inland, was the region where these birds were most numerous. There were more extensive areas also where *wauke* [paper mulberry] and *mamaki* [small native tree], which supplied bast for the making of *tapa* [cloth], grew in abundance. In fact, ‘Ewa was famous for its *mamaki*. There was, too, much *olona* [native shrub used for cordage] grown in the interior, and wild bananas and yams flourished. [Handy and Handy 1972:470]

‘Ewa was also known for a special and tasty variety of *kalo* called *kāī* that was native to the district. Handy collected four varieties; the *kāī ‘ula‘ula* (red *kāī*), *kāī koi* (*kāī* that pierces), *kāī kea* or *kāī ke‘oke‘o* (white *kāī*), and *kāī uliuli* (dark *kāī*) (Handy 1940:81). A *kama‘āina* of ‘Ewa described the *kāī kea* as being very fragrant. The *kāī ke‘oke‘o* made exceptionally good *poi* and was said to be reserved for the *ali‘i* (chiefs). An 1899 newspaper account says of the *kāī koi*, “That is the taro that visitors gnaw on and find it so good that they want to live until they die in ‘Ewa. The *poi* of *kāī koi* is so delicious” (*Ka Loea Kālai‘āina* 1899, translated in Sterling and Summers 1978:8). So famous was the *kāī* variety that ‘Ewa was sometimes affectionately called Kāī o ‘Ewa (Handy and Handy 1972:471). The cultivation of this prized and delicious taro led to the saying:

> *Ua ‘ai i ke kāī-koi o ‘Ewa*. He has eaten the Kāī-koi taro of ‘Ewa.
>
> *Kāī* is O‘ahu’s best eating taro; one who has eaten it will always like it. Said of youth or a maiden of ‘Ewa, who, like the Kāī taro, is not easily forgotten. [Pukui 1983:305]

In addition, breadfruit, coconuts, *wauke*, bananas, and *olonā*, and other plants were grown in the interior. ‘Ewa was known as one of the best areas to grow gourds and was famous for its *māmaki* (Handy and Handy 1972:471).

4.2 Early Historic Period

4.2.1 Observations of Early Explorers and Visitors

Captain James Cook landed in the Hawaiian Islands in 1778, and ten years later the first published description of Pearl Harbor appeared. Captain Nathaniel Portlock, observing the coast of Honolulu for Great Britain, recorded the investigation of a “fine, deep bay running well to the northward” around the west point of “King George’s Bay” in his journal (Portlock 1789:74). Portlock’s description matches the entire crescent-shaped shoreline from Barber’s Point to Diamond Head.

Captain George Vancouver made three voyages to the Hawaiian Islands between 1792 and 1794. In 1793, the British captain recorded the name of the harbor opening as “O-poo-ro-ah” and

sent several boats across the sand bar to venture into the harbor proper (Vancouver 1798:884). The area known as “Pu‘u-loa” was comprised of the western bank at the entrance to Pearl River. George Vancouver anchored off the entrance to West Loch in 1793, and the Hawaiians told him of the area at “a little distance from the sea, [where] the soil is rich and all the necessaries of life are abundantly produced” (Vancouver 1798, cited in Sterling and Summers 1978:36). Mr. Whitbey, one of Vancouver’s crew, observed, “from the number of houses within the harbor it should seem to be very populous; but the very few inhabitants who made their appearance were an indication of the contrary” (Vancouver 1798, cited in Sterling and Summers 1978:36).

The waters of Pearl Harbor were first used for warfare when a sea captain named John Kendrick used his ship to bombard the Chief Ka‘eo of Kaua‘i and his invading warriors on behalf of O‘ahu’s Chief Kalanikūpule during the Battle for Kuki‘iahu. On 6 December 1794, both Kendrick and a British sea captain named Brown, who was commanding two additional ships named *Jackal* and *Prince Le Boo*, landed troops ashore and stood off to bombard those opposed to Kalanikūpule. The battle lasted for two days, with fighting recorded in various areas of ‘Ewa, including ‘Aiea (Fornander 1996:264).

During the first decades of the nineteenth century, several western visitors described the ‘Ewa landscape near Pearl Harbor. Archibald Campbell, an English sailor, spent some time in Hawai‘i between 1809-1810. He had endured a shipwreck off the Island of Sannack on the northwest coast of America. As a result, both his feet became frost-bitten and were amputated. He spent over a year recuperating in the Hawaiian Islands. His narrative is considered noteworthy because it describes life before the missionaries arrived. During part of his stay, he resided with King Kamehameha I, who granted him 60 acres in Waimano Ahupua‘a in 1809. Campbell described his land:

> *In the month of November the king was pleased to grant me about sixty acres of land, situated upon the Wymummee [Wai Momi, traditional Hawaiian name for Pearl River], or Pearl-water, an inlet of the sea about twelve miles to the west of Hanaroora [Honolulu]. I immediately removed thither; and it being Macaheite time [Makahiki], during which canoes are tabooed, I was carried on men’s shoulders. We passed by footpaths winding through an extensive and fertile plain, the whole of which is in the highest state of cultivation. Every stream was carefully embanked, to supply water for taro beds. Where there was no water, the land was under crops of yams and sweet potatoes. The roads and numerous houses are shaded by cocoa-nut trees, and the sides of the mountains are covered with wood to a great height. We halted two or three times, and were treated by the natives with the utmost hospitality. My farm, called Wymannoo [Waimano], was upon the east side of the river, four or five miles from its mouth. Fifteen people with their families resided upon it, who cultivated the ground as my servants. There were three houses upon the property; but I found it most agreeable to live with one of my neighbours, and get what I wanted from my own land. This person’s name was William Stevenson a native of Borrowstouness.* [Campbell 1967:103–104]

Of the Pearl River area, Campbell wrote,

> Wymumme, or Pearl River, lies about seven miles farther to the westward. This inlet extends ten or twelve miles up the country. The entrance is not more than a

> quarter of a mile wide, and is only navigable for small craft; the depth of water on the bar, at the highest tides, not exceeding seven feet; farther up it is nearly two miles across. There is an isle in it, belonging to Manina, the king’s interpreter, in which he keeps a numerous flock of sheep and goats. [Campbell 1967:114]
>
> The flat land along shore is highly cultivated; taro root, yams, and sweet potatoes, are the most common crops; but taro forms the chief object of their husbandry, being the principal article of food amongst every class of inhabitants. [Campbell 1967:115]

The botanist F.J.F. Meyen, visiting in 1831, confirms the abundant vegetation described by Campbell in the vicinity of Pearl Harbor:

> At the mouth of the Pearl River the ground has such a slight elevation, that at high tide the ocean encroaches far into the river, helping to form small lakes which are so deep, that the long boats from the ocean can penetrate far upstream. All around these water basins the land is extraordinarily low but also exceedingly fertile and nowhere else on the whole island of Oahu are such large and continuous stretches of land cultivated. The taro fields, the banana plantations, the plantations of sugar cane are immeasurable. [Meyen 1981:63]

A contrasting picture of ‘Ewa is recorded in the missionary William Ellis’ description from 1823-1824 of the ‘Ewa lands away from the coast:

> The plain of Eva is nearly twenty miles in length, from the Pearl River to Waiarua, and in some parts nine or ten miles across. The soil is fertile, and watered by a number of rivulets, which wind their way along the deep water-courses that intersect its surface, and empty themselves into the sea. Though capable of a high state of improvement, a very small portion of it is enclosed or under any kind of culture, and in travelling across it, scarce a habitation is to be seen. [Ellis 1963:7]

4.2.2 Missionary Census and Population Census

The first company of Protestant missionaries from America, part of the American Board of Commissioners of Foreign Missions (ABCFM), arrived in Honolulu in 1820. They quickly established churches in Kona on Hawai‘i Island, Waimea on Kaua‘i, and Honolulu on O‘ahu. Although the O‘ahu missionaries were based in Honolulu, they traveled around the islands intermittently to preach to the rural Hawaiians and to check on the progress of English and Bible instruction schools set up by local converts.

In 1828, the missionary Levi Chamberlain (1956:39-40) made a circuit of O‘ahu, stopping wherever there was a large enough population to warrant a sermon or to visit a school. In his trek through the ‘Ewa District from Wai‘anae, he stopped at Waimānalo ‘Ili in Honouliuli, on the western border of ‘Ewa. At around 11 o‘clock the next day, on a Saturday, Chamberlain and his companions set out toward the east, reaching Waikele at 3 or 4 o‘clock. The group did not stop in Hō‘ae‘ae, suggesting that the population was too small for a school, but Waikele had two schools, an obviously larger population than Hō‘ae‘ae. in fact, Chamberlain decided to stay in Waikele until the next day, on the Sabbath, and preach to the Hawaiians who lived there. A crowd of 150 to 200 gathered for the sermon. The next day at 6 o’clock they set out for the village of Waipi‘o, which had one school. They left Waipi‘o at about 8:30, and walked to Waiawa, where there were

two schools. Around ten o’clock, they began their circuit again, stopping only in the *ahupua‘a* of Kalauao in the ‘Ewa District before they reached Moanalua Ahupua‘a in the Kona District. The account does not give much information on the surroundings, but does indicate the relatively populated areas of ‘Ewa, in western Honouliuli, Waikele, Waipi‘o, Waiawa, and Kalauao, and the time it took to travel by foot along the trail across the ‘Ewa District.

In the following years, the Protestant missionaries established smaller churches in outlying areas, sometimes presided over by a foreign missionary or led by a Hawaiian convert, with periodical visits by a pastor from one of the main churches. The first mission in ‘Ewa was established in 1834 in Waiawa. Two missionaries, Lowell and Abigail Smith, were assigned to the station and were in charge of building a church and a house for themselves (Hawaiian Mission Children’s Society 1969:3–9). The *ali‘i,* Kīna‘u, daughter of Kamehameha I and an early Christian convert, offered the missionaries to “settle upon her land, will build us a house and do anything to promote our happiness” (letter from Lowell Smith 1833, cited in Frear 1934:69). Citing his wife’s poor health, the Smiths went to Moloka‘i instead. But at the General Meeting of the missionaries in June and July 1834, the board decided the Smiths should be transferred to ‘Ewa to a place 3 miles from the king‘s favorite country seat (Frear 1934:93). Lowell selected the site for the new church on a hill called Haupu‘u (built-up hill) that was elevated 200 ft above the ‘Ewa plain. This church is depicted as it looked in 1851 in Figure 10 and the location of this church approximately 1.5 km southeast of the south end of the present study area is shown on an 1881 map of O‘ahu (Figure 11). This ‘Ewa Church on the hill Haupu‘u was probably situated near the demographic center of Waiawa Ahupua‘a from time immemorial and would dominate the geographic and social landscape of Waiawa for decades.

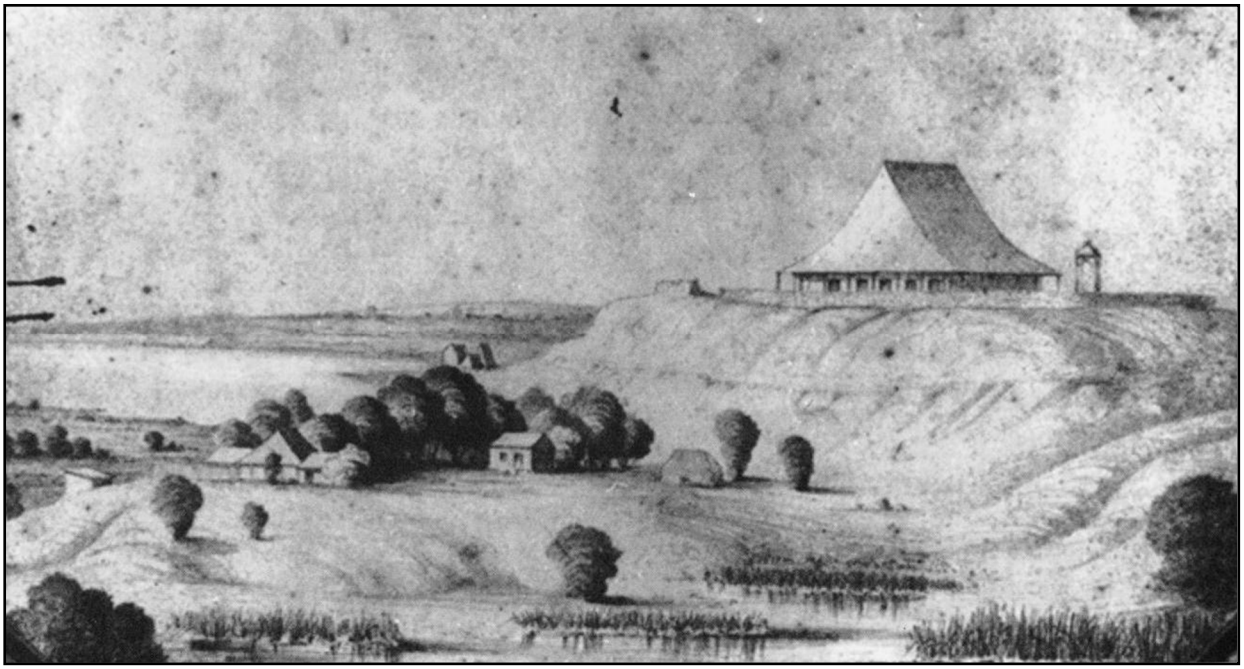

Figure 10. 1851 sketch of ‘Ewa Church on the hill Haupu‘u in Waiawa (original sketch by Paul Emmert in the Mission Houses Museum Library; reprinted in Gowans 1993:10)

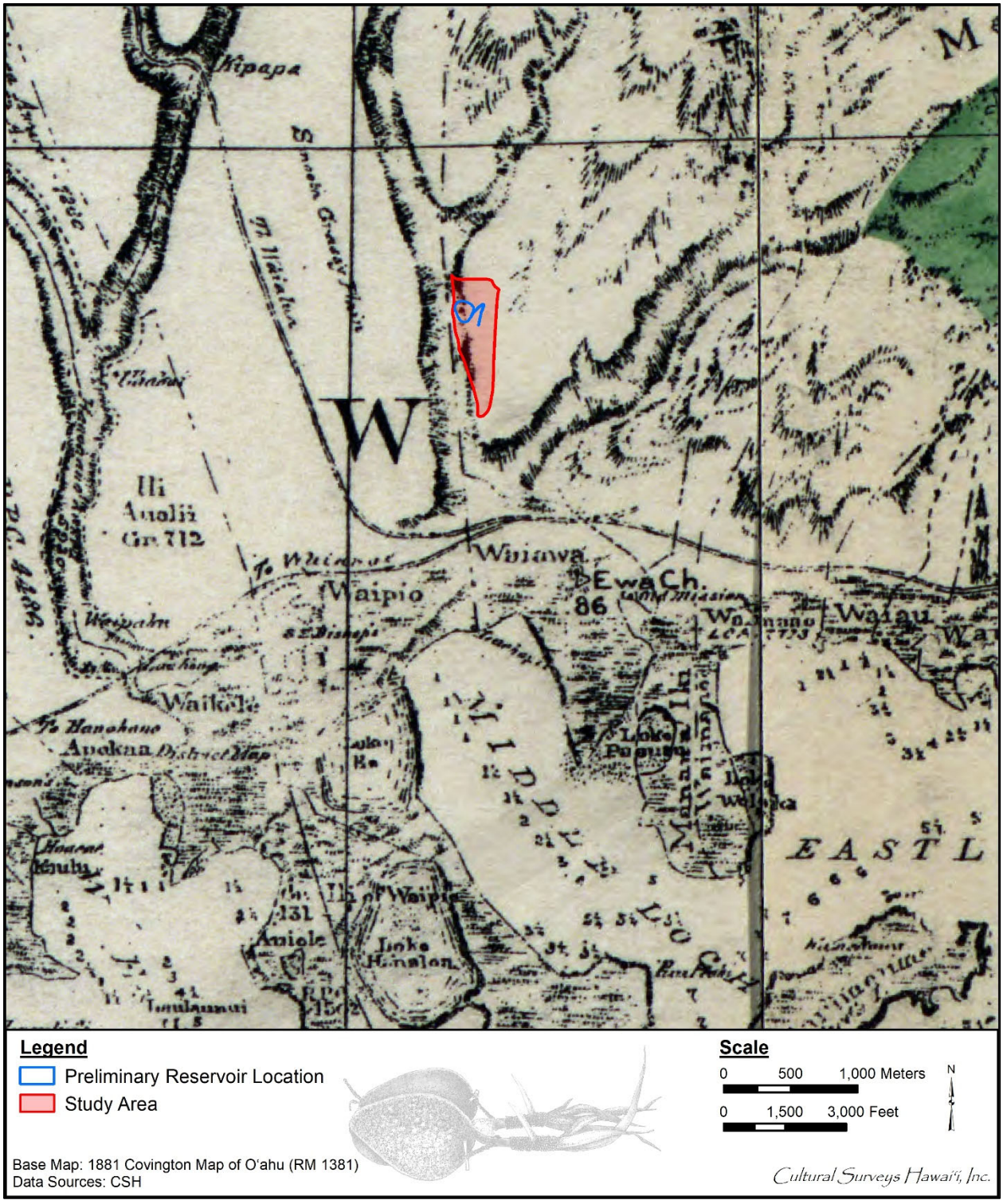

Figure 11. 1881 map of O‘ahu (portion) by R. Covington (RM 1381); the new roads follow the old trails; the main taro / rice wetlands and the Ewa Church are *makai* of the main coastal road

Lowell Smith's congregation was spread out over an area of 20 miles, and he traveled to different areas to preach to crowds. He also established two schools, one for boys and one for girls, and treated the sick, especially inoculating his parishioners against smallpox. In 1836, Abigail's health deteriorated, and the mission decided that the two should live in Honolulu instead. To carry on the work at the mission, the Reverend Artemas Bishop and his family were transferred to ‘Ewa. Sereno Bishop, the son of Artemas Bishop, remembered the move:

> Our predecessors at Ewa were Rev. and Mrs. Lowell Smith, specially capable and devoted missionaries who had been only two years in the field. Mr. Smith had built a comfortable house of adobe bricks, thatched with grass and well plastered inside and out. He had also erected the adobe walls of a church, capable of holding an audience of about one thousand people […] The adobe walls fifteen feet high were covered by a steeply pitched roof, which extended out in a verandah on all four sides, in order to protect the base of the mud walls from being destroyed by raindrip. The timbers of the roof were long beams dragged from the mountains entirely by human strength, the labor being secured by volunteering, under the leadership of the chiefs.
>
> The mission house was located on the west bank of the Waiawa creek, about one-fourth mile northwest of the present railway station at Pearl City. There was nearly an acre of ground enclosed in an adobe wall. Some distance seaward was a glebe of a couple of acres of taro swamp, a little below where the railway bridge now crosses the creek. A small cattle pen was enclosed about twenty rods north. An old wall of the natives separated the upland from the planted lands and kept out the pigs and afterward the cattle. Copious springs of most delicious water abounded throughout the district of Ewa, a small one being in our own grounds. [Bishop 1916:41–42]

The church, shown on an 1851 sketch (see Figure 10), was finally completed in early 1837 (Frear 1934:137) on a lot that is now a portion of the Leeward Community College (LCC) and the adjacent College Gardens Condominiums. It was described as follows:

> An elegant church building, ninety feet long, forty two feet wide with a veranda all around it,--plastered inside and out, a good pulpit, etc., etc. The house will contain from ten to twelve hundred people. [letter from Lowell Smith 1857, cited in Frear 1934:115]

During the U.S. Exploring Expedition of 1839-1841, a member of Captain Wilkes' crew visited ‘Ewa and noted the church and thriving village at Waiawa:

> At Ewa, Mr. Bishop has a large congregation. The village comprises about fifty houses, and the country around is dotted with them. The village presents an appearance of health and cleanliness, clearly indicating the influence Mr. Bishop has exerted over his flock, in managing which he is much aided by his lady.
>
> The church is a large adobe building, situated on the top of a small hill, and will accommodate a great number of persons. Mr. Bishop sometimes preaches to two thousand persons.

> The natives had made some advance in the arts of civilized life; there is a sugar-mill, which, in the season, makes two hundred pounds of sugar a day. They have been taught, and many of them are now able to make their own clothes, after the European pattern. There is a native blacksmith and several native carpenters and masons, how are able to work well.
>
> In 1840, the church contained nine hundred members, seven hundred and sixty of whom belonged to Ewa, the remainder to Waianae; but the Catholics have now established themselves at both these places, and it is understood are drawing off many from their attendance on Mr. Bishop's church. […]
>
> This is the best part of the island of Oahu for raising cattle and sheep, which are seen here in greater numbers than elsewhere. [Wilkes 1845:80–81]

The reports left by Artemas Bishop of the Ewa Protestant Station in Waiawa shed light on the massive impact disease was having on the Hawaiian people in the ‘Ewa District. The 1831–1832 census of O‘ahu recorded a population of 4,015 within the ‘Ewa District. Four years later, in 1836, the ‘Ewa population had dropped to 3,423 (Schmitt 1973:9, 36), "a decrease of 592 in 4 years" (‘Ewa Station Report 1836). Reverend Lowell Smith noted,

> The people of Ewa are a dying people. I have not been able to obtain an exact count of all the deaths & births since the last general meeting. But my impression is that there have been as many as 8 or 10 deaths to one birth. I have heard of but 4 births on Waiawa during the year, & all of these children are dead. I have attended about 20 funerals on that one land, & 16 of these were adults. [‘Ewa Station Report 1836]

The population stabilized in the 1830s and early 1840s. In January 1849, the population was 2,386 people, but the population dropped with a measles epidemic in October 1849. Although Bishop attempted to vaccinate as many individuals as possible, the smallpox epidemic of 1853-1854 killed upwards of 400 people in the ‘Ewa District. The comments of Artemas Bishop reflect the destitution people were suffering district wide:

> It is not necessary that I go into detail of that season of sorrow and trial which we passed through, and from which I did not myself escape without feeling its influence in my own person. Let it suffice here, that not a house or family in Ewa escaped. In many cases, whole families were cut off. Husbands and wives parents and children were separated by death. The whole state of society became disorganized; almost every family was broken up. In the whole district between July and October inclusive, upwards of half of the people died and of those who escaped, many are still enfeebled in consequence. In the church we have lost upwards of 400 members, including several of my best men. We feel ourselves very much crippled in consequence. Many sad and affected feelings, mingled with discouragement have followed my labors through the year, and that to a degree far beyond what I ever before suffered. [‘Ewa Station Report 1854]

Sereno Bishop also remembered his father's efforts to save his congregation, but with limited success in ‘Ewa:

> The greatest destruction of Hawaiian population took place in the summer of 1853, by an invasion of small-pox. This broke out in Honolulu. Rev. A. Bishop

> immediately procured a supply of vaccine matter, which proved to be spurious. He then proceeded to inoculate the people with small-pox, thus saving hundreds of lives, and himself coming down with varioloid, having formerly been vaccinated. But more than half of the population of Ewa perished in a few weeks. The earliest cases were pathetic. A young woman in Kalauao was visiting in Honolulu, and contracted the malady. She hastened home in terror and summoned her friends and kindred from all the villages of Ewa to bid her farewell. They all came and kissed her, then returned to their homes and all died. The young woman herself recovered. [Bishop 1916:46]

In 1860, Artemas Bishop reported,

> The people of the district are rapidly diminishing, and whole neighborhoods where in former years were numerous families and cultivated lands, there are now no inhabitants, and the land is left to run to waste. The fathers have died off, and the children wander into other parts, and there are none to fill their places. [‘Ewa Station Report 1860]

Sereno Bishop, recollecting his life at the mission station in ‘Ewa in the mid-eighteenth century, commented on the population decline: “Throughout the district of Ewa the common people were generally well fed. Owing to the decay of population great breadths of taro marsh had fallen into disuse, and there was a surplus of soil and water for raising food” (Bishop 1916:44).

The consequences of the great numbers of deaths were far reaching, one of which was the large displacement of people from traditionally settled lands. When Reverend Bishop no longer preached at the church, various short-term pastors and deacons took his place, but the attendance dropped off and the pastors often were not paid. ‘Ewa Church, long neglected both physically and spiritually, fell into a state of despair (Ellis 1995:20). A new adobe church building was begun by the cquire r Samuel Nawaa in 1882, which was built 20 ft west of the old church. Nawaa had trouble paying for the construction and petitioned the help of King Kalākaua, the seventh in the line of Hawaiian monarchs. Kalākaua paid the debt and Nawaa honored him at the dedication in 1884 by calling the church Kahikuonālani (the seventh of the kings). The church was moved east into Mānana Ahupua‘a in 1906 as the population shifted to the new residential sections of Pearl City. The church moved once again in 1957 to Pearl City Highlands (Ching 1992:28–29).

4.2.3 The Sandalwood Trade and the Introduction of Domesticated Animals

Subsequent to Western Contact in the area, the landscape of the ‘Ewa plains and Wai‘anae slopes was adversely affected by the removal of the sandalwood forest, and the introduction of domesticated animals and new vegetation species. Domesticated animals, including goats, sheep, and cattle, were brought to the Hawaiian Islands by Vancouver in the early 1790s, and allowed to graze freely about the land for some time after. It is unclear when the domesticated animals were brought to O‘ahu; however, L.A. Henke reports the existence of a longhorn cattle ranch in Wai‘anae by at least 1840 (Frierson 1972:10). During this same time, perhaps as early as 1790, exotic vegetation species were introduced to the area. These typically included vegetation best suited to a terrain disturbed by the logging of sandalwood forest and eroded by animal grazing.

Sereno Bishop stated that his father was the first to bring cows to ‘Ewa:

> Waiawa valley above us lay knee deep with the richest of grass, where our cows rioted. Out goats took to the higher ground, where they flourished, being driven in and penned at night. […] The herd gradually multiplied and in a few years became large. [Bishop 1916:42]

These herds contributed to the deforestation of the upper valley, as noted by Bishop:

> There was a very passable road down Ewa and Waianae way. Once while making the trip down to Waialua, to which there was a good horse trial, I discovered that even at that early day [ca. 1858] that cattle had made great inroads into the forests of ti plants which had theretofore clad the foothills and upland pasturages, even to the highest tracts. [Bishop 1916:60]

4.3 Mid-Nineteenth Century and the Great 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). The Māhele, the division of lands among the *ali‘i*, and subsequently the Kuleana Act, the awarding of lands to the common people, introduced the concept of private property into Hawaiian society. In 1848, Kamehameha III divided the land into four categories: King/Crown Lands to be reserved for himself and the royal house; Government Lands set aside to generate revenue for the government; Konohiki Lands set aside for *ali‘i* and their *konohiki* (stewards); and *kuleana* (Native Hawaiian land rights), habitation and agricultural plots claimed by the common people (Chinen 1958:15–16).

During the Māhele land division of Hawai‘i in 1848, Waiawa Ahupua‘a was awarded to Princess Victoria Kamāmalu (sister of Kamehameha IV and V) as part of land claim 7713. During the second half of the nineteenth century, Waiawa was passed on to successive members of the *ali‘i*. Victoria Kamāmalu died in 1866 at the age of 27. Her entire estate was inherited by her father, Mataio Kekūanao‘a, who died two years later. The estate went to Kekūanao‘a’s son Lot Kapuāiwa, who by that time reigned as Kamehameha V. Kapuāiwa died in 1872, whereupon Ruth Ke‘elikōlani, Kapuāiwa’s half-sister, petitioned for and received in 1873 the entire estate. By 1883, Ruth Ke‘elikōlani died, leaving all of her estate to her cousin Bernice Pauahi Bishop (Kame‘eleihiwa 1992:309–310). Kamehameha Schools and the Bernice Pauahi Bishop Estate presently retain ownership of most of the *ahupua‘a*. The present study area is entirely within the award to Victoria Kamāmalu and *mauka* of all the smaller *kuleana* awards to individuals. There were no *kuleana* awarded within the study area.

A total of 33 awards were made in Waiawa, cquireing the award of Waiawa to Victoria Kamāmalu (Figure 12 and Table 1). One large award, LCA 387, was to the ABCFM. It comprised 4.13 acres in the *makai* portion of Waiawa and included a salt pond, a *mo‘o* (land strip) for the church, and a house lot. Artemas Bishop, the Protestant missionary stationed at ‘Ewa from 1836–1856, made the application and drew a map of the Waiawa *kuleana* awards in 1887 (see Figure 8). This map shows the location of topographic features, trails, LCA awards, and *‘ili.* The remaining 31 awards in Waiawa were for *kuleana*. The claims included 28 house lots, 176 taro *lo‘i*, 20 *loko i‘a*, 23 *kula* (dryland agriculture), eight *paukū ‘auwai* (section of ditch), and seven banana *kula*

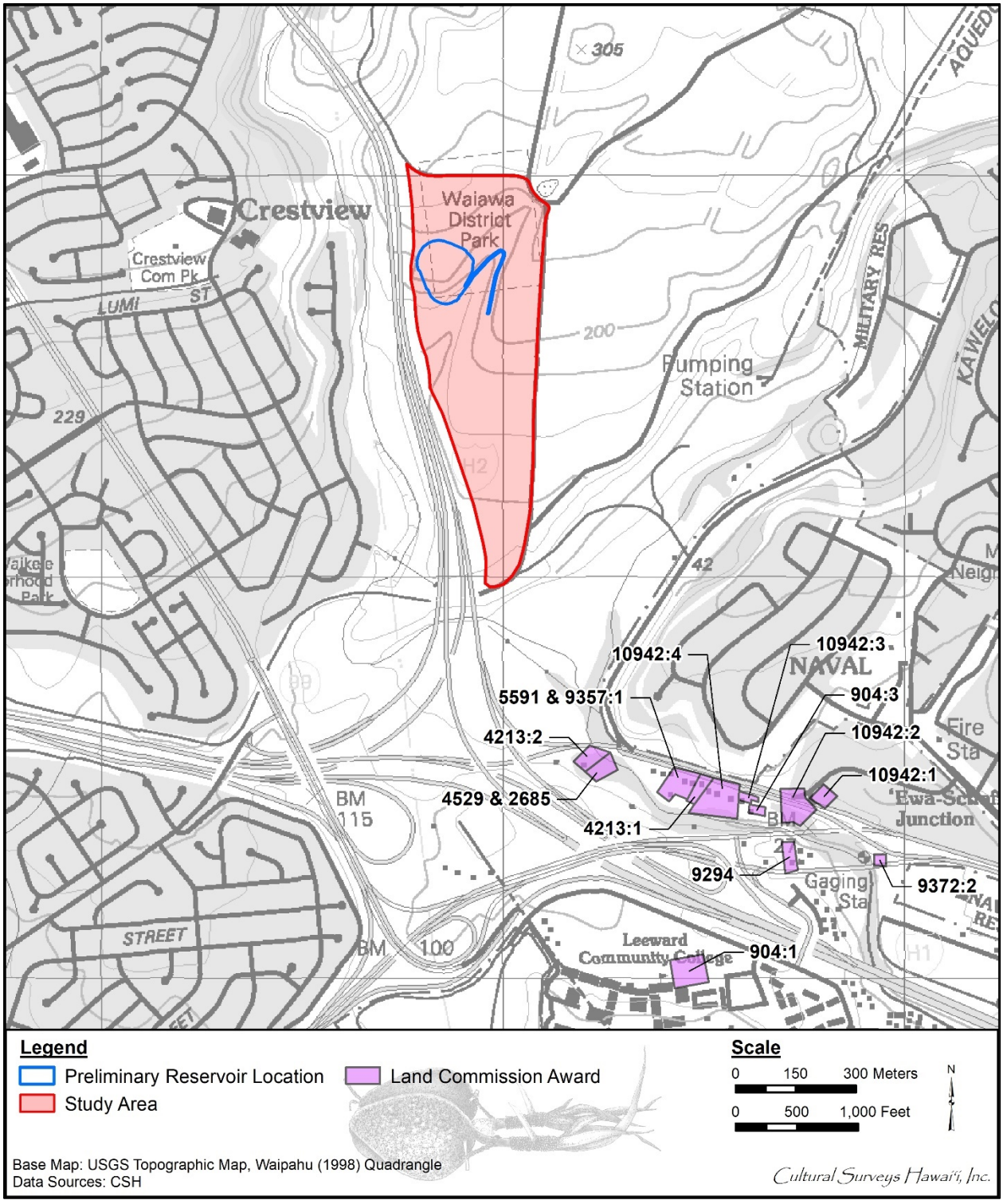

Figure 12. Land Commision Awards in the vicinity of the study area

Table 1. LCAs and *‘Ili* in Waiawa Ahupua‘a

LCA	Awardee	Acres	*‘Ili*
387	ABCFM	4.13	Pānaio
879	Puakai	0.619	Pānaio, Kapuaihalulu (*‘āpana* [lot] 1), Kionaole (*‘āpana* 2, 3)
882	Poonui	0.78	Kuhialoko
904	Naheana, Noa	1.608	Pānaio (*‘āpana.* 1); Kuhiawaho (*‘āpana.* 2); Kahō‘ai‘ai (*‘āpana.* 3)
1696	Namomoku	3.91	Kuhialoko (*‘āpana* 3)
1715	Haa	2.4	Kuhialoko (*‘āpana* 1 and *‘āpana* 2)
2146	Paahana	0.372	Kapuaihalulu
2448	Kikane	0.844	Pānaio (*‘āpana* 1), Kapuaihalulu (*‘āpana* 2, 3, 4)
2685, 4529	Ohia	1.227	Holoipiapia (*‘āpana* 3), Kapuaihalulu (*‘āpana* 3)
4213	Kauhi	1.285	Holoipiapia (*‘āpana* 2), Kahō‘ai‘ai (*‘āpana* 1)
5591; 9357	Kekua	1.24	Kahō‘ai‘ai
5644; 9362	Kamalii	3.196	Kuhialoko
7713:46	Kamāmalu, Victoria	entire *ahupua‘a*	Waiawa Ahupua‘a
9294	Kekeni	0.67	Piliaumoa
9320	Keoho	1.47	Kapaloa (two *‘āpana*)
9357-B	Opunui	1.628	Pānaio (*‘āpana* 1 and 2)
9358	Kaanuu	1.155	Kapuaihalulu
9360; 5847	Kapaa	0.9	Hanakehau
9361; 1711	Hanamaulu	1.54	Kuhiawaho
9362-B	Naone	0.595	Kapuaihalulu
9364; 6086	Makanui	0.61	Hanakehau
9366; 1594	Keawe	0.687	Hanakehau
9368; 1604	Kakoo	0.43	Kuhiawaho
9372	Keiki	1.38	Kapaloa (two *‘āpana*)
9373	Kamoku	0.52	Kapaloa
9374; 5646	Kaionio	1.214	Pānaio (*‘āpana* 1); Kulaokamakau (*‘āpana* 2)
9375; 1683	Peahi	1.176	Pānaio (one *‘āpana*); Kulaokamakau (one *‘āpana*)
9376	Kupihea	1.306	Kapaloa (two *‘āpana*)
9377	Lio	1.21	Kapaloa, Hale‘aha
9384	Nahalepili	1.58	Kapopou (*‘āpana* 1 and 2)

LCA	Awardee	Acres	*‘Ili*
9409	Puhiki	0.937	
10567	Ohulenui	1.264	Kapuaihalulu (three *‘āpana*) , Kalona
10942	Wallace, William	3.651	Kahō‘ai‘ai (*‘āpana* 1–4)

(Cordy 1996:5). All historic maps show the 31 claims adjacent or *makai* of the Government Road, which later became Kamehameha Highway.

As documented in the above LCA claims, much of the land during the mid- to late 1800s was being utilized for dryland crops, wetland crops, and pond fields. Waiawa Stream was the logical means of irrigation, although there were also freshwater springs about the area. In marsh areas, the Hawaiians made earth mounds for *kalo* crops. A majority of these LCA parcels were in the lower, wetter elevations where wetland agriculture was propagated. Areas *mauka* of the highway may have had scattered fields of dryland crops, such as sweet potatoes. While the uplands of Waiawa were probably used for the procurement of resources, there is no evidence of permanent settlements in traditional Hawaiian times.

4.4 Late Nineteenth Century

4.4.1 Ranching

Both John Young and Kamehameha I brought the first cattle to O‘ahu from Kaua‘i in 1809 (Kamakau 1992:268). It is probable that Young had cattle at his Hālawa lands as well.

> Several individuals had large flocks of them. The queen had one [*sic*], consisting of about one hundred and fifty; and Manina had several hundreds on the island [Moku‘ume‘ume or Ford Island] in Pearl river. The cattle lately introduced are pastured upon the hills, and those parts of the country not under cultivation, the fences not being sufficient to confine them. [Campbell 1967:117–118]

As previously noted, the missionaries assigned to the ‘Ewa Church in Waiawa allowed their cattle to roam on the Waiawa uplands as early as the late 1830s. In 1868, a 50-year lease and leaseholds in Waiawa were granted to James Robinson, an early shipbuilder in Hawai‘i. After James Robinson’s death in 1890, his son, Mark P. Robinson, acquired a 25-year lease and ran cattle on the Waiawa lands. Robinson had expanded his father’s business, and was part owner in a large lumber yard business and in operating several inter-island steamers. He was also one of the three largest landowners in the ‘Ewa District, along with James Campbell, who had a large cattle ranch in Honouliuli and Charles ‘Ī‘ī Brown, who owned lands from the Waipi‘o Peninsula to the uplands. The Robinson homestead was between Ho‘ae‘ae and Waikele (west of the study area), but he had fee simple lands in Mānana and Waimano, and a number of leased lands in Waiau, Waiawa and Waimano Uka (Yardley 1981:131).

As late as the 1894 Kanakanui map (Figure 13) virtually no human modification of the vicinity of the study area is indicated other than the pre-Contact coastal cross-*ahupua‘a* trail (“Road to Honolulu”) and the ‘Ewa Church. It is understood that the land north of the coastal cross-*ahupua‘a* trail was quite undeveloped Robinson family ranch land to that time.

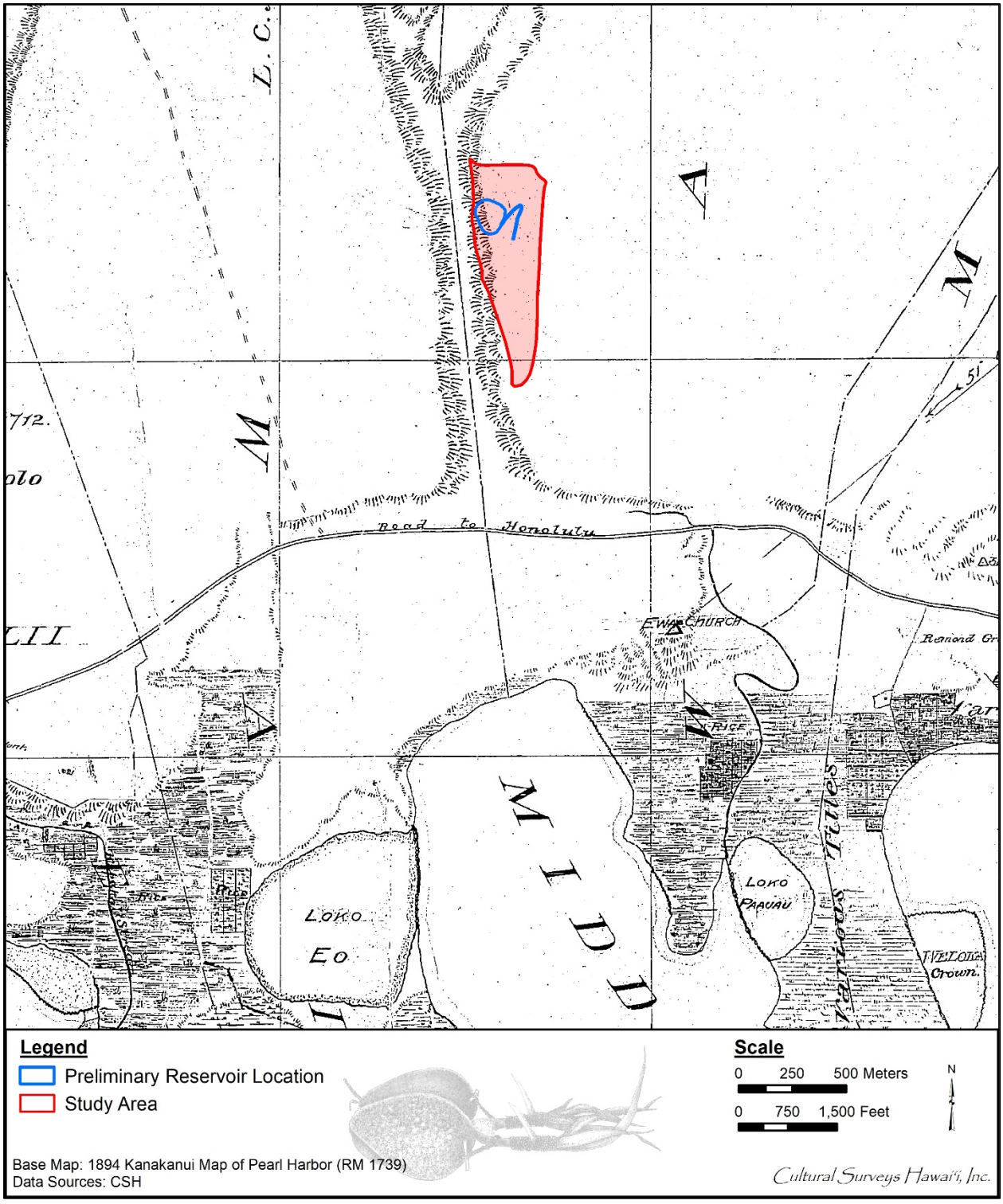

Figure 13. Portion of 1894 map of Pearl Harbor by S.M. Kanakanui (RM 1739) showing the study area

4.4.2 The Origins of OR&L

Mark Robinson was one of the early supporters of B.F. Dillingham's Oahu Railway and Land (OR&L) Company, and later became one of the managers. Robinson initially agreed to put his lands and cattle into the new corporation, in exchange for cash and stock and bonds. He and Dillingham planned to use the sale of bonds of the new company to build and equip the first 15 miles of the railroad (Yardley 1981:131). From the agreement, we learn the extent of the ‘Ewa ranch lands owned by Robinson.

> Mark [Robinson] had committed himself to put into the railway company, in exchange for stock and bonds, 2,010 acres in fee simple at $25 an acre, a paid-up lease from the Bishop Estate for twenty years on 18,000 acres, one thousand head of cattle and fifty horses, 45,000 *‘ohi‘a* railroad ties [from his lumber yards], and the steamer *Ewa.* [Yardley 1981:135–136]

By 1889, the OR&L had completed its first 9 miles of railway. It connected the wharves at Honolulu Harbor to Hālawa and the agricultural coastline of Pearl Harbor. O‘ahu's Ewa Plantation was incorporated in 1889 and the growing railroad of B.F. Dillingham was leveling the Waipahu-to-‘Ewa Junction in anticipation of service to the ‘Ewa plains and beyond. Due to this increased construction, harbor commissioners for the new Territory planned for extensive terminal construction and harbor development to accommodate the steady growth of O‘ahu's sugar industry (U.S. War Department, Army Corps of Engineers 1935). The railroad extended from Honolulu to Pearl City in 1890, to Wai‘anae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:100). This railroad line eventually ran across the center of the ‘Ewa Plain at the lower boundary of the sugar fields (Frierson 1972:15). The OR&L tracks extended along the margin of Pearl Harbor. The 1899 Beasley map (Figure 14) shows the OR&L track quite close to the northern margin of Middle Loch south of the present study area.

4.4.3 The Sugar Industry

Although sugarcane was already being grown as a cash crop as far back as the early 1800s, the industry revealed its economic potential in 1879 when the first artesian well was drilled in ‘Ewa (Ellis 1995:22). The availability of subsurface water resources enabled greater irrigation possibilities for expanding plantations besides the use of water diversions from the surrounding stream systems. This prompted the drilling of many other wells throughout the Hawaiian Islands, thereby commencing the Hawai‘i sugar plantation era. By the early 1900s, all the main Hawaiian Islands had land devoted to the production of sugarcane.

Agricultural field systems, railroads, and residential areas in ‘Ewa were developed by three sugarcane companies: the Ewa Plantation, located largely in the *ahupua‘a* of Honouliuli and Hō‘ae‘ae in the western section of the ‘Ewa; the Oahu Sugar Company, extending in the areas upland of the Ewa Plantation in central ‘Ewa, including a portion of the uplands of Waiawa; and the Honolulu Plantation Company, with fields extending through Mānana to Hālawa in the eastern section of the ‘Ewa.

In 1886, Campbell and B.F. Dillingham put together the "Great Land Colonization Scheme," which was an attempt to sell Honouliuli land to homesteaders (Thrum 1887:74). This homestead idea failed; two factors for the failure were the lack of water and the distance from ‘Ewa to Honolulu. The water problem was solved by drilling artesian wells, and Dillingham decided the

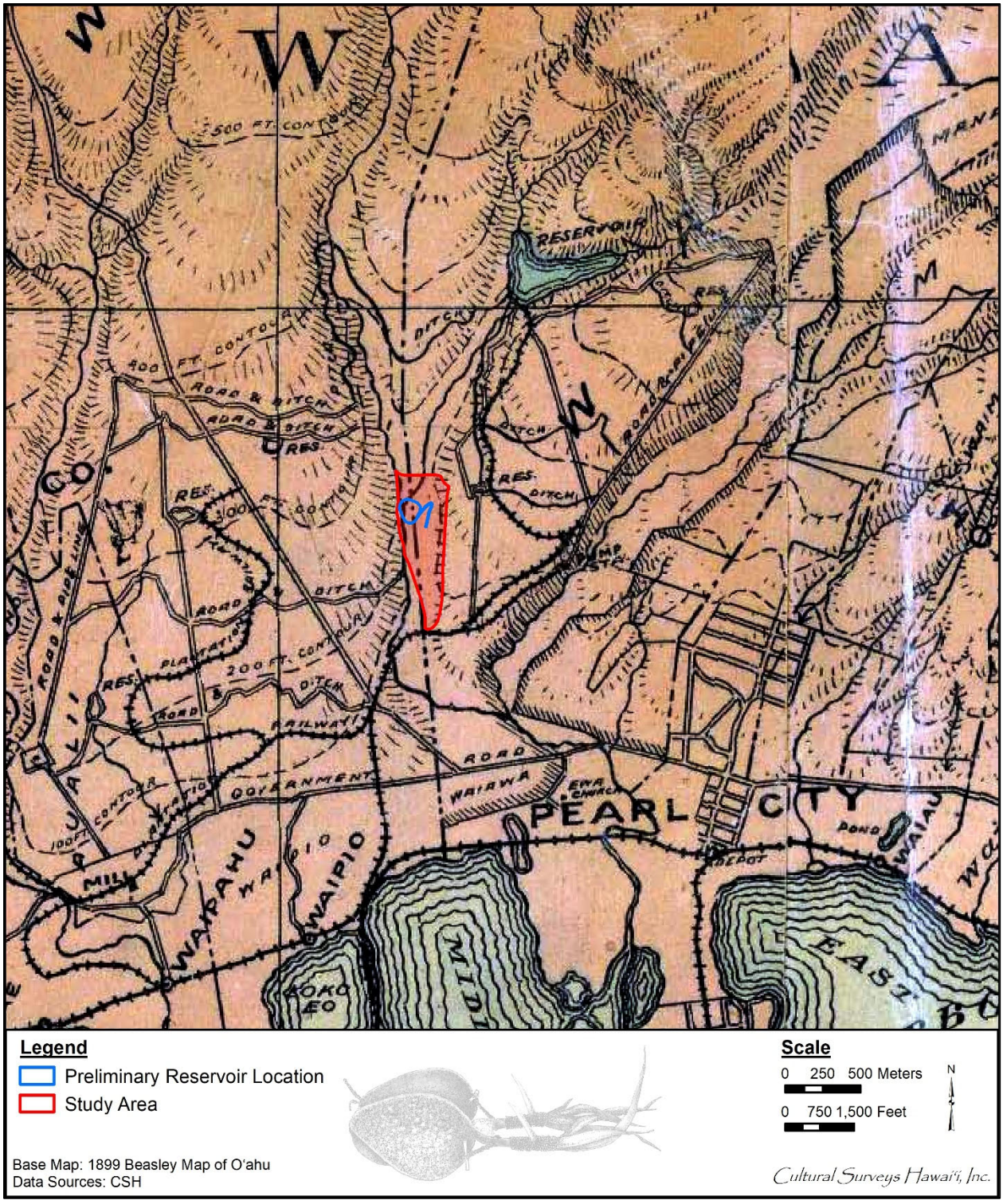

Figure 14. 1899 Beasley map of O‘ahu (portion) showing the study area

area could be used instead for large-scale cultivation (Pagliaro 1987:4). The transportation problem was solved by constructing a railroad, which B.F. Dillingham soon began to finance as OR&L.

The Ewa Plantation Company was incorporated in 1890 for sugarcane cultivation. The first crop of 2,849 tons of sugar was harvested in 1892. ‘Ewa was the first all-artesian plantation, and it gave an impressive demonstration of the role artesian wells were to play in the later history of the Hawaiian sugar industry (Kuykendall 1967:69).

In 1897, B.F. Dillingham established the Oahu Sugar Company on 12,000 acres leased from the estates of John Papa ‘Ī‘ī, Bishop, and Robinson. The OR&L subleased Waiawa lands to the Oahu Sugar Company for 43 years on 1 January 1897. It describes the property as “All that part of the Ahupua‘a of Waiawa lying west of Waiawa Gulch and below the contour line of 650 feet elevation […] area of about twelve hundred acres” (Bureau of Land Conveyances 169:181–183 as quoted by Gwen Hurst in Appendix B, Goodman and Nees 1991:152) This included the present study area. The 1899 Beasley map (see Figure 14) shows how quickly plantation infrastructure was developed depicting an extensive networks of roads, railroads, a large reservoir, and ditches on the Waiawa table lands to the east and northeast of the present study area.

The Oahu Sugar Company had over 900 field workers, composed of 44 Hawaiians, 473 Japanese, 399 Chinese, and 57 Portuguese. The first sugar crop was harvested in 1899, ushering in the sugar plantation era in central and eastern ‘Ewa (Ohira 1997).

Prior to commercial sugar cultivation, these lands were described as being “of near desert proportion until water was supplied from drilled artesian wells and the Waiahole Water project” (Condé and Best 1973:313). Dillingham had successfully promoted the Ewa Plantation Company in 1890; the sprawling sugar company was just south of and adjacent to the Oahu Sugar Company. Artesian wells had converted the arid ‘Ewa lands into a thriving plantation, and Dillingham recognized the same potential in the northern area.

A Donn 1906 land use map (Figure 15) shows the extent of the Oahu Plantation sugarcane lands clearly including the entirety of the present study area. The 1919 U.S. War Department map (Figure 16) shows the entire surrounding area as a sea of sugarcane.

Water to irrigate the upper cane fields was initially pumped to levels of 150 m (500 ft) by some of the “largest steam pumps ever manufactured” (Dorrance and Morgan 2000:49). The expense of pumping water to the high elevations of the plantation led to the proposal to transport water from the windward side of the Ko‘olau Mountains. The Waiahole Water Company was formally incorporated in 1913 and was originally a subsidiary of the Oahu Sugar Company. The Waiāhole Ditch was designed by engineer Jorgen Jorgensen, with recommendations by engineer J.B. Lippencott and assisted by W.A. Wall. When completed, 27 tunnels connected 37 stream intakes on the north side of the Ko‘olau with the main bore through Waiāhole Valley. This connected to 14 tunnels on the southern side of the Ko‘olau at Waiawa and then by ditch westward to Honouliuli. Overall, the tunnel and ditch system covered a total of 13.6 km (Condé and Best 1973:37). Upon its completion in 1916, the Waiāhole Ditch was 21.9 miles long (35 km) and cost $2.3 million. The 32 million gallons of daily water enabled the Oahu Sugar Company to grow to “some 20 square miles […] ranging in elevation from 10 feet at the Waipio Peninsula […] to 700 feet at the Waiahole Ditch” (Condé and Best 1973:313). The Waiāhole ditch system, with some modifications, is still in use (SIHP # 50-80-09-02268).

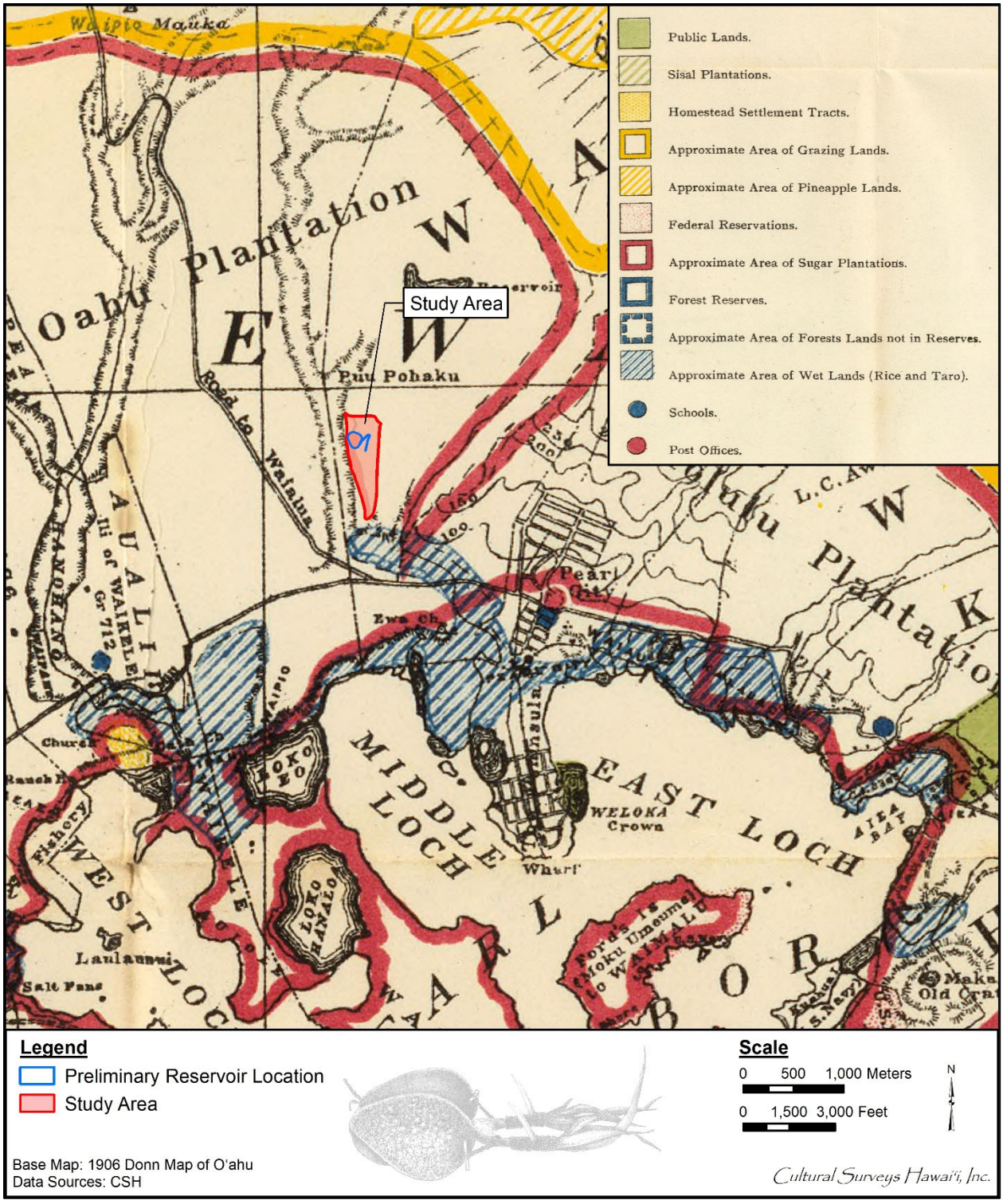

Figure 15. Portion of the 1906 Donn map of O‘ahu showing land use showing the study area

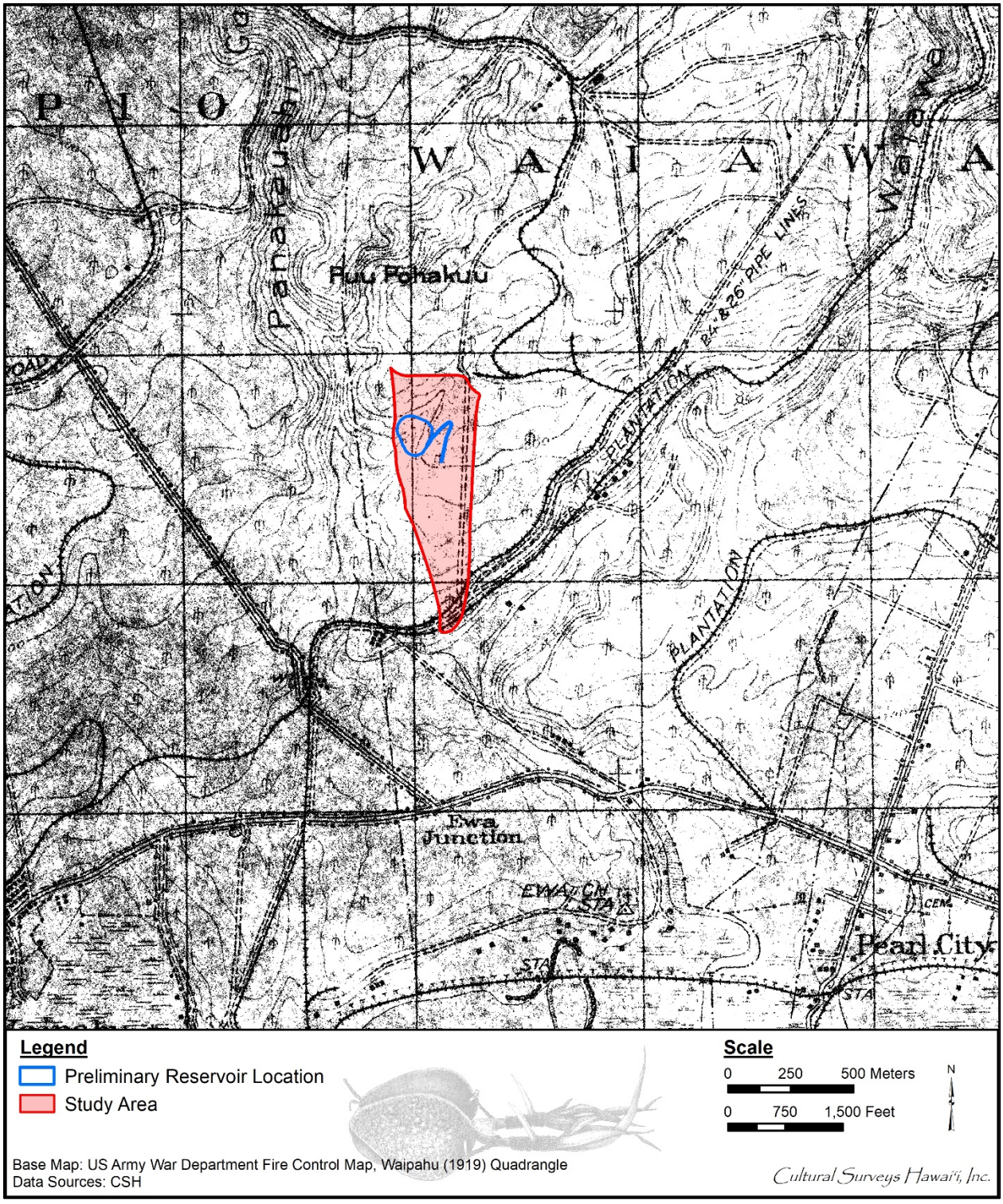

Figure 16. Portion of the 1919 U.S. Army War Department fire control map, Waipahu quadrangle, showing the study area

The Waiahole Ditch greatly opened up *mauka* lands to irrigation and sugarcane production.

> The Waiahole Water Co. has taken over from the Oahu Sugar Co. the Ahrens Ditch in Waiawa, the Kipapa Ditch, the Waikakalaua Ditch in Waipio, and the Hoaeae Ditch. Two redwood pipes having a total length of 1,223 feet have been laid across two gulches on the line of Hoaeae Ditch, cutting out 21 miles of ditch. The water delivered by the Waiahole System is chiefly used on newly planted cane on land above the lift of the pumps. [Kluegel 1916:107]

Oahu Sugar Plantation railroad lines were quickly developed to access these *mauka* fields (see Figure 16 and Figure 17).

A 1925 map (Figure 18) of the Oahu Sugar Company sugarcane fields indicates the study area lands were situated in sugarcane Field 4.

The eastern section of ‘Ewa was largely developed by the Honolulu Plantation Company. Mr. J.R. Williams first developed sugarcane in the 1850s and then leased land and built a sugar mill in ‘Aiea in 1899 with the Honolulu Sugar Company (Condé and Best 1973:327). It then became the Honolulu Plantation Company in 1900. Originally in ‘Aiea, the plantation expanded along the northern inshore and upland areas of Pearl Harbor. The expanse of the Honolulu Plantation Company lands seems to extend from ‘Aiea westward as far as Mānana and Waiawa streams. Additionally, several land sections lay southeast of Pearl Harbor where the present Honolulu International Airport and Hickam Air Force Base are located. In 1914, the company harvested 19,000 tons of sugar. It was taken over by the Oahu Sugar Company in 1947 (Condé and Best 1973:313).

4.5 Twentieth Century to Present

4.5.1 OR&L in the Twentieth Century

Operations at the OR&L began to slow down in the 1920s when electric streetcars were built for public transportation within the city of Honolulu and automobiles began to be used by families for transportation outside the city (Chiddix and Simpson 2004:185). The build-up to World War II turned this decline around as the U.S. military utilized the OR&L lines to transport materials to build defense projects around the island. Historians have noted one of the most serious mistakes made by the Japanese in their 1941 attack on Pearl Harbor was their decision not to bomb the railway infrastructure. Soon after the attack, the OR&L operated 24 hours a day, transporting war materials and troops from Honolulu to the new and expanded army, naval, and air bases. The huge navy base at Pearl Harbor had its own rail lines that connected to the OR&L rail lines.

With the end of the war in August 1945, the use of the OR&L railway lines for military transport came to an abrupt halt:

> She had served her country well and proudly during the war, but operating round-the-clock on what little maintenance could be squeezed in, had taken a prodigious hit on the locomotives and track. Traffic stayed steady for a short time, but soon dropped precipitously as soldiers and sailors went home, military posts were shrunk or razed, and civilians could again get tires, gasoline and new cars. [Chiddix and Simpson 2004:257]

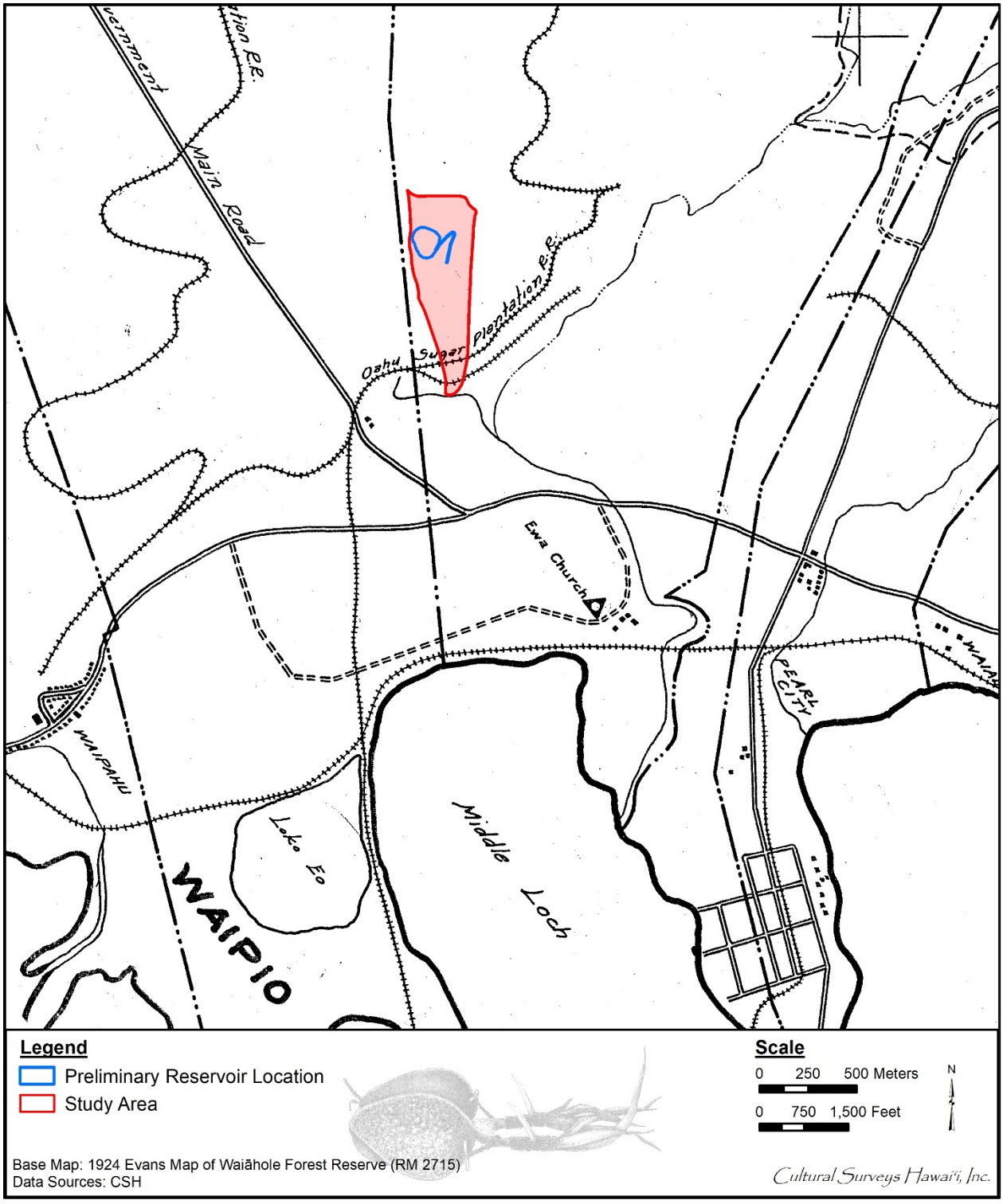

Figure 17. Portion of the 1924 Evans map of Waiahole Forest Reserve (RM 2715) showing the study area (the two railroad lines are believed to have actually been slightly further south than indicated in this sketch, at the southern tip of the present study area)

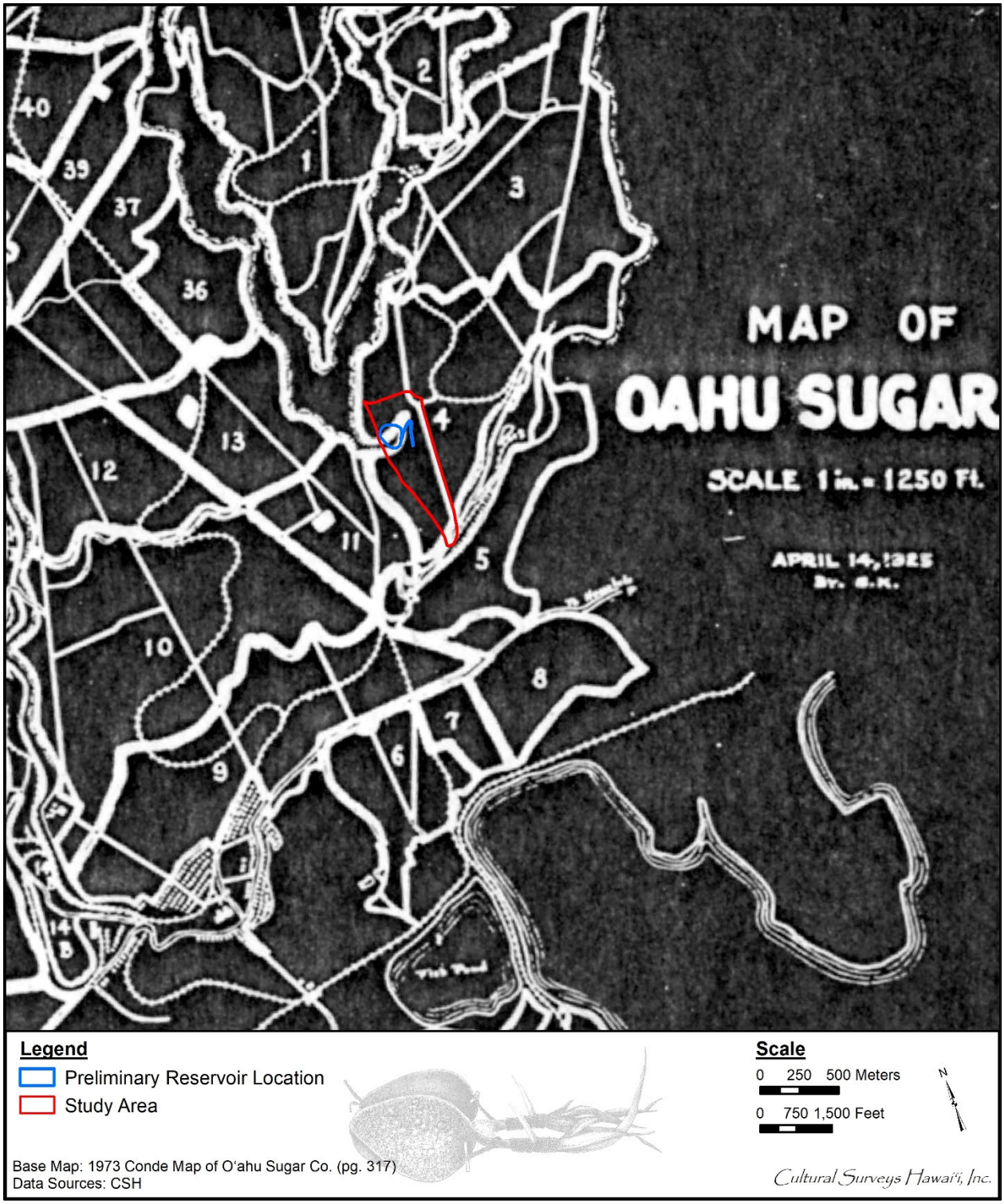

Figure 18. Portion of the 1925 Oahu Sugar Company map of numbered sugarcane fields in Honouliuli to Waiawa (reprinted in Condé and Best 1973:317) showing the study area

There was no choice but to abandon the OR&L main line, and in 1946 Walter F. Dillingham, son of B.F. Dillingham, wrote the following:

> The sudden termination of the war with Japan changed not only the character of our transportation, but cut the freight tonnage to a third and the passenger business to a little above the pre-war level. With the increased cost of labor and material and the shrinkage in freight tonnage and passenger travel, it was definite that the road could not be operated as a common carrier. With no prospect of increased tonnage, and the impossibility of increasing rates against truck competition, your management has applied to the Interstate Commerce for authority to abandon its mainline. [Chiddix and Simpson 2004:257]

After the war, most of the 150 miles of OR&L track were pried up, locomotives were sold to businesses on the U.S. mainland, and railway cars were scrapped. In 1947, the U.S. Navy took over a section of the OR&L track to transport bombs, ammunition, and torpedoes from the ammunition magazines at Lualualei in the West Loch of Pearl Harbor and Waikele on OR&L's Wahiawā Branch to Pearl Harbor Naval Base (Treiber 2005:25–26). The track to Waipahu was abandoned in the 1950s, but the line from the magazines in Lualualei to the wharves in West Loch at Pearl Harbor remained open until 1968 (Chiddix and Simpson 2004).

At its height, the OR&L connected the lines of the Koolau Railway, the private lines of the sugar plantations in Waialua, Waianae, ‘Ewa, Kahuku, Waimānalo, and Honolulu, and the private city trolley lines of Desky and Honolulu Rapid Transit. As aforementioned, the OR&L lines also serviced the Honolulu Plantation Company in transporting goods and workers from the sugarcane fields. The Lualualei Naval Ammunition Storage Depot, the West Loch Munitions Loading Station, and the Nānākuli Navy Rest Camp were serviced by their own railroad equipment using OR&L track. The Wahiawā branch of the railroad connected the James Drummond Dole Pineapple plantation to Waipahu, which also linked the U.S. Army Base at Schofield Barracks with Pearl Harbor via the Waipahu Junction. The Pearl Harbor Navy Yard train and the Barber's Point Naval Air Station train were commuter specials timed to deliver workers to each shift (Chiddix and Simpson 2004).

4.5.2 Pineapple Cultivation

In the early decades of the twentieth century, lands in the *mauka* portion of the central and eastern sections of ‘Ewa were being acquired for pineapple cultivation. The Donn 1906 land use map (see Figure 15) shows extensive pineapple cultivation approximately 2.7 km northeast of the present study area.

There is a record of attempted pineapple irrigation utilizing water from shallow wells in Waiawa Gulch in 1893 and prior to 1913 most of the plateaus in Waiawa were planted in pineapple (Goodman and Nees 1991:59). In 1899, the Hawaiian Pineapple Company leased 1,000 acres in Waiawa for pineapple cultivation from the OR&L. In 1901, they obtained an additional 61 acres in Waiawa through public auction. The extent of the upland pineapple fields in Waiawa is shown in the 1906 land use map (see Figure 15). These fields were *mauka* of the present study area. Initially, most pineapple was shipped to California for packing. In an attempt to speed up processing, save money, and produce a fresher product, the Pearl City Fruit Company constructed

a cannery in Waiawa in 1905, but it became a part of the Hawaiian Pineapple Company operations after it went bankrupt. The cannery was in operation from 1905 to 1935.

Pineapples were handpicked, graded, boxed, and loaded into trucks before the introduction of machinery into the harvesting process. The introduction of the mechanical field fruit harvester in 1947 eliminated the labor-intensive process of grading, boxing, and loading. The pineapple industry employed both male and female Japanese and Filipino workers in the fields and in the cannery. Camps were set up throughout Waiawa to be used as housing for the workers and their families. There was also a small cemetery associated with the workers camp (Goodman and Ness 1991:165). Japanese and Filipino camps were established next to the cannery from roughly 1905 to 1935 (Goodman and Ness 1991:154–155). In the 1920s, pineapple was abandoned and by 1935, much of the present Kamehameha Schools parcels in Waiawa were planted in sugarcane. The cannery and its camp in Waiawa were connected by rail to the OR&L line along the coast. This Camp Complex is designated on the SIHP # 50-80-09-01470/171.

4.5.3 Military Development of Pearl Harbor

In 1891, Russian explorer Otto von Kotzebue tried to observe Pearl River, but his group could not obtain a canoe. What he was told led him to speculate on the possible importance of Pearl Harbor in the future.

> In the mouth of this river are several islands; it is so deep, that the greatest ship of the line can lie at anchor a few fathoms from the shore; and so broad, that a hundred vessels can conveniently find room in it. The entrance into the Pearl Rivers is in the same situation as the harbor of Hana-rura; but the windings between the reefs are, however, said to render a passage more difficult. If this place were in the hands of the Europeans, they would certainly employ means to make this harbour the finest in the world. [Kotzebue 1821:338–348]

The early missionary Levi Chamberlain was able to take an outrigger canoe trip to Pearl River, and noted the difficulty of access for larger ships.

> Kawaa took passage in our canoe to go down the harbor to a place where oysters are abundant to give orders to his people to gather a mess. The sail down the harbor was delightful […] The passage down the creek for a number of miles was very pleasant till we got down near the reef and our course altered. We then could sail no longer as the wind was against us. The sail was lowered the mast taken down and secured across the outrigger and the rowers plied their paddles. [Journal of Levi Chamberlain 1822-1849, Hawaiian Mission Children’s Society Library, cited in Sterling and Summers 1978:51]

The first foreign attempt to survey Pearl Harbor was made in 1840 during the U.S. Exploring Expedition led by Charles Wilkes.

> In this district is a large inlet of the sea, into which the river Ewa empties; at the entrance of this inlet is the village of Laeloa (at Kalaeloa Pont): the shore is known by the name of Pearl River or harbour, from the circumstance that the pearl oyster is found here; and it is the only place in these islands where it occurs.

> The inlet has somewhat the appearance of a lagoon that has been partly filled up by alluvial deposits. At the request of the king, we made a survey of it: the depth of water at its mouth was found to be only fifteen feet; but after passing this coral bar, which is four hundred feet wide, the depth of water becomes ample for large ships, and the basin is sufficiently extensive to accommodate any number of vessels. If the water upon the bar should be deepened, which I doubt not can be effected, it would afford the best and most capacious harbour in the Pacific. [Wilkes 1845:79]

Although Wilkes was impressed by the harbor, he was not at this time thinking of how this survey could benefit the American government in the future. In fact, Wilkes (1845:79) concluded, "As yet there is no necessity for such an operation, for the port of Honolulu is sufficient for all the present wants of the islands, and the trade that frequents them."

The low impression of Wilkes for the use of Pearl Harbor had changed in less than 30 years. The U.S. military had tried to make a coaling station on Midway Island in 1869 by blasting through the coral reef to make a harbor, but the plan failed. In 1873, General Schofield presented a confidential report to the U.S Secretary of War, recommending that Pearl Harbor should be available to the U.S. Navy. Schofield wrote,

> In case it should become the policy of the Government of the United States to obtain the possession of this harbor for naval purposes, jurisdiction over all the waters of Pearl River with the adjacent shores to the distance of 4 miles from any anchorage should be ceded to the United States by the Hawaiian Government. […]
>
> The cession of Pearl River could probably be obtained by the United States in consideration of the repeal of the duty of Sandwich Island sugar. Indeed, the sugar –planters are so anxious for a reciprocity treaty, or so anxious rather for free trade in sugar with the United States, that many of them openly proclaim themselves in favor of annexation of these islands of the United States. [Sen. Ex. Docs, 52nd Cong. 2nd Sess. No. 77:150–154, reproduced in Judd 1971:Appendix 3]

This reciprocity treaty was concluded in 1876 with the provision that Hawai‘i would not "lease or relinquish sovereignty to another country or any harbor, etc." (Judd 1971:128). In 1887, the treaty was renewed and amended, and this allowed the United States the "exclusive right to enter the harbor of Pearl River, in the Island of Oahu, at to establish and to maintain there a coaling and repair station for the use of vessels of the United States" (Judd 1971:128).

The most dramatic change affecting both the use of Pearl Harbor and the growth of the sugar industry in Hawai‘i occurred 7 July 1898. Following years of diplomatic pressure from delegates to Washington, the Congress of the United States approved a joint resolution of annexation that established the Republic of Hawaii as a Territory of the United States. On 30 April 1900, President William McKinley signed the Organic Act for the Territory of Hawaii, which provided a government whose leaders were appointed by the United States and otherwise defined the political structure and powers of the newly established government (U.S. Department of the Interior 1900).

After annexation of the Islands to the United States in 1899, development began in order to make a Pacific base that could be used as a staging area for the Spanish-American war (Coletta 1985:433). In 1901, the U.S. Congress formally ratified the annexation of the Territory of Hawaii, and the first 1,356.01 acres of Pearl Harbor land were transferred to U.S. ownership. The U.S.

Navy began a preliminary dredging program, which created a 30-ft deep entrance channel measuring 200 ft wide and 3,085 ft long. Additional dredging to deepen and widen the channel was conducted in 1908 and again in the 1920s. Money for the funding of the construction of dry docks and other support facilities was approved in 1908. In 1931, the Navy built an ammunition depot at West Loch on a 213-acre parcel that it had bought from the Campbell Estate. Construction of a new depot in Lualualei Valley and at West Loch Harbor began in 1931 (Downes 1953).

As American ground forces fought to stabilize the Philippine government between 1898 and 1904, military transport ships took on coal, oil, and livestock feed at Honolulu Harbor's military docks. Troops in transit to various military bases in the Pacific were also in need of temporary barracks while awaiting deployment. Concurrent with the military modernization of its Honolulu Harbor facilities, the first land purchases at Pearl Harbor were made in 1901, including the site of the Pearl Harbor Shipyard (Naval Historical Center Archives 1995). The U.S. Government began acquiring additional coastal lands of ‘Ewa for the development of its naval base at Pearl Harbor.

Between 1903 and 1911, civilian contractor Walter Dillingham dredged Pearl Harbor deep enough to receive the largest warships of the fleet. In 1914, the United States Marine Corps barracks were moved from Honolulu to the ‘Ewa end of Pearl Harbor in order to accommodate and maintain airship (dirigible) mooring masts. Throughout the 1920s, American trade with India, Australia, and the East Indies grew to over two thousand million dollars. Protection of the Pacific trade routes required the U.S. Navy to develop Pearl Harbor as an advanced forward base. By the 1930s, a gradual expansion of facilities at Pearl Harbor kept pace with increasing levels of instability in the Pacific region. The original purchase for the Pearl Harbor Naval Yard consisted of:

Original Owner		
Bishop Estate	693.47 acres	$ 52,737.50
John Ii Estate (Ford's Island)	25.83 acres	$ 3,000.00
J.J. Dowsett Estate (Leasehold)	48.88 acres	$ 2,400.00
Oahu Sugar Company (Leasehold)	25.83 acres	$ 1.00
Honolulu Plantation Company (Leasehold)	562.00 acres	$ 75,000.00
Other expenses		$ 500.00
Total	1,356.01 acres	$133,640.50

[Knox 1936]

When the USS *California* docked at the Pearl Harbor Navy Yard on 16 December 1911, Hawai‘i's last monarch, Queen Lili‘uokalani, and the Territory's first president, Sanford B. Dole, attended the event. They were both guests aboard the battleship as she sailed through the entrance channel and berthed at the new deep-draft docks. The event marked the beginning of increased facility construction within the Navy Yard (Naval Historical Center Archives 1995).

By 1913, the first dry dock had been under construction for two years at Pearl Harbor when the enormous structure designed to complete the Navy's ship repair yard exploded. The entire framework was blown out of its foundation by hydrostatic forces greater than Navy engineers predicted. After blessings to appease the angry shark goddess Ka‘ahupāhau, the dry dock was finally completed in 1919 (Beckwith 1940:163).

The development of the service and supply depot facilities continued. Three additional dry docks were designed, and the Navy Yard was diversified to accommodate separate submarine and aircraft squadrons. By the mid-1930s, over 42 million dollars had been spent on development and modernization. The pace of spending at Pearl Harbor increased with the disintegration of diplomatic relations between Japan and the United States. Japan's denial of access to the "Mandate Islands" in 1932, coupled with Japan's invasion of Nanking in 1937, caused the United States military to accelerate construction of defensive facilities in the Philippines, on islands such as Wake, Howland, Jarvis, Midway, and Johnson, and throughout the Hawaiian Islands (Downes 1953).

Prior to the bombing of Pearl Harbor by the armed forces of Japan on 7 December 1941, there existed a high degree of coordination between civilian interests and the military. On 17 February 1941, the Oahu Sugar Company granted blanket permission to the Sixty-fourth Coast Artillery (Anti-Aircraft) to occupy positions from time to time on the property owned and controlled by the plantation. Similar authorizations had previously been given to the same artillery unit by the Honolulu Plantation Company in 1939. Troop maneuvers involving thousands of men using plantation roads and lands occurred throughout 1940 and 1941 (Spalding 1945).

Expenditures for new Pearl Harbor construction measured in the hundreds of millions of dollars at the end of 1941. With the Japanese surprise attack on Pearl Harbor, 7 December 1941, much of the new construction had been damaged, and in some cases, destroyed. A furious pace of reconstruction was instituted to double the war capacity of Pearl Harbor. Military planners approved a new ammunition depot in the mountainside of Waipahu, a huge new hospital in ‘Aiea, and thousands of additional changes to the Navy Yard to accommodate the new aircraft carrier task forces (Woodbury 1946:342–343).

By 1943, over 24,000 people were working at Pearl Harbor. Navy Housing Areas 1 and 2 and Civilian Housing Area 3 had grown large enough to be considered separate cities. Barracks and temporary housing for workers filled every available piece of land for miles between Pearl Harbor and the outskirts of Honolulu. A ring of huge barrage balloons was set up for the protection of the once-quiet waters of Wai-momi, which had since become one of the greatest Navy bases in the world (Downes 1953).

Before the war, the main Pearl Harbor Naval yard was sufficient for a staging and storage area for the Pacific fleet, but after the Japanese attack and the beginning of World War II, additional areas were needed for supply depots and warehouses. The government procured additional land after the beginning of World War II to expand the functionality of the military bases. The Navy took all of the coastline area in eastern ‘Ewa District from the coast inland of the OR&L railroad tracks (Ching 1996:24). Iroquois Point in Hālawa, Pearl City (Mānana) Peninsula, Waipi‘o Point, Waiawa Gulch, and small areas in Honolulu were taken over as supply depots and storage areas. By 1944, the Navy had claimed close to 2,400-acres of land in the Pearl Harbor and Pearl City areas within Mānana, Waiawa, and Hālawa for use as military staging areas in the war effort (Allen 1999:234).

Four main portions of Waiawa were used by the military—the Pearl City Peninsula *makai* of Kamehameha Highway, a diesel drum storage area at Ewa Junction, also *makai* of the highway, an aviation supply depot along Waiawa Stream *mauka* of the highway and adjacent to the eastern

boundary of the study area, and a military reservation in upland Waiawa, approximately 0.75 km northeast of the study area, used for communications and training (Allen 1999).

On the Pearl City Peninsula in Mānana, three large warehouses were built for a storage area. Other sections of the peninsula, including the Waiawa portion, were used for supply depot warehouses and spare part distribution centers. One of these was the U.S. Navy Mānana Supply Center, now known as the U.S. Navy Mānana Storage Area. A 25-acre portion of the former Supply Center on the Waiawa side of Mānana Peninsula was set aside in 1972 as a portion of the Pearl Harbor National Wildlife Refuge. This refuge for endangered wetland water birds was set up in the former area of Loko Kuhialoko and Loko Mo‘o. A non-contiguous section of the U.S. Navy Mānana Storage Area was *mauka* of Kamehameha Highway. It began as an aviation supply depot on the border between Waiawa and Mānana. The Navy built 50 wood-frame structures and spaced open-storage areas along the banks of Waiawa Stream for 2 miles (Allen 1999).

The Ewa Junction Fuel Drumming Facility was built on a 44-acre site in 1943 as a fuel drumming and transportation terminal at the site of the old OR&L railroad junction. Thus, it had railroad lines to the Pearl Harbor Shipyard and Hickam Air Field to the east, to Barbers Point Naval Air Station and other bases in Waianae to the west, and to Schofield Barracks and Wheeler Air Field Base to the north. The facilities consist of two 585,000-gallon fuel storage tanks, a fuel drumming building, and associated piping. The site has been inactive since the 1970s (Allen 1999).

The aviation supply depot of the Naval Reservation adjacent to Waiawa Gulch consisted of 50 wood-frame structures and open storage areas along the banks of the Waiawa Stream for two miles, connected by paved roads (U.S. Department Navy 1947:132).

Waiawa is one of many supply depots built by the Navy before and after entering World War II (one of only two on O‘ahu specifically designated for aviation supplies) (north of the study area) (Mason Architects, Inc. and Hawaii Army National Guard 2002:4). The reservation is 650.0 acres consisting of both gulch and plateau lands. From 1941 to 1945, the reservation was used as a training area for tanks and personnel and as an artillery impact area. The area was also used for the storage of munitions and supplies. The primary structure built by the military was a communications center, including a radio tower. This center consists of four buildings and a tunnel system. The communications center was subsequently used by the State of Hawai‘i as a minimum-security prison called the Waiawa Correctional Facility. The transfer of the 198-acre site to the State of Hawai‘i was completed in 1985 (Goodman and Ness 1991:158).

Following World War II, much of the lower lands of Waiawa and Mānana remained part of the Naval Reservation and were used mainly as housing for military families and also sites for military warehousing. To this day, much of the Pearl City peninsula remains in the custody of the U.S. Navy; however, in the late 1990s, much of the rest of the previous Pearl City regions were released to the state for public use (Allen 1999).

A supply depot for fuel drums was also set up along the coast called the Waiau Drum Storage. This site is actually in Waimalu Ahupua‘a. It was built on land the U.S. Navy purchased from the OR&L in 1942, and it was used to clean and store empty fuel drums. Between 1943 and 1963, waste oils were destroyed at the site (Dega and O’Rourke 2003:15). In 1963, the U.S. Navy gave the land to the City and County of Honolulu, which created the Neal Blaisdell Park on the property.

4.5.4 Twentieth Century Developments as Reflected in Maps and Aerial Photographs

A series of historic maps and aerial photographs (see Figure 15 through Figure 24) visually demonstrate the development of Waiawa and the ‘Ewa District in the twentieth century.

The 1881 and 1906 maps of O‘ahu (see Figure 11 and Figure 15) show little development of Waiawa except for agricultural purposes. The only settlement in the vicinity is that around Ewa Church, *makai* of the main road (later Farrington Highway) and the study area. A 1919 U.S. War Department map (see Figure 16) shows the early twentieth century changes in the area. Although the Ewa Church moved to Mānana in 1906, the site of the old church, labeled on the map, was still a notable feature. The OR&L railroad line parallels the coast with a major station in Waiawa at the Ewa Junction. The Ewa Junction became a focal point for rail activity on the OR&L line. According to Thrum (1900, not paginated), tourist travel on the railroad afforded “good views of Pearl Harbor,” and trips could be arranged three times a day to the Ewa Plantation and back. The junction eventually allowed trains to travel east to Honolulu, west toward Wai‘anae, and north to Wahiawā, Wheeler Field, and Schofield Barracks. Railroads from the OR&L and the Honolulu Plantation Company snake upward into the extensive inland sugarcane fields. Unimproved roads lead from the rails upward through sugarcane fields to the site of the pineapple cannery at an elevation of 600 ft AMS, *mauka* of the study area. This cannery operated between 1905 and 1935. The 1919 map shows an unimproved north-south trending road just east of the study area but no other plantation infrastructure in the vicinity.

The 1928 map (Figure 19) depicts several new reservoirs, both *mauka* and *makai* of the study area, with the nearest being a large reservoir established by 1928 just east of the study area at 240-ft elevation. The pineapple cannery called out on the 1919 map is not labeled.

The 1935 U.S. Army War Department map (Figure 20) depicts more clearly the reservoir at 240-ft elevation just east of the study area, and just east of the unimproved north/south trending road. No other infrastructure development in the immediate vicinity is indicated.

A 1943 U.S. Army War Department map (Figure 21) shows the same pattern of railroad infrastructure in the Waiawa uplands as shown on the 1919 map (see Figure 16). The area around the old Ewa Church (still labeled on the map) is not densely inhabited, while Pearl City to the east continues to grow in size and density. The fishponds along the shore appear to be filled. The military filled in many of the ponds along Pearl Harbor when it took over the coastal land in ‘Ewa at the beginning of World War II. The *mauka* old pineapple cannery is deserted with no structures shown standing. A new military complex is depicted on the map by clusters of large rectangular warehouse buildings near Waiawa Stream east of the study area. This military reservation was rapidly built after the 1941 Japanese attack on Pearl Harbor. The railroad system within the Oahu Sugar Company fields is depicted for the last time.

A 1952 USGS aerial photograph (Figure 22) clearly shows sugarcane cultivation in the study area and extensive pineapple cultivation just to the north and east. It appears the gulch on the south side of the reservoir area was not in cane production at that time.

A 1954 Army Mapping Service map (Figure 23) depicts the railroad alignments as having been converted to roads. The north/south trending plantation road east of the study area is indicated as having been improved. A new unimproved road is indicated north of the study area at Pu‘u Pōhaku.

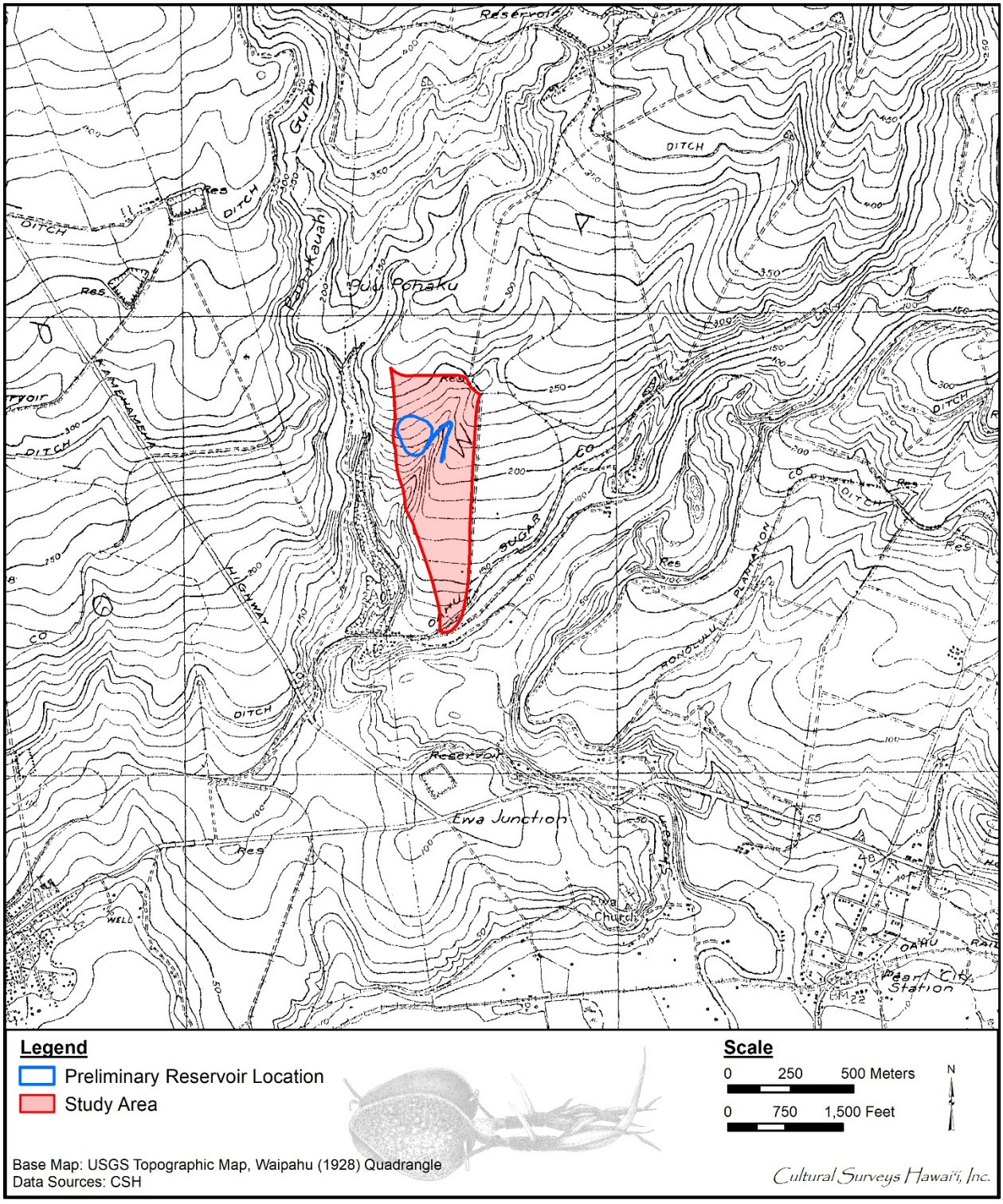

Figure 19. Portion of the 1928 USGS topographic map, Waipahu quadrangle, showing the study area

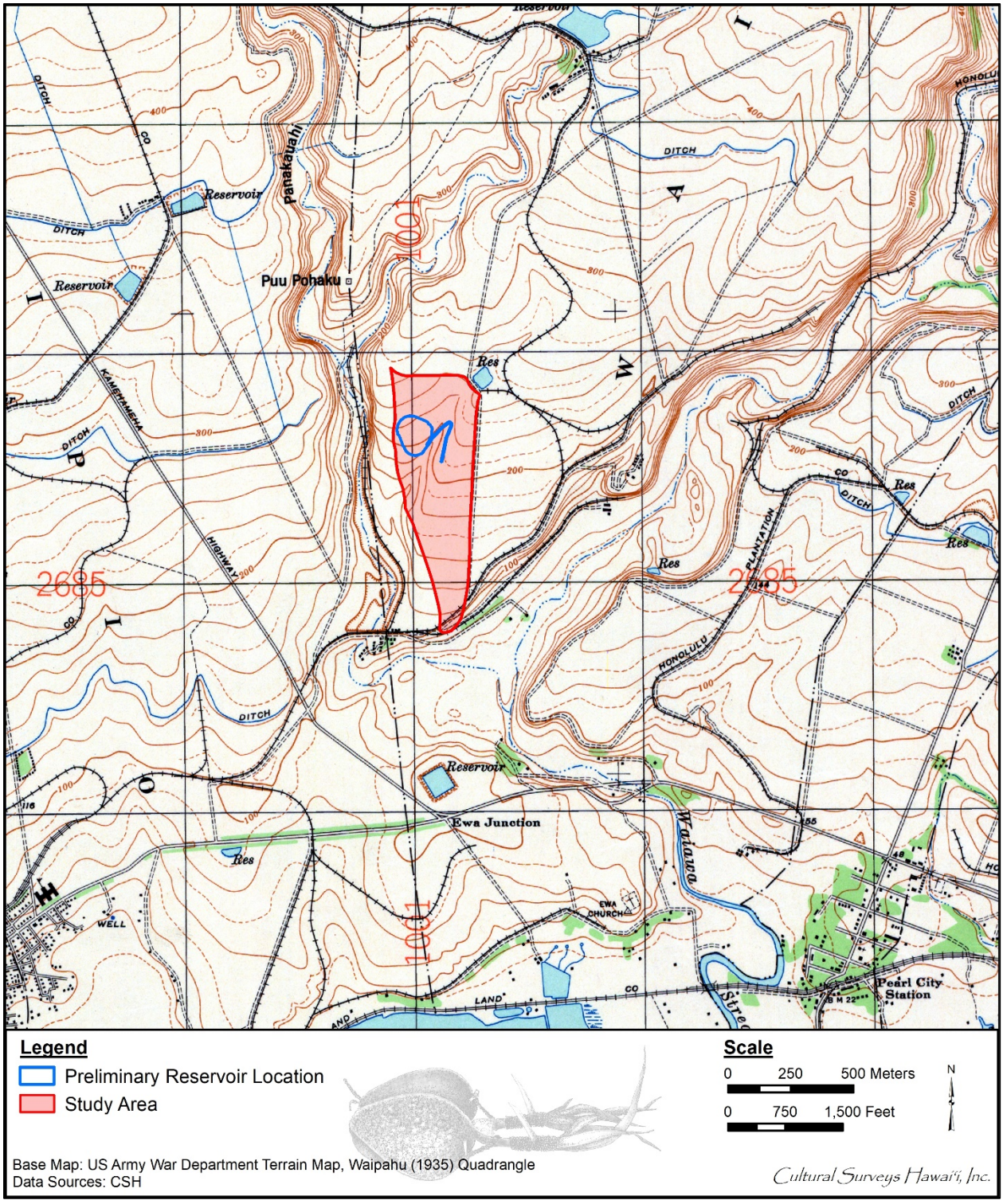

Figure 20. Portion of the 1935 U.S. Army War Department terrain map, Waipahu quadrangle, showing the study area

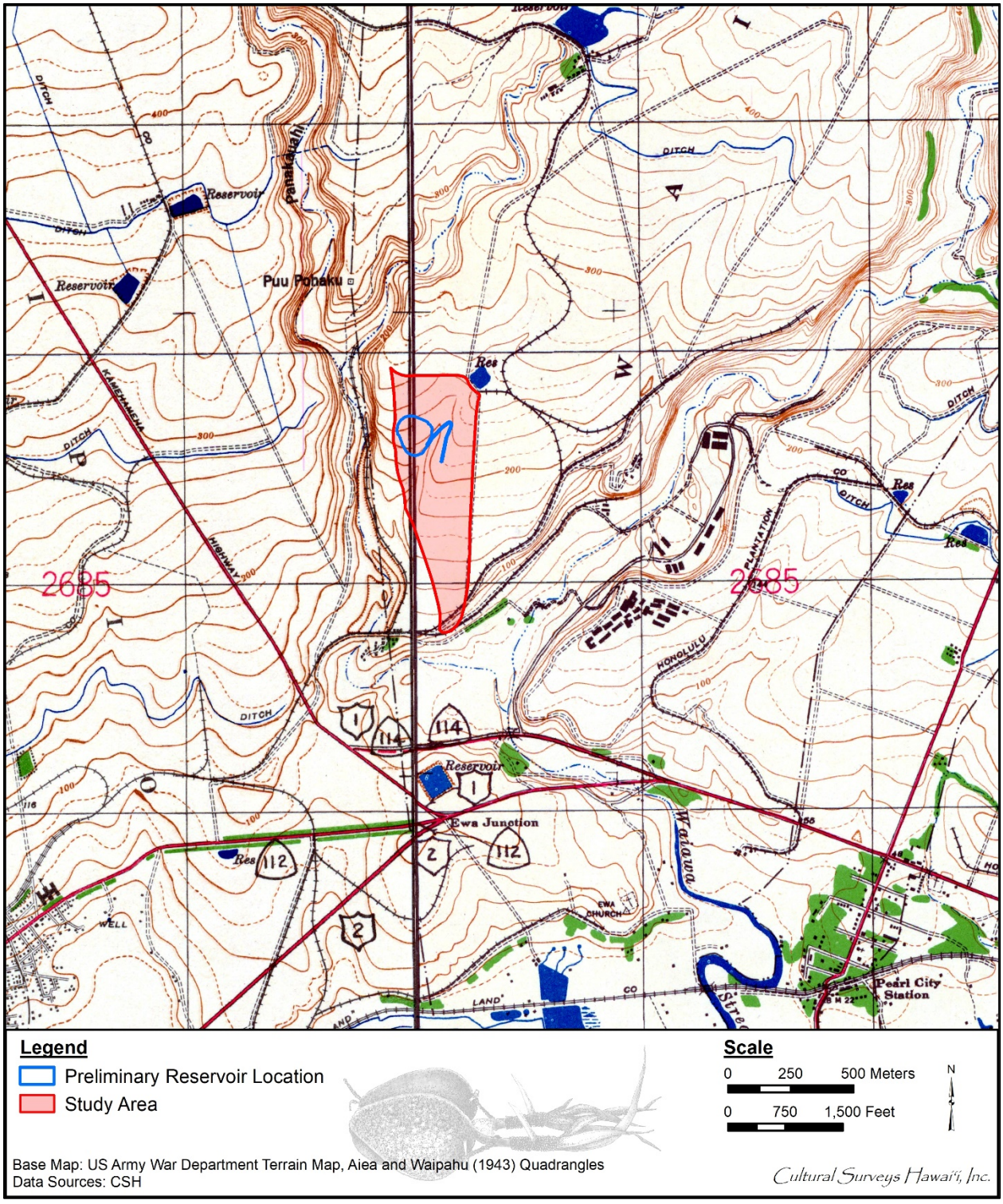

Figure 21. Portion of the 1943 U.S. Army War Department terrain map, Aiea and Waipahu quadrangles, showing the study area

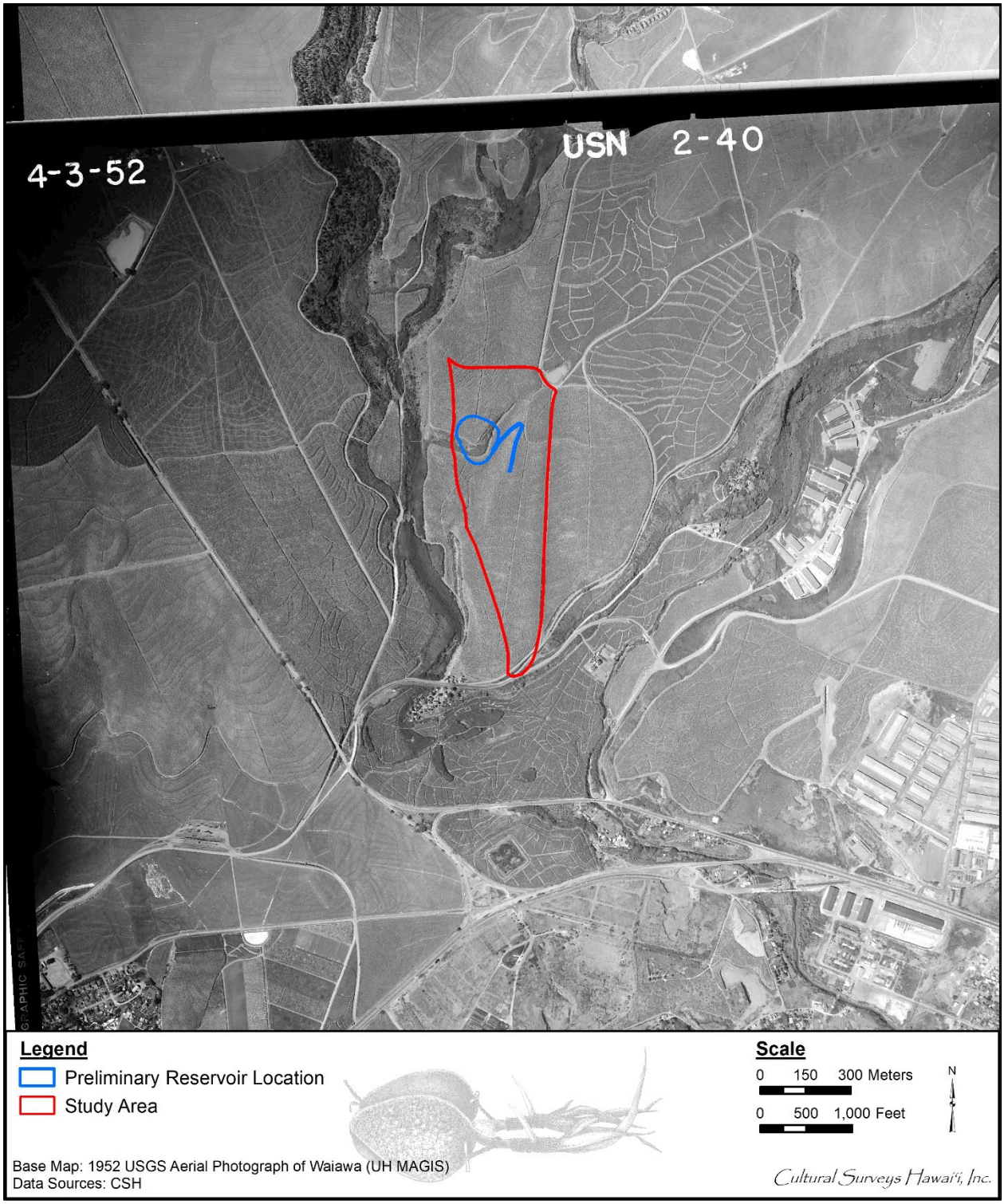

Figure 22. 1952 USGS aerial photograph of Waiawa (UH MAGIS) showing the study area

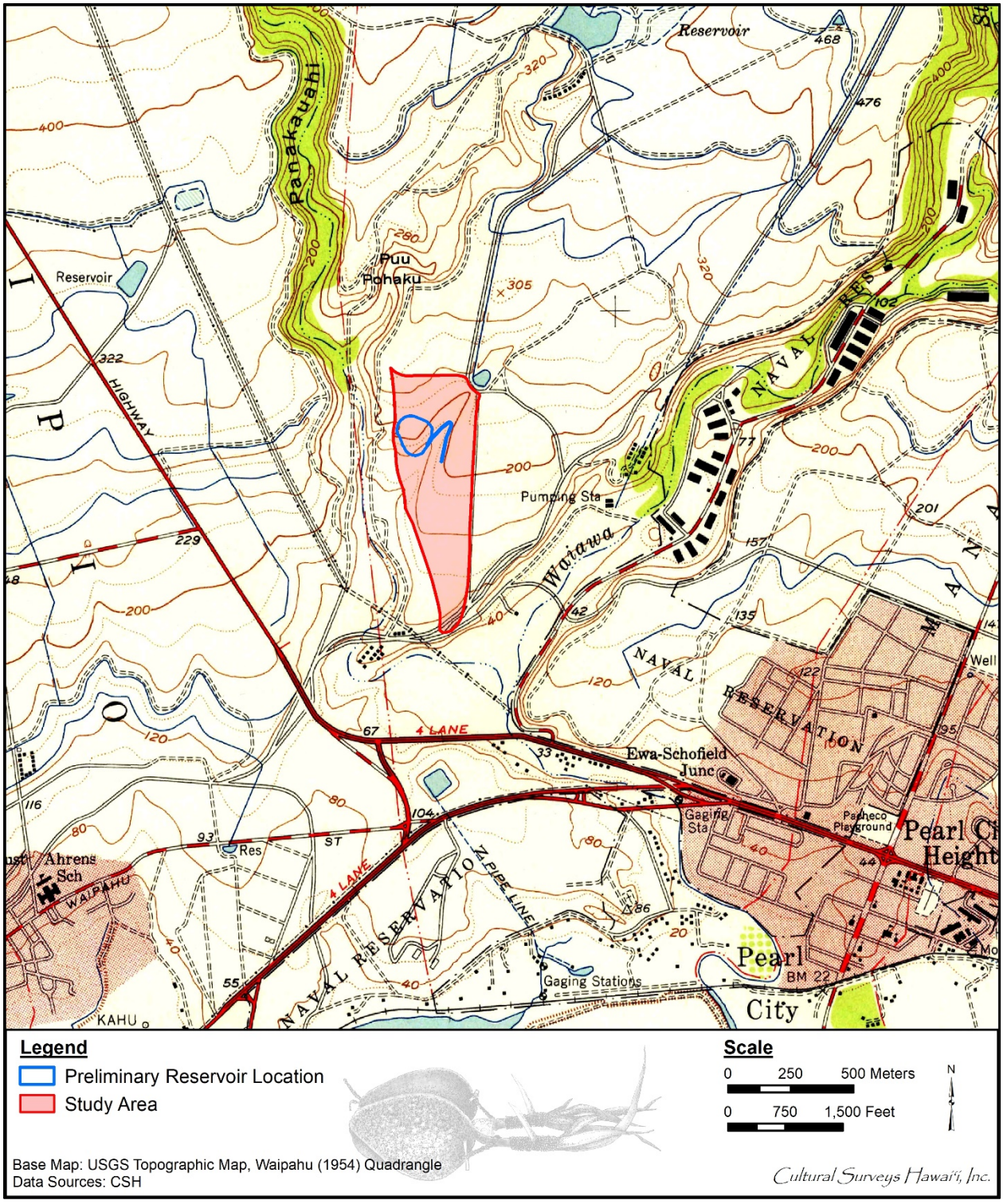

Figure 23. Portion of the 1954 Waipahu USGS topographic quadrangle, showing the study area

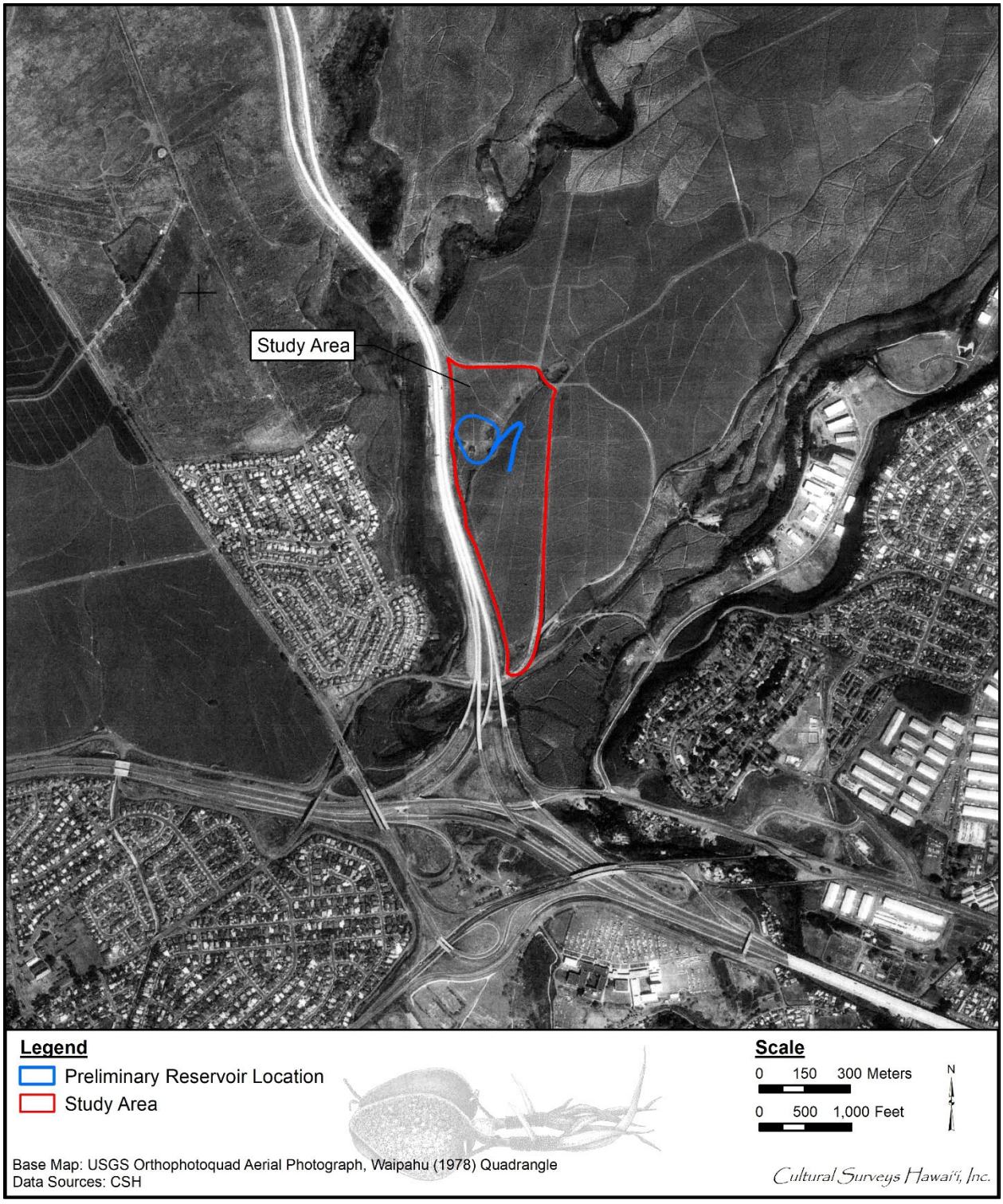

Figure 24. 1978 USGS orthophotoquad aerial photograph, Waipahu quadrangle, showing the study area

Naval reservations have been expanded along Waiawa Stream southeast of the study area. The immediate vicinity of the study area still lacks any infrastructure or indicated improvements.

A 1978 aerial photograph (see Figure 24) shows the lack of residential and commercial development at Waiawa. The early campus of the Leeward Community College can be seen *makai* of the H-1 highway.

Section 5 Previous Archaeological Research

This section presents an overview of previous archaeological research in and near the current study area. Previous archaeological studies in the vicinity of the study area are depicted in Figure 25 and are summarized in Table 2. Previously identified historic properties in the vicinity of the study area are depicted in Figure 26 and are summarized in Table 3. Section 5.1 summarizes research in the *ahupua‘a* of Waiawa, in general. Section 5.2 summarizes research in the current study area, specifically.

5.1 General Findings in Waiawa – Outside the Current Study Area

Overall, the *makai* lands surrounding Pearl Harbor and extending into the gulches of the *mauka* lands were continuously used in pre- and early post-Contact times for ceremonies (*heiau*), aquaculture (*loko i‘a*), and agriculture (terraces and ponded fields). Post-Contact sugar and pineapple cultivation, dredging and land reclamation, and military use of the land significantly impacted pre- and early post-Contact historic properties as may have been present previously.

In his 1931 surface survey of the island of O‘ahu, Bernice Pauahi Bishop Museum archaeologist J. Gilbert McAllister (1933) recorded the specific locations of important archaeological and cultural sites, and the general locations of some sites of lesser importance. A single site (SIHP # 50-80-09-00121) was recorded in the inland portion of Waiawa Ahupua‘a. According to McAllister’s data, this site was once located *mauka* of the current study area. The following description was provided for Site 121:

> Site 121 Puoiki heiau, at the juncture of Manana and Waiawa gulches. The heiau crowned the top of a small oval knoll that is about 50 feet high by 100 feet wide and 200 feet long. The sides of the knoll are perpendicular except for a steep and narrow neck on the mountainside. During the ceremonies, the people are said to have been at the foot of the knoll and surrounding the heiau. There are no remains. [McAllister 1933:105]

There was a second *heiau* in Waiawa Ahupua‘a, near the “maika playing field of Haupu‘u” (Waialeale 1834:23). It was demolished in 1834 and the Protestant Ewa Church was built directly over the *heiau*. Thrum and McAllister do not mention this *heiau*, probably because it was long gone by the early twentieth century. McAllister recorded three fishponds adjacent to Pearl Harbor in Waiawa Ahupua‘a—Loko Apala (SIHP # -00118), Loko Kuhialoko (SIHP # -00119), and Loko Mo‘o (SIHP # -00120). All three of these ponds are shown on the S. Bishop map (1887) (see Figure 11) but they were coastal far from the present study area.

In the 1970s, the Bishop Museum conducted a reconnaissance survey of all lands owned or controlled by the Army (Rosendahl 1977). This survey included 6.18 acres of the total 13 acres comprising the Waiawa Gulch National Guard Storage Area, as well as 4.94 acres within the total 9-acre Waiawa Military Reservation. The archaeologists did not inventory any sites in Waiawa, though they did note these areas were “probably used for food crop cultivation” and that an old trail was known to exist though the area (Rosendahl 1977:1-54 and 1-55).

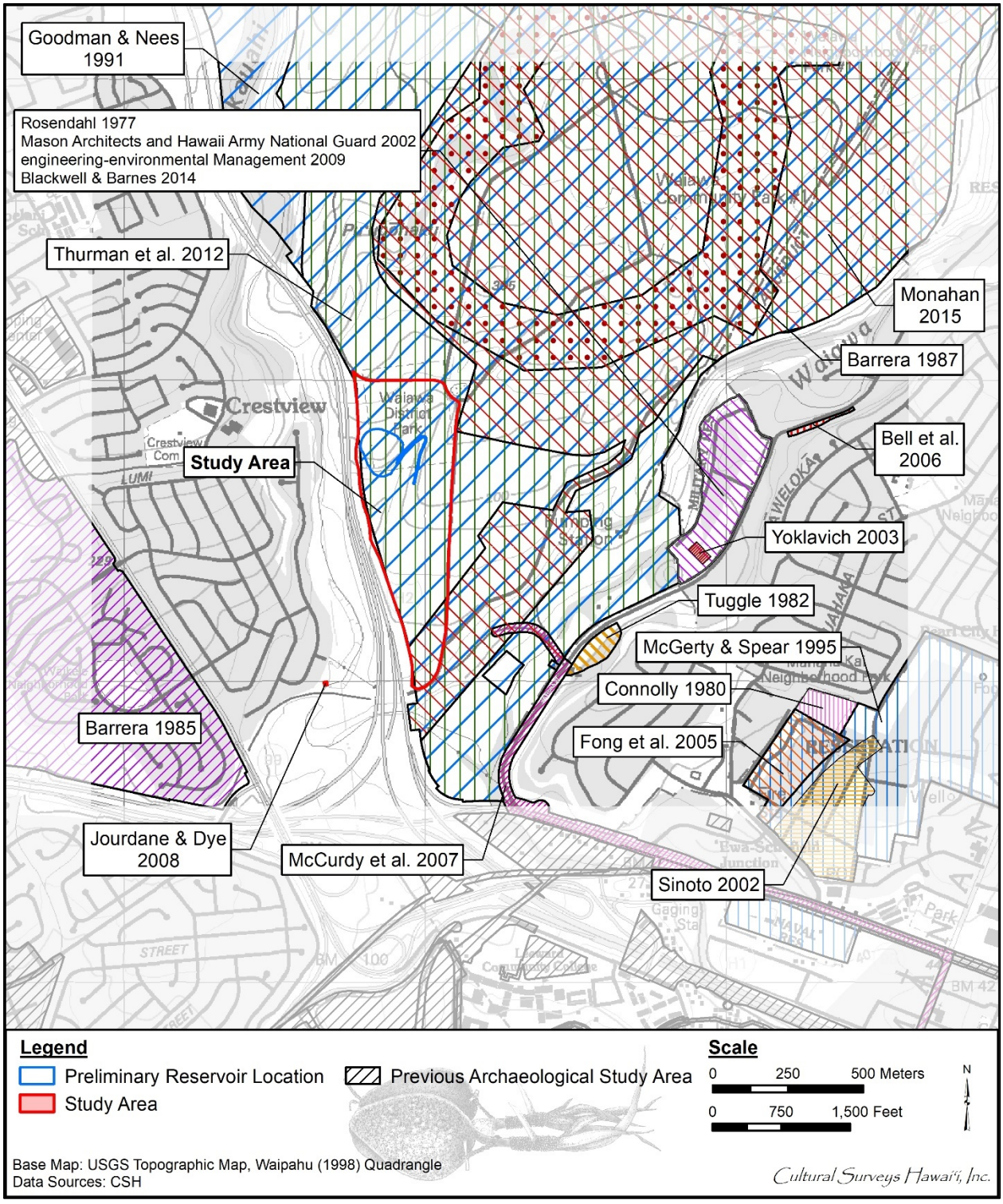

Figure 25. Previous cultural resource management studies in the vicinity of the study area (base map: portion of the 1998 Waipahu USGS topographic quadrangle)

Table 2. Previous cultural resource management studies in the vicinity of the study area (all SIHP #s are prefixed “50-80-09” unless otherwise noted)

Source	Type of Investigation	General Location	Results (SIHP # 50-80-09, unless otherwise noted)
McAllister 1933	Reconnaissance survey	Island-wide	Four historic properties described, including Puoiki Heiau (SIHP # -00121), Loko Apala (SIHP # -00118), Loko Kuhialoko (SIHP # -00199) and Loko Mo‘o (SIHP # -00120)
Rosendahl 1977	Archaeological reconnaissance survey	Included Waiawa Gulch National Guard Storage Area and Waiawa Military Reservation	No historic properties found in Waiawa study areas
Connolly 1980	Archaeological reconnaissance survey	Manana Kai Neighborhood Park, TMK: (1) 9-7-024:040	No historic properties identified
Tuggle 1982	Archaeological inventory survey	Waihona St, Waiawa	Possible agricultural canal documented
Barrera 1985	Archaeological reconnaissance	Kilohana, Waipi‘o, (Waiola Estates Subdivision)	Two-page memo addresses 270 acres in pineapple cultivation at the time; no historic properties reported
Barrera 1987	Archaeological survey	Waiawa Ridge	Four sites recorded, including a boulder alignment (SIHP # -01469), a dump site (SIHP # -01470), a pineapple cannery (SIHP # -01471), and a former camp area (SIHP # -01472)
Goodman and Nees 1991	Archaeological inventory and reconnaissance survey(s)	3,600 acres bounded by H-1, H-2, and Waiawa Stream, Waiawa (includes entirety of current study area)	17 historic properties, historic and pre-contact; found previously recorded sites (SIHP #s -01469 through -01472); new sites designated (SIHP #s -02261 through -02273)
McGerty and Spear 1995	Field inspection literature review	“Manana and Pearl City Junction Sites” Manana and Waiawa Ahupua‘a, TMKs: (1) 9-7-024: por. 006, 9-7-023:001; 138.5 acres	No historic properties identified

Source	Type of Investigation	General Location	Results (SIHP # 50-80-09, unless otherwise noted)
Mason Architects, Inc. and Hawaii Army National Guard 2002	Assessment of buildings	Waiawa Unit Training Equipment Site	Discusses six buildings (Buildings 13, 22, 25, 27, 28, and 65)
Sinoto 2002	Field inspection literature review	Proposed Wal-Mart Development Pearl City, Manana	No historic properties identified; monitoring of construction related excavations that exceed 1m (3 ft) recommended
Yoklavich 2003	Written historical descriptive data and photographs	Hawaii Army National Guard, Waiawa Unit Training Equipment Site 96-1176 Waihona St, TMK: (1) 9-6-004:015	Documents WWII Building 22 at former Navy Aviation Supply Depot
Fong et al. 2005	Archaeological literature review and field inspection	Manana Parcel B (cquire. 13 acres), TMK: (1) 9-7-024:057	No historic properties identified
Bell et al. 2006	Archaeological field check and literature review	Rockfall remediation project Waihona St, TMKs: (1) 9-6-007: por. 012 and 013	Observed one historic property (designated “CSH 1”), a small terrace structure likely of post-Contact construction but unknown function
McCurdy et al. 2007	Archaeological literature review and field inspection	Waiawa Off-Site Sewer Line Alignment No. 2, Waiawa and Manana Ahupua‘a, TMKs: (1) 9-6-003, 004; 9-7-016, 020–024	Portions of two historic properties identified, a plantation-era railroad berm and associated retaining wall (SIHP # -02270) and irrigation ditch (SIHP # -02273) are features of previously identified site complexes (Goodman and Nees 1991); southern portion of their project corridor also parallels OR&L Right-of-Way (SIHP # 50-80-12-09714)
Jourdane and Dye 2008	Historic properties assessment	Proposed T-Mobile Cell Site at 94-977 Lumipolu St, TMK: (1) 9-4-056:109 por.	No historic properties identified (no field inspection conducted)

Source	Type of Investigation	General Location	Results (SIHP # 50-80-09, unless otherwise noted)
engineering-environmental Management, Inc. 2009	Historic building survey and evaluation report	Waiawa Gulch Hawaii Army National Guard facility	Presents survey results for WWII-era buildings: Buildings 13, 25, and 65
Thurman et al. 2012	Archaeological reconnaissance survey	1,680 scres of KS Lands in Waiawa, TMKs: (1) 9-4-006:034, 036, 037; 9-6-004:024 and 025	Three new sites documented: CSH 1, a traditional Hawaiian petroglyph site consisting of three images; CSH 2, a possible rock shelter recommended for subsurface testing; and CSH 3, a traditional Hawaiian lithic quarry; ten previously documented historic properties in and adjacent to their project area revisited, including SIHP #s -01470, -01471, -01472, -02262, -02263, -02264, -02270, -02271, -02272 and -02273
Blackwell and Barnes 2014	Historic building survey and evaluation	Waiawa Gulch Unit Training Equipment Site (UTES) and Regional Training Site Maintenance (RTSM)	Building 22A (UTES FMS) surveyed and photographed
Monahan 2015	Archaeological inventory survey	1,395 acres of Kamehameha Schools' lands in Waiawa and Waipi‘o Ahupua‘a, TMKs: (1) 9-4-006:034 por., 035 por., 036, 037 por.; 9-6-004:024 por., 025, 026; 9-6-005:001 por.	Documented three historic properties, all plantation-era sites dating from early to middle 20th century, consisting of 55 component features: 1) SIHP # -02270, a network of roads and railroad rights-of-way consisting of 28 features; 2) SIHP # -02273, an irrigation system consisting of 25 features; and 3) SIHP # -02271, remains of workers' camps consisting of two features
Shideler 2020	Archaeological reconnaissance for geotechnical testing	Present study area	Notes presence of temporary ditch segments

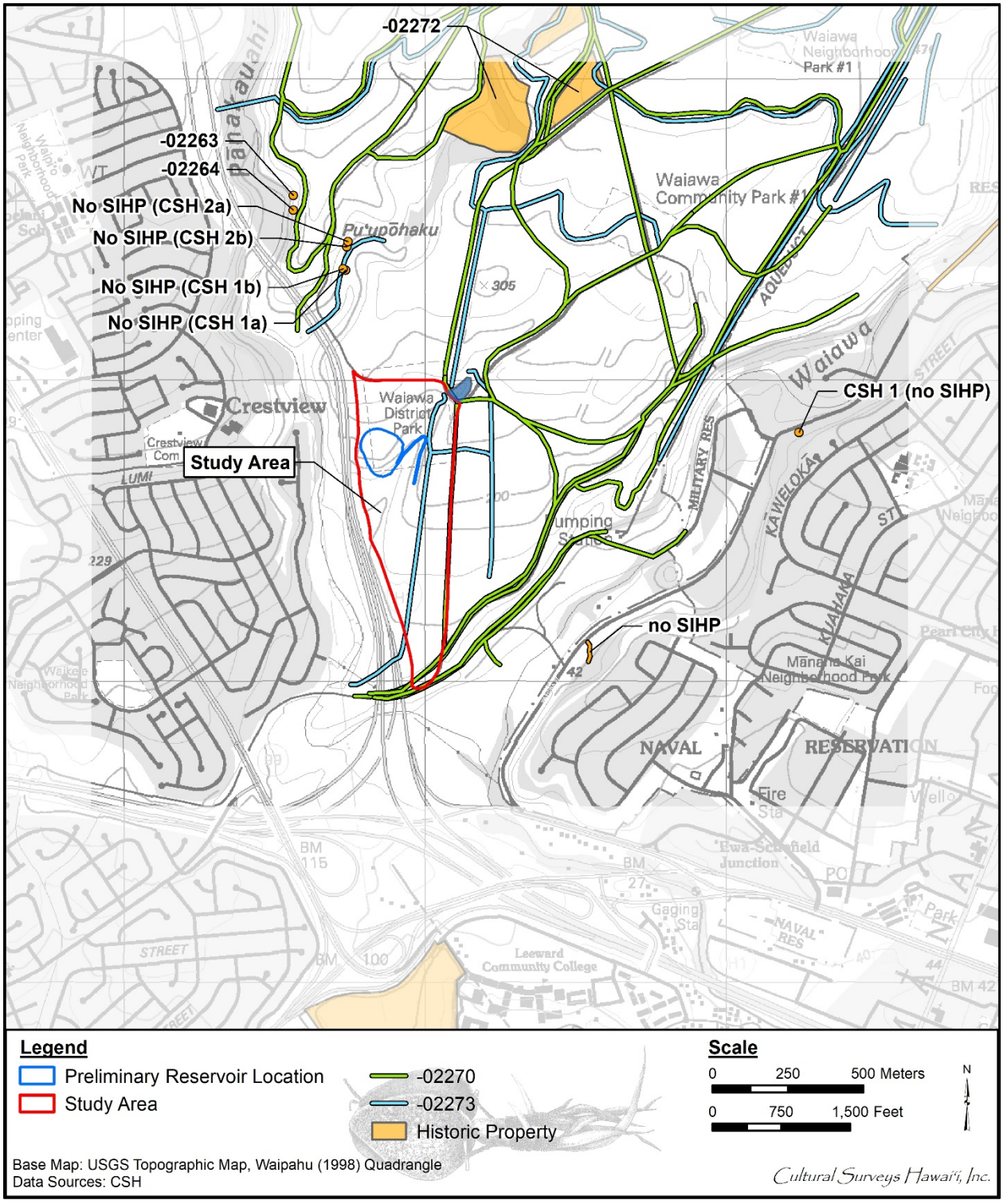

Figure 26. Previously identified historic properties in the vicinity of the study area (base map: portion of 1998 Waipahu USGS topographic quadrangle)

Table 3. Previously identified historic properties in the vicinity of the study area

SIHP #	Nature of Site	Comments	Source
2263	Rock shelters with associated petroglyphs	A complex of rock shelters with associated petroglyphs and terracing	Goodman and Nees 1991, Thurman et al. 2012
2264	Trail	Runs along base of Gulch D, oriented north/south; trail crosses over a dry stream bed in base of Gulch D	Goodman and Nees 1991, Thurman et al. 2012
2270	Roads and railroad rights-of-way	Goodman and Nees (1991) identified 44 features; Monahan (2015) identified 28 features in his project area	Goodman and Nees 1991, Thurman et al. 2012, Monahan 2015
2272	Military utilization areas	Military structures built from 1941 to 1983; primary structure is a communications center currently used by State of Hawai‘i as a minimum security prison	Thurman et al. 2012
2273	Irrigation infrastructure	Goodman and Nees (1991) identified 35 features; Monahan (2015) identified 25 features in his project area	Goodman and Nees 1991, Thurman et al. 2012, Monahan 2015
CSH 1a (No SIHP #)	Petroglyphs	The southernmost petroglyph consists of a pair of human images.	Thurman et al. 2012
CSH 1b (No SIHP #)	Petroglyph	One human image	Thurman et al. 2012
CSH 2a (No SIHP #)	Possible rock shelter	A 1-m deep 3-m tall overhang appears to be filled with eroded soil deposits from the western upslope side of the gulch. Basalt stones surrounding the overhang may be manuports or may have been deposited through erosion.	Thurman et al. 2012
CSH 2b (No SIHP #)	Concentrated scratching or etching on rock outcrop	Possibly related to tool sharpening	Thurman et al. 2012
CSH 1 (east) (No SIHP #)	Terrace	A small terrace structure likely constructed historically, but of unknown function	Bell et al. 2006
No SIHP # (Southeast)	Ditch	Possible agricultural canal	Tuggle 1982

Tuggle (1982) conducted an archaeological survey of a 3.18-acre parcel east of Waihona Street at the Mānana Marine Housing in Waiawa Ahupua‘a, east of the present study area (see Figure 25). The remains of a possible agricultural canal associated with two natural terraces were discovered. Tuggle reports the canal water source was probably a spring, although another possibility was the nearby Waiawa Stream.

Barrera (1987) conducted a reconnaissance survey along a proposed golf course on Waiawa Ridge northeast of the present study area (see Figure 25). Four historic sites were identified, including parallel boulder alignments (SIHP # -01469), a historic dump site by a pineapple cannery (SIHP # -01470), the remains of the cannery itself (SIHP # -01471), and a former camp area associated with the Oahu Sugar Company (SIHP # -01472).

In 1991, Applied Research Group of the Bishop Museum conducted reconnaissance and inventory surveys of a 3,600-acre parcel within Waiawa bounded by the H-2 Freeway (Goodman and Nees 1991). Their study area included the entire current study area (see Figure 25). In all, they recorded 13 sites (discussed further below).

CSH conducted a cultural impact assessment for a 3,600-acre parcel within Waiawa bounded by the H-2 Freeway, Waiawa Gulch, Dole pineapple fields, and Kīpapa Gulch (Bushnell et al. 2003, same project area as studied by Goodman and Nees 1991) and including the entire present project area.

CSH (Thurman et al. 2012) undertook a reconnaissance survey of 1,680 acres in Waiawa for Kamehameha Schools including the current study area (see Figure 25). Three new sites were documented during this study: CSH 1, a traditional Hawaiian petroglyph site consisting of three images; CSH 2, a possible rock shelter that requires additional investigation (subsurface testing); and CSH 3, a traditional Hawaiian lithic quarry. In addition, historic properties previously documented by Barrera (1987) and Goodman and Nees (1991) in and adjacent to their project area were revisited, including SIHP #s -01470, -01471, -01472, -02262, -02263, -02264, -02270, -02271, -02272, and -02273. Of these revisited sites, SIHP # -02263—a very impressive petroglyph complex consisting of at least 65 images, first identified in 1991 (Goodman and Nees 1991)—is the most significant. This site is unique on the island of O‘ahu, and although it is located outside their project area boundary (to the west), it was recommended as a primary focus of collaborative preservation and conservation efforts between Kamehameha Schools and the adjacent landowner.

5.2 Findings Near the Current Study Area

5.2.1 Goodman and Nees 1991

The Goodman and Nees (1991) study focused on “significant historical and pre-Contact sites” (of which there were none near the present study area) (Figure 27, Figure 28, and Figure 29) and provides little data on sites regarded as of no further significance such as a plantation irrigation historic property and a road/railroad system historic property.

Features of two historic properties were identified in the vicinity of the presently proposed Waiawa 228 Reservoir study area including features 19 and 20 of SIHP # -02273 designated as “the irrigation complex” (Goodman and Nees 1991:59, Figure 28) and features 33, 35, and 36 of SIHP # -02270 designated as the “Road/railroad system” (Figure 29).

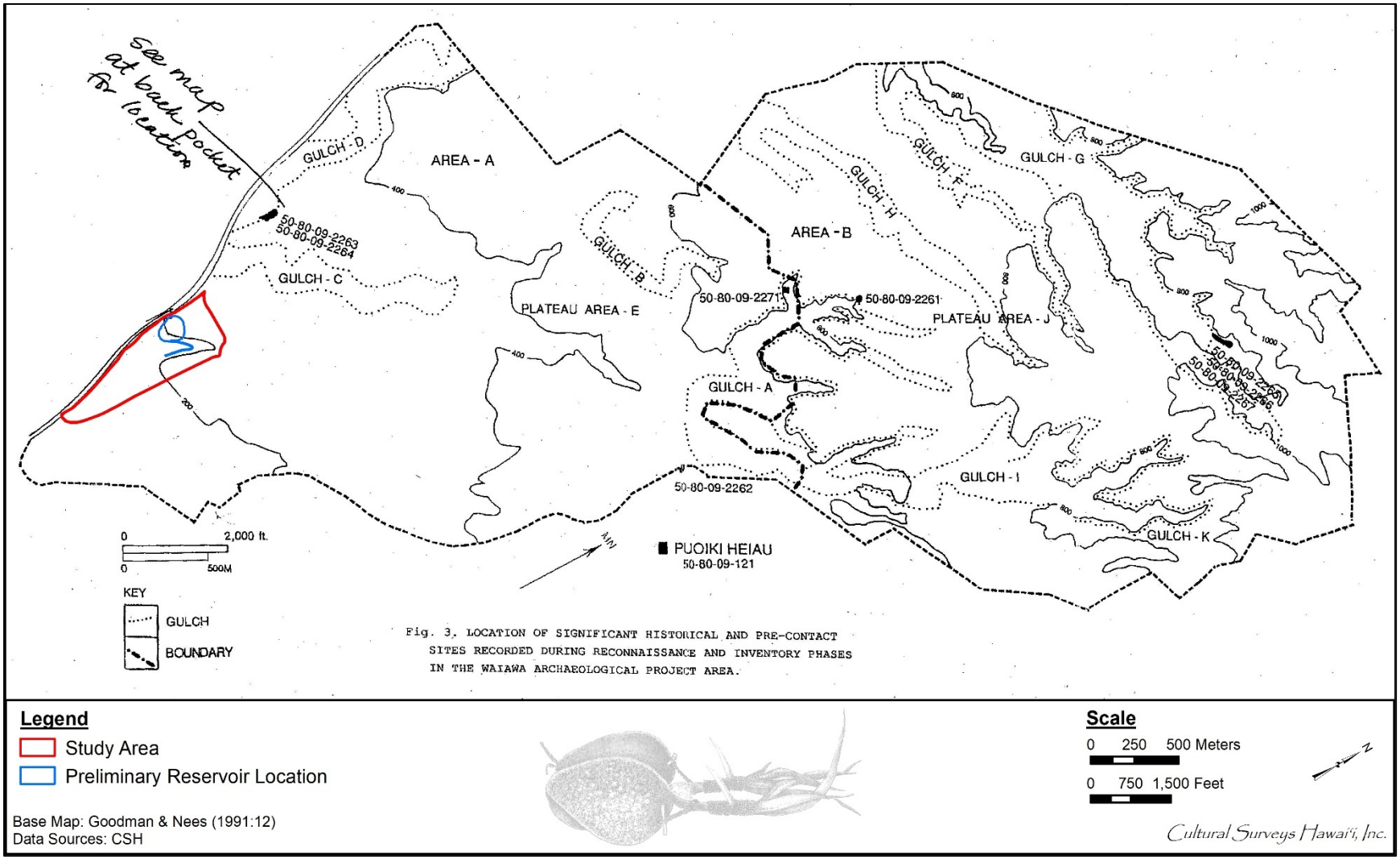

Figure 27. Map showing the “Location of Significant Historical and Pre-Contact Sites” recorded by Goodman and Nees (1991:12) in relation to the present study area (none are depicted near the present study area)

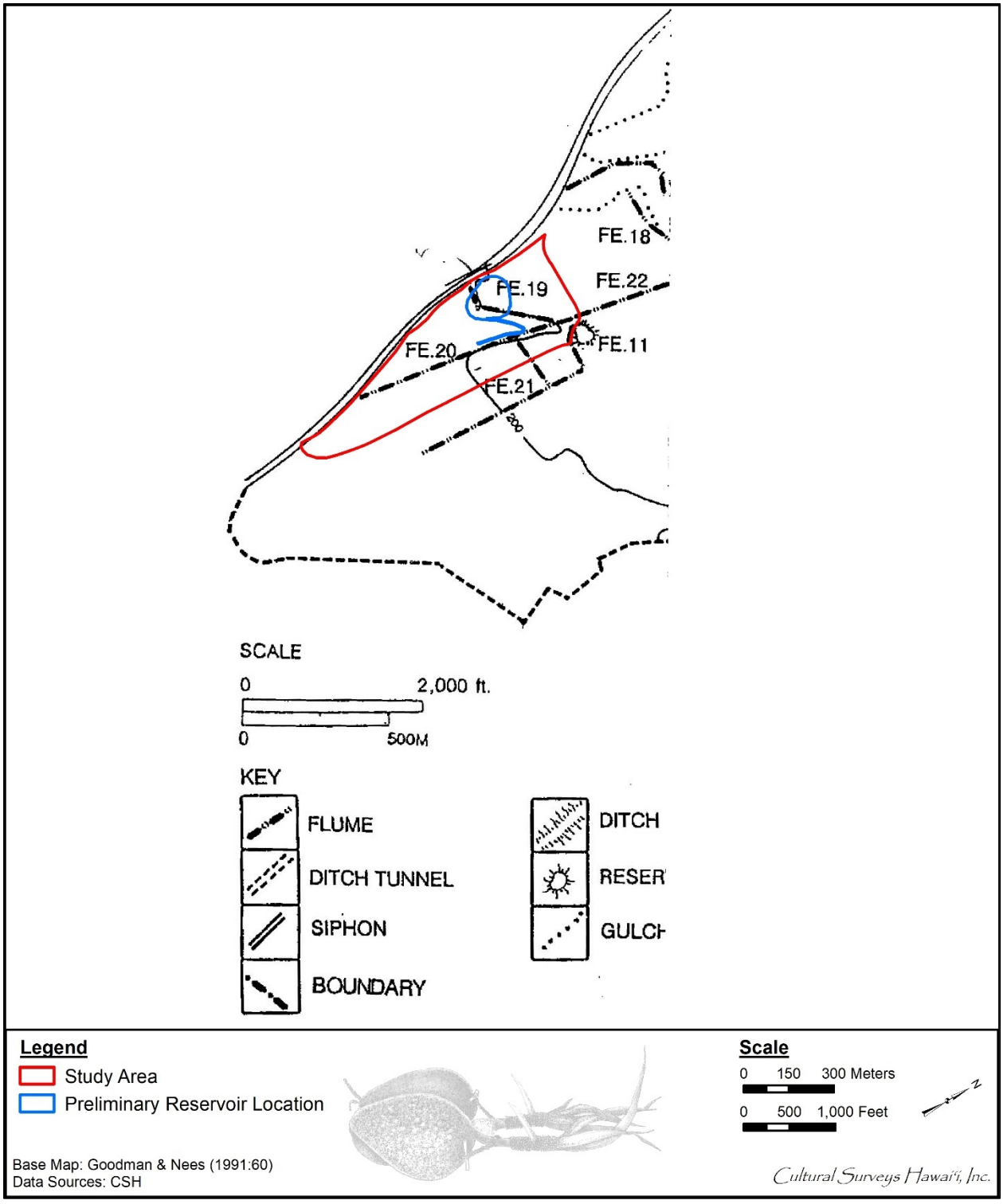

Figure 28. Goodman and Nees (1991:60) map of features of SIHP # -02273 designated as “the irrigation complex” (portions of Features 19 and 20 approximate a 12-ft wide proposed access roadway)

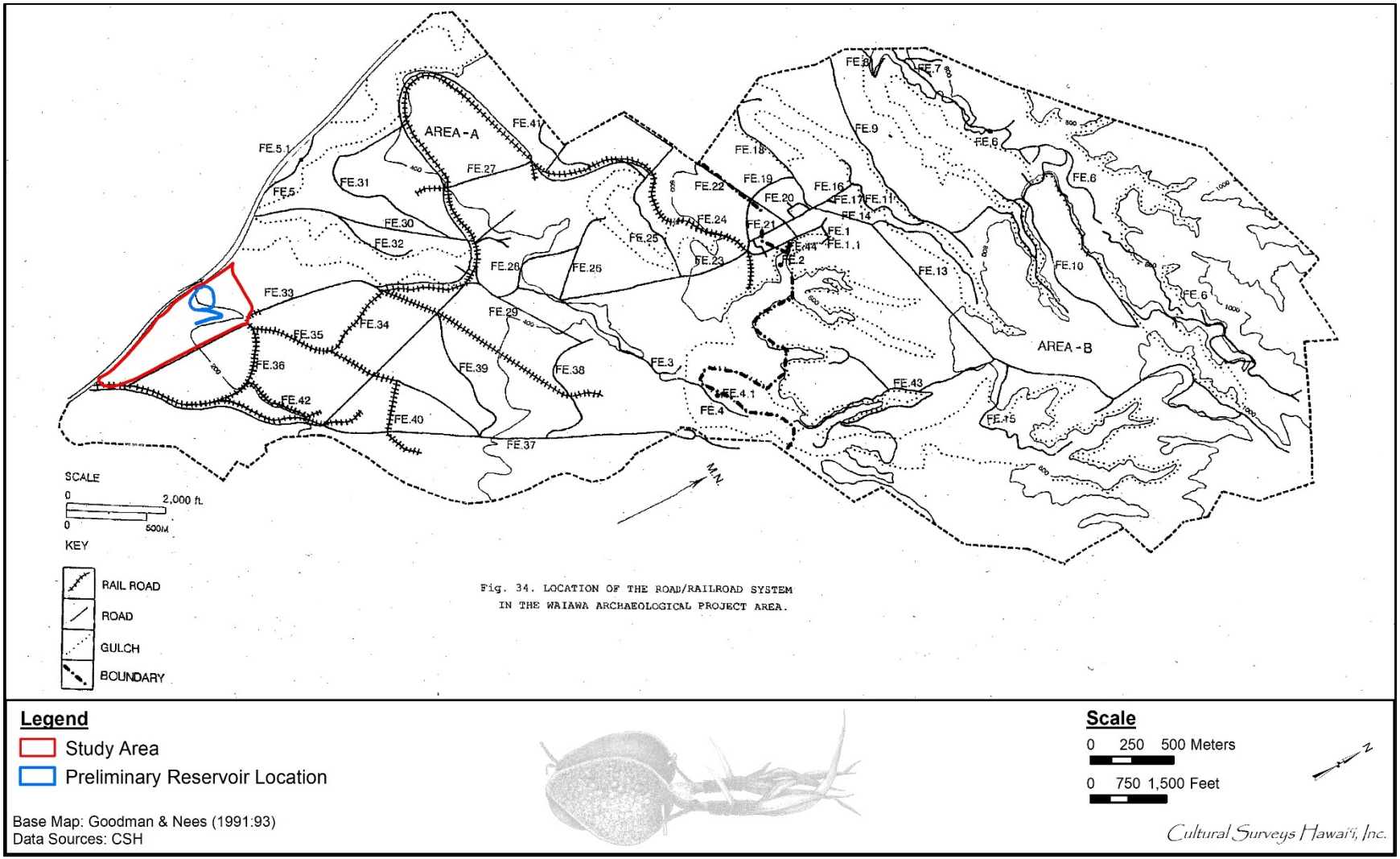

Figure 29. Goodman and Nees (1991:93) map of the location of the road/railroad system (SIHP # -2270) showing three designated features (Features 33, 35, and 36) converging near the head of a small valley near a hairpin turn of a 12-ft wide proposed access roadway

Ditches and flumes, siphons, reservoirs, pumping stations, and wells within their study area were assigned feature and sub-feature designations of SIHP # -02273. Their master "Table 1 Sites and Features Recorded […]" (Goodman and Nees (1991:19) lists 40 features and sub-features of SIHP # -02273 (Features 1 through 35 and sub-features 14.1 through 14.6) but many of these are lumped, as in Features 16–29 being simply described as "Straight Ditches." The location of approximately eight of these designated features is depicted on one figure (see present Figure 28) but the location of the majority of the features is not depicted.

It appears the only data specific to Features 19 and 20 near the present study area is in their Table 1 that lumps features 16–29 as "historical" "straight ditches" in their designated Areas A/B (Goodman and Nees 1991:20). There is a summary discussion of "Straight Ditches":

> Straight ditches are supply ditches that branch from a main water supply, such as a reservoir or the Waiahole Ditch. There are approximately 13 of these features (Features 16 through 29) in the project area [reference to the figure presented in present Figure 28]. They generally tend to be located: 1) along the gulch rims, 2) adjacent to roads, and 3) in the bottom of some of the gulches. They often bisect fields in order to connect reservoirs. These ditches generally are perpendicular to the contour of the field and deliver the majority of the water to separate fields in a distributary fashion.
>
> The most common technique used in the construction of straight ditches utilizes cement and fractured basalt. These were used to line a trench that in cross section appears as a boxed C-shape with well-defined corners and straight sides [a photographic example is supplied, shown in the present Figure 30]. Another construction technique for this type of ditch is that of cement plaster reinforced with chicken-wire netting. This technique involves plastering a chicken-wire base with cement plaster and stapling the whole base with heavy wire staples into the ditch sides. The bottom of the ditch is also constructed of concrete. These ditches have a wide, U-shaped cross section and are flat on the bottom.
>
> Another technique utilizes the Penhollow pre-cast concrete slab and is commonly seen in modern irrigation ditches (Penhollow 1914). Cement is poured in a mold constructed along the sides of an excavated trench. This ditch appears as a very explicit U-shape in cross section, with straight edges and sharp corners. [Goodman and Nees 1991:64, 66, 68]

Their map of features of SIHP # -02273 (see present Figure 28) indicates Feature 19 approximated the 200-ft contour on the northwest side of a small gulch on the east side of the proposed reservoir approximating the alignment of a 12-ft wide proposed access roadway to the reservoir (and then exiting the study area to the northwest, effectively cut by the H-2 freeway). This seemingly connects with the linear Feature 20 that approximated the east side of the small gulch extending to the south. It is unclear why a few of the irrigation features of SIHP # -02273 were depicted but most were not. This makes it impossible to determine the location of most of the designated features of SIHP # -02273 (and next to impossible to determine if there is anywhere in their project area where these features were not present). Whether the indicated locations were actually determined as a result of archaeological fieldwork, or were effectively traced from a map, is unclear.

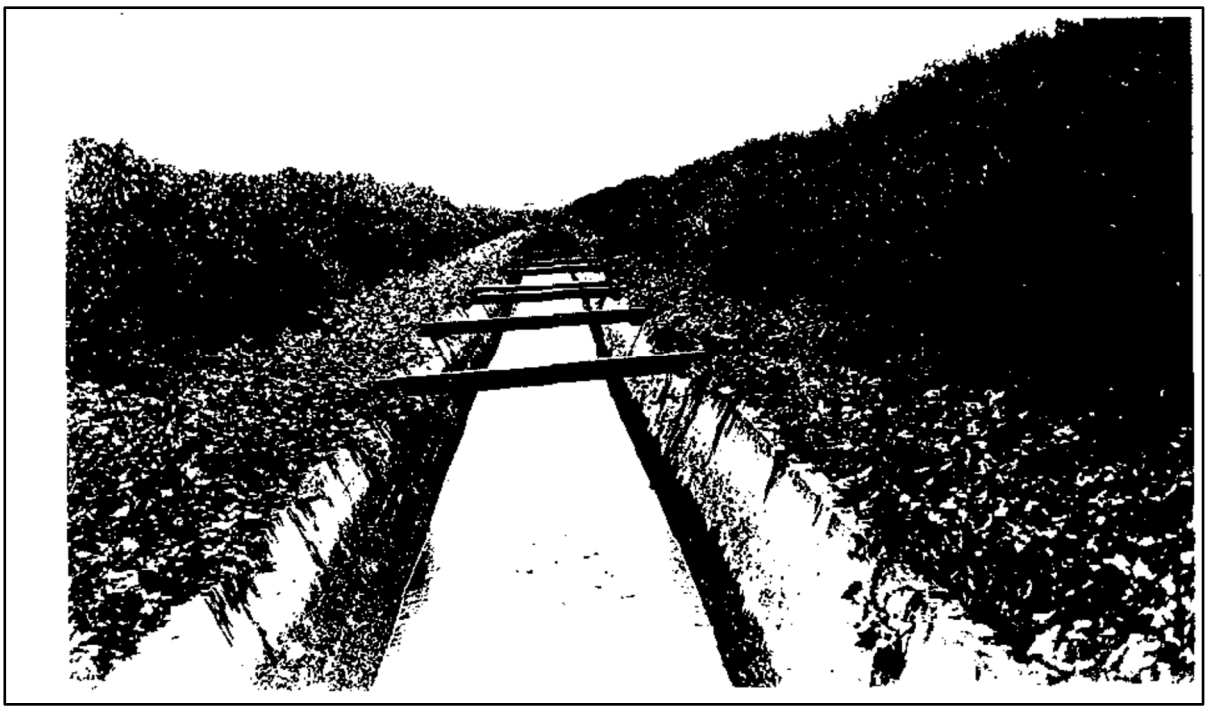

Figure 30. Photograph of a (presumably representative) “Straight Ditch” (BM Neg. No. CP93828, no date from Goodman and Nees 1991:67)

Goodman and Nees (1991) describe SIHP # -02270 as a “Road/Railroad System” with a summary description as follows:

> This site consists of all paved and unpaved roads used by the plantation and military concerns in the area and associated structures, such as retaining walls and roadbeds. The right-of-way for a temporary railroad that serviced the area early in the 20th century (now non-existent) is also included. [Goodman and Nees 1991:18]

Their master “Table 1 Sites and Features Recorded […]” (Goodman and Nees (1991:19) lists only two features:

- Feature 1.1 Retaining wall for roadbed; and
- Feature 2 Parallel rock alignment for road

They assert that SIHP # -02270 included 43 features (Goodman and Nees 1991:i). Their map (Goodman and Nees 1991:93, reproduced here as Figure 29) appears to list features numbered 1 to 11, 13 to 44 and sub-features 1.1, 4.1, and 5.1. The main point here is that “The information on this map was derived from Bishop Estate maps (1933-1936)” (Goodman and Nees 1991:92). The Bishop Estate maps indicated as the source of the data are not presented.

While descriptions of some of the features (features 1 through 9) are provided, there appear to be no descriptions at all of features 10 through 44 and it is unclear whether these numbered features were ever identified on the ground. A cryptic assertion is that “Because there are no remains of the railroad system still present in Waiawa, no feature numbers were assigned” (Goodman and Nees 1991:92) whereas quite a number of feature designations in the south or *makai* portion of their

project area are indicated to have been segments of railroad lines (see figure reproduced in present Figure 29).

It appears no description of the indicated Features 33, 35, and 36 of SIHP # -02270 near the present study area is provided beyond the provided map (reproduced in present Figure 29). The map indicates Features 35 and 36 were railroad alignments as was the southernmost portion of Feature 33 but much of Feature 33 is depicted as a road.

The Goodman and Nees study (1991:137, 138) evaluates historic properties' significance in terms of National Register of Historic Places criteria finding six sites as significant but does not find either SIHP # -02270 or SIHP # -02273 as significant. The study concludes the significance of these sites "has been realized through field and archival research and no further work is recommended" (Goodman and Nees 1991:137).

5.2.2 Thurman et al. 2012

In 2011 CSH carried out fieldwork for an archaeological reconnaissance survey of 1,680 acres of Kamehameha School lands in Waiawa Ahupua‘a (Thurman et al. 2012). Like the Goodman and Nees (1991) study, the fieldwork focused on gulches and rock outcrops that were more likely to contain previously undocumented historic properties and also focused on revisiting previously recorded historic properties. The Thurman et al. (2012) study did not identify any additional historic properties in the vicinity of the present study area.

Section 6 Traditional Cultural Practices

Timothy R. Pauketat succinctly describes the importance of traditions, especially in regard to the active manifestation of one's culture or aspects thereof. According to Pauketat,

> People have always had traditions, practiced traditions, resisted traditions, or created traditions […] Power, plurality, and human agency are all a part of how traditions come about. Traditions do not simply exist without people and their struggles involved every step of the way. [Pauketat 2001:1]

It is understood that traditional practices are developed within the group, in this case, within the Hawaiian culture. These traditions are meant to mark or represent aspects of Hawaiian culture that have been practiced since ancient times. As with most human constructs, traditions are evolving and prone to change resulting from multiple influences, including modernization as well as other cultures. It is well known that within Hawai‘i, a "broader 'local' multicultural perspective exists" (Kawelu 2015:3). While this "local" multicultural culture is deservedly celebrated, it must be noted that it has often come into contact with "traditional Hawaiian culture." This contact between cultures and traditions has undoubtedly resulted in numerous cultural entanglements. These cultural entanglements have prompted questions regarding the legitimacy of newly evolved traditional practices. The influences of "local" culture are well noted throughout this section, and understood to represent survivance or "the active sense of presence, the continuance of native stories, not a mere reaction, or a survivable name. Native survivance stories are renunciations of dominance, tragedy and victimry" (Vizenor 1999:vii). Acknowledgement of these "local" influences helps form nuanced understandings of entanglement and of a "living [Hawaiian] contemporary culture" (Kawelu 2015:3). This section strives to articulate traditional Hawaiian cultural practices practiced within the *ahupua‘a* in ancient times, and the aspects of these traditional practices that continue to be practiced today; however, this section also challenges "tropes of authenticity" (Cipolla 2013) and acknowledges the multicultural influences and entanglements that may "change" or "create" a tradition.

This section integrates information from Sections 3–5 in examining cultural resources and practices identified within or in proximity of the project area in the broader context of the encompassing Waiawa landscape. As no testimony was provided by community contacts detailing the nature of current cultural resources and/or ongoing cultural practices within the proposed project area, the information provided below has been derived solely through document research.

6.1 Agricultural Practices

Traditionally, the *moku* of ‘Ewa was widely inhabited by pre-Contact populations, including the Hawaiian *ali‘i*. This would be attributable to the plentiful marine and estuarine resources available at the coast, along with irrigated lowlands which were suitable for wetland taro cultivation including a rare taro called the *kāī o ‘Ewa*, which was grown in mounds in marshy locations (Handy and Handy 1972:471).

The *makai* regions of Pu‘uloa were once covered with *lo‘i kalo*. In an interview conducted for an *Ethnohistoric Study of Kamehameha Schools' Lands in Waiawa, Waiau, and Kalauao* (Genz et al. 2010:159*-162), Dr. Ishmael Stagner stated that *makai* of the present-day Kamehameha Highway a floodplain had formerly been dense with taro fields and rice paddies, and eventually

watercress ponds. He noted the Pu‘uloa variety of *kalo* yielded four crops each year due to an abundance of freshwater springs and streams, and this was enough to supply *kalo* and *poi* for one-third of the island of O‘ahu. Hawaiians also cultivated *tī* in the *lo‘i kalo* (‘Ī‘ī 1959:85).

In an interview conducted for *Pearl City, A Look at the Past. An Oral History Project by Pearl City Public Library* (Ching 1992:41), Edith Kapule McKinzie stated her father leased about five acres of *lo‘i.* She recalled,

> We used to make poi from taro. My mother would get up at something like two o’clock in the morning and lomi (knead) the poi to help him. He used to get kiawe (algaroba) wood for the fire. He would go down to Wai‘anae and go past Nanakuli to pick kiawe to make the best charcoal. They cooked the taro and just about daylight, it would be cool enough to handle so you could peel it. We kept the outside peels to be used for mulching. We had lots of taro plants in the lo‘i (taro patches). [Ching 1992:41]

In addition to taro, breadfruit, coconuts, *wauke*, bananas, *olonā* and other plants were also grown in the interior. ‘Ewa was also known as one of the best areas to grow gourds and was famous for its *māmaki*. Handy and Handy (1972:429) noted the “lower part of the valley sides were excellent for the cultivation of yams and bananas.”

Mrs. McKinzie (in Ching 1992:41) also recalled her neighbors grew mango, *‘ilima* (large native shrubs; all species of *Sida*, especially *S. fallax*), *pua kenikeni* (shrub or small tree; *Fagraea berteriana*), watercress, and lotus.

Harold Sakai (in Ching 1992:50–52) described Waiawa as a “farming district.” He recalled that his father had “an acre and a half of property” which was “located right in front of Pearl Harbor water on Middle Loch shore” where they “raised hogs, cows, chickens, and had a vegetable garden.”

The traditional use of the land shifted from *lo‘i kalo* cultivation to cattle ranching in the 1840s, then to sugarcane cultivation in the 1870s, next to rice cultivation and watercress farming in the early 1900s, and finally to housing developments in the 1950s. Agricultural and aquacultural intensification in the area along Waiawa Stream supported substantial food production and human population. E.S. Craighill Handy (1940:81) observed a few seaward terraces for taro cultivation which were irrigated by Waiawa Stream during his survey of O‘ahu.

Other participants interviewed for the *Ethnohistoric Study of Kamehameha Schools’ Lands in Waiawa, Waiau, and Kalauao* (Genz et al. 2010) discussed the cultivation of sugar and pineapples in Waiawa. Chu Hoy Lee stated, “Sugar was grown from Hālawa to Pearl City. Pearl City and Waiawa was in pineapple. Then it became sugar again in Waipahu” (Genz et al. 2010:149). He recalled,

> When pineapple went out in 1958, there were 1500 acres, each that had been producing $150 per acre of lease rent. That is about $200,000. The budget for Kamehameha Schools was $1,500,000 and 10% came from Waiawa. Libby, who was the lessee for the Waiawa property, gave up the land in 1958. When Libby gave back the land, Bishop Estate was left with nothing. [Genz et al. 2010:149]

Richard Lee (in Genz et al. 2010:152) noted that in the 1930s, the residents of Waiawa used the land primarily to grow sugarcane, as well as to cultivate small plots of rice. He recalled how sugarcane filled the area from the lowland to the forest reserves of the mountainous regions, and from Waiawa in the west to the ‘Aiea sugar mill and Hālawa in the east.

Mr. Lee oversaw the development of swamp land from Kalauao to Waiawa into agricultural land in the 1970s, including the area *makai* of the Leeward Community College (LCC) which was owned by Kamehameha Schools and Bishop Estate. He also spent considerable time constructing roads in the lower regions of Waiawa and maintaining the roads in the upper regions of Waiawa, including sections of the H-1 Interstate.

Tim Hu Young (in Genz et al. 2010:168) stated that before he was born, the land *mauka* of Kamehameha Highway was heavily forested, but then it shifted to grazing land during his childhood and later to sugarcane. Farther *makai*, the lowland regions were used primarily for taro and rice cultivation. He stated, “When I was a kid, all this area was lowland for taro patches, all this area here. And later on when rice became profitable it was rice. And up on the hill was all sugar cane where Leeward [Community] College is” (Genz et al. 2010:169).

Handy and Handy (1972:429) also noted the *moku* of ‘Ewa was famous for its *‘awa* which grew “farther inland.” *Mo‘olelo* suggest the *ahupua‘a* of Waiawa was named for the *‘awa* plant. According to the *mo‘olelo*, Maihea, a farmer living in the upland of Waiawa, prayed daily to the unknown gods with his offering of *‘awa*, taro greens, and sweet potatoes (Handy and Handy 1972:472).

Community groups in Waiawa continue to preserve and perpetuate cultural traditions and resources while also sharing their knowledge and providing opportunities for community members and students to connect with and restore the *‘āina* through the cultivation of *kalo* and other native plants used for food or other cultural purposes.

Named for an *‘ili ‘āina* in Waiawa, Kuhiawaho is a grassroots organization that strives to “provide Kanaka ‘Ōiwi [Native Hawaiian] leadership opportunities and instill kanaka identity through ‘āina based stewardship” including “‘āina restoration, mālama Hāloa [care for Hāloa (son of Wākea and Ho’ohōkūkalani; and ancestor of the Hawaiian people from which the taro (kalo) plant sprouted from)], waele [to weed, clear, remove grass or weeds], huki [to pull or plug], kanu [to plant], ku‘i kalo [pounding taro], and imu [underground oven]” (Uyeoka et al. 2018:177). Located on the shores of Pu‘uloa, Kuhiawaho is a “pu‘uhonua, a safe gathering place, for extended ‘ohana and community to re-connect to ‘āina, to learn, and to perpetuate Native Hawaiian practices” (Kuhiawaho 2020a). Kuhiawaho also offers internships to “college going haumāna [students] that are interested in mālama ‘āina [land cquire hip] and are committed to strengthening our moku of ‘ewa” (Kuhiawaho 2020a). The internships provide “the unique opportunity to work outdoors and cquire the skills and knowledge that it takes to cultivate lo‘i kalo, loko wai [fresh-water pond or lake], as well as create strong relationships to ‘āina and people within the ‘Ewa moku” (Kuhiawaho 2020b).

Another community group, Ko‘ihonua, is “a not for profit organization dedicated to reclaiming and providing cultural space for our lāhui [nation] to learn/practice/engage in Hawaiian traditions and practices” (Ko‘ihonua n.d.). Also located on the shores Pu‘uloa in Waiawa Makai at Hanakēhau Learning Farm, their work includes “reestablishing lo‘i kalo, clearing land for mala

[gardens], planting native and non-native food and other cultural use plants" (Ko‘ihonua n.d.). Their work is also "focused on hana no‘eau—creating traditional and modern Hawaiian implements—and using those implements in our daily practice to grow our Hawaiian consciousness and understanding" (Ko‘ihonua n.d.).

Also located at Waiawa Kai, Kuhialoko "educates and works to restore the land and the species connected to its health while bringing families together to strengthen their relationships with each other, their community, and the surrounding environment" (Hawaii People's Fund 2023). *Kahu* (caretaker) Ali‘i Miner grew up in Kuhialoko and his "'ohana has cared for Kuhialoko for generations" (Uyeoka et al. 2018:187). He also has "a 'kalo bank,' which is home to numerous varieties of kalo that he grows to sustain his 'ohana" (Uyeoka et al. 2018:187).

6.2 Coastal and Marine Resources

Mo‘olelo of Waiawa and the broader *moku* of ‘Ewa discuss the importance of the waters of Pu‘uloa and the surrounding land to Hawaiians. The significance of water in ‘Ewa is also embedded in the places names of ‘Ewa including six of the 12 *ahupua‘a* names in the *moku*—Waikele, Waipi‘o, Waiawa, Waimano, Waiau, and Waimalu—which begin with *wai*, the Hawaiian word for fresh water. Community members (Ching 1992; Genz et al. 2010) have also asserted that names of the *ahupua‘a* of ‘Ewa refer to their freshwater resources which signifies an abundance of streams, ponds, and freshwater aquifer springs. In an interview conducted for a *Cultural Impact Assessment for 3,600 acres in Waiawa and Waipi‘o Ahupua‘a in O‘ahu* (Bushnell et al. 2003), Tim Hu Young explained his own interpretation of the name Waiawa based on the flow of the streams:

> […] And when I used to watch the water, the rivulets would come twisting and turning like little *‘awa* roots, twisted. If you ever harvest that *‘awa* root, you got to see, it's like a big root coral. It's all tangled into each other. And it reminds me, when it flooded down in the lowland, all these little rivulets, twisting and turning, like the *‘awa* root. [Bushnell et al. 2003:10]

Dr. Ishmael Stagner (in Genz et al. 2010:162) emphasized that the single most important feature of ‘Ewa is its watershed. Tim Hu Young (in Genz et al. 2010) also stated,

> But, the real wealth of this place here, Pu‘uloa, was because, this whole area that surrounds Pearl Harbor, they are called like Waipahu, Waikele, Waiawa, Waiao, tells you that the source of water here is great. Everything pours into Pearl Harbor. According to old Hawaiian legends and stories, in reality Hawaiians considered *waiwai* [wealth], water is wealth, not oil, not gold, not silver, but water was the wealth of our place here, in Waiawa. Although Waiawa might refer to the water, the *‘awa* that's growing up in the mountains. And with the water source, Waipahu might be related to the pounding of the water like the drum, you know, so that's the wealth here, the water. [Genz et al. 2010:166]

Mirroring the *ahupua‘a* boundaries, water flows from the Ko‘olau mountains down to the waters of Pu‘uloa throughout a network of streams and an underwater system of tunnels. These contribute heavily to the Hālawa Aquifer, which now supplies the majority of the drinking water for the island of O‘ahu. Dr. Stagner (in Genz et al. 2010:159) stated there were freshwater aquifer springs all over the region and *mo‘o ‘aumākua* guarded these tunnels of water.

The waters flowing down the streams and up through the aquifers eventually entering the *wai momi*, or the "pearl waters," of Pu‘uloa. *Loko i‘a* once occupied the intersection of land and sea. Small fish would enter these nutrient-rich waters, feed, and become too big to escape through the narrow channels. Hawaiians used to catch and feast on these fish.

McAllister recorded three *loko i‘a* adjacent to Pearl Harbor in Waiawa Ahupua‘a—Loko Apala (SIHP # -00118), Loko Kuhialoko (SIHP # -00119), and Loko Mo‘o (SIHP # -00120). Mid-nineteenth century Māhele documents also mention numerous *loko i‘a* including Loko Apalakai, Apalawai (Loko Apala), Kuakuanui, Ho‘opililoko, Loko Kuhialoko, Loko Mo‘o, Kalokohanahou, Kama‘ihi, Kepoelalo, Kepoeluna, Loko Mōkōlea, and Mōkōlea (Soehren 2009).

Harold Sakai (in Ching 1992:51) recalled living near Loko Kuhialoko. He stated, "[…] Mr. Minami had a fishpond (Loko Kuhialoko) in Waiawa, below the railroad track. He used to put small fish in the pond, and once the mullets got big, he would sell it at the market."

Charles Howard Edmondson (1946:5) noted the coastal waters of Pearl Harbor were "a natural aquarium for many varieties of marine animals." Margaret Titcomb (1952:7) also mentioned the Pearl Harbor area as the only large natural inland lagoon, famous for its fish and fishponds. The lochs of Pearl Harbor were said to be filled with *nehu*.

Tim Hu Young (in Genz et al. 2010:171) discussed the abundance of marine and freshwater resources in and near Pu‘uloa. He stated,

> In fact this was a breadbasket in the ancient times. It had fish, crab, oysters, clam, it had everything. It was a rich area to live, you would never starve. I can remember my mom saying when she got the place on the Big Island she noticed how harsh the people had to live there with the lava flows and no running streams. They had to plant dryland taro. Over here they had wetland taro, which was *‘ono* [delicious]. It's like that the good tasting *poi* going to Hanalei, fresh water. [Genz et al. 2010:165]

Mr. Young reminisced about fishing for mullet as a child. He also explained the ecology of mullet, which involves traveling from the ocean through the brackish waters of Pu‘uloa and upstream to the spring-fed taro patches:

> You needed the ocean to flush the harbor out. We had a lot of fish like the mullet that were accustomed to the salty and brackish water. You have to have the mix of brackish water. Pearl Harbor was ideal. When we were kids it was almost the same as when I read some of the readings by Kamakau. He would say Pearl Harbor and this area was so rich that when the mullets went upstream, it wouldn't be just one school, but [saying rapidly] school after school after school after school, like that. Then as a young boy [saying slowly] school after school after school. In other words, in the ancient days was constant, but when I was a kid not that constant, started to diminish. Today, lucky to ever see a school of mullet, right here in this river.
>
> What we do when we kids, after school run down to the bridge, so much mullet going by all you have to do is jerk up and have a fish. Just jerk it, forget bait. That's how good it was. In those days the river was clear. You don't have these sewer lines. The mullet would come upstream when it was clear and come up to these

> areas cleared off. If this stream from this land went to this bridge, the mullet would come all the way up through the lock through west lock through the stream and into your little taro patch. And breed, even if no taro just swampy land, it was still okay ‘cause the water was coming from the stream. Then breed and go back out again, a constant replenishment of your fish. Guess what, the crabs get good eat. And when we were kids it was common to go out and get a gunny sack full of crabs. In the old days if you had one of these little streams running through your property, the guys at the top couldn’t put all this crap or stop it, has to let it down so your taro patch gets filled and the water goes back to Pearl Harbor. [Genz et al. 2010:167]

He also noted the abundance of pearls in Pu‘uloa.

> Of course at that time Hawaiians had developed pearls in Pearl Harbor, what was growing naturally. The Hawaiian pearl was a source of income and although the pearls weren’t as well cultivated they were colorful and a little smaller though. [Genz et al. 2010:166]

Dr. Stagner (in Genz et al. 2010:160) recalled hunting crabs and harvesting clams in Pu‘uloa in his youth. Harold Sakai (in Ching 1992:51) also recalled fishing, swimming, and boat riding as a kid. He stated, “As a kid, I used to do a lot of fishing, swimming, boat riding, all that. It was really convenient to bring up a family in the country. But there was a lot of work to be done.”

Edith Kapule McKinzie (in Ching 1992:41) lived on “the *‘*ewa (west) side of Waiawa Stream, about a quarter of a mile in from Waiawa Road.” She recalled, “My dad used to set his nets across the stream, right where the railroad tracks went across “18 Bridge.” My sister and I would jump on the boat with our dad, and paddle up the stream to fish” (Ching 1992:41).

Prior to Dillingham’s dredging at the beginning of the twentieth century and the Navy’s later occupation of Pearl Harbor, the channel to Pearl Harbor was narrow, restricting the movement of ocean water into the freshwater basin.

Dr. Stagner (in Genz et al. 2010:160) recalled swimming and paddling canoes in Pu‘uloa which was mostly fresh water. In fact, several people who grew up swimming in Pu‘uloa went on to compete in the Olympics. Dr. Stagner mentioned that one of the residents of the Pearl City peninsula, Clarence “Buster” Crabbe, won the 1928 Olympics by swimming faster than Johnny Weissmuller and Duke Kahanamoku. Dr. Stagner also mentioned he was aware of chants that describe how Queen Liliuokalani and King Kalākaua swam in Pu‘uloa.

Dr. Stagner (in Genz et al. 2010:162), Mr. Young and his wife Helen Kealiiwahineulawenaokola He‘ia Colburn (in Genz et al. 2010:171), and Mr. Chew Lee (in Genz et al. 2010:150) stressed that the ‘Ewa watershed should be responsibly managed and conserved. They mention cases of lowland flooding during times of heavy rains, especially in the Waiawa River, due to heavy urbanization, disturbed ground cover, and inadequate drainage. In particular, Dr. Stagner warned the *mauka* regions of Waiawa and neighboring *ahupua‘a* must not be developed and the highland streams must be regularly cleared and maintained to prevent future lowland flooding.

6.3 *Mo‘olelo*

Mo‘olelo also connect Pu‘uloa to the ancestral homeland of Hawaiians in central Polynesia, describe the marine and freshwater resources of Pu‘uloa, and detail the feats and journeys of legendary heroes, gods, and *‘aumākua*.

Tim Hu Young’s ancestors, the La‘amaikahiki family, trace their lineage to the first settlers that landed on the shores of Pu‘uloa after voyaging from Kahiki, the ancestral homeland of Hawaiians in central Polynesia (Genz et al. 2010:163). Mr. Young elaborated on the connections between La‘amaikahiki and the family’s land at the mouth of Waiawa River:

> The interesting thing about all this is on my mom’s father’s side, my grandfather’s mom was La‘amaikahiki Wahine. And her family actually lived at the mouth of the Waiawa River here, right here in Pearl Harbor, Pu‘uloa.
>
> Well here, this land here belonged to my side of the family, through the La‘amaikahiki. As you know, he was one of the earlier settlers in Hawai‘i. La‘amaikahiki, that is where he landed. One of his four wives is from here. That’s us, our family. The original migration, right here at the mouth of the river. […] [Genz et al. 2010:163]

Mr. Young (in Bushnell et al. 2003:83) also detailed the significance of the waters of Pu‘uloa to the ancient history of the settling of O‘ahu:

> […] in the ancient days when the Hawaiians settled on O‘ahu, one of the pathways was through Pu‘uloa, Pearl Harbor. That was the perfect place for the canoes to come in. And later on, the sailing vessels came in, and then that led to the Pearl Harbor we know today. [Bushnell et al. 2003:82-83]

Pu‘uloa was associated with the shark *‘aumakua*. These sharks were the guardians of Pu‘uloa and protected the *kama‘āina* of ‘Ewa from other man-eating sharks. There are numerous *mo‘olelo* associated with Ka‘ahupāhau, the queen shark of O‘ahu, and her brother, Kahi‘ukā, who lived in Pu‘uloa.

Tim Hu Young (in Genz et al. 2010:169) shared a *mo‘olelo* about the *‘aumākua* of Pu‘uloa—the *manō* (shark) and *pueo* (owl):

> Pu‘uloa was the home of the shark, that’s our *‘aumakua*. We have two [*‘aumakua*], the shark and owl, *pueo*. The interesting thing about this when I went to school at Chaplain College in New York after the war, my engineering teacher, Dean Canon, was a young engineer at Pearl Harbor building Drydock 1. At that time the local people were saying they better make a dedication or *lū‘au* to celebrate that ‘cause where they are digging is the home of the shark god. The moment they open the doors to the drydock, it collapsed. Number 1 drydock. When they went to rebuild it they found a huge cave with a whole skeleton with a shark. [Genz et al. 2010:174]
>
> This area was like a breadbasket in the old days. Our *‘aumakua* used to warn our people here in this area of the raiders, like Wai‘anae, Nānākuli, when they had a drought or hard time, they would come over on the canoes and raid the Pearl Harbor area and raid our people. Our people knew what was going on. The owl warned us,

> but we knew that these people over there needed food, so we would all lay low, we didn’t fight them, we let them have it because we had so much here, and we might be *‘ohana*. That is the story I heard from my parents. The older stories that came through chants and *mele* were about this area being so fruitful. [Genz et al. 2010:169]

Arlene Wainaha Ku‘uleialoha Nakihei Rayleen Brede Eaton (in Genz et al. 2010:133) shared her experiences riding *manō* with her *tūtū* that resembled those described by Pukui (1943:56) and Sheldon (1883). She recalled,

> I’ve ridden that thing. My *tūtū* used to ride that, the shark. When I tell them, people don’t believe me. I feel close to Ka‘ahu Pahau. My *tūtū* would get on the sharks, on the back. It is not easy riding those sharks, you can get cut with the skin. There were certain ones that would come up, and he would call them, hit the side of the canoe, feed them, talk to them in Hawaiian, and pretty soon he would jump over and ride away. They understand what he was saying. I never tried on my own for the simple reason that you cannot just do It if you don’t know the *oli*, and it must be done right. As time went on I did get to the know the *oli*, but by that time, it was like God saying, it is not your time. So I stopped. [Genz et al. 2010:133]

6.4 *Wahi Pana*

A Hawaiian *wahi pana* “physically and poetically describes an area while revealing its historical or legendary significance” (Landgraf 1994:v). ‘Ewa Moku contains numerous *wahi pana* and associated *mo‘olelo* that place the study area within a broader cultural context.

Several *heiau* were located within the *moku* of ‘Ewa. A *heiau* called Puoiki was located on the boundary point between Waiawa and Mānana Ahupua‘a, at the point of the ridge called Lae Pōhaku (McAllister 1933:105). According to McAllister, the ceremonies at this *heiau* were performed at the base of the knoll where the *heiau* was built. A second *heiau* in Waiawa Ahupua‘a was located near the “maika playing field of Haupu‘u” (Waialeale 1834:23), however, it was demolished in 1834 and the Protestant Ewa Church was built directly over the *heiau*.

Shad Kāne (in Genz et al. 2010:139-140) stated that the traditional cultural landscape in the *makai* sections of ‘Ewa near the waters of Pu‘uloa remains intact underground. He stated,

> The ancient Hawaiian resources, due to the very nature of the alteration in the region, has not been removed. It has all been filled in. In other words, the cultural landscape within all of ‘Ewa is still there. It is just buried. The stuff that was on the high ground, where they planted sugar cane and pineapple is gone. Within the valleys, the low-lying areas, and the wetlands adjacent to Pearl Harbor, from ‘Ewa Beach to ‘Aiea, much of that cultural landscape—the cultural layer—is still in place. [Genz et al. 2010:139]
>
> […] Much of Pearl Harbor was fishponds and salt ponds. All of those are still there, there are just filled up. […] To show that the traditional cultural landscape, I have to speak about the ancient Hawaiian land use, and not in terms of physical structures. We are talking about land that was used for specific purposes by Native Hawaiians. We can talk about it in terms of gathering resources, fishing. We can

> talk about in terms of a place to gather salt. We can speak of it in terms of a place of worship and pray. We can speak of it in terms of a place to gather medicinal plants. A traditional cultural landscape is that. It is land that was used for a specific cultural purpose. [Genz et al. 2010:139-140]

He also asserted that the ancient canoes are still near the shores of Pu‘uloa suggesting the sediment and mud from the rivers flowing into Pu‘uloa have buried the canoes that were once left abandoned on the shores over time

Mr. Kāne (in Genz et al. 2010:140) also recalled reading about a large *heiau* on a ridge at the intersection of the Mānana and Waiawa rivers, however, the area was never cleared for agriculture and remains heavily forested, which prevented him from locating it on horseback.

Tim Hu Young (in Genz et al. 2010:170) also mentioned “stone formations” near Leeward Community College that look like they may have originally been part of a *heiau*. He stated,

> The only thing up *mauka* there [on the hill by Leeward Community College] are stone formations that look like they came from somewhere else, maybe a *heiau*. Of course this hill here was an old *heiau* where the housing is, right up here where you park the cars at Leeward [Community] College. I think there was an ancient *heiau* there. My grandmother was buried there, right next to the surveyor’s bench mark. That’s where the first church was built in this area. [Genz et al. 2010:170–171]

Trails were and continue to be valuable resources for Native Hawaiian culture and life ways. In the past, trails were well-used for travel within the *ahupua‘a* between *mauka* and *makai* and laterally between *ahupua‘a*. There were several pre-Contact/early historic trails across the *moku* of ‘Ewa including a cross-*ahupua‘a* trail which passed through ‘Ewa connected Honolulu to Wai‘anae. The coastal trail ran along the inward boundary of the Pearl Harbor floodplain and irrigated taro fields (‘Ī‘ī 1959:96–98). The coastal cross-*ahupua‘a* trail was close to the present H-1 alignment approximately 500 m south of the south end of the present study area and the eastern trail heading north up the central valley is understood to have approximated the present Kamehameha Highway (Highway 99) alignment approximately 800 m west of the present study area.

Recent archaeological surveys have similarly revealed very few additional archaeological sites. In Waiawa, surveys have revealed terraces and associated petroglyphs, a complex of six rock mounds, a trail, and lithics (Goodman and Nees 1991), as well as a rock alignment (Henry et al. 1993).

Section 7 Summary and Recommendations

CSH undertook this cultural literature review at the request of The Limtiaco Consulting Group, on behalf of the City and County of Honolulu BWS. The research broadly covered the entire *ahupua‘a* of Waiawa, including the current project area.

7.1 Results of Background Research

Background research for this study yielded the following results, in approximate chronological order:

1. The study area is located in the *ahupua‘a* of Waiawa which extends from the Middle Loch of Pearl Harbor up the summit of the Ko‘olau Range, and is bounded by the *ahupua‘a* of Waipi‘o on the west and the *ahupua‘a* of Manana to the east.
2. The meaning and correct pronunciation of Waiawa is in dispute. It is variously spelled Waiawa or Wai‘awa, which leads to different interpretations. *Awa* is both the word for milk fish or a harbor, cove, channel, or passage (Pukui and Elbert 1986:33). With an alternate spelling, *‘awa* is the word for the native plant used to make a soporific and muscle relaxant drunk by the Hawaiians. Traditional accounts suggest Waiawa may have been acknowledged in early times as the site of a special variety of the *‘awa* plant.
3. Other traditional accounts concerning Waiawa include the *mo‘olelo* of Kawelo (Fornander 1919:700–701), Keakua‘ōlelo (*Ka Loea Kālai‘āina* 1899, translated in Sterling and Summers 1978:22), and Maihea (Handy and Handy 1972:472; *Ka Loea Kālai‘āina*, 1 July 1899, translated in Sterling and Summers 1978:5; Maly and Maly 2003:95).
4. The *moku* of ‘Ewa had more *loko i‘a* than any other district on O‘ahu, indicating agricultural and aquacultural intensification was a direct link to the chiefs who resided there and to the increasing needs of the population (McAllister 1933:28; Handy and Handy 1972:270,470).
5. Archaeologist Gilbert McAllister recorded three *loko i‘a* adjacent to Pearl Harbor in Waiawa Ahupua‘a—Loko Apala (SIHP # -00118), Loko Kuhialoko (SIHP # -00119), and Loko Mo‘o (SIHP # -00120). Mid-nineteenth century Māhele documents also mention numerous *loko i‘a* including Loko Apalakai, Apalawai (Loko Apala), Kuakuanui, Ho‘opililoko, Loko Kuhialoko, Loko Mo‘o, Kalokohanahou, Kama‘ihi, Kepoelalo, Kepoeluna, Loko Mōkōlea, and Mōkōlea (Soehren 2009).
6. There were numerous *heiau* within the *moku* of ‘Ewa. McAllister (1933:105) recorded a *heiau* called Puoiki located on the point of the ridge called Lae Pōhaku, the boundary point between Waiawa and Mānana Ahupua‘a. A second *heiau* in Waiawa Ahupua‘a was located near the “maika [Ancient Hawaiian game suggesting bowling] playing field of Haupu‘u” (Waialeale 1834:23). It was demolished in 1834 and the Protestant Ewa Church was built directly over the *heiau*.
7. There were several pre-Contact/early historic trails across the *moku* of ‘Ewa including a cross-*ahupua‘a* trail which passed through ‘Ewa connecting Honolulu to Wai‘anae. The coastal trail ran along the inward boundary of the Pearl Harbor floodplain and irrigated taro fields (‘Ī‘ī 1959:96–98). The coastal cross-*ahupua‘a* trail was close to the present H-1 alignment approximately 500 m south of the south end of the present study area and the eastern trail heading north up the central valley is understood to have approximated the

present Kamehameha Highway (Highway 99) alignment approximately 800 m west of the present study area.

8. Beginning with the time of Western Contact, Hawaiian populations were introduced to many virulent western diseases which began to decimate the native populations. The 1831–1832 census of O‘ahu recorded a population of 4,015 within the ‘Ewa District. Four years later, in 1836, the ‘Ewa population had dropped to 3,423 (Schmitt 1973:9, 36), “a decrease of 592 in 4 years” (‘Ewa Station Report 1836). The population stabilized in the 1830s and early 1840s. In January 1849, the population was 2,386 people, but the population dropped with a measles epidemic in October 1849 (Ewa Station Report 1849:3, 4).
9. The first mission in ‘Ewa was established in 1834 in Waiawa. Two missionaries, Lowell and Abigail Smith, were assigned to the station and were in charge of building a church and a house for themselves (Hawaiian Mission Children’s Society 1969:3–9). Lowell selected the site for the new church on a hill called Haupu‘u (built-up hill) that was elevated 200 ft above the ‘Ewa plain. This ‘Ewa Church on the hill Haupu‘u was probably situated near the demographic center of Waiawa Ahupua‘a from time immemorial and would dominate the geographic and social landscape of Waiawa for decades.
10. During the Māhele in 1848, Waiawa Ahupua‘a was awarded to Princess Victoria Kamāmalu (sister of Kamehameha IV and V) as part of land claim 7713. During the second half of the nineteenth century, Waiawa was passed on to successive members of the *ali‘i*. In 1883, Bernice Pauahi Bishop received Waiawa following the death of her cousin Ruth Ke‘elikōlani (Kame‘eleihiwa 1992:309–310). The Bernice Pauahi Bishop Estate and Kamehameha Schools presently retain ownership of most of the *ahupua‘a*. The present study area is entirely within the award to Victoria Kamāmalu and *mauka* of all the smaller *kuleana* awards to individuals.
11. In 1868, a 50-year lease and leaseholds in Waiawa were granted to James Robinson, an early shipbuilder in Hawai‘i. After James Robinson’s death in 1890, his son, Mark P. Robinson, acquired a 25-year lease and ran cattle on the Waiawa lands. The Robinson homestead was between Ho‘ae‘ae and Waikele (west of the study area), but he had fee simple lands in Mānana and Waimano, and a number of leased lands in Waiau, Waiawa, and Waimano Uka (Yardley 1981:131).
12. In 1897, B.F. Dillingham established the Oahu Sugar Company on 12,000 acres leased from the estates of John Papa ‘Ī‘ī, Bishop, and Robinson. The Oahu Sugar Company had over 900 field workers, composed of 44 Hawaiians, 473 Japanese, 399 Chinese, and 57 Portuguese. The first sugar crop was harvested in 1899, ushering in the sugar plantation era in central and eastern ‘Ewa (Ohira 1997).
13. By 1889, the Oahu Railway and Land (OR&L) Company connected the wharves at Honolulu Harbor to Hālawa and the agricultural coastline of Pearl Harbor. O‘ahu’s Ewa Plantation was incorporated in 1889 and the growing railroad of B.F. Dillingham was leveling the Waipahu-to-‘Ewa Junction in anticipation of service to the ‘Ewa plains and beyond. The railroad extended from Honolulu to Pearl City in 1890, to Wai‘anae in 1895, to Waialua Plantation in 1898, and to Kahuku in 1899 (Kuykendall 1967:100). This railroad line eventually ran across the center of the ‘Ewa Plain at the lower boundary of the sugar fields (Frierson 1972:15). The OR&L tracks extended along the margin of Pearl Harbor close to the northern margin of Middle Loch south of the present study area.

14. In the early decades of the twentieth century, lands in the *mauka* portion of the central and eastern sections of ‘Ewa were being acquired for pineapple cultivation. There is a record of attempted pineapple irrigation utilizing water from shallow wells in Waiawa Gulch in 1893 and prior to 1913 most of the plateaus in Waiawa were planted in pineapple (Goodman and Nees 1991:59). In 1899, the Hawaiian Pineapple Company leased 1,000 acres in Waiawa for pineapple cultivation from the OR&L. In 1901, they obtained an additional 61 acres in Waiawa through public auction. These fields were *mauka* of the present study area. In the 1920s, pineapple was abandoned and by 1935, much of the present Kamehameha Schools parcels in Waiawa were planted in sugarcane.
15. The early twentieth century saw the U.S. Government begin acquiring the coastal lands of ‘Ewa for development of a naval base at Pearl Harbor. In 1901, the U.S. Congress formally ratified annexation of the Territory of Hawaii, and the first 1,356.01 acres of Pearl Harbor land were transferred to U.S. ownership (Knox 1936).
16. Four main portions of Waiawa were used by the military—the Pearl City Peninsula *makai* of Kamehameha Highway, a diesel drum storage area at Ewa Junction, also *makai* of the highway, an aviation supply depot along Waiawa Stream *mauka* of the highway and adjacent to the eastern boundary of the study area, and a military reservation in upland Waiawa, approximately 0.75 km northeast of the study area, used for communications and training (Allen 1999).

7.2 Impacts and Recommendations

Based on the information gathered from the cultural and historic background detailed in this cultural impact assessment, the proposed project should not have any impacts to cultural resources and practices. Although highly unlikely, in the event that any cultural resources are encountered during construction, we recommend the following:

1. In the event that *iwi kūpuna* (Native Hawaiian skeletal remains) are identified, all earth moving activities in the area will stop, the area will be cordoned off, and the SHPD and Police Department will be notified pursuant to HAR §13-300-40. In addition, in the event of an inadvertent discovery of human remains, the completion of a burial treatment plan, in compliance with HAR §13-300 and HRS §6E-43, is recommended.
2. In the event that *iwi kūpuna* and/or cultural finds are encountered during construction, project proponents should consult with cultural and lineal descendants of the area to develop a reinternment plan and/or preservation plan.

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APPENDIX F

Pre-Assessment Consultation

EXAMPLE

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

September 15, 2022

Marianne Rossio, P.E., Chief
Clean Air Branch
Hawaii State Department of Health
2827 Waimano Home Road #130
Pearl City, HI 96782

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, Oʻahu, Hawaiʻi
Tax Map Key (1) 9-6-004:024 (por.)

Dear Ms. Rossio,

On behalf of the Board of Water Supply (BWS), we are contacting you to inform you and solicit comments regarding the proposed Waiawa 228 Reservoir project. The BWS proposes construction of a new 8.5 million-gallon (MG) reservoir facility on a portion of TMK parcel (1) 9-6-004:024. The project site is located adjacent to the Interstate H-2 freeway between Waipio and Pearl City (Figure 1 enclosed).

We are soliciting comments as part of the Environmental Assessment (EA) process. Comments you provide will be considered in the forthcoming Draft EA which, once completed, will be made available for public review and comment pursuant to Chapter 343, Hawaii Revised Statutes (HRS) and Title 11, Chapter 200.1, Hawaii Administrative Rules (HAR) of the Department of Health.

Project Purpose
The BWS proposes construction of a new 8.5 MG reservoir facility to meet the needs of existing demand on its Honolulu 180' potable water distribution system. The additional storage capacity will help reduce water pressure fluctuations, provide water during emergencies, and help meet peak consumption demand. Additional storage will stabilize water pumping rates, reducing stress on the water supply and distribution system.

Project Description
The proposed facility will be located on approximately 3.7 acres of former agricultural land. The site will be mass graded to accommodate the new reservoir facility. Construction of an access road and installation of a 30-inch water main will connect the reservoir to the existing Honolulu 180' distribution system. A preliminary site plan is shown in Figure 2 (enclosed)

If you wish to provide preliminary input on the project at this time or be a consulted party while the EA is being prepared, please submit your written comments to the address below by October 15, 2022.

1622 Kanakanui Street • Honolulu, Hawaii 96817
(808) 596-7790 • tlcghawaii.com

EXAMPLE

Please send comments to:

Jason Nakata, Environmental Planner
The Limtiaco Consulting Group
1622 Kanakanui Street
Honolulu, HI 96817
email: jason.n@tlcghawaii.com

Thank you for your interest and participation in the environmental review process. Should you have any questions, please contact me at (808) 386-5241 or via email at jason.n@tlcghawaii.com.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

Enclosures:
Figure 1 – Location Plan
Figure 2 – Site Plan

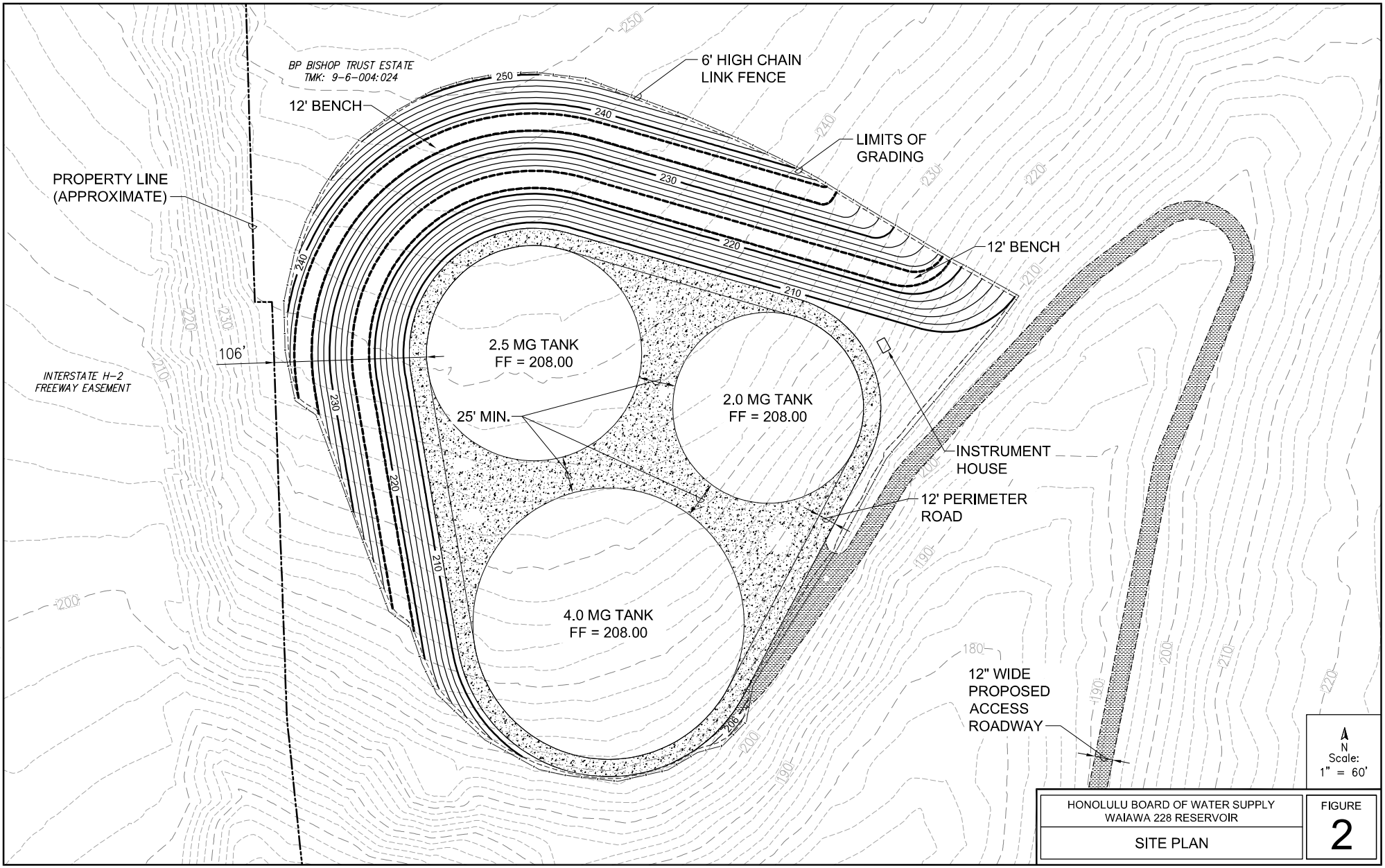
EXAMPLE

HONOLULU BOARD OF WATER SUPPLY
WAIAWA 228 RESERVOIR

LOCATION PLAN

FIGURE 1

EXAMPLE


BP BISHOP TRUST ESTATE
TMK: 9-6-004:024
6' HIGH CHAIN LINK FENCE
12' BENCH
LIMITS OF GRADING
PROPERTY LINE (APPROXIMATE)
12' BENCH
106'
INTERSTATE H-2 FREEWAY EASEMENT
2.5 MG TANK
FF = 208.00
25' MIN.
2.0 MG TANK
FF = 208.00
INSTRUMENT HOUSE
12' PERIMETER ROAD
4.0 MG TANK
FF = 208.00
12" WIDE PROPOSED ACCESS ROADWAY
N
Scale: 1" = 60'
HONOLULU BOARD OF WATER SUPPLY
WAIAWA 228 RESERVOIR
SITE PLAN
FIGURE
2

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

RICK BLANGIARDI
MAYOR

HAKU MILLES, P.E.
ACTING DIRECTOR

BRYAN GALLAGHER, P.E.
ACTING DEPUTY DIRECTOR

October 3, 2022

SENT VIA EMAIL

Jason Nakata
Jason.n@tlcghawaii.com

Dear Mr. Nakata:

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, Oahu, Hawaii
Tax Map Key (1) 9-6-004:024 (por)

Thank you for the opportunity to review and comment. The Department of Design and Construction has no comments to offer at this time.

Should you have any questions, please contact me at (808) 768-8481.

Sincerely,

Bryan Gallagher
for Haku Milles, P.E.
Acting Director

HM:krn (888805)

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Haku Milles, P.E., LEED AP, Director
Department of Design and Construction
650 S. King Street, 11th Floor
Honolulu, HI 96813

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O‘ahu, Hawai‘i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Mr. Milles,

Thank you for your department’s letter dated October 3, 2022 regarding the subject project. We acknowledge that the City and County of Honolulu Department of Design and Construction has no comments at this time.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

1622 Kanakanui Street • Honolulu, Hawaii 96817
(808) 596-7790 • tlcghawaii.com

Jason Nakata

From: Jacinto-Kawabata, Marie <m.jacinto-kawaba@honolulu.gov>
Sent: Thursday, September 22, 2022 10:04 AM
To: Jason Nakata
Subject: Waiawa 228 Reservoir Environmental Assessment

Aloha Mr. Nakata,

Director Toiya has no comments for the Waiawa 228 Reservoir Environmental Assessment.

Mahalo,

Marie Jacinto-Kawabata
Clerk
City & County of Honolulu
Department of Emergency Management
808-723-8960

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Hirokazu Toiya, Director
Department of Emergency Management
650 S. King Street, Basement
Honolulu, HI 96813-3078

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Mr. Toiya,

Thank you for your department's e-mail dated September 22, 2022 regarding the subject project. We acknowledge that the City and County of Honolulu Department of Emergency Management has no comments at this time.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

1622 Kanakanui Street • Honolulu, Hawaii 96817
(808) 596-7790 • tlcghawaii.com

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

RICK BLANGIARDI
MAYOR

DAWN B. SZEWCZYK, P.E.
DIRECTOR AND CHIEF ENGINEER

WARREN K. MAMIZUKA
DEPUTY DIRECTOR

IN REPLY REFER TO:
DRM 22-304

September 27, 2022

The Limtiaco Consulting Group
Mr. Jason Nakata, Environmental Planner
1622 Kanakanui Street
Honolulu, Hawaii 96817

Dear Mr. Nakata:

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply 228 Reservoir Environmental Assessment, Waiawa
Tax Map Key: (1) 9-6-004:024 (por.)

Thank you for the opportunity to review and comment on the subject project.

We have no comments at this time, as we do not have any facilities or easements on the subject property.

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

Sincerely,

for Dawn B. Szewczyk, P.E.
Director and Chief Engineer

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Warren K. Mamizuka, Acting Director
Department of Facility Maintenance
1000 Uluohia Street, Suite 215
Kapolei, HI 96707

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Mr. Mamizuka,

Thank you for your department's letter dated September 27, 2022 regarding the subject project. We acknowledge that the City and County of Honolulu Department of Facility Maintenance has no comments at this time.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

1622 Kanakanui Street • Honolulu, Hawaii 96817
(808) 596-7790 • tlcghawaii.com

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

October 10, 2022

REF: RFD.5940.3

TO: Jason Nakata, Environmental Planner
The Limtiaco Consulting Group

FROM: M. Kaleo Manuel, Deputy Director
Commission on Water Resource Management

SUBJECT: Pre-Assessment Consultation for the Honolulu Board of Water Supply Waiawa 228 Reservoir Environmental Assessment

FILE NO.: RFD.5940.3
TMK NO.: (1) 9-6-004:024 (por.)

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at http://dlnr.hawaii.gov/cwrm.

Our comments related to water resources are checked off below.

[X] 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.

[ ] 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.

[ ] 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.

[ ] 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at http://www.usgbc.org/leed. A listing of fixtures certified by the EAP as having high water efficiency can be found at http://www.epa.gov/watersense.

[X] 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at http://planning.hawaii.gov/czm/initiatives/low-impact-development/

[X] 6. We recommend the use of alternative water sources, wherever practicable.

[ ] 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at http://energy.hawaii.gov/green-business-program.

[ ] 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at

http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf.

[X] 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

[ ] 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.

[ ] 11. The Hawaii Water Plan is directed toward the achievement of the utilization of reclaimed water for uses other than drinking and for potable water needs in one hundred per cent of State and County facilities by December 31, 2045 (§174C-31(g)(6), Hawaii Revised Statutes). We strongly recommend that this project consider using reclaimed water for its non-potable water needs, such as irrigation. Reclaimed water may include, but is not limited to, recycled wastewater, gray water, and captured rainwater/stormwater. Please contact the Hawai'i Department of Health, Wastewater Branch, for more information on their reuse guidelines and the availability of reclaimed water in the project area.

[ ] 12. A Well Construction Permit(s) is (are) are required before the commencement of any well construction work.

[ ] 13. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.

[ ] 14. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.

[ ] 15. Ground-water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.

[ ] 16. A Stream Channel Alteration Permit(s) is (are) required before any alteration can be made to the bed and/or banks of a steam channel.

[ ] 17. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is constructed or altered.

[ ] 18. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.

[ ] 19. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.

[ ] OTHER:

If you have any questions, please contact Katie Roth of the Commission staff at (808) 587-0218.

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

M. Kaleo Manuel, Deputy Director
Commission on Water Resource Management
Hawaii State Department of Land and Natural Resources
1151 Punchbowl Street, Room 227
Honolulu, HI 96813

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Mr. Manuel,

Thank you for your department's letter dated October 10, 2022 regarding the subject project. The comments provided by your department will be included in the Environmental Assessment and provide the following responses to your itemized comments:

1. The Honolulu Board of Water Supply (BWS) is currently in the process of developing its Primary Urban Center Watershed Master Plan, which will be part of the City's Water Use and Development Plan.
2. The project site will comply with all City and State requirements for stormwater management. Stormwater Best Management Practices will be used during construction to mitigate the potential for pollutant- or sediment-laden stormwater runoff from leaving the project site. The contractor will be required to comply with National Pollutant Discharge Elimination System (NPDES) permit requirements during construction. Once completed, stormwater will either be retained onsite or treated using appropriate storm water management techniques prior to discharge, as required by City rules.
3. Thank you for your recommendation for the use of alternative water sources, wherever practical. The purpose of the proposed project is for additional reservoir storage capacity. No additional source water is proposed.
4. The subject project will comply with all State Department of Health (DOH) rules relating to water quality.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

1622 Kanakanui Street • Honolulu, Hawaii 96817
(808) 596-7790 • tlcghawaii.com

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

October 19, 2022

LD 0289

Jason Nakata, Environmental Planner
Limtiaco Consulting Group
1622 Kanakanui Street
Honolulu, HI 96817

Via email: jason.n@tlcghawaii.com

Dear Sirs:

SUBJECT: **Pre-Assessment Consultation for the Honolulu Board of Water Supply**
Waiawa 228 Reservoir Project
Waiawa, Island of Oahu, Hawaii
TMK: (1) 9-6-004:024 (por.)

Thank you for the opportunity to review and comment on the subject project. The Land Division of the Department of Land and Natural Resources (DLNR) distributed copies of your request to DLNR's various divisions for their review and comment.

Enclosed are comments received from our (a) Engineering Division and (b) Division of Forestry and Wildlife. Should you have any questions, please feel free to contact Barbara Lee via email at *barbara.j.lee@hawaii.gov*. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Attachments
cc: Central Files

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

September 21, 2022

LD 0289

MEMORANDUM

FROM: ~~TO:~~

DLNR Agencies:
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
_X_ Engineering Division *(via email: DLNR.engr@hawaii.gov)*
_X_ Div. of Forestry & Wildlife *(via email: rubyrosa.t.terrago@hawaii.gov)*
__Div. of State Parks
_X_ Commission on Water Resource Management *(via email: DLNR.CWRM@hawaii.gov)*
__Office of Conservation & Coastal Lands
_X_ Land Division – Oahu District *(via email: barry.w.cheung@hawaii.gov)*

TO: ~~FROM:~~ Russell Y. Tsuji, Land Administrator *Russell Tsuji*

SUBJECT: **Pre-Assessment Consultation for the Honolulu Board of Water Supply Waiawa 228 Reservoir Project**

LOCATION: Waiawa, Island of Oahu, Hawaii
TMK: (1) 9-6-004:024 (por.)

APPLICANT: **Limtiaco Consulting Group on behalf of Honolulu Board of Water Supply**

Transmitted for your review and comment is information on the above-referenced project. Please review the attached information and submit any comments by the internal deadline of **October 12, 2022** to *barbara.j.lee@hawaii.gov* at the Land Division.

If no response is received by the above due date, we will assume your agency has no comments at this time. Should you have any questions about this request, please contact Barbara Lee at the above email address. Thank you.

BRIEF COMMENTS:

( ) We have no objections.
( ) We have no comments.
( ) We have no additional comments.
(✓) Comments are included/attached.

Signed: [signature]
Print Name: Carty S. Chang, Chief Engineer
Division: Engineering Division
Date: Oct 10, 2022

Attachments
Cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji

Ref: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Project
Location: Waiawa, Island of Oahu,
TMK(s): (1) 9-6-004:024 (por.)
Applicant: Limtiaco Consulting Group on behalf of Honolulu Board of Water Supply

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a Special Flood Hazard Area (high-risk areas). Be advised that 44CFR, Chapter 1, Subchapter B, Part 60 reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood zones subject to NFIP requirements are identified on FEMA's Flood Insurance Rate Maps (FIRM). The official FIRMs can be accessed through FEMA's Map Service Center (msc.fema.gov). Our Flood Hazard Assessment Tool (FHAT) (http://gis.hawaiinfip.org/FHAT) could also be used to research flood hazard information.

If there are questions regarding the local flood ordinances, please contact the applicable County NFIP coordinating agency below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7139.
- Kauai: County of Kauai, Department of Public Works (808) 241-4849.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: Oct 10, 2022

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

September 21, 2022

LD 0289

MEMORANDUM

TO: **DLNR Agencies:**
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
_X_ Engineering Division *(via email: DLNR.engr@hawaii.gov)*
_X_ Div. of Forestry & Wildlife *(via email: rubyrosa.t.terrago@hawaii.gov)*
__Div. of State Parks
_X_ Commission on Water Resource Management *(via email: DLNR.CWRM@hawaii.gov)*
__Office of Conservation & Coastal Lands
_X_ Land Division – Oahu District *(via email: barry.w.cheung@hawaii.gov)*

FROM: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: **Pre-Assessment Consultation for the Honolulu Board of Water Supply Waiawa 228 Reservoir Project**
LOCATION: Waiawa, Island of Oahu, Hawaii
TMK: (1) 9-6-004:024 (por.)
APPLICANT: **Limtiaco Consulting Group on behalf of Honolulu Board of Water Supply**

Transmitted for your review and comment is information on the above-referenced project. Please review the attached information and submit any comments by the internal deadline of **October 12, 2022** to *barbara.j.lee@hawaii.gov* at the Land Division.

If no response is received by the above due date, we will assume your agency has no comments at this time. Should you have any questions about this request, please contact Barbara Lee at the above email address. Thank you.

BRIEF COMMENTS:

( ) We have no objections.
( ) We have no comments.
( ) We have no additional comments.
(☑) Comments are included/attached.

Signed: *Lainie Berry*
Print Name: Lainie Berry, Wildlife Pgrm Mgr
Division: Forestry and Wildlife
Date: Sep 30, 2022

Attachments
Cc: Central Files

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET, ROOM 325
HONOLULU, HAWAII 96813

September 30, 2022

MEMORANDUM **Log No. 3819**

TO: RUSSELL Y. TSUJI, Land Administrator
Land Division

FROM: LAINIE BERRY, Wildlife Program Manager
Division of Forestry and Wildlife

SUBJECT: **Division of Forestry and Wildlife Comments for the Pre-Assessment Consultation for the Honolulu Board of Water Supply (BWS) Waiawa 228 Reservoir Project on O'ahu**

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) has received your pre-assessment consultation request for the Honolulu BWS Waiawa 228 Reservoir project in Waiawa, on the island of O'ahu, TMK: (1) 9-6-004:024 (por.). The proposed project consists of developing a new 8.5-million-gallon reservoir facility on approximately 3.7 acres of former agricultural land that will be mass graded to accommodate the new reservoir facility, constructing an access road, and installing a 30-inch water main to connect the reservoir to the existing Honolulu 190' distribution system.

The State listed Hawaiian Hoary Bat or 'Ōpe'ape'a (*Lasiurus cinereus semotus*) could potentially occur at or in the vicinity of the project and may roost in nearby trees. Any required site clearing should be timed to avoid disturbance to bats during their birthing and pup rearing season (June 1 through September 15). During this period woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed. Barbed wire should also be avoided for any construction because bats can become ensnared and killed by such fencing material during flight.

Artificial lighting can adversely impact seabirds that may pass through the area at night by causing them to become disoriented. This disorientation can result in their collision with manmade structures or the grounding of birds. For nighttime work that might be required, DOFAW recommends that all lights used to be fully shielded to minimize the attraction of seabirds. Nighttime work that requires outdoor lighting should be avoided during the seabird fledging season, from September 15 through December 15. This is the period when young seabirds take their maiden voyage to the open sea. Permanent lighting also poses a risk of seabird attraction, and as such should be minimized or eliminated to protect seabird flyways and preserve the night sky. For illustrations and guidance related to seabird-friendly light styles that also protect seabirds and

the dark starry skies of Hawai'i please visit https://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf.

The State endangered Hawaiian Short-eared owl or pueo (*Asio flammeus sandwichensis*) could potentially occur in the project vicinity. Pueo are most active during dawn and dusk twilights. Before clearing any vegetation, DOFAW recommends twilight pre-construction surveys by a qualified biologist. If pueo nests are present, DOFAW staff should be notified and a buffer zone should be established in which no clearing occurs until nesting is completed.

DOFAW recommends minimizing the movement of plant or soil material between worksites. Soil and plant material may contain pathogens, pests such as Little Fire ants and/or Coconut Rhinoceros beetles, or invasive plant parts that could harm our native species and ecosystems. We recommend consulting the O'ahu Invasive Species Committee (OISC) at (808) 266-7994 to help plan, design, and construct the project, learn of any high-risk invasive species in the area, and ways to mitigate their spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive species.

DOFAW recommends using native plant species for landscaping that are appropriate for the area (i.e., climate conditions are suitable for the plants to thrive, historically occurred there, etc.). Please do not plant invasive species. DOFAW also recommends consulting the Hawai'i-Pacific Weed Risk Assessment website to determine the potential invasiveness of plants proposed for use in the project (https://sites.google.com/site/weedriskassessment/home). Please refer to www.plantpono.org for guidance on the selection and evaluation of landscaping plants.

Due to the arid climate and risks of wildfire to listed species, we recommend coordinating with the Hawai'i Wildfire Management Organization at (808) 850-900 or admin@hawaiiwildfire.org, on how wildfire prevention can be addressed in the project area.

We appreciate your efforts to work with our office for the conservation of our native species. These comments are general guidelines and should not be considered comprehensive for this site or project. It is the responsibility of the applicant to do their own due diligence to avoid any negative environmental impacts. Should the scope of the project change significantly, or should it become apparent that threatened or endangered species may be impacted, please contact our staff as soon as possible. If you have any questions, please contact Paul Radley, Protected Species Habitat Conservation Planning Coordinator at (808) 295-1123 or paul.m.radley@hawaii.gov.

Sincerely,

Lainie Berry

LAINIE BERRY
Wildlife Program Manager

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Russell Tsuji, Administrator
Land Division
Hawaii State Department of Land and Natural Resources
1151 Punchbowl Street, Room 220
Honolulu, HI 96813

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Mr. Tsuji,

Thank you for your department's letter dated October 19, 2022 regarding the subject project. The comments provided by your department will be included in the Environmental Assessment and provide the following responses to your itemized comments:

Engineering Division
We acknowledge that the rules and regulations of the National Flood Insurance Program, Title 44 of the Code of Federal Regulations, are in effect when the development falls within the Special Flood Hazard Area. The project site does not fall within a Special Flood Hazard Area. The project site is located in Zone D, with areas immediately adjacent and downgradient of the site designated as Zone X.

Division of Forestry and Wildlife
We acknowledge that the State listed Hawaiian Hoary Bat could potentially occur at or in the vicinity of the project and may roost in nearby trees. The EA will include your recommendation that site clearing and the disturbance, removal, or trimming of woody plants greater than 15 feet should be avoided during the bat birthing and pup rearing season (June 1 through September 15). The EA will also include your recommendation that barbed wire should be avoided because bats can become ensnared and killed by such fencing material during flight.

We acknowledge that artificial lighting can adversely impact seabirds at night by causing them to become disoriented. No night work is anticipated for the proposed project. However, the EA will include your recommendation that night work should be avoided during the seabird fledging season, from September 15 through December 15. The EA will include your recommendation that fully shielded lighting should be used for any permanent light fixtures.

We acknowledge that the endangered Hawaiian short-eared owl or pueo could potentially occur in the project vicinity. The EA will include your recommendation that

twilight pre-construction surveys should be performed by a qualified biologist prior to vegetation clearing activities and that DOFAW staff should be notified and a buffer zone established if any nesting sights are discovered.

Thank you for your recommendations for consulting the Oahu Invasive Species Committee, Hawaii-Pacific Weed Risk Assessment website, and Hawaii Wildfire Management Organization for their resources regarding mitigating the spread of endangered species, the use of native and non-invasive plant species for landscaping, and mitigating risks of wildfires, respectively. Appropriate materials will be incorporated into the Environmental Assessment.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

DAVID Y. IGE
GOVERNOR OF HAWAII

ELIZABETH A. CHAR, 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:

September 20, 2022

Mr. Jason Nakata, Environmental Planner
The Limtiaco Consulting Group
1622 Kanakanui Street
Honolulu, HI 96817
email: jason.n@tlcghawaii.com

Dear Mr. Nagata:

Thank you for your submittal requesting comments to the Pre-assessment Consultation for the Honolulu Board of Water Supply Waiawa 228 Reservoir Environmental Assessment in Waiawa, Oahu, Hawaii, Tax Map Key (1) 9-6-004:024 (por.).

Project activities shall comply with the following Administrative Rules of the Department of Health:

- Chapter 11-46 Community Noise Control
- Chapter 11-501 Asbestos Requirements
- Chapter 11-504 Asbestos Abatement Certification Program

Information pertaining to other health and environmental issues may be addressed by other programs within our department.

Should you have any questions, please contact me at (808) 586-4700.

Sincerely,

Thomas G. Lileikis
Program Manager
Indoor and Radiological Health Branch

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Indoor and Radiological Health Branch
Hawaii State Department of Health
99-945 Halawa Valley Street
Aiea, HI 96701

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

To Whom it May Concern,

Thank you for your department's letter dated September 20, 2022 regarding the subject project. The project will be required to comply with State regulations on Community Noise Control (HAR 11-46), Asbestos Requirements (HAR 11-501) and Asbestos Abatement Certification Program, if applicable. No asbestos containing materials are anticipated at the project site.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

1622 Kanakanui Street • Honolulu, Hawaii 96817
(808) 596-7790 • tlcghawaii.com

Jason Nakata

From: shwb <shwb@doh.hawaii.gov>
Sent: Thursday, October 6, 2022 1:54 PM
To: Jason Nakata
Subject: Limitiaco Conulting, Waiawa 228
Attachments: Limitiaco Consulting Group, Waiawa 228.PDF; STANDARD COMMENTS.pdf

Aloha Jason Nakata,

Attached is our comments for Waiawa 228 Reservoir.

Solid and Hazardous Waste Branch
State of Hawaii | Department of Health
2827 Waimano Home Road, #100, Pearl City, HI 96782
Phone Number: (808) 586-4226 | Fax Number: (808) 586-7509

Solid and Hazardous Waste Branch Standard Comments

November 26, 2018

The Solid and Hazardous Waste Branch administers programs in the areas of:

1) Management of hazardous waste;
2) Management of solid waste; and
3) Regulation of underground storage tanks.

Our general comments on projects are below. For further information about these programs, please contact the Solid and Hazardous Waste Branch at (808) 586-4226. All chapters of the Hawaii Revised Statutes (HRS) are at https://www.capitol.hawaii .gov/hrscurrent/.

Hazardous Waste Program

- The state regulations for hazardous waste and used oil are in chapters 11-260.1 to 11-279.1, Hawaii Administrative Rules (HAR) [http://health.hawaii.go v/shwb/hwrules/]. These rules apply to the identification, handling, transportation, storage and disposal of regulated hazardous waste and used oil. Generators, transporters and treatment, storage, and disposal facilities of hazardous waste and used oil must adhere to these requirements. Violations are subject to penalties under chapter 342J, HRS.

Solid Waste Section

- The Solid Waste Section (SWS) enforces laws and regulations contained in chapters 342H and 3421, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii .gov/shwb/solid-waste/].

- The purpose of the rules is to establish minimum standards governing the design, construction, installation, operation, and maintenance of solid waste disposal, recycling, reclamation and transfer systems.

- All facilities that accept solid wastes are required to obtain a solid waste management permit from the SWS. Examples of the types of facilities governed by these regulations include landfills, transfer stations and convenience centers, recycling facilities, composting facilities, and salvage facilities. Medical waste, infectious waste, and foreign waste treatment facilities are also included.

- Generators of solid waste are required to ensure that their wastes are properly delivered to permitted solid waste management facilities. Managers of construction and demolition projects should require their waste contractors to submit disposal receipts and invoices to ensure proper disposal of wastes.

- Chapter 342G, HRS, encourages the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste. The project developer is highly encouraged to develop a demolition and construction solid waste management plan to ensure proper handling of wastes and divert recyclables from being landfilled. Ideally, the plan would seek to maximize waste diversion and minimize disposal.

  Furthermore, building plans should include designated areas to promote the collection of reusable and recyclable materials.

- Chapters 342H and 3421, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" requires the proper management of solid wastes. Generators of solid waste are required to ensure that their wastes are properly delivered to permitted solid waste management facilities. Project managers should require their waste contractors to submit disposal (and recycling) receipts and invoices to ensure proper disposal (or recycling) of wastes.

Office of Solid Waste Management

- The Office of Solid Waste Management (OSWM) administers statewide integrated solid waste management planning activities, which apply to the counties, as well as various recycling programs, e.g. the Glass Advance Disposal Fee (ADF) and Deposit Beverage Container (DBC) Programs. Management of the DBC Program is conducted pursuant to chapter 342G, HRS, which contains compliance and enforcement provisions, and Chapter 11-282, HAR, "Deposit Beverage Recycling" [http://health.hawaii.gov/hi5/rules-regulations- additional- links/]. OSWM is also responsible for limited enforcement and compliance of solid waste management facilities that operate primarily as certified DBC redemption centers pursuant to chapter 342H, HRS, and chapter 11-58.1, HAR, "Solid Waste Management Control" [http://health.hawaii.gov/shwb/solid-waste/]. Authority for the integrated solid waste management planning and ADF programs is contained in chapter 342G, HRS.

- Glass Advance Disposal Fee Program: Businesses that import glass containers into Hawaii are required to register with the Department of Health and pay a 1.5 cent per container fee. Fee revenue is distributed to the counties for the operation of glass recycling programs.

- Deposit Beverage Container Program: Business that manufacture or import deposit beverage containers into Hawaii are required to register with the Department of Health and pay the five-cent deposit and one cent container fee on each deposit container. Deposits and fees are deposited into a special fund and are used to reimburse DBC redemption center refunds paid to consumers; and to pay handling fees to redemption/recycling companies to process and recycle collected deposit beverage containers; and to pay program administrative costs.

- The Department of Health reimburses and pays an associated handling fee for the redemption of deposit beverage containers (DBC). These transactions are conducted only with certified redemption centers. Certification requires obtaining a solid waste management permit from

the SWS (which addresses environmental issues) and a certification from the DBC program (which standardizes the redemption process).

- Chapter 342G, HRS, encourages the reduction of waste generation, reuse of discarded materials, and the recycling of solid waste. Businesses, property managers and developers, and government entities are highly encouraged to develop solid waste management plans to ensure proper handling of wastes and divert recyclables from being landfilled. The project developer is highly encouraged to develop a solid waste management plan to ensure proper handling of wastes and divert recyclables from being landfilled. Ideally, the plan would seek to

  maximize waste diversion and minimize disposal. Such plans should include designated areas to promote the collection of reusable and recyclable materials.

- Solid waste management plans seek to maximize waste diversion and minimize disposal. Such plans should include designated areas to promote the collection of reusable and recyclable materials.

Underground Storage Tank Program

- The state's underground storage tank (UST) regulations, found in chapter 11-280.1, HAR [http://health.hawaii.gov/shwb/underg round-storage-tanks/], include specific requirements that UST owners and operators must meet when installing, operating, and permanently closing their UST systems and addressing releases from USTs. Violations are subject to penalties under chapter 11-280.1, HAR, and chapter 342L, HRS.

- A permit is required prior to the installation and operation of a UST. Any new UST system that will be installed must have secondary containment with interstitial monitoring. Refer to subchapters 2, 3, 4, and 12 of chapter 11-280.1, HAR. The installation permit expires 1 year from the date of issuance. The operation permit expires 5 years from the date of issuance.

- §11-280.1-50, HAR, requires owners and operators of USTs or tank systems to notify DOH within twenty-four (24) hours and follow the procedures in§ 11-280.1-52, HAR, if any of the following occur, with specific exceptions found in the rules:
  1) The discovery by any person of evidence of regulated substances which may have been released at the UST site or in the surrounding area (such as the presence of free product or vapors in soils, basements, sewer and utility lines, or nearby surface water);
  2) Unusual UST system operating conditions observed or experienced (such as the erratic behavior of product dispensing equipment, the sudden loss of product from the UST, or an unexplained presence of water in the tank); or
  3) Monitoring results from a release detection method required under §§11-280.1-41 or 11-280 .1-42 indicate a release may have occurred.

- For release response actions, responsible parties and their consultants and contractors should follow the applicable guidance in the Department of Health Hazard Evaluation Emergency (HEER) Office Technical Guidance Manual, HEER Environmental Action Level (EAL) guidance, and other guidance documents on the DOH HEER Office website [http://eha-web.doh.hawaii.gov /eha-cma/Org/HEER/], including those pertaining to Multi-Increment Sampling of soil, low flow groundwater sampling, soil vapor sampling, and Environmental Hazard Evaluations (EHE)/Environmental Hazard Management Plans (EHMP).

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Lene Ichinotsubo, Chief
Solid and Hazardous Waste Branch
Hawaii State Department of Health
2827 Waimano Home Road #100
Pearl City, HI 96782

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O‘ahu, Hawai‘i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Ms. Ichinotsubo,

Thank you for your department’s email dated October 6, 2022 regarding the subject project. We acknowledge that the Solid and Hazard Waste Branch administers the areas of hazardous waste management (HAR 11-260.1 to 279.1), solid waste management (HAR 11-58.1), and underground storage tank regulations (HAR 11-280.1). The EA will address relevant rules as they apply to the proposed project.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

1622 Kanakanui Street • Honolulu, Hawaii 96817
(808) 596-7790 • tlcghawaii.com

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

RICK BLANGIARDI
MAYOR

DAWN TAKEUCHI APUNA
ACTING DIRECTOR

October 14, 2022

2022/ELOG-1973(jl)
2247044

Mr. Jason Nakata
Environmental Planner
The Limtiaco Consulting Group
1622 Kanakanui Street
Honolulu, Hawaii 96817

Dear Mr. Nakata:

SUBJECT: Preparation of an Environmental Assessment (EA) for Waiawa 228 Reservoir (Project)

This is in response to your letter dated, September 15, 2022, regarding the request for comments in preparation of an EA for the Project.

Based on the information provided in the Pre-Assessment Consultation, the Department of Planning and Permitting provides the following comments:

1. The Draft EA should discuss how the Project is consistent with the General Plan.

2. The Draft EA should discuss how the Project is consistent with the objectives and policies of the revised Central Oahu Sustainable Communities Plan.

3. The Draft EA should identify the Project site's State land use district classification, and discuss compliance with Hawaii Revised Statues, Chapter 205.

4. Although not subject to the unilateral agreements of Ordinances 98-01 and 98-69, the Project should comply with the Archaeological Preservation Plan approved by the State Historic Preservation Division in 2015.

5. The Board of Water Supply should submit a formal request for determination on whether a Public Infrastructure Map Amendment will be required for the Project.

6. Pursuant to the Revised Ordinances of Honolulu, Chapter 21, Land Use Ordinance (LUO), the proposed reservoir is considered a public use and structure, which is an allowable use within the AG-1 Restricted Agricultural District.

7. The Draft EA should evaluate the Project's consistency with the LUO. To ensure continued compliance with LUO Table 21-3.1 Agricultural District Development Standards, the Draft EA should include an analysis of the total proposed building area within the reservoir site versus building area over the whole of TMK 9-6-004: 024. Refer to Conditional Use Permit (CUP) No. 2020/CUP-2 for additional information on previously-permitted development on the zoning lot.

8. The Draft EA should include an analysis of impacts to archaeological and cultural resources, biological resources, transportation and/or access, visual resources, and water quality and hydrology (drainage); and should specify any regulatory compliance, standard mitigation measures, or site-specific mitigation measures proposed to reduce potential impacts to less than significant.

Should you have any questions, please contact Jeffrey Lee, of our staff, at (808) 768-8202.

Very truly yours,

Dawn Takeuchi Apuna
Acting Director

DTA:tc

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Dawn Takeuchi Apuna, Director
Department of Planning and Permitting
650 S. King Street
Honolulu, HI 96813

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Ms. Takeuchi Apuna,

Thank you for your department's letter dated October 14, 2022 regarding the subject project. The comments provided by your department will be included in the Environmental Assessment and provide the following responses to your itemized comments:

1. The Environmental Assessment will discuss consistency with the General Plan of the City and County of Honolulu.
2. The Environmental Assessment will discuss consistency with the Central Oahu Sustainable Communities Plan.
3. The Environmental Assessment will discuss the State land use designation of the project site and the consistency and compliance with the proposed use as it pertains to Hawaii Revised Statutes, Chapter 205.
4. Considerations of the Archaeological Preservation Plan approved by the State Historic Preservation Division (SHPD) in 2015 pursuant to Ordinances 98-01 and 8-69 will be addressed in the Environmental Assessment. The proposed project will be subject to SHPD review pursuant to HRS 6E-8 and will comply with any monitoring and/or preservation commitments brought about through that process.
5. The proposed project establishes a new water reservoir facility, which must be shown on Public Infrastructure Maps pursuant to Revised Ordinances of Honolulu §4-8.3 and -8.4. The BWS will apply for a Public Infrastructure Map revisions for the proposed project.
6. We acknowledge that the proposed reservoir facility is considered a public use and structure, which is an allowable use within the AG-1 Restricted Agricultural District.
7. We Environmental Assessment will evaluate the project's consistency with the LUO. We acknowledge that the EA should include an analysis of total building area for the project parcel, and will refer to information from previously issued Conditional Use Permit 2020/CUP-2.

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8. The Environmental Assessment will include analysis of archaeological and cultural resources, biological resources, transportation and access, visual resources, and water quality and hydrology. Regulatory requirements and mitigation measures will be discussed.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

DAVID Y. IGE
GOVERNOR

JADE T. BUTAY
DIRECTOR

Deputy Directors
ROSS M. HIGASHI
EDUARDO P. MANGLALLAN
DAVID J. RODRIGUEZ
EDWIN H. SNIFFEN

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

IN REPLY REFER TO:

HWY-2972
HWY-PS 2.9756

September 27, 2022

VIA EMAIL: jason.n@tlcghawaii.com

Mr. Jason Nakata
Environmental Planner
The Limtiaco Consulting Group
1622 Kanakanui Street
Honolulu, Hawaii 96817

Dear Mr. Nakata:

Subject: Pre-Assessment Consultation
Honolulu Board of Water Supply Waiawa 228 Reservoir
Waiawa, Oahu, Hawaii
Tax Map Key: (1) 9-6-004:024 (portion)

Thank you for your letter dated September 15, 2022, requesting the Hawaii Department of Transportation's comments on the subject document.

Based on the information provided, the project does not appear to have direct or indirect impacts on state highways, specifically Interstate H-2 which is located adjacent to the project site. The Environmental Assessment should confirm the following:

1. No stormwater flow from the site would be conveyed to the Interstate H-2 right-of-way.
2. No new access to state highways is proposed.
3. No work is proposed in state highways.

If you have any questions, please contact Jeyan Thirugnanam, Systems Planning Engineer, Highways Division, Planning Branch at (808) 587-6336 or by email at jeyan.thirugnanam@hawaii.gov. Please reference file review number PS 2022-163.

Sincerely,

SERGIO GEORGE G. ABCEDE
Highways Administrator

Date: 9/19/2022

State of Hawaii
DEPARTMENT OF TRANSPORTATION

Log No: HWY-2972

Suspense: 10/14/2022

FROM: HWY ADMINISTRATOR

TO:

- ☐ DIR
- ☐ DEP-S
- ☐ DEP-A
- ☐ DEP-H
- ☐ DEP-HWY
- ☐ DIR-CZ
- ☐ DIR-P
- ☐ OCR
- ☐ PER
- ☐ PMN
- ☐ PPB
- ☐ STP
- ☐ _____
- ☒ HWY
- ☐ HAR
- ☐ AIR
- ☐ BUS
- ☐ BUS-F
- ☐ BUS-O
- ☐ CON
- ☐ CSS
- ☐ LEG

FOR:

- ☒ Appropriate Attention & Action
- ☐ Okay for DIR to Sign?
- ☐ Investigate & Report Back
- ☒ Comments & Recommendations
- ☐ Draft Reply
- ☐ Direct Action/Reply
- ☐ Information
- ☐ See Me
- ☐ Signature
- ☐ Submit Copy of Response
- ☐ File
- ☐ Return
- ☐ Phone Call _____
- ☐ Follow-up Interim Reply

Subject: PRE-ASSESSMENT CONSULTATION FOR THE HONOLULU BOARD OF WATER SUPPLY WAIAWA 228 RESERVOIR ENVIRONMENTAL ASSESSMENT WAIAWA, OAHU, HAWAII TAX MAP KEY (1) 9-6-004:024 (por.)

HWY-P

DO NOT REMOVE FROM CORRESONDENCE

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

George Abcede, Highways Administrator
Highways Division
Hawaii State Department of Transportation
869 Punchbowl Street, Room 513
Honolulu, HI 96813

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Mr. Abcede,

Thank you for your department's letter dated September 27, 2022 regarding the subject project. The comments provided by your department will be included in the Environmental Assessment and provide the following responses to your itemized comments:

1. The Environmental Assessment will address drainage from the project site, including stormwater and reservoir drainage. Reservoir drainage may be discharged offsite following existing overland drainage patterns, which flow through culverts under the Interstate H-2 Freeway. If this is required, BWS will coordinate with HDOT during the design phase of the project.
2. The Environmental Assessment will address access to the project site. No new access to State highways is proposed.
3. The Environmental Assessment will address areas of proposed work. No work is proposed in State highways.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

1622 Kanakanui Street • Honolulu, Hawaii 96817
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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

RICK BLANGIARDI
MAYOR

SHELDON K. HAO
FIRE CHIEF

JASON SAMALA
DEPUTY FIRE CHIEF

October 4, 2022

Mr. Jason Nakata
Environmental Planner
The Limtiaco Consulting Group, Inc.
1622 Kanakanui Street
Honolulu, Hawaii 96817

Dear Mr. Nakata:

Subject: Preassessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
96-1110 Waihona Street
Waiawa, Oahu, Hawaii
Tax Map Key: 9-6-004: 024 (Portion)

In response to your letter received on September 19, 2022, regarding the abovementioned subject, the Honolulu Fire Department (HFD) reviewed the submitted information and 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 (46 meters) 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; 2018 Edition, Sections 18.2.3.2.2 and 18.2.3.2.2.1, as amended.)

   A fire department access road shall extend to within 50 feet (15 meters) of at least one exterior door that can be opened from the outside and that provides access to the interior of the building. (NFPA 1; 2018 Edition, Section 18.2.3.2.1.)

2. An approved water supply capable of supplying the required fire flow for fire protection shall be provided to all premises upon which facilities, buildings, or portions of buildings are hereafter constructed or

moved into the jurisdiction. The approved water supply shall be in accordance with NFPA 1; 2018 Edition, Sections 18.3 and 18.4.

3. The fire department access roads shall be in accordance with NFPA 1; 2018 Edition, Section 18.2.3.

4. Submit civil drawings to the City and County of Honolulu's Department of Planning and Permitting and route them to the HFD for review and approval.

Should you have questions, please contact Acting Battalion Chief Kendall Ching of our Fire Prevention Bureau at 808-723-7154 or kching3@honolulu.gov.

Sincerely,

CRAIG UCHIMURA
Acting Assistant Chief

CU/MD:bh

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Sheldon K. Hao, Fire Chief
Honolulu Fire Department
636 South Street
Honolulu, HI 96813

Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Chief Hao,

Thank you for your department's letter dated October 4, 2022 regarding the subject project. The NFIP requirements you provided regarding fire department access, water supply for fire protection, and proximity of buildings to access roads will be included in the Environmental Assessment and incorporated into the design of the proposed facility. The BWS will submit civil drawings to the City and County of Honolulu Department of Planning and Permitting and route them to the Honolulu Fire Department for review and approval prior to construction.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.

Jason Nakata
Environmental Planner

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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

RICK BLANGIARDI
MAYOR

ARTHUR J. LOGAN
CHIEF

KEITH K. HORIKAWA
RADE K. VANIC
DEPUTY CHIEFS

OUR REFERENCE EO-DNK

September 22, 2022

SENT VIA E-MAIL

Mr. Jason Nakata
jason.n@tlcghawaii.com

Dear Mr. Nakata:

This is in response to your letter of September 15, 2022, requesting input on the Pre-Assessment Consultation for the proposed new Board of Water Supply Waiawa 228 Reservoir facility in Waiawa.

The Honolulu Police Department has reviewed the information provided and does not have any comments at this time.

If there are any questions, please call Major Robert Towne of District 3 (Pearl City) at (808) 723-8803.

Thank you for the opportunity to review this project.

Sincerely,

Glenn Hayashi

GLENN HAYASHI
Assistant Chief of Police
Support Services Bureau

THE LIMTIACO CONSULTING GROUP
CIVIL ENGINEERING AND ENVIRONMENTAL CONSULTANTS

May 11, 2023

Arthur "Joe" Logan, Chief of Police
Honolulu Police Department
801 S. Beretania Street
Honolulu, HI 96813

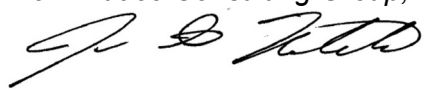
Subject: Pre-Assessment Consultation for the Honolulu Board of Water Supply
Waiawa 228 Reservoir Environmental Assessment
Waiawa, O'ahu, Hawai'i
Tax Map Key (1) 9-6-004:024 (por.)

Dear Chief Logan,

Thank you for your department's letter dated September 22, 2022 regarding the subject project. We acknowledge that the Honolulu Police Department has no comments at this time.

Thank you for your interest and participation in the environmental review process.

Best regards,
The Limtiaco Consulting Group, Inc.



Jason Nakata
Environmental Planner

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(808) 596-7790 • tlcghawaii.com