DAVID Y. IGE
Governor

JOSH GREEN
Lt. Governor

PHYLLIS SHIMABUKURO-GEISER
Chairperson, Board of Agriculture

MORRIS M. ATTA
Deputy to the Chairperson

State of Hawaii
DEPARTMENT OF AGRICULTURE
1428 South King Street
Honolulu, Hawaii 96814-2512
Phone: (808) 973-9600 FAX: (808) 973-9613

April 28, 2022

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

Dear Ms. Evans:

SUBJECT: Draft Environmental Assessment and Anticipated Finding of No Significant Impact
Spillover Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir; Waimānalo, O'ahu

With this letter, the State of Hawai'i, Department of Agriculture hereby transmits the Draft Environmental Assessment and anticipates a Finding of No Significant Impact (AFONSI) for the proposed Spillover Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir situated on Tax Map Key 4-1-024: 068, on the island of O'ahu, for publication in the next available edition of *The Environmental Notice*.

In addition to this letter, the Environmental Review Program Publication Form and the Draft Environmental Assessment AFONSI have been submitted through the ERP website. Should you have any questions, please contact Kirk Saiki, Engineering Program Manager at (808) 973-9468 or by e-mail at Kirk.I.Saiki@hawaii.gov.

Sincerely,

Phyllis Shimabukuro-Geiser

Phyllis Shimabukuro-Geiser, Chairperson
Board of Agriculture

Island Fresh

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Monday, May 2, 2022 10:27:44 AM

Action Name

Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir

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

Koʻolaupoko, Oʻahu

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

(1) 4-1-024:068

Action type

Agency

Other required permits and approvals

See page 14 of the Draft EA

Proposing/determining agency

State Department of Agriculture

Agency contact name

Glenn Okamoto

Agency contact email (for info about the action)

glenn.m.okamoto@hawaii.gov

Email address or URL for receiving comments

gabrielle@townscapeinc.com

Agency contact phone

(808) 973-9436

Agency address

1428 South King Street
Honolulu, Hawaii 96814
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

Townscape, Inc.

Consultant contact name

Gabrielle Sham

Consultant contact email

gabrielle@townscapeinc.com

Consultant contact phone

(808) 536-6999

Consultant address

900 Fort Street Mall
Suite 1160
Honolulu, Hawaii 96813
United States
Map It

Action summary

The State of Hawaii Department of Agriculture is seeking to rehabilitate a spillway and clear vegetation within the decommissioned Tai Lee reservoir in Waimānalo on the island of Oʻahu. The former irrigation reservoir is located on a 3.04 acre parcel, Tax Map Key 4-1-024: 068. Proposed improvements are needed to address existing ponding issues that occur on the property during heavy rain events and to address issues with debris clogging the culvert crossing Mokulama Street. As a result of the clogged culvert, stormwaters have overtopped the roadway. The Proposed Action consists of: clearing vegetation on approximately 91,069 square feet and re-vegetating the cleared area with grass; install two rows of staggered bollards to capture debris; and grading approximately 37,436 feet of the property.

Reasons supporting determination

FONSI. See page 32 of the Draft EA.

Attached documents (signed agency letter & EA/EIS)

- Tai-Lee-Reservoir_DEA_2022-05-02_for-submittal.pdf
- Tai-Lee-Reservoir_DEA_Agency-Signed-Letter.pdf

Action location map

- Tai_Lee_TMK.zip

Authorized individual

Gabrielle Sham

Authorization

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

Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir

Draft Environmental Assessment

May 2022

Proposing Agency:

Department of Agriculture
STATE OF HAWAII

Prepared By:

TOWNSCAPE, INC.
Environmental & Community Planning

At the request of:

Okahara and Associates, Inc.
ENGINEERS AND LANDSCAPE ARCHITECTS

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Project Information Summary

Project Name	Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Proposing and Determining Agency	Department of Agriculture State of Hawai‘i 1428 S. King Street Honolulu, HI 96814
Agent	Townscape, Inc. 900 Fort Street Mall, Suite 1160 Honolulu, HI 96813 Phone: (808) 550-3894 E-mail: gabrielle@townscapeinc.com
HRS, Chapter 343 Trigger	Use of State lands and funds
Project Location	41-645 Mokulama Street Waimānalo, HI 96795
Tax Map Key (TMK) and Recorded Fee Owner	4-1-024: 068 State of Hawai‘i
Parcel Size	Approximately 3.04 acres
State Land Use District	Agricultural
Development Plan	Ko‘olau Poko Sustainable Communities Plan
Special Management Area (SMA)	Not inside the SMA
Flood Zone	Zone AE (area within the 100-year floodplain, Base Flood Elevation determined) Zone AEF (floodway areas in the 100-year floodplain) Zone X (area outside floodplain)
Anticipated Determination	Finding of No Significant Impact (FONSI)

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Table of Contents

Table of Figures

Appendices

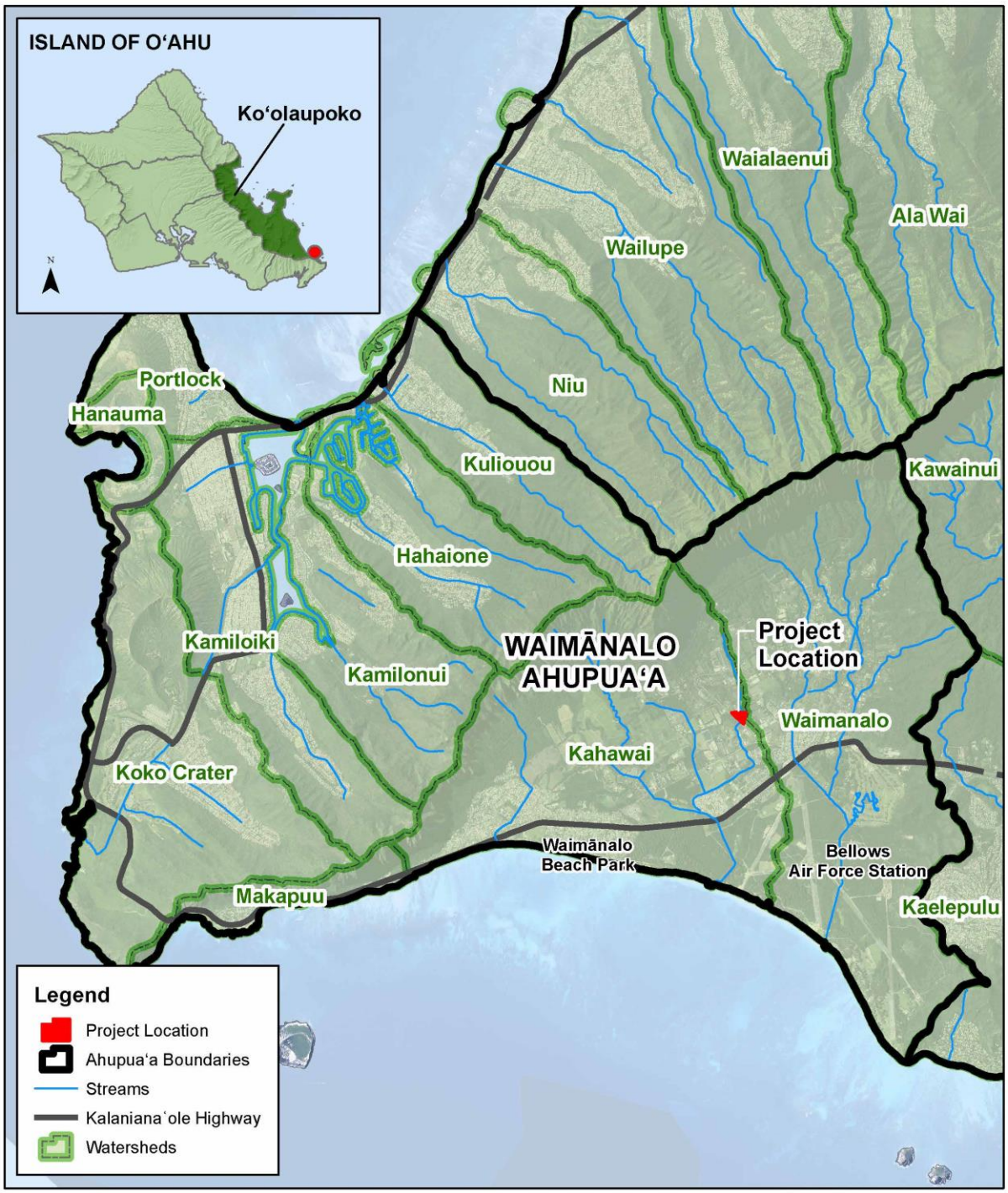


Figure 1. Regional Map

Introduction

The State of Hawaii Department of Agriculture (Proposing Agency) is seeking to rehabilitate a spillway and clear vegetation within the decommissioned Tai Lee reservoir in Waimānalo on the island of Oʻahu. The former irrigation reservoir is located on a 3.04 acre parcel, Tax Map Key 4-1-024: 068. Proposed improvements are needed to address existing ponding issues that occur on the property during heavy rain events and to address issues with debris clogging the culvert crossing Mokulama Street. As a result of the clogged culvert, stormwaters have overtopped the roadway.

Purpose of the Environmental Assessment

This Environmental Assessment (EA) is prepared in accordance with Chapter 343 Hawaiʻi Revised Statutes (HRS), as amended, and Title 11, Chapter 200.1, Hawaiʻi Administrative Rules (HAR), Environmental Impact Statement Rules. An EA is required due to the use of State lands and funds for the project.

This EA evaluates the sum of effects of the proposed action on the quality of the environment, and describes the affected environment, potential impacts and mitigation measures. The intent of the EA is to provide sufficient analysis for determining whether the Proposed Action requires preparation of an environmental impact statement or a Finding of No Significant Impact (FONSI) pursuant to Chapter 343 HRS.

Project Description

Project Location

The decommissioned Tai Lee reservoir site is located at 41-645 Mokulama Street in the ahupuaʻa of Waimānalo, moku of Koʻolaupoko, on the island of Oʻahu (Figure 1). Located approximately 2,500 feet south (mauka) of Kalanianaʻole Highway, the project site is bordered by Mokulama Street to the east and agricultural and residential parcels to the south and north. The proposed project area is highlighted in yellow within the triangular-shaped parcel as shown in Figure 2.

(Right) View of Kahawai Stream and spillway on the property and culvert crossing Mokulama Street

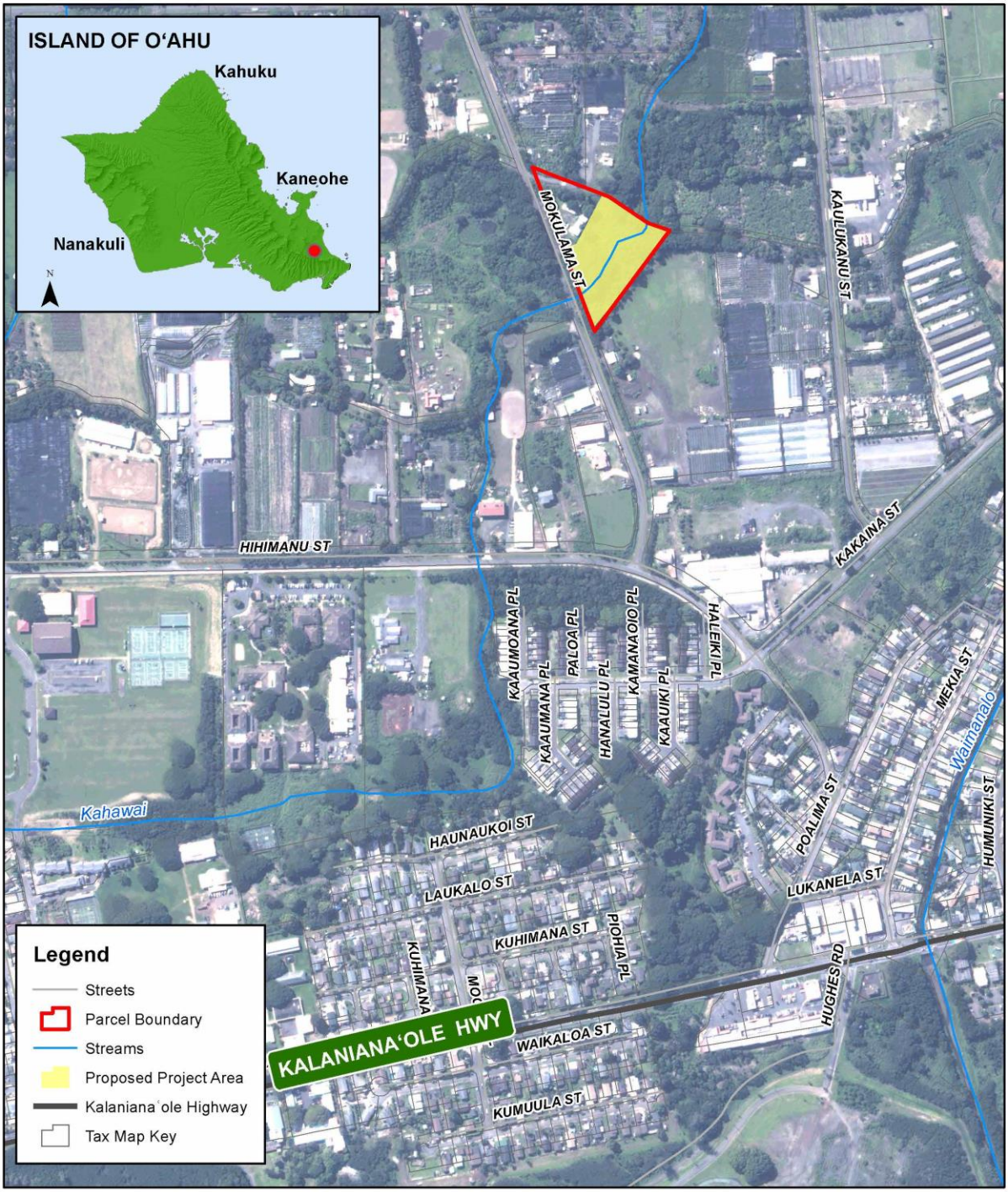
Purpose and Need for Action

The purpose of the proposed action is to address existing ponding issues that occur on the property when it rains. A concrete stormwater structure is located along the northeastern section of the property line which directs stormwater towards a culvert crossing Mokulama Street. Overflow of stormwater runoff along this floodway has often been attributed to the build up of debris from upstream that occasionally clogs the culvert and from overgrown vegetation on the parcel itself. The proposed project is needed to address the ponding issues on-site and to capture debris that may otherwise block the downstream culvert and cause stormwater to overtop the roadway.

Description of the Project Site

The parcel consists of a former irrigation reservoir with well-established, primarily non-native vegetation throughout the property. There are several existing building structures located on the southern section of the parcel, outside of the boundaries of the proposed improvement area. These structures are utilized by the State Department of Agriculture as an office and base yard area. Vehicular access to the base yard area is located off of Mokulama Street.

View of spillway from Mokulama Street facing west



Location Map
41-645 Mokulama Street, Waimānalo, HI 96795
(TMK 4-1-024: 068; 3.04 acres)
February 2022

Figure 2. Location Map

Description of the Proposed Action

The Proposed Action consists of:

- Clearing vegetation on approximately 91,069 square feet, including 65 trees on the property, and re-vegetating the cleared area with grass (area highlighted in green and purple in Figure 3).
- Installing two rows of staggered bollards with two-foot thick grouted riprap and a two-foot round drilled concrete footing, six feet deep below the rip rap, to capture debris. The height of the bollards is anticipated to be four feet. The approximate water elevation during the 100-year event from available Federal Emergency Management Agency (FEMA) flood maps is three feet above the ground elevation. The first row of bollards will be located 22 feet west of the property boundary followed by another row of bollards 6 feet from the first row of bollards (location shown in magenta).
- Grading approximately 37,436 square feet of the property (area highlighted in purple).

Figure 3. Proposed Improvements (from Okahara and Associates, Inc., 2022)

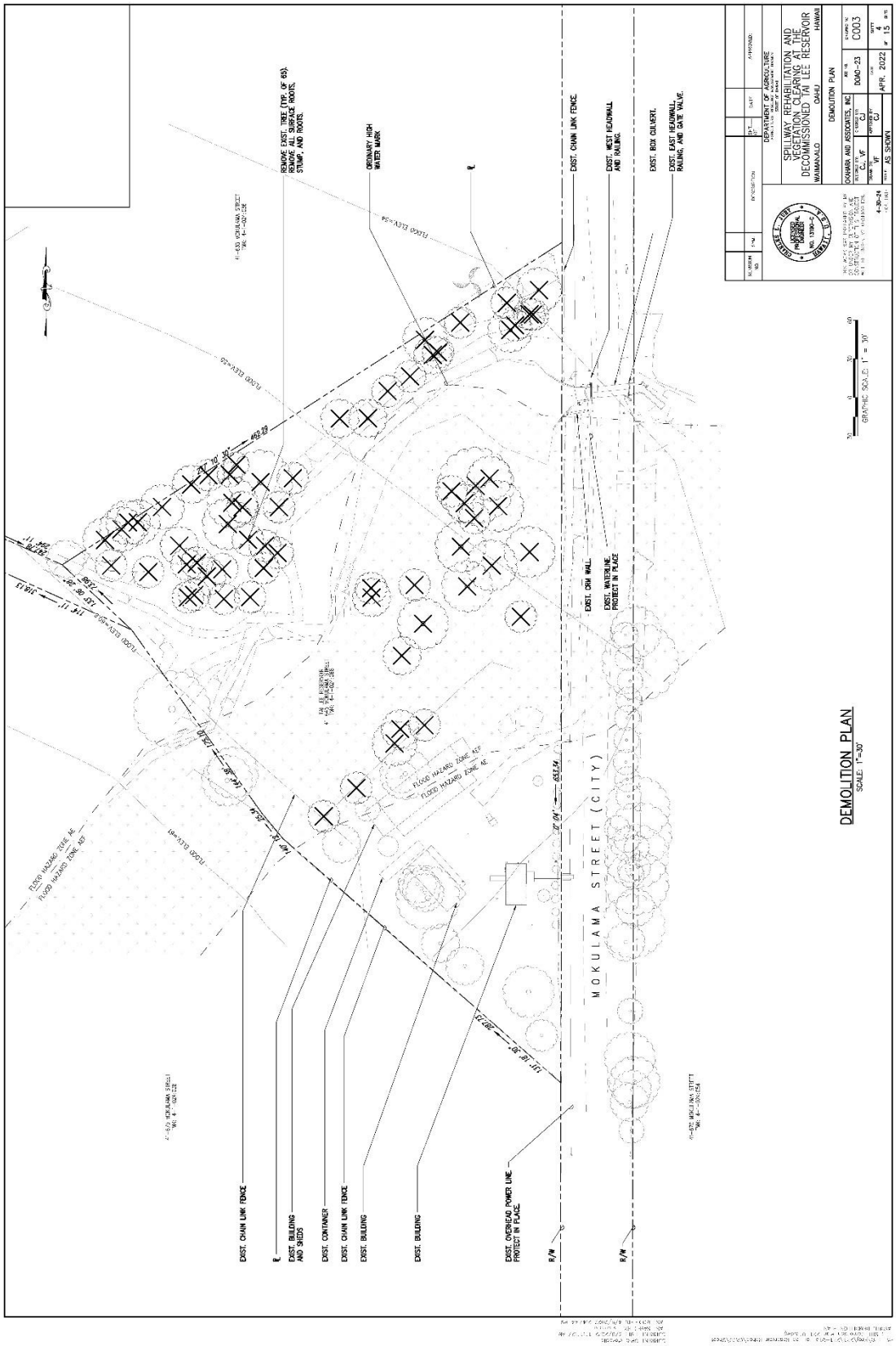


Figure 4. Demolition Plan (from Okahara and Associates, Inc., 2022)

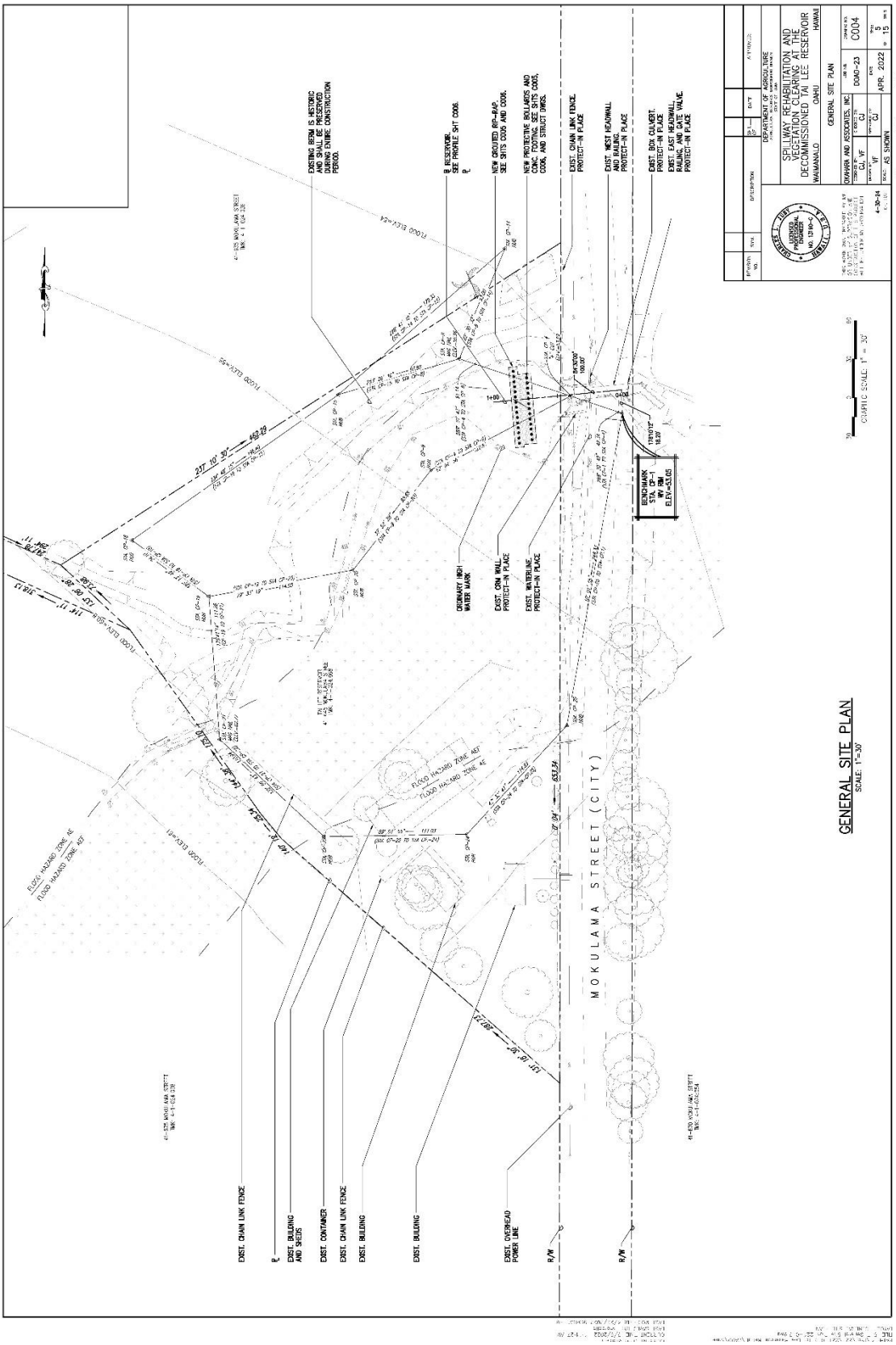


Figure 5. General Site Plan (from Okahara and Associates, Inc., 2022)

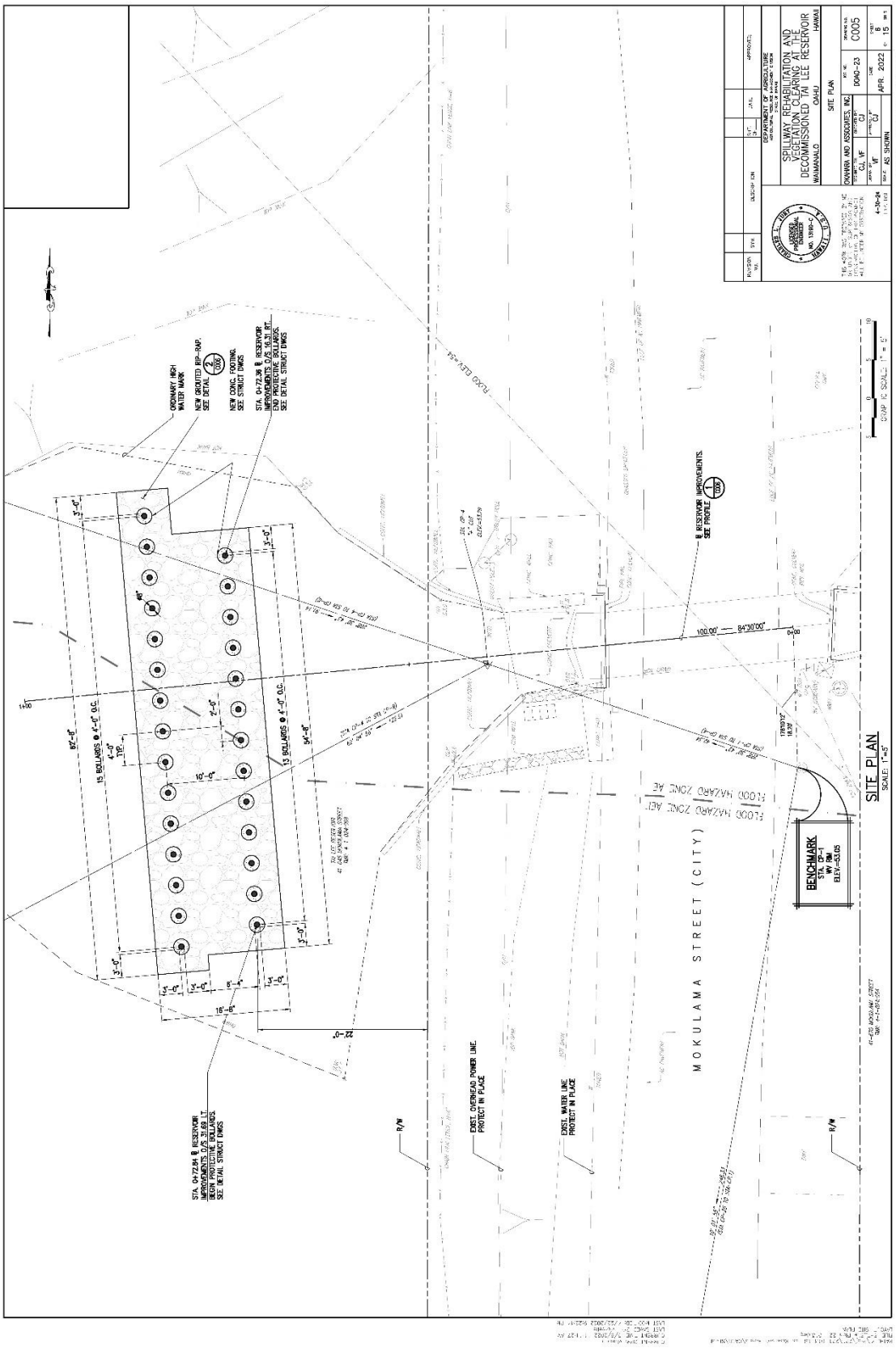


Figure 6. Site Plan (from Okahara and Associates, Inc., 2022)

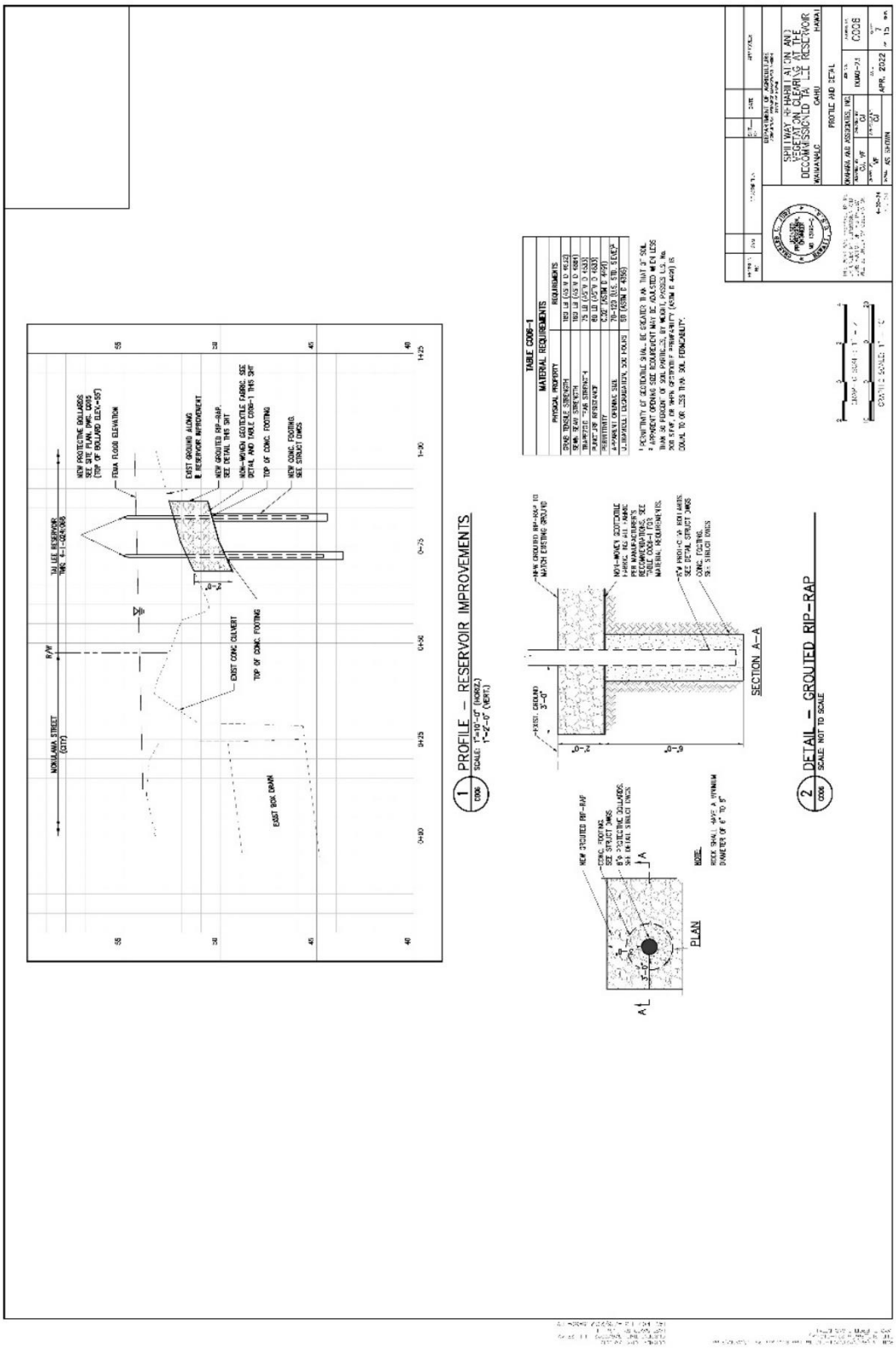


Figure 7. Profile and Detail (from Okahara and Associates, Inc., 2022)

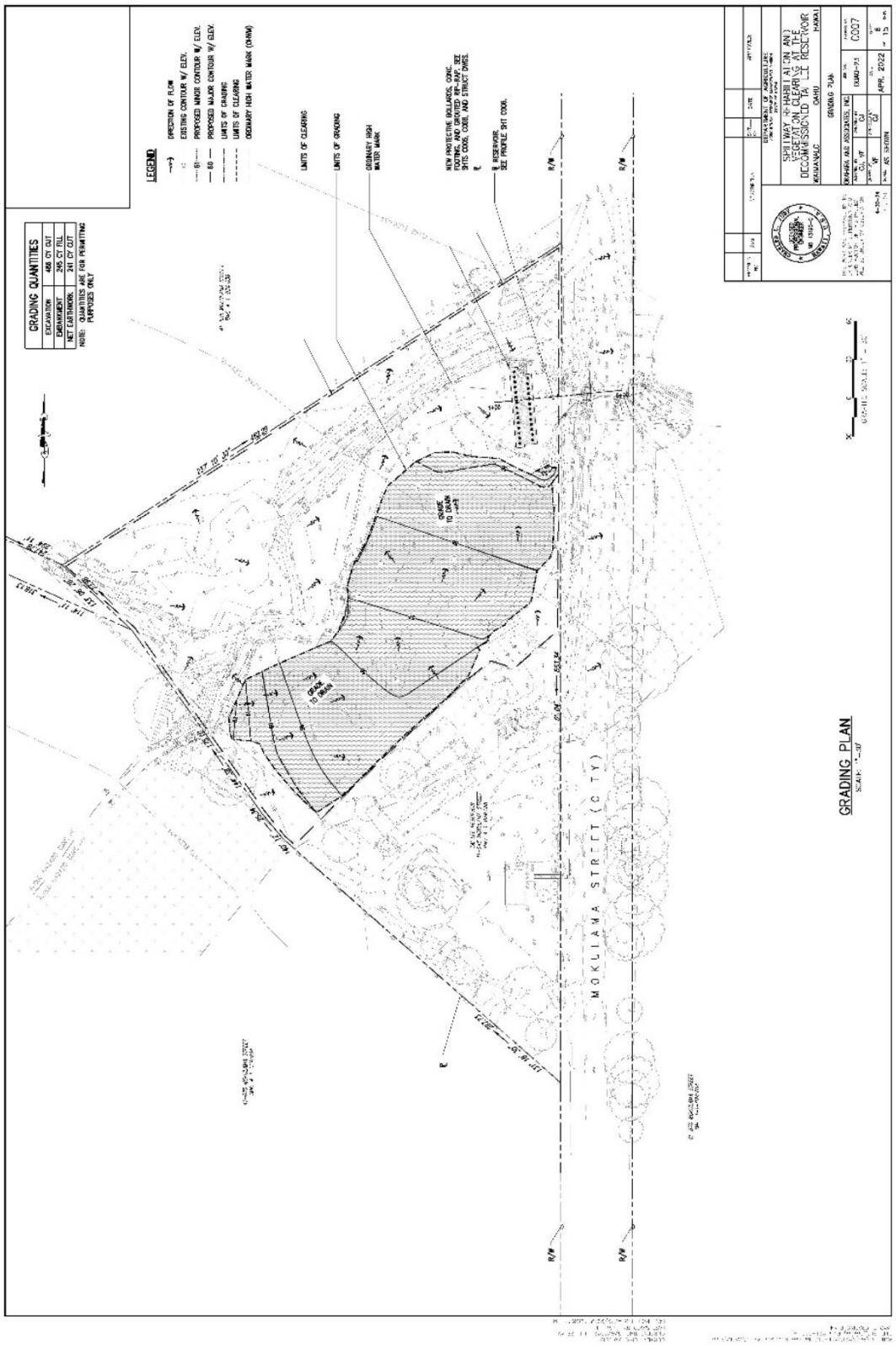


Figure 8. Grading Plan (from Okahara and Associates, Inc., 2022)

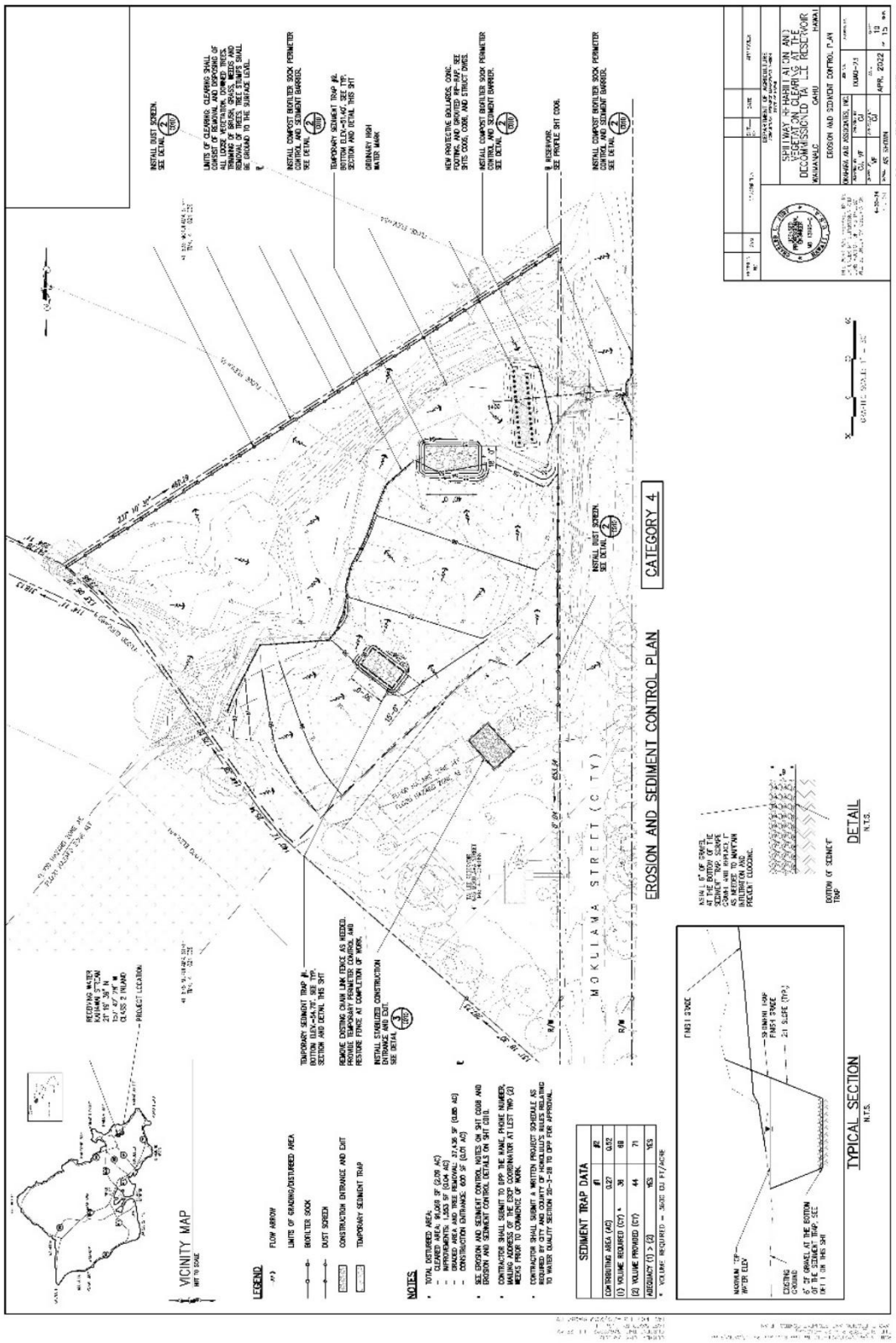


Figure 9. Erosion and Sediment Control Plan (from Okahara and Associates, Inc., 2022)

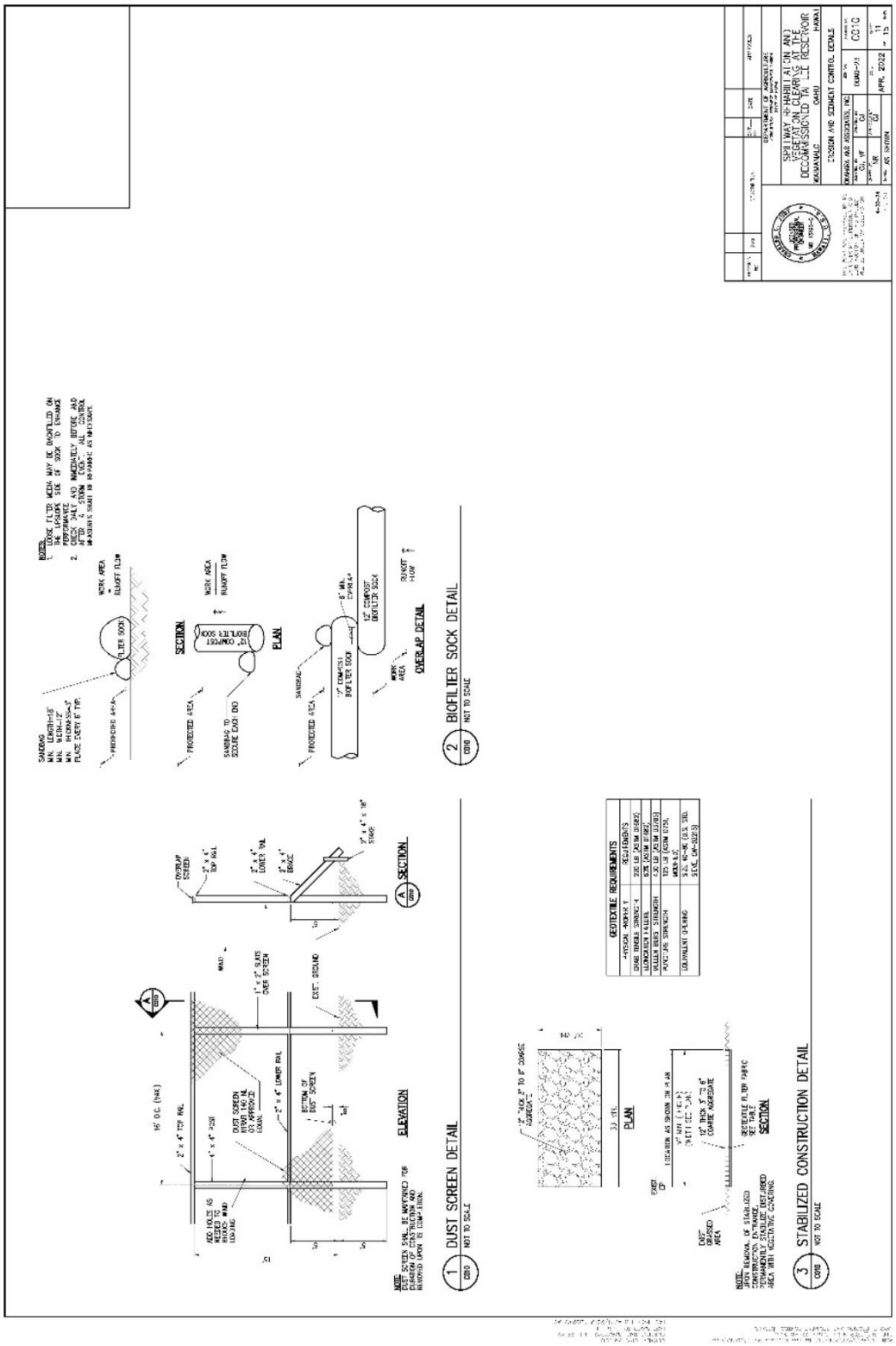


Figure 10. Erosion and Sediment Control Details (from Okahara and Associates, Inc., 2022)

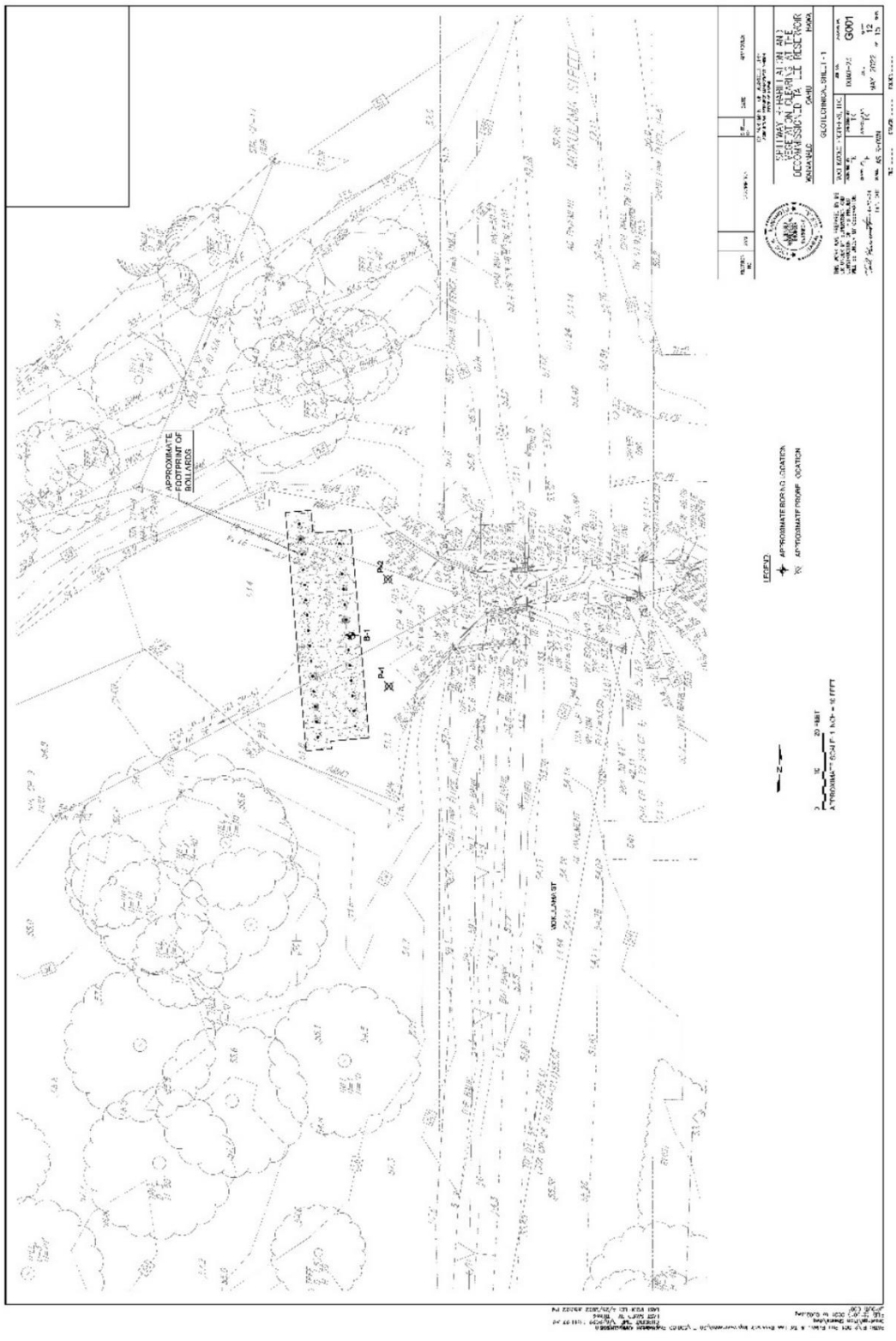


Figure 11. Approximate Footprint of Bollards (from Okahara and Associates, Inc., 2022)

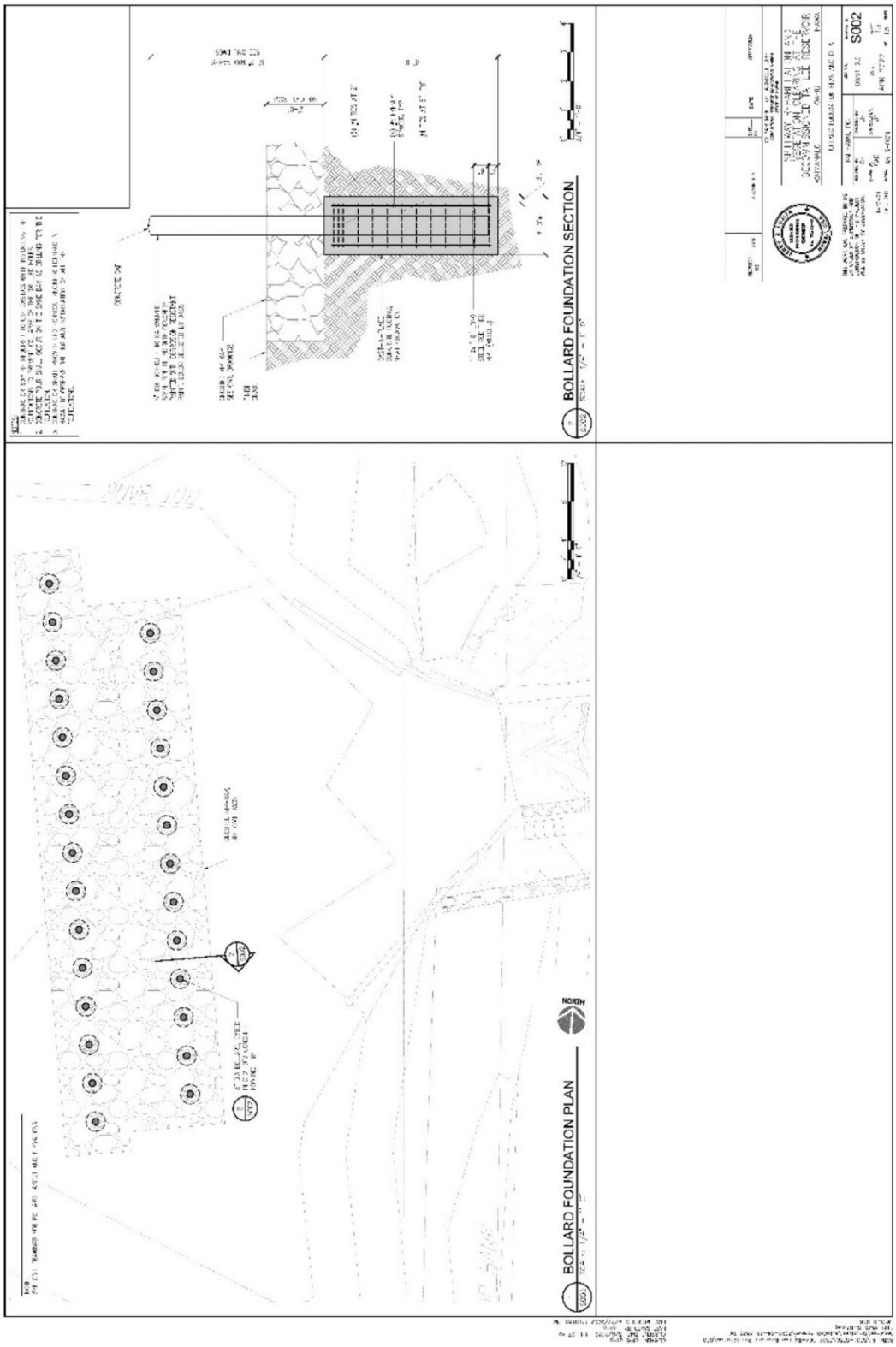


Figure 12. Bollard Foundation Plan and Section (from Okahara and Associates, Inc., 2022)

Alternatives to the Proposed Action

Alternative A – No Action

The no action alternative would consist of not making any of the proposed improvements, resulting in continued ponding of the property and stormwater overtopping Mokulama Street during heavy rainfall events. This alternative would increase the risk of future flooding in this area and possible flood damage to adjacent properties and roadways.

Alternative B – Reconstruct Existing Culvert

Reconstruction of the existing culvert crossing Mokulama Street was considered, including installing new south and north wing walls. This alternative would include construction of a new bottom for the culvert and grading to the existing ground. However, this alternative was not selected because the proposed improvements would not have been entirely within the Tai Lee reservoir property boundary. Some of the improvements would be required within the City's right of way for Mokulama Street.

Required Permits and Approvals

The Proposed Action will require the following federal, state, and county permits and approvals:

- Federal
  - Section 404 Nationwide Permit from the Department of the Army
  - Conditional Letter of Map Revision (CLOMR) from the FEMA, as applicable
  - Letter of Map Revision from FEMA, as applicable
- State of Hawai‘i
  - Section 401 Water Quality Certification Permit from the Department of Health
  - Community Noise Permit from the Department of Health, as applicable
  - Historic Preservation Program, Hawai‘i Revised Statutes, Chapter 6E Compliance from the State Historic Preservation Division
  - Stream Channel Alteration Permit from the Commission on Water Resource Management
- City and County of Honolulu
  - Grading permit from the Department of Planning and Permitting
  - Grubbing permit from the Department of Planning and Permitting
  - Street Usage Permit from the Department of Transportation Services, as applicable

Agencies, Organizations, and Individuals Contacted for Early Consultation

Below is a list of the agencies, organizations, and individuals contacted as part of the early consultation prior to the publication of the Draft EA. Agencies that provided a response letter during the early consultation process are marked with an "*". A copy of the letter sent to these entities and comments received are provided in the Appendix.

State of Hawai‘i Agencies

- Department of Agriculture
- Department of Hawaiian Home Lands*

- Department of Health
- Department of Land and Natural Resources*
- Department of Transportation
- Hawai‘i Housing Finance & Development Corporation

City and County of Honolulu Agencies

- Department of Environmental Services*
- Department of Facilities Maintenance
- Department of Planning and Permitting*
- Department of Transportation Services*
- Honolulu Board of Water Supply*
- Honolulu Fire Department*
- Honolulu Police Department*

Elected Officials

- Vice Chair Esther Kia‘āina, Honolulu City Council District 3
- Hawai‘i State Representative Lisa Marten, House District 51
- Hawai‘i State Senator Chris Lee, Senate District 25
- Chair Kimeona Kane, Waimānalo Neighborhood Board No. 32

Adjacent Properties

- 41-474 Hihimanu Street, Waimānalo, HI 96795
- 41-486 Hihimanu Street, Waimānalo, HI 96795
- 41-504 Hihimanu Street, Waimānalo, HI 96795
- 41-520 Hihimanu Street, Waimānalo, HI 96795
- 41-660 Kaulukanu Street, Waimānalo, HI 96795
- 41-666 Kaulukanu Street, Waimānalo, HI 96795
- 41-587 Makakalo Street, Waimānalo, HI 96795
- 41-614 Mokulama Street, Waimānalo, HI 96795
- 41-630 Mokulama Street, Waimānalo, HI 96795
- 41-635 Mokulama Street, Waimānalo, HI 96795
- 41-679 Mokulama Street, Waimānalo, HI 96795
- 41-670 Mokulama Street, Waimānalo, HI 96795

Description of the Affected Environment, Potential Impacts and Mitigation Measures

Climate

The climate in the Hawaiian Islands is generally influenced by the prevailing trade winds from the Northeast, which carry with them moisture picked up over the ocean. There are generally two seasons that are distinguished by cooler temperatures and wet conditions during the winter months, typically between October and April, and drier and warmer conditions during the summer months. The average annual high temperature recorded in the vicinity of the project area is 77.7 Fahrenheit and the average annual low temperature is 70.5 Fahrenheit. While temperatures only vary a few degrees between seasons, the warmest month for this area is typically August and the coolest month is usually January. Total rainfall for the area averages 47.2 inches a year, with December being the wettest month (6.8 inches on average) and June being the driest (1.6 inches on average). (Giambelluca et al. 2014)

Potential Impacts and Mitigation Measures

The proposed project is not anticipated to have any impact on the local climate; thus, no mitigation measures will be needed.

Geology, Topography, and Soils

The Hawaiian Islands are the result of volcanic eruptions over time as the Earth's plates move to the northwest over a "hot spot" in the ocean floor. As a result, the age of the islands increases to the northwest, making the island of Oʻahu the second oldest of the main Hawaiian Islands. The island of Oʻahu was created from the formation of two major shield volcanoes, Waiʻanae Volcano and Koʻolau Volcano. Waimānalo Valley is the remnant of the Koʻolau shield volcano that has been deeply eroded since eruptions ceased approximately 2 million years ago.

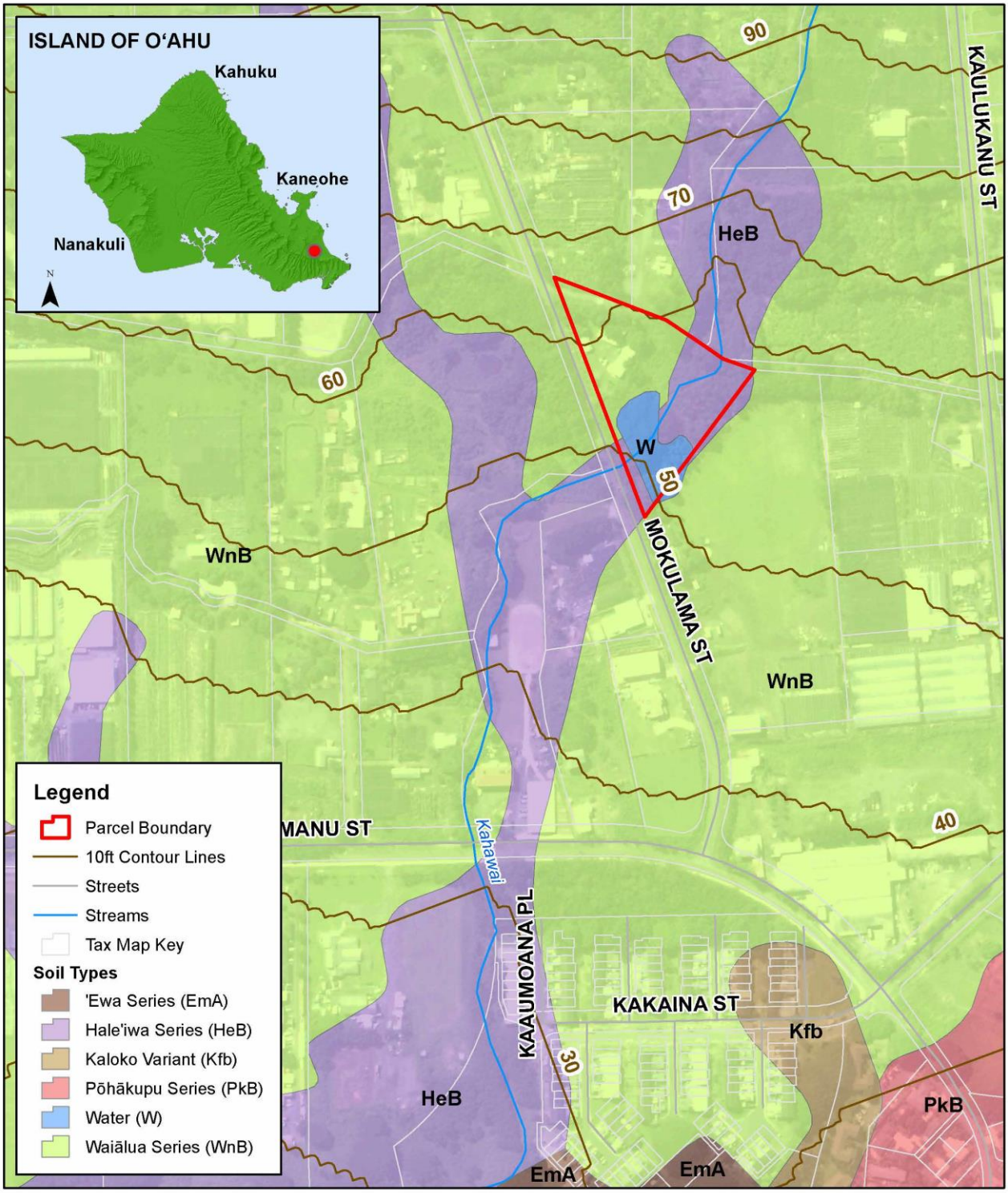
The topography of the property is relatively flat, but slopes slightly from the north at an elevation of 50 feet to the south with an elevation of 60 feet above mean sea level. An area near the decommissioned reservoir contains a 6-foot hole.

The soils on the parcel are designated as Haleʻiwa silty clay (HeB) with 2 to 6 percent slopes and Waiālua clay (WnB) with 2 to 6 percent slopes. Although the decommissioned reservoir area is dry, the area is designated as Water (W). The majority of the project area is designated as HeB and W. The USDA Natural Resource Conservation Service describes both the Haleʻiwa silty clay and Waiālua clay as having slow runoff with a slight erosion hazard.

Potential Impacts and Mitigation Measures

In the short-term, clearing and grading activities will temporarily disturb and expose soils. Areas where vegetation will be cleared will be re-vegetated with grass. Some soil disturbance may occur as a result of the bollards being constructed to catch upstream debris. BMPs will be employed to minimize erosion and soil loss during construction. Construction practices will comply with the guidelines found in the following regulations:

- Revised Ordinances of Honolulu Chapter 14, Articles 13-16, relating to Grading, Grubbing, Stockpiling, Soil Erosion, and Sediment Control;



Soils Map
41-645 Mokulama Street, Waimānalo, HI 96795
(TMK 4-1-024: 068)
February 2022

TOWNSCAPE INC
0 150 300 Feet
N

Figure 13. Soils Map

- Rules Relating to Soil Erosion Standards and Guidelines (April 1999), Department of Planning and Permitting, City and County of Honolulu; and
- Erosion and Sediment Control Guide for Hawaii (1968), Soil Conservation Service, US Department of Agriculture.

Climate Change and Sea Level Rise

According to the National Climate Assessment Report (2018), climate change will consist of rising carbon dioxide in the atmosphere, rising air and sea temperatures, rising sea levels and upper-ocean heat content, changing ocean chemistry and increasing ocean acidity, changing rainfall patterns, decreasing base flow in streams, changing wind and wave patterns, changing climate extremes, and changing habitats and species distribution. In Hawai‘i, the effects of global climate change have already been observed, with air temperature increasing by 0.76 degrees Fahrenheit over the last century and a general downward trend in rainfall. Sea surface temperatures and ocean pH (an indicator of acidity) have also increased.

Located at least a mile inland, the project area will not be directly impacted from coastal flooding due to sea level rise. However, other changes in the climate may impact the project site. There are currently two different models that are used to project future annual average rainfall in Hawai‘i through 2100: statistical downscaling and dynamical downscaling. The statistical downscaling model projects a generally drier climate while the dynamical downscaling model projects a generally wetter climate (Elison et al, 2015). Climate change scientists are not certain which model yields the more probable projections; the projections will be refined as new data become available. Data from the U.S. Global Change Research Program (2018) shows that the annual rainfall in the vicinity of the project area has increased at least one percent per decade between 1920 to 2012.

Potential Impacts and Mitigation Measures

The project area is not within the 3.2-feet sea level rise exposure area (SLR-XA). It is not anticipated to be directly impacted by sea level rise although the lower section of Kahawai Stream will experience rising sea levels. The proposed project will help address flooding issues which is critical in the long-term as more intense rainfall may occur due to ongoing climate changes.

Flooding

According to the Federal Emergency Management Agency’s Flood Insurance Rate Map (2014), the majority of the parcel is in the flood zone subject to inundation by the 1% annual chance flood. Flood zones within the project area include Zones AE and AEF with Base Flood Elevations (BFE) ranging from 54 to 61 feet. A small section of the southern corner of the parcel, although outside of the project area boundary, is designated in Flood Zone X. Zone AE is an area within the 1% annual chance flood (or 100-year floodplain); Zone AEF is the floodway area, or the channel of a stream plus any adjacent areas that must be kept free of encroachment so that the 1% annual chance of flood can be carried without increasing the BFE; and Flood Zone X is an area of low-to-moderate flood hazard risk (determined to be outside of the 0.2% annual chance flood or 500-year floodplain). Flood hazard areas are shown in Figure 8.

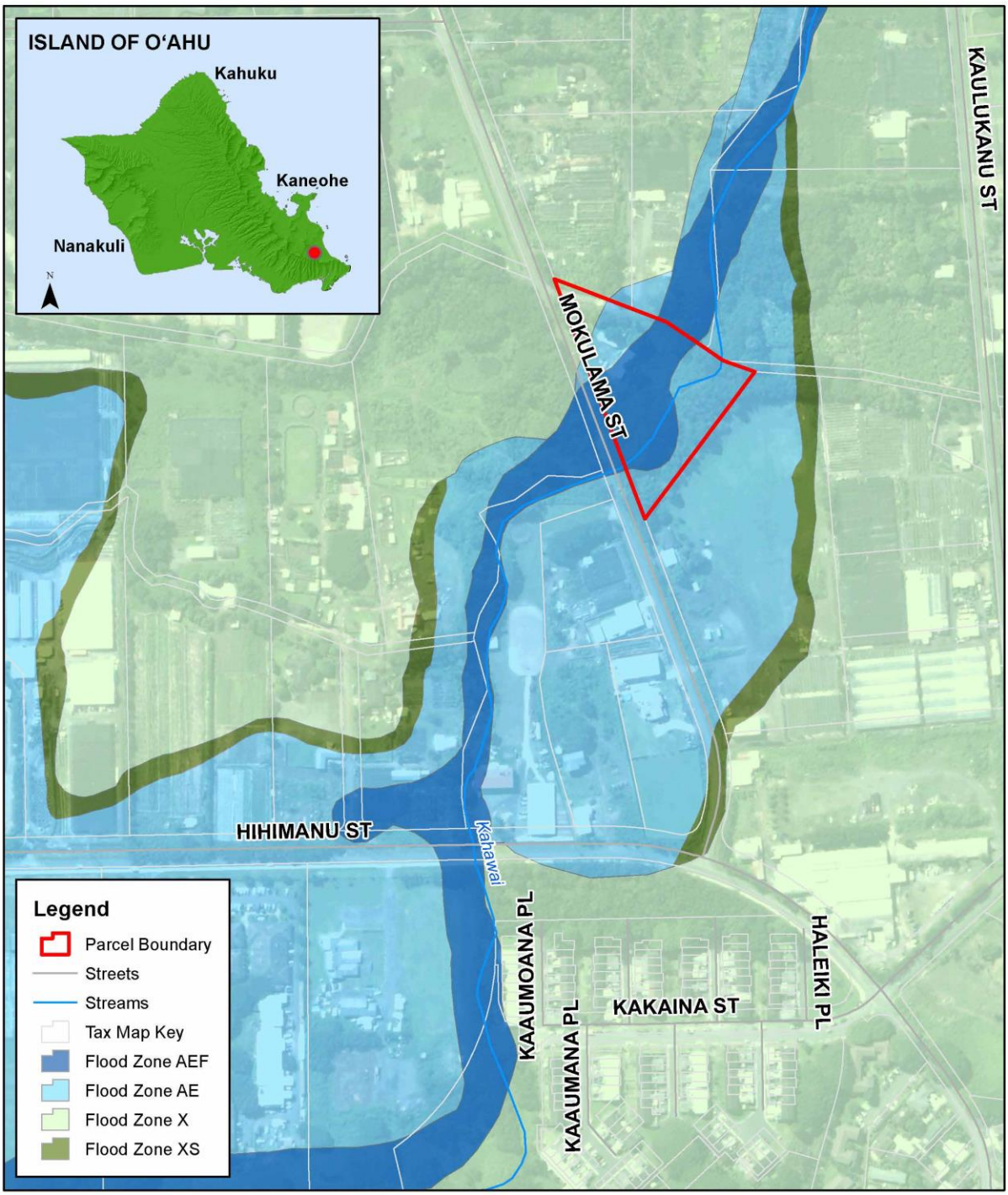


Figure 14. Flood Zone Map

Potential Impacts and Mitigation Measures
The proposed project is intended to minimize the existing ponding issues on the property and to keep the floodway/stormwater structures crossing Mokulama Street free and clear of encroachments, which has resulted in stormwater overtopping the road during previous severe rain events. The proposed improvements will help curb flooding impacts to the surrounding properties and ensure that the roadway remains passable during rain events.

The total earthwork will result in a "net cut" condition, thus any changes to the flood boundary are anticipated to be beneficial by means of reducing the overall flood boundary width. A "No-Rise" determination is being submitted to the City for review. If hydraulic analysis of post-construction conditions changes the 100-year flood boundary, a Conditional Letter of Map Revision and Letter of Map Revision will be submitted to FEMA.

Historic, Archaeological, and Cultural Resources

A Draft Archaeological Literature Review and Field Inspection (LRFI) Report was prepared by Cultural Surveys Hawai'i (CSH) in March 2022. This section summarizes the findings from the Draft LRFI Report, which is included in the Appendix.

There are relatively few historic properties that have been previously identified in the vicinity of the project area and none within 800 meters with the exception of the Waimānalo Sugar Company irrigation infrastructure. Field inspection of the project site was conducted by archaeologists from CSH on January 21, 2022. The archaeologists described the reservoir as "composed of broad earthen dams on its east and northwest sides that are typically 8.8 meters wide, approximately 2.0 meters high on the interior, and approximately 1.15 meters high on the exterior side" and the actual structure of the reservoir appeared "subtle within the dense vegetation."

The Tai Lee reservoir is assumed to have been built by Tai Lee to support Chinese rice growing in Waimānalo possibly as early as circa 1876, and later to assist Chinese sugarcane growing until around the early 1900s when it was effectively taken over by the Waimānalo Sugar Company. The Tai Lee reservoir was used by the Waimānalo Sugar Company until its closure in 1947. Following the closure of the Waimānalo Sugar Company, the plantation's water license and irrigation ditch system reverted to the Territory of Hawai'i. The Tai Lee reservoir was later repurposed with a new irrigation ditch (the "Tai Lee" or "Reservoir" Ditch) to support diversified agriculture. The Tai Lee reservoir is understood to have been decommissioned shortly after the Department of Agriculture conducted an Environmental Assessment to abandon the Waimānalo Ditch Irrigation System in August 1993.

The Tai Lee reservoir predates both the Waimānalo Sugar Company infrastructure and the Tai Lee Ditch, but is a contributing feature to both. State Inventory of Historic Places (SIHP) # 50-80-15-4042 is understood as a general designation for all the Waimānalo Sugar Company infrastructure, which includes the three ditch systems (Pump Ditch, Kailua Ditch, and the Maunawili Ditch). The Tai Lee reservoir is a component of the Pump Ditch from at least as early as 1919 until the closure of the Waimānalo Sugar Company in 1947. When the Tai Lee reservoir was repurposed to support diversified agriculture, it became part of the new, lower elevation ditch system referred to as the "Tai Lee" or "Reservoir" Ditch. The Tai Lee reservoir was a water source for the "Tai Lee" or "Reservoir" Ditch, which is believed to date from 1943 to 1952. The "Tai Lee" or "Reservoir" Ditch is designated as SIHP #50-80-15-6427.

Based on CSH field work, they concluded that the Tai Lee reservoir is an archaeological historic property and is suggested to be significant under HAR §13-284-6 for the following criteria:

- as associated with events that have made an important contribution to the broad patterns of our history, specifically Chinese rice growing and Chinese sugarcane growing transitioning into sugar plantation cultivation.
- for having yielded information important for research on history of Chinese agriculture in Waimānalo.

CSH determined that "the character defining features of this archaeological historic property are suggested to be the perimeter low and wide earthen walls on the northwest and east sides of the former reservoir."

Potential Impacts and Mitigation Measures
CSH concluded that proposed project is not expected to have a major impact on the character-defining features of the reservoir. It is recommended that care be taken during construction to minimize degradation of the earthen walls of the reservoir. The Draft LRFI report will be submitted to the State Historic Preservation Division (SHPD) for a SHPD determination letter and for SHPD concurrence of "No historic properties affected."

Surface Water and Water Quality

The property lies within the Kahawai watershed, which covers an area of 1,792 acres (Param et al, 2008). The left branch of Kahawai Stream passes through the project area entering from the southwest corner of the parcel and flowing northeasterly across the property before crossing below Mokulama Street.

Kahawai Stream originates at approximately 2,175 feet above sea level and flows towards the ocean where the left branch of Kahawai Stream joins the right branch just inland of the estuary at Kalaniana'ole Highway. The stream mouth is blocked by a natural sand dune and is only breached during significant flooding events. Thus, a muliwai, or estuarine, stream mouth pond, is normally located at the stream mouth.

Kahawai Stream is classified as a perennial stream with a stream length of 3.4 miles in the Atlas of Hawaiian Watersheds & Their Aquatic Resources (Param et al, 2008), although it is not on the list of perennial streams in the Hawai'i Stream Assessment (Hawaii Cooperative Park Service Unit, 1990). AECOS conducted fieldwork in May 2021 to delineate the ordinary high water mark (OHWM) and to complete a water quality survey in the Kahawai Stream in the vicinity of the project area. Approximately 1,581 feet of Kahawai Stream in and around the project area was delineated. Based on their assessment, AECOS concluded that this reach of Kahawai Stream is an "intermittent tributary" with surface connection to Waimānalo Bay.

The section of the stream within the project area is normally a dry-bed stream although AECOS (2021) described the reservoir area as having a hummocky terrain with drift deposits, thus indicating stream flow had extended into the reservoir recently.

Kahawai Stream is a Class 2 inland water body as listed in the Hawai'i water quality standards by the State Department of Health (DOH). According to HAR 11-54, the objective of Class 2 waters is "to protect their use for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping, and navigation." Kahawai Stream is not listed on the DOH 2018 list of impaired waters in Hawai'i prepared under the Clean Water Act.

AECOS (2021) found the water quality of Kahawai Stream to be fair despite the lack of flow during the time of their sample collection. The water was described by AECOS as being supersaturated with dissolved oxygen, which can occur under conditions of high algal productivity; conditions may be eutrophic.

Potential Impacts and Mitigation Measures
During the short-term, BMPs will be carried out during construction activities to ensure that the proposed project will not adversely impact Kahawai Stream and its water quality.

As recommended by the water quality report (AECOS, 2021), the proposed project can be completed with minimal impacts to stream water quality and without negative impacts to long-term water quality if proper BMPs are implemented, including conducting construction activities during the dry season or when the stream is not flowing; incorporating BMPs to construction plans such as separating stream flow from construction sites to prevent degradation of water in Kahawai Stream.

As the proposed project involves work in Kahawai Stream, ongoing consultation with the U.S. Army Corps of Engineers to address applicable permit requirements will be needed. A State 401 Water Quality Certification approval and State Stream Channel Alteration Permit will be obtained prior to construction as may be applicable.

Groundwater Hydrology

The Waimānalo aquifer system underlies the Property, which is part of the greater Windward Oʻahu aquifer sector. The estimated sustainable yield for the aquifer is 10 million gallons per day.

The State Department of Health established an underground injection control (UIC) line as a boundary between potable and non-potable ground water resources. The project area is located upland of the UIC line. Areas upland of the UIC line have an underlying aquifer that is considered a drinking water source.

Potential Impacts and Mitigation Measures
The proposed project is not anticipated to impact the groundwater hydrology. No mitigative measures are proposed.

Wetlands

Fieldwork conducted by AECOS (2021) concluded that there are no wetlands present at the project site.

Potential Impacts and Mitigation Measures
The proposed project does not pass through any wetlands and is not anticipated to have any impacts on wetlands in the area. No mitigative measures are proposed.

Flora

No federally designated or proposed critical habitat in the areas of the project site is present. A biological survey conducted by AECOS (2021) did not find any rare, threatened, or endangered plant species on the property.

Of the 71 plant taxa recorded by AECOS (2021), there was only one native plant species, pōpolo (*Solanum americanum*). The indigenous pōpolo are found naturally in Hawaiʻi but are not

unique to the Hawaiian islands. Six plant species regarded as early Polynesian introductions consisted of ʻulu (*Artocarpus altilis*), kukui (*Aleurites moluccana*), nui (*Cocos nucifera*), kalo (*Colocasia esculenta*), ape (*Alocasia macrorrhizos*), and ki (*Cordyline fruticosa*). The most common plant species recorded on the property are elephant grass (*Cenchrus purpureus*), guinea grass (*Megathyrsus maximus*), vigrate mimosa (*Desmanthus pernambucanus*), and koa haole (*Leucaena leucocephala*).

Potential Impacts and Mitigation Measures
The proposed project is not anticipated to impact any rare, threatened, or endangered plant species. The project area is dominated by non-native flora. During the early consultation process with DOFAW, the following recommendations were received:

- Minimize any movement of plant or soil material between worksites, such as infill. Soil and plant material may contain invasive fungal pathogens, vertebrate and invertebrate pests, or invasive plant parts that could harm native species and ecosystems.
- Consult with the Oʻahu Invasive Species Committee (OISC) in planning, design, and construction of the project to help inform the Contractor of any high-risk invasive species in the area and ways to mitigate spread.
- Keep all equipment, materials, and personnel cleaned of excess soil and debris to minimize the risk of spreading invasive species. Gear that may contain soil, such as work boots and vehicles, will be thoroughly cleaned with water and sprayed with 70% alcohol solution to prevent the spread of harmful fungal pathogens.

Fauna

Avian Fauna: Fieldwork by AECOS (2021) recorded common non-native species that are well-established in the Hawaiian Islands such as the warbling white-eye (*Zosterops japonicus*) and white-rumped shama (*Copsychus malabaricus*). Based on initial consultation with DOFAW, State-listed waterbirds such as the Hawaiian Duck (*Anas wyvilliana*), Hawaiian Stilt (*Himantopus mexicanus knudseni*), Hawaiian Coot (*Fulica alai*), and Hawaiian Common Gallinule (*Gallinula chloropus sandvicensis*) could potentially occur in the vicinity of the proposed project site, although AECOS (2021) concluded that habitat for these endangered waterbird species is not present in the Tai Lee reservoir. AECOS also did not detect any owl species during their survey and determined that no suitable nesting habitat for owl species exists on the property. However, DOFAW noted that the State endangered Hawaiian Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) could potentially occur in the vicinity of the project site, although they are not habitat restricted. The Pueo is a crepuscular species that are most active during dawn and dusk twilights.

Mammals: The State listed Hawaiian Hoary Bat or ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*) could potentially fly over or roost in the vicinity of the project site during the season. The only mammal observed by AECOS (2021) was the small Indian mongoose (*Herpestes javanicus*) during their fieldwork.

Aquatic Fauna: No aquatic animals were recorded in the survey area. Aquatic fauna observed at the water quality station located outside of the project area were poeciliid fishes, cane toad tadpoles (*Rhinella marina*), American bullfrog (*Lithobates catesbeianus*), and a red-eared slider (*Trachemys scripta elegans*).

Early consultation with DOFAW suggests that the project work on the Tai Lee reservoir and Kahawai Stream could affect endangered native Hawaiian damselflies (*Megalagrion* spp.) that may be present.

Potential Impacts and Mitigation Measures
No rare, threatened, or endangered species were detected during the fieldwork by AECOS (2021). There is also no federally delineated critical habitat present in the project area, but there may be potential impact to the Hawaiian hoary bats from clearing and grubbing of vegetation. Removal of trees within the project site may temporarily displace individual bats using a tree as a roosting place. The disturbance to the Hawaiian hoary bats associated with removal of the vegetation is likely to be minimal since they use multiple roosts within a home territory. However, during the pupping season, females carrying pups may be less able to rapidly vacate a roost tree that is being felled. Adult female bats sometimes leave their pups in the roost tree when they forage. Very small pups may be unable to flee a tree that is being felled. As recommended by DOFAW, 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 be avoided for any construction because bat mortalities have been documented as a result of becoming ensnared by this type of fencing during flight.

If any State-listed waterbird species are present during construction activities, then all activities within 100 feet (30 meters) should cease, and the bird should not be approached. Work may continue after the bird leaves the area of its own accord. If a nest is discovered at any point, the O‘ahu Branch DOFAW Office will be contacted. It is against State law to harm or harass these species.

To mitigate any potential impacts to the State endangered Hawaiian Short-eared Owl, twilight pre-construction surveys should be conducted by a qualified biologist prior to clearing vegetation. If Pueo nests are present, a buffer zone should be established in which no clearing occurs until nesting ceases, and DOFAW staff should be notified.

Similarly, to mitigate any potential impacts to endangered native Hawaiian damselflies (*Megalagrion* spp.) that may be present, a survey should be conducted by a qualified entomologist to determine if listed damselflies are present in the project area and to assess any potential impacts to those species prior to construction.

Air Quality and Noise

Air quality impacts in the vicinity of the project site are generally limited to dust generated from agricultural activities and emissions from vehicles that occasionally pass along Mokulama Street. The closest ambient air quality monitoring station to the project area is the Honolulu Station, located in downtown Honolulu.

The surrounding properties are mostly privately-owned agricultural lands with a mix of commercial agriculture and residential uses. Ambient noise near the project area is limited. Sources of ambient noise are from vehicular travel and/or agricultural machinery.

Potential Impacts and Mitigation Measures
Impacts of air quality and noise from the proposed project are anticipated to be minor and short-term. Project activities may require machinery that generates noise and dust, and emissions from construction equipment and vehicles may slightly impact air quality in the area.

The short-term effects on noise and air quality during construction will be mitigated by compliance with the DOH rules on air pollution and noise control. Best management practices during construction typically include:

- Providing an adequate water source at the site prior to start-up of construction activities for dust control;
- Landscaping and rapid covering of bare areas;
- Controlling of dust from shoulder and access roads;
- Providing adequate dust control measures during weekends, after hours, and prior to daily start-up of construction activities; and
- Controlling of dust from debris being hauled away from the project site.

Heavy vehicles traveling to and from the project site must comply with the provisions of the DOH's Administrative Rules, Chapter 11-42, "Vehicular Noise Control for Oʻahu." All work is anticipated to be done during daytime hours. Should any work be performed during nighttime, the Contractor will obtain a noise variance. Furthermore, activities associated with the construction phase of the project must comply with the DOH's Administrative Rules, Chapter 11-46, "Community Noise Control" which states that:

- The Contractor must obtain a noise permit if the noise levels from the construction activities are expected to exceed the allowable levels of the rules as stated in Section 11-46-6(a).
- Construction equipment and on-site vehicles requiring an exhaust of gas must be equipped with mufflers as stated in Section 11-4-6(b) (1)(A).
- The Contractor must comply with the requirements pertaining to construction activities as specified in the rules and the conditions issued with the permit as stated in Section 11-46-7 (d)(4).

Existing and Surrounding Land Use

As stated earlier, the surrounding parcels are mostly privately-owned agricultural lands with a mix of commercial agriculture and residential uses, including plant nurseries and livestock. Downstream properties consist of privately-owned parcels and State lands. Other properties in close proximity to the project area include housing developments such as the Waimānalo Housing Development and Waimānalo Village Subdivision and the Department of Hawaiian Home Lands (DHHL) Kumuhau and Kakaʻina homesteads.

Potential Impacts and Mitigation Measures

The proposed project may create short-term nuisances related to noise and dust from construction; however, it will not adversely impact the existing and surrounding land uses in the long-term. BMPs, including appropriate dust control and noise mitigation measures, will be implemented. The proposed improvements are anticipated to prevent stormwater from overtopping the roadway during heavy rain events. It is intended to minimize future risk of flooding to surrounding landowners and downstream properties. The area representative, neighborhood board, as well as the area residents, businesses, emergency personnel, will be kept apprised of the details and status throughout the project and the impacts that the project may have on the adjoining local street area network. As recommended by the DHHL during the early consultation process, DHHL's beneficiaries should be included in future consultations.

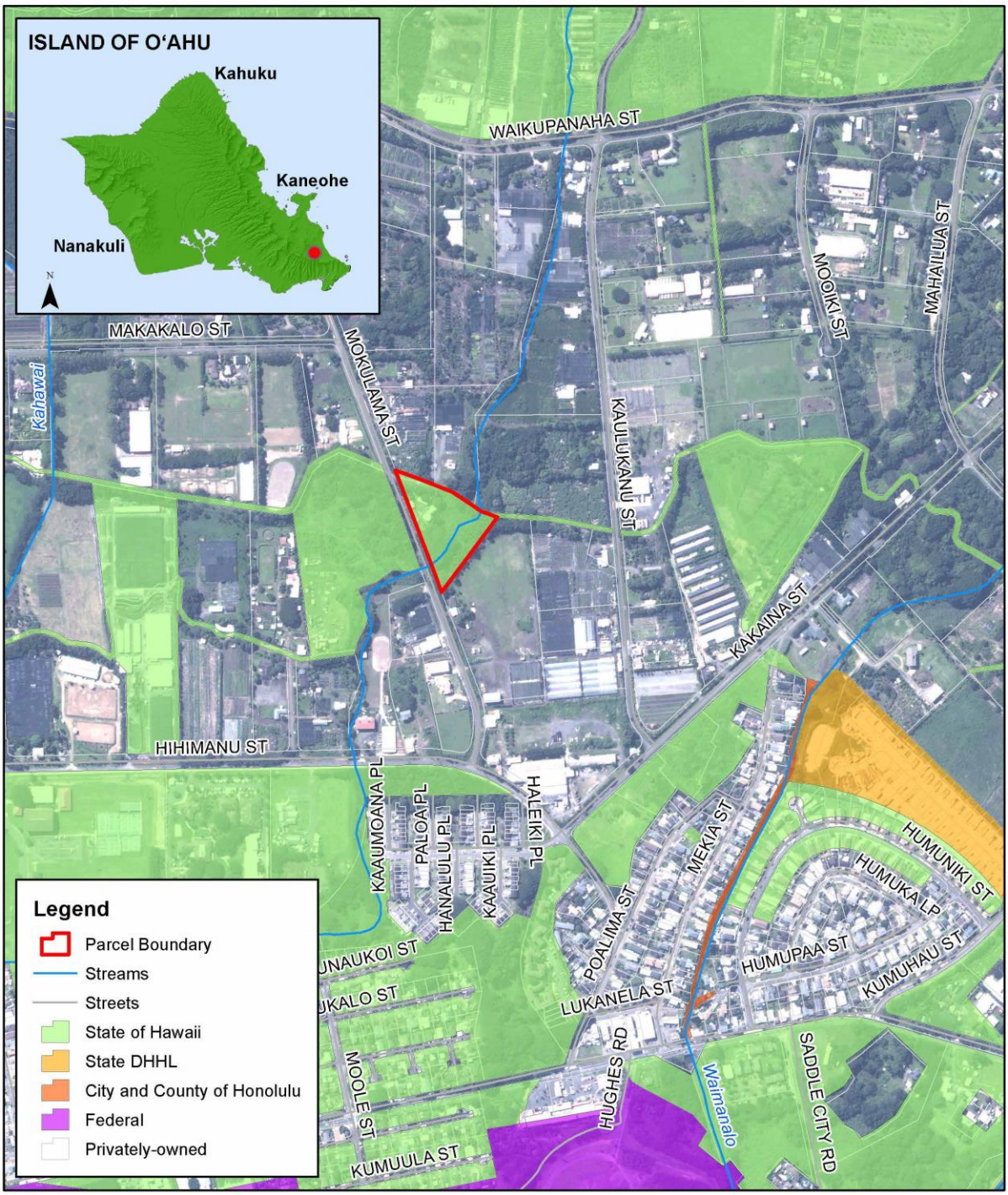


Figure 15. Surrounding Landowners Map

Utilities and Infrastructure

Roadway: The main vehicular access to the property is from Mokulama Street, which is owned and maintained by the City. Mokulama Street, a two-lane asphalt road, runs north-south and borders the western boundary of the parcel. It intersects Hīhīmanu Street (approximately 1,000 feet to the north), which then connects to Kalaniana'ole Highway, the only roadway entering Waimānalo from the East and West. Mokulama Street also connects Hīhīmanu Street with Waikupanaha Street.

Stormwater/Drainage: Stormwater runoff follows the contours of the land, from the south section of the parcel towards the north. The location of the former reservoir contains an earthen berm surrounding the edge with a lower depression at the center, thus rainwater naturally gathers in this area. An existing spillway near the northeastern boundary of the parcel directs stormwater to the culvert that crosses Mokulama Street.

Sewer: The property does not have a wastewater system. Parcels mauka of Hīhīmanu Street are generally not connected to the City's sewer system. According to the Hawai'i State Department of Health's data (2017), on-site sewage disposal systems are present on the parcels adjacent to the project area.

Water: The Honolulu Board of Water Supply provides municipal water service to surrounding properties.

Potential Impacts and Mitigation Measures
The proposed project is not anticipated to impact utilities such as sewer or potable water, and will not require any additional connections to the BWS system or City's sewer system.

Short-term construction activities may temporarily affect vehicular traffic in the vicinity of the project area. A street usage permit will be obtained for any construction-related work that may require the temporary closure of any traffic lane on Mokulama Street. Adequate notification will be made by the Contractor to the public and businesses on Mokulama Street in the event of road closures that may impact pedestrian and/or vehicular traffic. The Contractor will be responsible for following Federal, State, County, and Occupational Safety and Health Administration regulations such as installing signage and barricades for safety around work areas.

As recommended by the City's Department of Transportation Services from the early consultation process, the area representatives, neighborhood board, as well as the area residents, businesses, emergency personnel (fire, ambulance, and police), O'ahu Transit Services, etc. will be kept apprised of the details and status throughout the project and the impacts that the project may have on the adjoining local street area network.

Police, Fire, and Emergency Services

The proposed project is within the service area of the Honolulu Police Department's District 4 which services the Kāne'ohe, Kailua, and Kahuku region. The nearest police substation is in Kailua.

Fire service to the project area is provided by the Honolulu Fire Department. The nearest fire station to the project area is Waimānalo Fire Station No. 27 on Kalaniana'ole Highway. Ambulance services is provided by the City's Department of Emergency Services, Emergency

Medical Services Division. The project area is serviced by the Waimānalo Emergency Medical Service Unit, which is quartered next to the Waimānalo Fire Station.

Potential Impacts and Mitigation Measures
The proposed project is not anticipated to impact police, fire, or emergency medical services. As recommended by the Honolulu Police Department during the early consultation, adequate notification will be made to the public and businesses on Mokulama Street in the event of road closures, as any impacts to pedestrian and/or vehicular traffic may lead to complaints.

Visual and Scenic Resources

The project area is overgrown with vegetation. The proposed project will clear vegetation and graded areas will be re-vegetated with grass.

Potential Impacts and Mitigation Measures
No significant impacts to visual and scenic resources are anticipated from the proposed project.

Relationship to Plans and Policies

Hawaii State Land Use District Boundaries

The State Land Use Law, Chapter 205 HRS, establishes an overall framework for land use management whereby the lands in the State are classified into one of four land use districts: Urban, Rural, Agriculture, or Conservation. The subject property is situated within the State Land Use Agriculture District.

State Historic and Cultural Site Review

Cultural Surveys Hawai‘i completed a Draft LRFI report in March 2022. It was determined that Tai Lee reservoir is an archaeological historic property and that the character defining features are suggested to be “the perimeter low and wide earthen walls on the northwest and east sides of the former reservoir.” The proposed project is not expected to have a major impact on the character-defining features of the reservoir. It is recommended that care be taken during construction to minimize degradation of the earthen walls of the reservoir. The Draft LRFI report will be submitted to the SHPD for a determination letter and for SHPD concurrence of “No historic properties affected.”

Special Management Area

The Special Management Area (SMA) is the most sensitive area of the coastal zone that is placed under special development control to effectively manage, use, protect, and develop areas along the coast. The property is not located within the SMA.

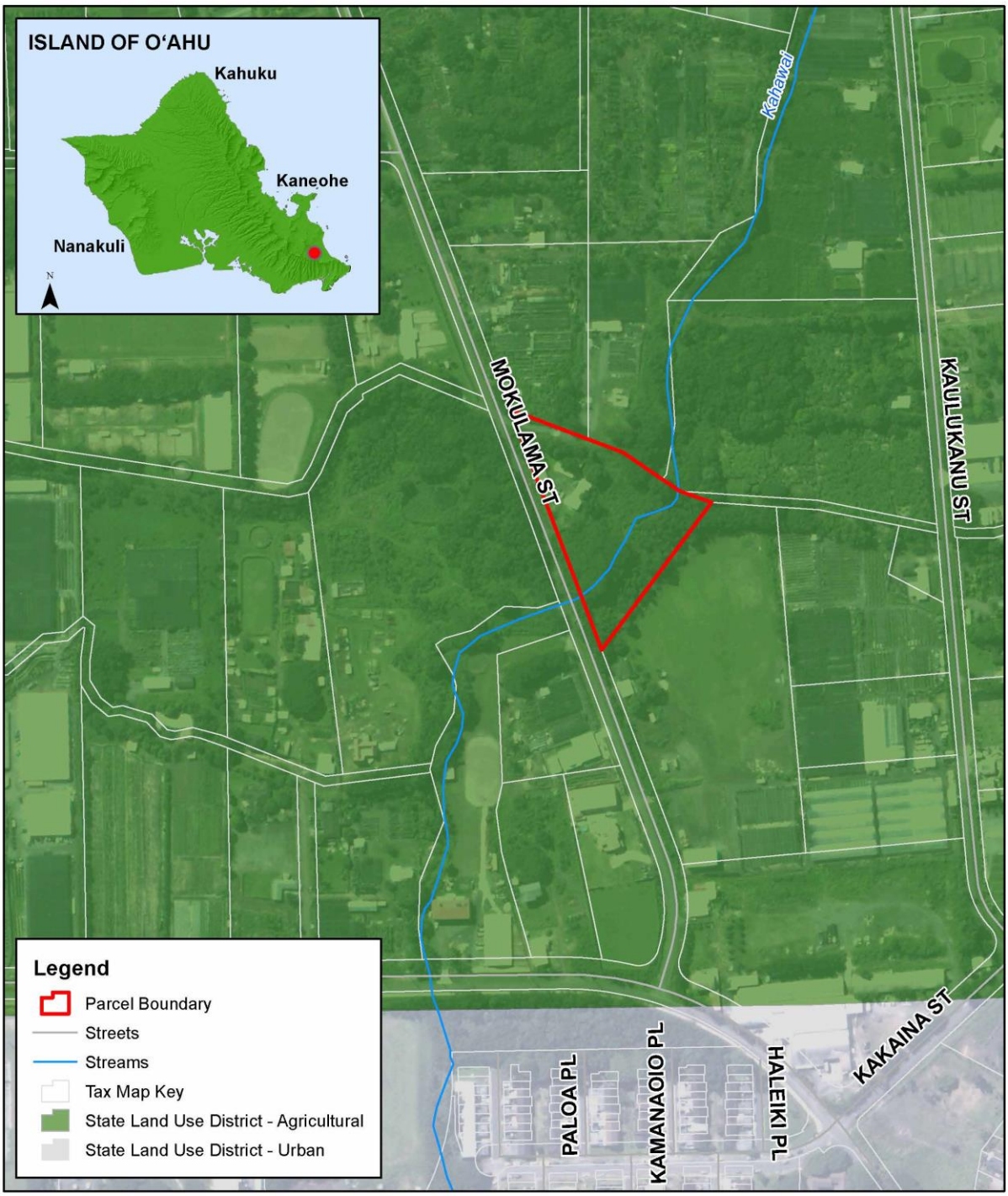


Figure 16. State Land Use District Map

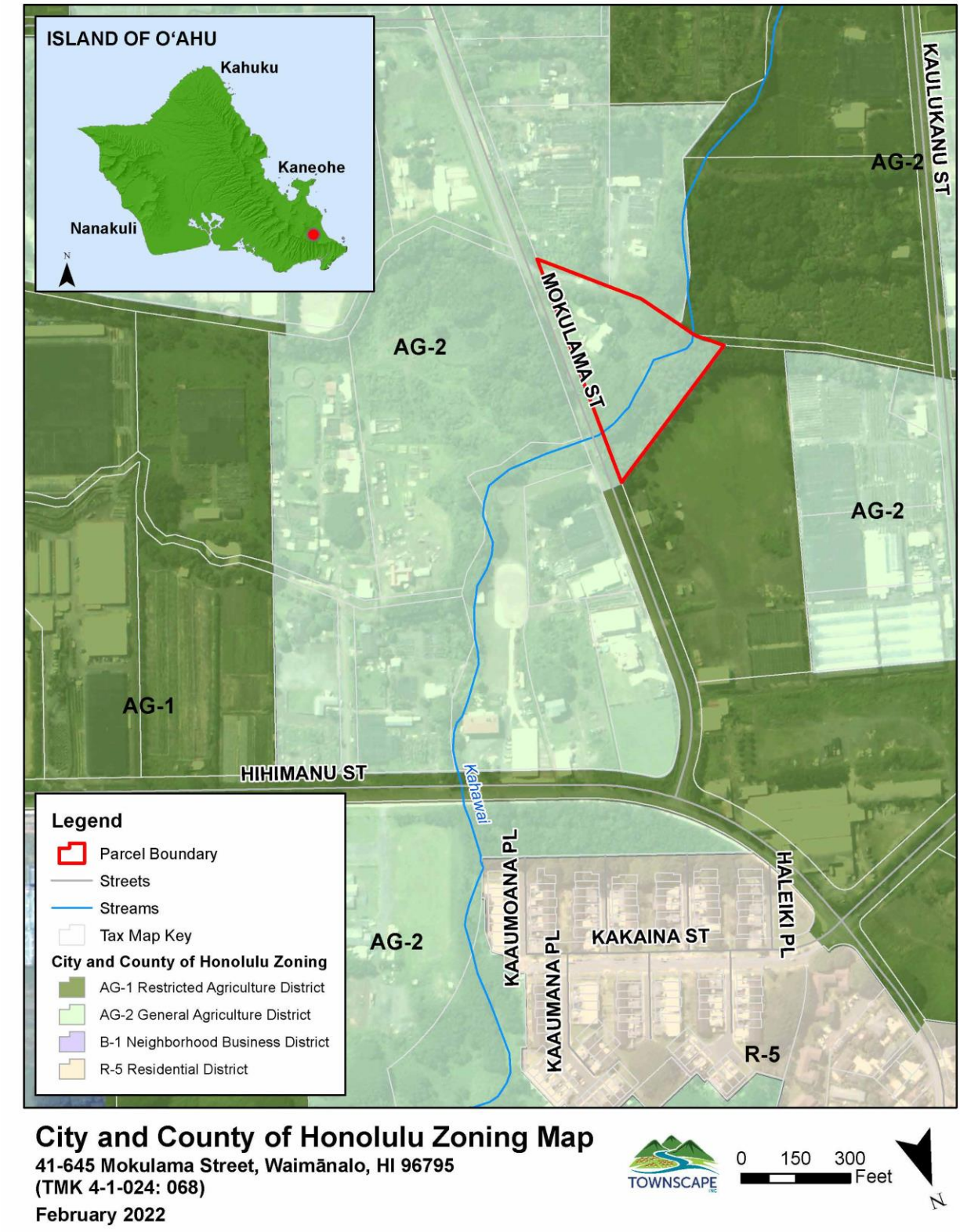


Figure 17. City and County of Honolulu Zoning Map

City and County of Honolulu Oʻahu General Plan

The Oʻahu General Plan (2021) is a comprehensive statement of objectives and policies that sets forth the long-range aspirations of Oʻahu's residents and outlines the strategies to achieve them. The proposed project is in compliance with the applicable objectives and policies, which are listed below:

- III. Natural Environment and Resource Stewardship
  - Objective A: To protect and preserve the natural environment.
    - Policy 6: Design and maintain surface drainage and flood-control systems in a manner which will help preserve natural and cultural resources.
    - Policy 8: Protect plants, birds, and other animals that are unique to the State of Hawaiʻi and Oʻahu, and protect their habitats.
- VIII. Public Safety and Community Resilience
  - Objective B: To protect residents and visitors and their property against natural disasters and other emergencies, traffic and fire hazards, and unsafe conditions.
    - Policy 3: Participate with State and federal agencies in the funding and construction of flood-control projects, and prioritize the use of ecologically sensitive flood-control strategies whenever feasible.
    - Policy 7: Provide adequate resources to effectively prepare for and respond to natural and manmade threats to public safety, property, and the environment.

- IX. Health and Education
  - Objective A: To protect the health and well-being of residents and visitors.
    - Policy 4: Integrate public health concerns such as air and water pollution as a consideration in land use planning decisions.

City and County of Honolulu Zoning

The City's Land Use Ordinance regulates land uses to encourage orderly development in accordance with adopted land use policies. Land uses within the City's jurisdiction are regulated under ROH, Chapter 21, Land Use Ordinance. The subject property is designated as General Agricultural (AG-2). Lands in this zoning district are intended to conserve and protect agricultural activities on smaller parcels of land, and allow for a fairly wide range of agricultural activities and farm structures.

Koʻolau Poko Sustainable Communities Plan

Oʻahu is divided into eight planning areas, each of which has a Development Plan or Sustainable Communities Plan adopted by the City Council as an ordinance. The Koʻolau Poko Sustainable Communities Plan (2017) designates the project area as Agricultural Areas. It also establishes a Community Growth Boundary, which identifies areas where growth and infill can occur and areas where agriculture, open space, and natural resources should be maintained and preserved. The Property is outside of the Community Growth Boundary.

DHHL General Plan

The DHHL General Plan (2002) is the overarching statewide plan that guides future plans for DHHL lands, policies, and programs with a long-term perspective. At the time of writing, DHHL was updating their General Plan, which is part of the DHHL's three-tiered planning system.

There are seven categories of goals and objectives in the General Plan to meet the DHHL's mission. The following are long-range goals in the DHHL General Plan that are relevant to the proposed project:

- **Land Use Planning**: Develop livable, sustainable communities that provide space for or access to the amenities that serve the daily needs of its residents.
- **Residential Uses**: Ensure existing homestead neighborhoods are maintained as healthy and attractive communities for future generations.

DHHL Oʻahu Island Plan

The DHHL Oʻahu Island Plan (2014) is in the second-tier of the three-tiered DHHL planning process, with a 10-year perspective for its landholdings on Oʻahu. There are approximately 1,914 acres within DHHL's landholdings in Waimānalo. Two existing residential homesteads are located near the project area, Kumuhau and Kakaʻina. The Oʻahu Island Plan recognizes that there are numerous natural and man-made drainage features that run though the Kumuhau homestead, which is susceptible to flooding if drainageways are not kept clear of debris.

DHHL Waimānalo Regional Plan

The DHHL Waimānalo Regional Plan (2008) is one of 21 regional plans that DHHL has developed in consultation with its beneficiaries. The Regional Plans are part of the third tier of the DHHL's three-tiered planning system. The third tier focuses on the community and regional level to identify issues and opportunities to guide the future direction of homestead lands within the two to four year time frame. It applies the goals, policies, and land use designations from the General Plan and Oʻahu Island Plan specifically to the Waimānalo area.

Anticipated Determination

The anticipated determination is **FONSI** (Finding of No Significant Impact). The Proposed Action is not determined to result in significant impacts on the quality of the environment. A review of the significance criteria as outlined in HRS 343 and HAR 11-200.1 is provided below.

(1) Irrevocably commit a natural, cultural, or historic resource.
The project will not irrevocably commit a natural, cultural, or historic resource. CSH (2022) determined that Tai Lee reservoir is an archaeological historic property and that the character defining features are suggested to be "the perimeter low and wide earthen walls on the northwest and east sides of the former reservoir." The proposed project is not expected to have a major impact on the character-defining features of the reservoir. It is recommended that care be taken during construction to minimize degradation of the earthen walls of the reservoir. The Draft LRFI report will be submitted to the SHPD for a determination letter and for SHPD concurrence of "No historic properties affected."

(2) Curtail the range of beneficial uses of the environment.
The proposed project will not curtail the beneficial use of the environment. It is not anticipated to adversely affect the water quality of Kahawai Stream or result in any long-term adverse impacts to air or ambient noise conditions. The proposed improvements are intended to address existing ponding issues on the property and to prevent stormwater from overtopping the roadway. Any potential short-term water quality impacts will be mitigated through the implementation of BMPs during construction to minimize

stormwater and sedimentation impacts to downstream properties. The vegetation within the project area is dominated by non-native plant species. No known rare, threatened, or endangered species of flora or fauna are located within the project area.

(3) Conflict with the State's environmental policies or long-term environmental goals established by law.
The proposed project does not conflict with the State's environmental policies or long-term environmental goals, but rather promotes the general welfare of the community and reduces the risk of future flooding.

(4) Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and State.
No substantial adverse impacts on the economic welfare, social welfare, or cultural practices of the community or State are anticipated. The proposed project will result in short-term economic and social benefits by providing construction and construction-related employment. It will prevent stormwater from overtopping the roadway during heavy rain events which would benefit the community.

(5) Have a substantial adverse effect on public health.
No substantial adverse impacts on public health are anticipated. BMPs will be implemented in the short-term during construction to mitigate any potential air quality and noise impacts. The proposed project is intended to address an existing flooding issue that presents health and safety impacts especially to downstream and adjacent properties. Thus, it will have a positive impact on public health by reducing the risk of future flooding.

(6) Involve adverse secondary impacts, such as population changes or effects on public facilities.
The proposed project is not anticipated to result in adverse secondary impacts. It is not a population generator and is intended to address existing flooding issues on the property.

(7) Involve a substantial degradation of environmental quality.
The proposed project is not anticipated to result in a substantial degradation of environmental quality. It is intended to improve the existing ponding issues that occurs on the property during large rain events. In the short-term, construction activities may result in air quality, water quality, or noise impacts. BMPs will be implemented to prevent these temporary impacts.

(8) Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions.
The proposed project does not involve a commitment for larger action.

(9) Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat.
The proposed project is not anticipated to have a substantial adverse impact on any rare, threatened, or endangered species, or their habitats, as none were identified in the field visit conducted by AECOS in May 2021.

(10) Have a substantial adverse effect on air or water quality or ambient noise levels.
The proposed project is not anticipated to have any substantial long-term adverse impact on air or water quality or ambient noise levels. In the short-term, construction activities may result in relatively minimal air quality, water quality, and noise impacts. BMPs for dust control measures, water quality, and noise impacts will be implemented.

(11) Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.
The proposed project is not anticipated to present significant adverse impacts on any environmentally sensitive areas. It is within Flood Zones AE and AEF, areas subject to inundation by the 1% annual chance flood (or 100-year floodplain). The proposed improvements will help curb impacts to the surrounding properties and ensure that the roadway remain passable during rain events. The total earthwork will result in a “net cut” condition, thus any changes to the flood boundary is anticipated to be beneficial by means of reducing the overall flood boundary width. A “No-Rise” determination is being submitted to the City for review. If hydraulic analysis of post-construction conditions changes the 100-year flood boundary, a Conditional Letter of Map Revision and Letter of Map Revision will be submitted to FEMA.

(12) Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies.
The proposed project is not anticipated to have a substantial adverse impact on scenic vistas or viewplanes.

(13) Require substantial energy consumption or emit substantial greenhouse gases.
The proposed project will not require substantial energy consumption or emit substantial greenhouse gases as the scope of improvements is limited to grading of the property and installing bollards to prevent debris from clogging the culvert downstream.

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Appendix A

Early Consultation Letter and Handout

TOWNSCAPE, INC.
Environmental & Community Planning

900 Fort Street Mall Suite 1160 · Honolulu, HI 96813 · PH: (808) 536-6999 · FAX: (808) 524-4998 · www.townscapeinc.com

January 31, 2022

Subject: Early Consultation Request for Draft Environmental Assessment (DEA)
Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir - Waimānalo, Island of Oʻahu, Hawaiʻi
Tax Map Key: 4-1-024: 068

Dear Participant,

On behalf of the State of Hawaiʻi, Department of Agriculture (DOA), Townscape, Inc. is preparing a DEA, pursuant to Hawaiʻi Revised Statues, Chapter 343, and Hawaiʻi Administrative Rules (HAR), Chapter 11-200.1 for the proposed Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir project ("Project").

Pursuant to HAR, Chapter 11-200.1-18, the DOA (Proposing Agency) is conducting early consultation to seek input from agencies, citizen groups, and individuals who may have an area of expertise, which may guide the scope and preparation of the DEA, and/or may be affected by the proposed Project. Please find enclosed an Early Consultation Handout with a project description and location map for your review and comment. We are requesting comments no later than **February 28, 2022** to be sent via mail or e-mail to:

Townscape, Inc.
Attn: Gabrielle Sham
900 Fort Street Mall, Suite 1160
Honolulu, HI 96813
E-mail: gabrielle@townscapeinc.com

If we do not receive a response by this date, we will assume your agency or organization has no comments. Please contact the undersigned with any questions you may have at (808) 550-3894 or via e-mail at gabrielle@townscapeinc.com. Thank you in advance for your participation in the early consultation for this Project.

Sincerely,

Gabrielle Sham
Associate Planner

Enclosure: Early Consultation Handout

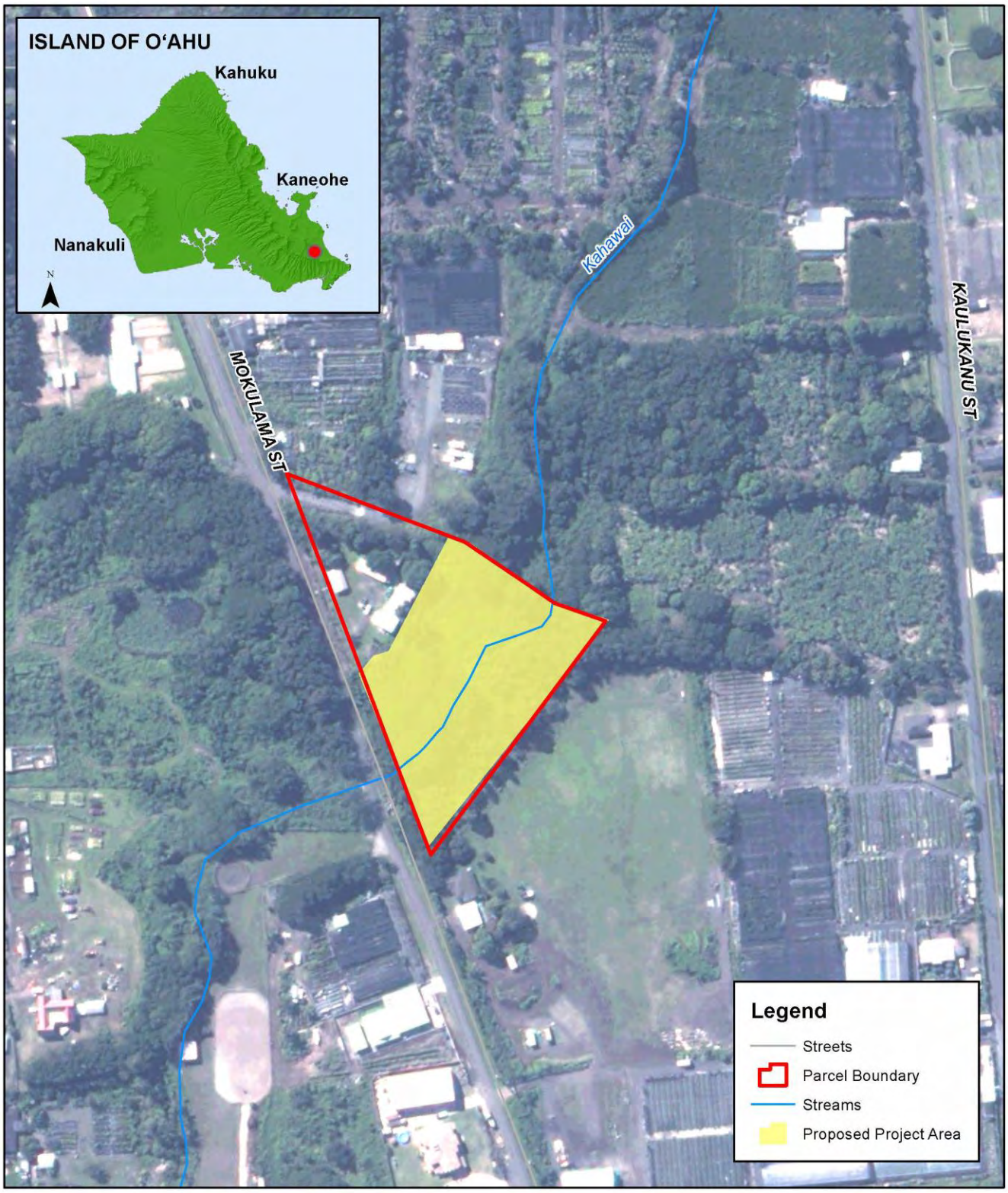
Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Early Consultation Handout for Draft Environmental Assessment

Project Information Summary

Project Name	Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Proposing and Determining Agency	Department of Agriculture State of Hawai‘i 1428 S. King Street Honolulu, HI 96814
Agent	Townscape, Inc. 900 Fort Street Mall, Suite 1160 Honolulu, HI 96813 Phone: (808) 550-3894 E-mail: gabrielle@townscapeinc.com
HRS, Chapter 343 Trigger	Use of State lands and funds
Project Location	41-645 Mokulama Street Waimānalo, HI 96795
Tax Map Key (TMK) and Recorded Fee Owner	4-1-024: 068 State of Hawai‘i
Project Area	Approximately 3.04 acres
State Land Use District	Agricultural
Development Plan	Ko‘olau Poko Sustainable Communities Plan
Special Management Area (SMA)	Not inside the SMA
Flood Zone	Zone AE (area within the 100-year floodplain, Base Flood Elevation determined) Zone AEF (floodway areas in the 100-year floodplain) Zone X (area outside floodplain)

Overview of Proposed Project

The project area is located on TMK 4-1-024: 068 in Waimānalo on the island of O‘ahu. The reservoir served as a former irrigation reservoir and was previously decommissioned. The current vegetation is well established within the decommissioned reservoir. Water ponds in a section of the property during rain events. The proposed project includes clearing the overgrown vegetation, grading to address existing ponding issues, and installing two rows of staggered bollards, approximately five feet in height, to capture debris. The proposed project area is highlighted in yellow on the attached Project Location map.



41-645 Mokulama Street, Waimānalo, HI 96795
(TMK 4-1-024: 068)
Project Location
February 2022

0 100 200 Feet

N

Appendix B

Early Consultation Comments

DEPARTMENT OF ENVIRONMENTAL SERVICES
CITY AND COUNTY OF HONOLULU
1000 ULUOHIA STREET, SUITE 308, KAPOLEI, HAWAII 96707
TELEPHONE: (808) 768-3486 ● FAX: (808) 768-3487 ● WEBSITE: http://envhonolulu.org

RICK BLANGIARDI
MAYOR

ROGER BABCOCK, JR., Ph.D., P.E.
DIRECTOR DESIGNATE

MICHAEL O'KEEFE
DEPUTY DIRECTOR

ROSS S. TANIMOTO, P.E.
DEPUTY DIRECTOR

IN REPLY REFER TO:
PRO 22-035

February 9, 2022

Ms. Gabrielle Sham
Townscape, Inc.
900 Fort Street Mall, Suite 1160
Honolulu, Hawaii 96813

Dear Ms. Sham:

SUBJECT: Early Consultation Request for Draft Environmental Assessment, Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir, Waimanalo, HI
TMK 4-1-024:068

We have reviewed the subject documents transmitted to us by your letter dated January 31, 2022. We have no comments and no objections to the proposed project.

Should you have any questions, please call Lisa Kimura, Civil Engineer, at (808) 768-3455.

Sincerely,

Roger Babcock, Jr., Ph.D., P.E.
Director Designate

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

DEAN UCHIDA
DIRECTOR

DAWN TAKEUCHI APUNA
DEPUTY DIRECTOR

EUGENE H. TAKAHASHI
DEPUTY DIRECTOR

February 9, 2022 2022/ELOG-258(GS)

Ms. Gabrielle Sham
Townscape, Inc.
900 Fort Street Mall, Suite 1160
Honolulu, Hawaii 96813

Dear Ms. Sham:

SUBJECT: Pre-Draft Environmental Assessment Consultation
41-645 Mokulama Street - Waimanalo
Tax Map Key 4-1-024: 068

This letter responds to your request received on February 2, 2022, for preliminary comments on an upcoming Draft Environmental Assessment (DEA) for the proposed spillway rehabilitation and vegetation clearing at the decommissioned Tai Lee Reservoir. The subject parcel is three acres (130,680 square feet) in area and is located within the AG-2 General Agricultural District. You indicate that the proposed work at the subject property includes clearing overgrown vegetation, grading to address ponding issues, and installing two rows of staggered five-foot bollards to capture debris (Project).

Please be advised that a grading permit may be required for the work proposed at the subject property. The Department of Planning and Permitting has no further comment at this time. We may have comments for the DEA when more detailed plans and a Project narrative are provided.

Should you have any questions, please contact Mr. Geoffry Spangler, of our Land Use Approval Branch, at (808) 768-8022 or via email at geoffry.spangler@honolulu.gov.

Very truly yours,

for Dean Uchida
Director

DEPARTMENT OF TRANSPORTATION SERVICES
CITY AND COUNTY OF HONOLULU
650 SOUTH KING STREET, 3RD FLOOR
HONOLULU, HAWAII 96813
Phone: (808) 768-8305 • Fax: (808) 768-4730 • web: www.honolulu.gov

RICK BLANGIARDI
MAYOR

J. ROGER MORTON
DIRECTOR

JON Y. NOUCHI
DEPUTY DIRECTOR

TP2/22-873323

February 18, 2022

Ms. Gabrielle Sham, Associate Planner
Townscape, Inc.
900 Fort Street Mall, Suite 1160
Honolulu, Hawaii 96813

Dear Ms. Sham:

Thank you for the opportunity to provide written comments regarding the Early Consultation Request for Draft Environmental Assessment (DEA); Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir - Waimanalo, Island of Oahu, Hawaii; Tax Map Key: 4-1-024: 068. We have the following comments.

1. Draft Environmental Assessment (DEA). The applicant shall submit the completed DEA to the Department of Transportation Services (DTS) for comment.

2. Street Usage Permit. A street usage permit from the DTS should be obtained for any construction-related work that may require the temporary closure of any traffic lane or pedestrian mall on a City street.

3. Neighborhood Impacts. The area representatives, neighborhood board, as well as the area residents, businesses, emergency personnel (fire, ambulance, and police), Oahu Transit Services, Inc. (TheBus and TheHandi-Van), etc., should be kept apprised of the details and status throughout the project and the impacts that the project may have on the adjoining local street area network.

4. Disability and Communication Access Board (DCAB). Project plans (vehicular and pedestrian circulation, sidewalks, parking and pedestrian pathways, vehicular ingress/egress, etc.) should be reviewed and approved

by DCAB to ensure full compliance with Americans with Disabilities Act requirements.

Should you have any questions, please contact Greg Tsugawa, of my staff, at (808) 768-6683.

Very truly yours,

J. Roger Morton
Director

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

February 14, 2022

Ms. Gabrielle Sham
Associate Planner
Townscape, Inc.
900 Fort Street Mall, Suite 1160
Honolulu, Hawaii 9683

Dear Mr. Sham:

Subject: Early Consultation Environmental Assessment
Spillway Rehabilitation and Vegetation Clearing at the Decommissioned
Tai Lee Reservoir Project
Waimanalo, Hawaii 96795
Tax Map Key: 4-1-024: 068

In response to your letter dated January 31, 2022, regarding the abovementioned subject, the Honolulu Fire Department reviewed the submitted information and determined that there will be no significant impact to fire department services.

Should you have questions, please contact Captain Timothy Caires of our Fire Prevention Bureau at 808-723-7094 or tcaires@honolulu.gov.

Sincerely,

CRAIG UCHIMURA
Acting Assistant Chief

CU/TC:bh

BOARD OF WATER SUPPLY

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

February 18, 2022

Ms. Gabrielle Sham
Townscape, Inc.
900 Fort Street Mall, Suite 1160
Honolulu, Hawaii 96813

Dear Ms. Sham:

Subject: Your Letter Dated January 31, 2022 Requesting Comments on the Draft Environmental Assessment for the Proposed Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Tax Map Key: 4-1-024: 068

Thank you for your letter regarding the proposed vegetation clearing project.

The Honolulu Board of Water Supply (BWS) does not have any objections to the proposed vegetation clearing project. BWS understands that the proposed project will not require any additional connections to the BWS system.

The BWS reserves further comments on the proposed project should any construction activity encroach onto BWS water lines and affect the BWS water system.

If you have any questions, please contact Robert Chun, Project Review Branch of our Water Resources Division at (808) 748-5443.

Very truly yours,

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

DAVID Y. IGE
GOVERNOR
STATE OF HAWAII

JOSH GREEN
LT GOVERNOR
STATE OF HAWAII

WILLIAM J. AILA, JR
CHAIRMAN
HAWAIIAN HOMES COMMISSION

TYLER I. GOMES
DEPUTY TO THE CHAIRMAN

STATE OF HAWAII
DEPARTMENT OF HAWAIIAN HOME LANDS
P. O. BOX 1879
HONOLULU, HAWAII 96805

February 23, 2022

In reply refer to:
PO-22-035

Sent by electronic mail: gabrielle@townscapeinc.com

Ms. Gabrielle Sham
Townscape, Inc.
900 Fort Street Mall, Suite 1160
Honolulu, HI 96813

Subject: Early Consultation for Draft Environmental Assessment
Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir – Waimānalo, O'ahu, Hawai'i, Tax Map Key 4-1-024:068

Dear Ms. Sham,

The Department of Hawaiian Home Lands (DHHL) acknowledges receiving the request for early consultation on the above-cited project. After review of the project description, we note that the site is located in close proximity to DHHL's Kumuhau and Kaka'ina homesteads in Waimānalo, O'ahu. Therefore, the proposed project should be assessed for its potential impacts on Hawaiian Home Lands in the region as well as evaluate the project's consistency with DHHL's General Plan, O'ahu Island Plan and the Waimānalo Regional Plan.

It is also important that DHHL's beneficiaries be included in future consultation to identify potential impact, propose mitigation and have input in the project timeline.

Mahalo for the opportunity to provide comments. If you have any questions, please call Pearlyn Fukuba, at (808) 620-9279 or contact via email at pearlyn.l.fukuba@hawaii.gov.

Aloha,

William J. Ailā Jr., Chairman
Hawaiian Homes Commission

c: DHHL Land Development Division
DHHL Land Management Division

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

RADE K. VANIC
INTERIM CHIEF

OUR REFERENCE EO-DK

February 23, 2022

SENT VIA EMAIL

Ms. Gabrielle Sham
gabrielle@townscapeinc.com

Dear Ms. Sham:

This is in response to your letter of January 31, 2022, requesting input on the Draft Environmental Assessment for the proposed Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir project located in Waimanalo.

The Honolulu Police Department (HPD) has reviewed the plans and has some concerns. The HPD recommends that adequate notification be made to the public and businesses on Mokulama Street in the event of road closures, as any impacts to pedestrian and/or vehicular traffic may lead to complaints.

If there are any questions, please call Major Crizalmer Caraang of District 4 (Kaneohe, Kailua, Kahuku) at (808) 723-8639.

Thank you for the opportunity to review this project.

Sincerely,

DARREN CHUN
Assistant Chief of Police
Support Services Bureau

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

February 28, 2022

LD 0099e

TOWNSCAPE, INC.
Attn: Gabrielle Sham
900 Fort Street Mall, Suite 1160
Honolulu, HI 96813

Via email: gabrielle@townscapeinc.com

Dear Sirs:

SUBJECT: **Early Consultation Request for Draft Environmental Assessment Spillway Rehabilitation and Vegetation Clearing at Decommissioned Tai Lee Reservoir – Waimanalo, Island of Oahu, Hawaii TMK: (1) 4-1-002:068**

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 is a response received from our Engineering Division. 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

Enclosure(s)
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

February 03, 2022

LD 0099e

MEMORANDUM

FROM: ~~TO:~~ **DLNR Agencies:**
X Div. of Aquatic Resources *(via email: kendall.l.tucker@hawaii.gov)*
__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: **Early Consultation Request for Draft Environmental Assessment Spillway Rehabilitation and Vegetation Clearing at Decommissioned Tai Lee Reservoir**
LOCATION: Waimanalo, Island of Oahu, Hawaii
TMK: (1) 4-1-024:068
APPLICANT: **TOWNSCAPE, INC. on behalf of the State of Hawaii Department of Agriculture**

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 **February 25, 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 barbara.j.lee@hawaii.gov. Thank you.

BRIEF COMMENTS:

( ) We have no objections.
(✓) We have no comments.
( ) We have no additional comments.
( ) Comments are included/attached.

Signed: *CSC*
Print Name: Carty S. Chang, Chief Engineer
Division: Engineering Division
Date: Feb 24, 2022

Attachments
Cc: Central Files

TOWNSCAPE, INC.
Environmental & Community Planning

900 Fort Street Mall Suite 1160 · Honolulu, HI 96813 · PH: (808) 536-6999 · FAX: (808) 524-4998 · www.townscapeinc.com

LD 0099e

RECEIVED
LAND DIVISION
2022 FEB 02 PM 3:30
DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

January 31, 2022

Subject: Early Consultation Request for Draft Environmental Assessment (DEA)
Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir - Waimānalo, Island of O'ahu, Hawai'i
Tax Map Key: 4-1-024: 068

Dear Participant,

On behalf of the State of Hawai'i, Department of Agriculture (DOA), Townscape, Inc. is preparing a DEA, pursuant to Hawai'i Revised Statues, Chapter 343, and Hawai'i Administrative Rules (HAR), Chapter 11-200.1 for the proposed Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir project ("Project").

Pursuant to HAR, Chapter 11-200.1-18, the DOA (Proposing Agency) is conducting early consultation to seek input from agencies, citizen groups, and individuals who may have an area of expertise, which may guide the scope and preparation of the DEA, and/or may be affected by the proposed Project. Please find enclosed an Early Consultation Handout with a project description and location map for your review and comment. We are requesting comments no later than **February 28, 2022** to be sent via mail or e-mail to:

Townscape, Inc.
Attn: Gabrielle Sham
900 Fort Street Mall, Suite 1160
Honolulu, HI 96813
E-mail: gabrielle@townscapeinc.com

If we do not receive a response by this date, we will assume your agency or organization has no comments. Please contact the undersigned with any questions you may have at (808) 550-3894 or via e-mail at gabrielle@townscapeinc.com. Thank you in advance for your participation in the early consultation for this Project.

Sincerely,

Gabrielle Sham
Associate Planner

Enclosure: Early Consultation Handout

RECEIVED
2022 FEB -2 AM 10:30
DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Early Consultation Handout for Draft Environmental Assessment

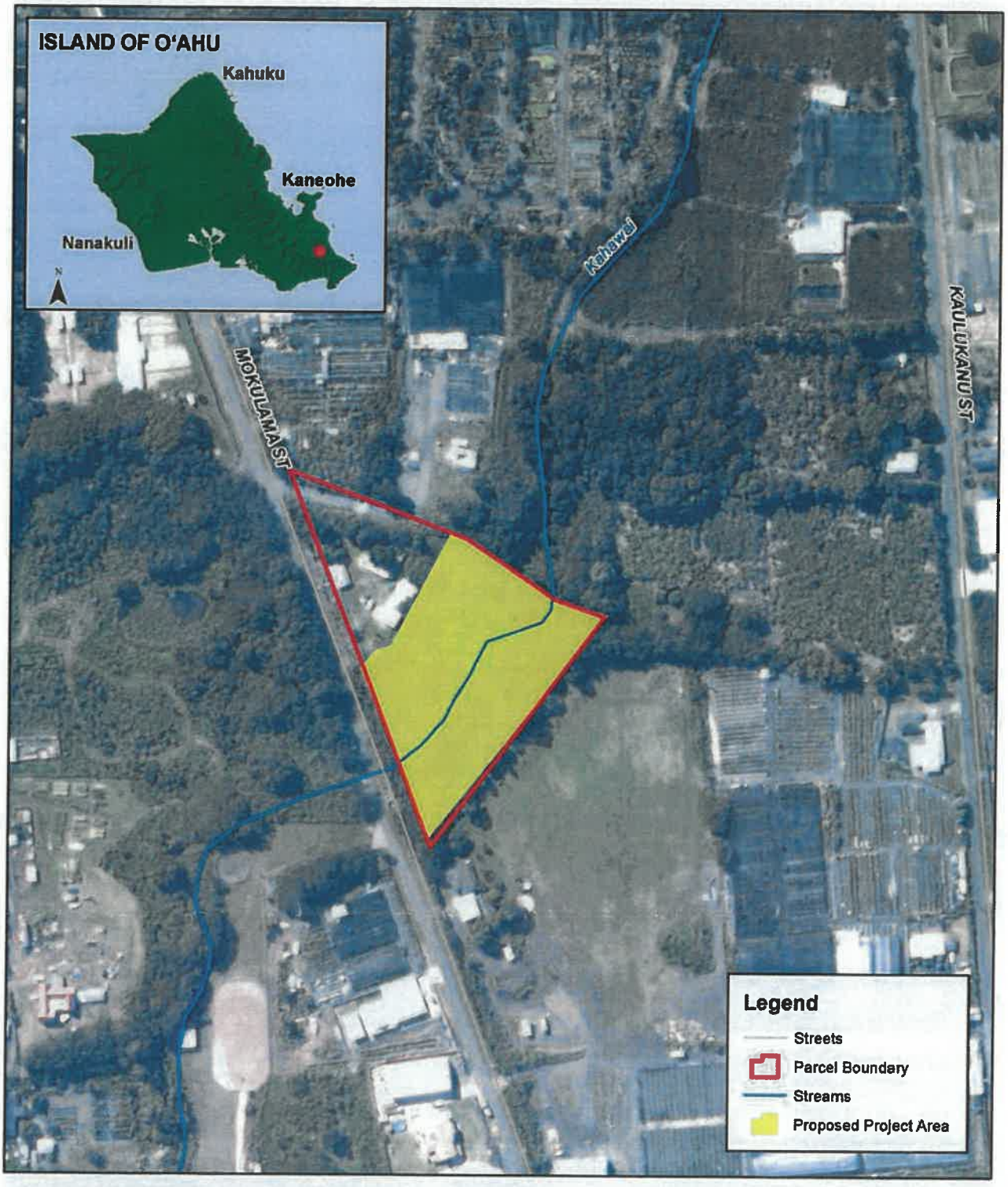
Project Information Summary

Project Name	Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Proposing and Determining Agency	Department of Agriculture State of Hawai'i 1428 S. King Street Honolulu, HI 96814
Agent	Townscape, Inc. 900 Fort Street Mall, Suite 1160 Honolulu, HI 96813 Phone: (808) 550-3894 E-mail: gabrielle@townscapeinc.com
HRS, Chapter 343 Trigger	Use of State lands and funds
Project Location	41-645 Mokulama Street Waimānalo, HI 96795
Tax Map Key (TMK) and Recorded Fee Owner	4-1-024: 068 State of Hawai'i
Project Area	Approximately 3.04 acres
State Land Use District	Agricultural
Development Plan	Ko'olau Poko Sustainable Communities Plan
Special Management Area (SMA)	Not inside the SMA
Flood Zone	Zone AE (area within the 100-year floodplain, Base Flood Elevation determined) Zone AEF (floodway areas in the 100-year floodplain) Zone X (area outside floodplain)

Overview of Proposed Project

The project area is located on TMK 4-1-024: 068 in Waimānalo on the island of O'ahu. The reservoir served as a former irrigation reservoir and was previously decommissioned. The current vegetation is well established within the decommissioned reservoir. Water ponds in a section of the property during rain events. The proposed project includes clearing the overgrown vegetation, grading to address existing ponding issues, and installing two rows of staggered bollards, approximately five feet in height, to capture debris. The proposed project area is highlighted in yellow on the attached Project Location map.

Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Early Consultation Handout for Draft Environmental Assessment



41-645 Mokulama Street, Waimānalo, HI 96795
(TMK 4-1-024: 068)
Project Location
February 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

March 03, 2022

LD 0099e

TOWNSCAPE, INC.
Attn: Gabrielle Sham
900 Fort Street Mall, Suite 1160
Honolulu, HI 96813

Via email: gabrielle@townscapeinc.com

Dear Sirs:

SUBJECT: **Early Consultation Request for Draft Environmental Assessment Spillway Rehabilitation and Vegetation Clearing at Decommissioned Tai Lee Reservoir – Waimanalo, Island of Oahu, Hawaii TMK: (1) 4-1-002:068**

Thank you for the opportunity to review and comment on the above subject. In addition to previous comments sent to you from the Department of Land and Natural Resources (DLNR) dated February 28, 2022, enclosed are comments received from DLNR's Division of Forestry and Wildlife.

Should you have any questions, please feel free to contact Barbara Lee at 587-0453 or barbara.j.lee@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Enclosure
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

February 03, 2022

LD 0099e

MEMORANDUM

TO: **DLNR Agencies:**
X Div. of Aquatic Resources *(via email: kendall.l.tucker@hawaii.gov)*
__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: **Early Consultation Request for Draft Environmental Assessment Spillway Rehabilitation and Vegetation Clearing at Decommissioned Tai Lee Reservoir**
LOCATION: Waimanalo, Island of Oahu, Hawaii
TMK: (1) 4-1-024:068
APPLICANT: **TOWNSCAPE, INC. on behalf of the State of Hawaii Department of Agriculture**

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 **February 25, 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 barbara.j.lee@hawaii.gov. Thank you.

BRIEF COMMENTS:

( ) We have no objections.
( ) We have no comments.
( ) We have no additional comments.
(☑) Comments are included/attached.

Signed: DGS
Print Name: DAVID G. SMITH, Administrator
Division: Division of Forestry and Wildlife
Date: Mar 3, 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

March 3, 2022

MEMORANDUM

Log no. 3523

TO: RUSSELL Y. TSUJI, Land Administrator
Land Division

FROM: DAVID G. SMITH, Administrator
Division of Forestry and Wildlif

SUBJECT: **Division of Forestry and Wildlife Comments for an Early Consultation Request on a Draft Environmental Assessment (DEA) for Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir on O'ahu**

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) has received your request for comment as a part of early consultation for a DEA concerning spillway rehabilitation and vegetation clearing at the decommissioned Tai Lee Reservoir in Waimanalo on the island of O'ahu, TMK: (1) 4-1-024:068. The proposed project consists of the clearing of overgrown vegetation at the spillways, grading to address existing ponding issues, and the installation of two rows of approximately 5 foot high staggered bollards to capture debris.

The State listed Hawaiian Hoary Bat or 'Ōpe'ape'a (*Lasiurus cinereus semotus*) could potentially occur in the vicinity of the project area 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 be avoided for any construction because bat mortalities have been documented as a result of becoming ensnared by this type of fencing during flight.

Artificial lighting can adversely impact seabirds that may pass through the area at night by causing disorientation. This disorientation can result in a 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.

State-listed waterbirds such as the Hawaiian Duck (*Anas wyvilliana*), Hawaiian Stilt (*Himantopus mexicanus knudseni*), Hawaiian Coot (*Fulica alai*), and Hawaiian Common Gallinule (*Gallinula*

chloropus sandvicensis) could potentially occur in the vicinity of the proposed project sites. It is against State law to harm or harass these species. If any of these species are present during construction activities, then all activities within 100 feet (30 meters) should cease, and the bird should not be approached. Work may continue after the bird leaves the area of its own accord. If a nest is discovered at any point, please contact the O'ahu Branch DOFAW Office at (808) 973-9778.

The State endangered Hawaiian Short-eared Owl or Pueo (*Asio flammeus sandwichensis*) could also potentially occur in the vicinity of the project site. The Pueo is a crepuscular species that most active during dawn and dusk twilights. DOFAW recommends twilight pre-construction surveys by a qualified biologist prior to clearing vegetation. If Pueo nests are present, a buffer zone should be established in which no clearing occurs until nesting ceases, and DOFAW staff should be notified.

The project work on the Tai Lee Reservoir and Kahawai Stream could affect endangered native Hawaiian damselflies (*Megalagrion* spp.) that may be present. Therefore, DOFAW recommends that a survey be conducted by a qualified entomologist to determine if listed damselflies are present in the project area and to assess any potential impacts to those species.

DOFAW recommends minimizing the movement of plant or soil material between worksites, such as in fill. Soil and plant material may contain invasive fungal pathogens (e.g., Rapid 'Ōhi'a Death), vertebrate and invertebrate pests (e.g., Little Fire Ants, 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 in planning, design, and construction of the project to learn of any high-risk invasive species in the area and ways to mitigate spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive species. Gear that may contain soil, such as work boots and vehicles, should be thoroughly cleaned with water and sprayed with 70% alcohol solution to prevent the spread of Rapid 'Ōhi'a Death and other harmful fungal pathogens.

To prevent the spread of Rapid 'Ōhi'a Death (ROD), if 'ōhi'a trees are present and will be removed, trimmed, or potentially injured DOFAW requests that the information and guidance at the following website be reviewed and followed: https://cms.ctahr.hawaii.edu/rod.

We appreciate your efforts to work with our office for the conservation of our native species. 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,

DAVID G. SMITH
Administrator

TOWNSCAPE, INC.
Environmental & Community Planning

900 Fort Street Mall Suite 1160 · Honolulu, HI 96813 · PH: (808) 536-6999 · FAX: (808) 524-4998 · www.townscapeinc.com

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RECEIVED
LAND DIVISION
2022 FEB 02 PM 3:30
DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

January 31, 2022

Subject: Early Consultation Request for Draft Environmental Assessment (DEA)
Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir - Waimānalo, Island of O'ahu, Hawai'i
Tax Map Key: 4-1-024: 068

Dear Participant,

On behalf of the State of Hawai'i, Department of Agriculture (DOA), Townscape, Inc. is preparing a DEA, pursuant to Hawai'i Revised Statues, Chapter 343, and Hawai'i Administrative Rules (HAR), Chapter 11-200.1 for the proposed Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir project ("Project").

Pursuant to HAR, Chapter 11-200.1-18, the DOA (Proposing Agency) is conducting early consultation to seek input from agencies, citizen groups, and individuals who may have an area of expertise, which may guide the scope and preparation of the DEA, and/or may be affected by the proposed Project. Please find enclosed an Early Consultation Handout with a project description and location map for your review and comment. We are requesting comments no later than **February 28, 2022** to be sent via mail or e-mail to:

Townscape, Inc.
Attn: Gabrielle Sham
900 Fort Street Mall, Suite 1160
Honolulu, HI 96813
E-mail: gabrielle@townscapeinc.com

If we do not receive a response by this date, we will assume your agency or organization has no comments. Please contact the undersigned with any questions you may have at (808) 550-3894 or via e-mail at gabrielle@townscapeinc.com. Thank you in advance for your participation in the early consultation for this Project.

Sincerely,

Gabrielle Sham
Associate Planner

Enclosure: Early Consultation Handout

RECEIVED
2022 FEB -2 AM 10:30
DEPT. OF LAND
& NATURAL RESOURCES
STATE OF HAWAII

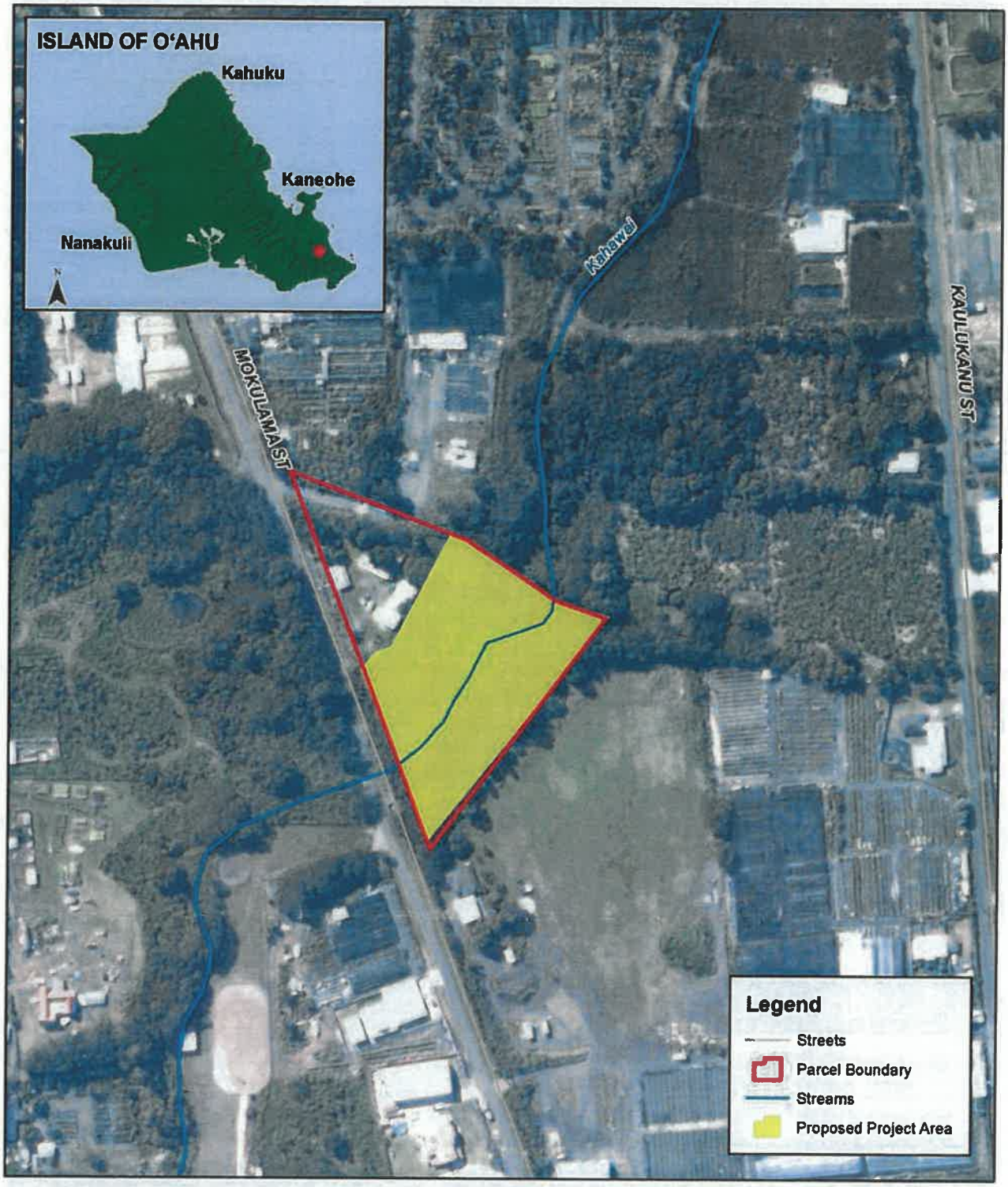
Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Early Consultation Handout for Draft Environmental Assessment

Project Information Summary

Project Name	Spillway Rehabilitation and Vegetation Clearing at the Decommissioned Tai Lee Reservoir
Proposing and Determining Agency	Department of Agriculture State of Hawai'i 1428 S. King Street Honolulu, HI 96814
Agent	Townscape, Inc. 900 Fort Street Mall, Suite 1160 Honolulu, HI 96813 Phone: (808) 550-3894 E-mail: gabrielle@townscapeinc.com
HRS, Chapter 343 Trigger	Use of State lands and funds
Project Location	41-645 Mokulama Street Waimānalo, HI 96795
Tax Map Key (TMK) and Recorded Fee Owner	4-1-024: 068 State of Hawai'i
Project Area	Approximately 3.04 acres
State Land Use District	Agricultural
Development Plan	Ko'olau Poko Sustainable Communities Plan
Special Management Area (SMA)	Not inside the SMA
Flood Zone	Zone AE (area within the 100-year floodplain, Base Flood Elevation determined) Zone AEF (floodway areas in the 100-year floodplain) Zone X (area outside floodplain)

Overview of Proposed Project

The project area is located on TMK 4-1-024: 068 in Waimānalo on the island of O'ahu. The reservoir served as a former irrigation reservoir and was previously decommissioned. The current vegetation is well established within the decommissioned reservoir. Water ponds in a section of the property during rain events. The proposed project includes clearing the overgrown vegetation, grading to address existing ponding issues, and installing two rows of staggered bollards, approximately five feet in height, to capture debris. The proposed project area is highlighted in yellow on the attached Project Location map.



41-645 Mokulama Street, Waimānalo, HI 96795
(TMK 4-1-024: 068)
Project Location
February 2022

Appendix C

Environmental survey for Tai Lee Reservoir
(AECOS, Inc., June 2021)

AECOS No. 1669

Environmental surveys for Tai Lee Reservoir, Waimānalo, Oʻahu

AECOS Inc.
45-939 Kamehameha Highway, Suite 104
Kāneʻohe, Hawaiʻi 96744

June 24, 2021

Environmental surveys for Tai Lee Reservoir, Waimānalo, Oʻahu

June 24, 2021 **DRAFT** *AECOS* No. 1669

Lesley Davidson, Bryson Luke, and Susan Burr
AECOS Inc.
45-939 Kamehameha Highway Suite 104
Kāneʻohe, Hawaiʻi 96744
Phone: (808) 234-7770 Fax: (808) 234-7775 Email: lesley@aecos.com

Introduction

The State of Hawaiʻi, Department of Agriculture, owns Tai Lee Reservoir (TMK: 4-1-024:068) in Waimānalo on windward Oʻahu (Figure 1). The parcel is 1.23 ha (3.04 ac) and zoned for agriculture use. The proposed action is to remove trees and rehabilitate the "dam" structure ("Project"). *AECOS* Inc. was contracted by Okahara & Associates to undertake environmental surveys of the parcel and prepare a report of findings[1]. Our report includes a jurisdictional waters determination and delineation, a flora and fauna survey, and an assessment of impacts.

Site Description

Tai Lee Reservoir is an impoundment of the left branch of Kahawai Stream[2] located in the relatively small Kahawai watershed (725 ha or 1792 ac; Parham et al., 2008) on the windward side of the Koʻolau Mountain (Figure 2). The left branch of Kahawai Stream originates at approximately 663 m (2175 ft) above sea level (ASL) and joins the right branch of Kahawai Stream just inland of the estuary at Kalanianaʻole Highway. The stream mouth is normally confined behind a sand barrier at Waimānalo Beach, forming what is known in Hawaiʻi as a *muliwai*: an estuarine, stream mouth pond. The sand barrier is only breached during significant flooding events; under low flow conditions, water from the stream flows out through the porous sand barrier into Waimānalo Bay.

[1] This report is intended to become part of the public record and incorporated into permitting documents and an EA for the subject project.

[2] Other sources refer to Kahawai Stream as Puna Stream (USGS, 2017) or Inoa'ole Stream (AECOS, 2016). This report will refer to the entire tributary as Kahawai Stream.

Figure 1. Location of Tai Lee Reservoir, yellow star and (inset) outlined in red.

Despite the moderately high annual rainfall in the upper reaches of the watershed of Kahawai Stream (~1900 mm or ~75 in; Giambelluca et. al., 2013), streams this far east on O'ahu are not perennial on either side of the Ko'olau ridgeline[3]. Given the predominantly karst nature of the Waimānalo plain, historic streams flowing onto the plain did not reach the ocean shore. Freshet flows likely sunk into the ground, sometimes producing localized flooding. The lowest reach of present-day Kahawai Stream is a man-made channel built to mitigate flood hazards. The channel is a permanent, brackish body of water that extend from the mouth to the inland boundary of Bellows Air Force Station.

The Waimānalo Irrigation System, currently operated by the Agricultural Resource Management Division of Hawai'i Department of Agriculture, includes a

[3] Kahawai Stream is classified as a perennial stream in the Hawaii Watershed Atlas (Param et al., 2008), but is not on the list of perennial streams in the Hawaii Stream Assessment (Hawaii Cooperative Park Service Unit, 1990).

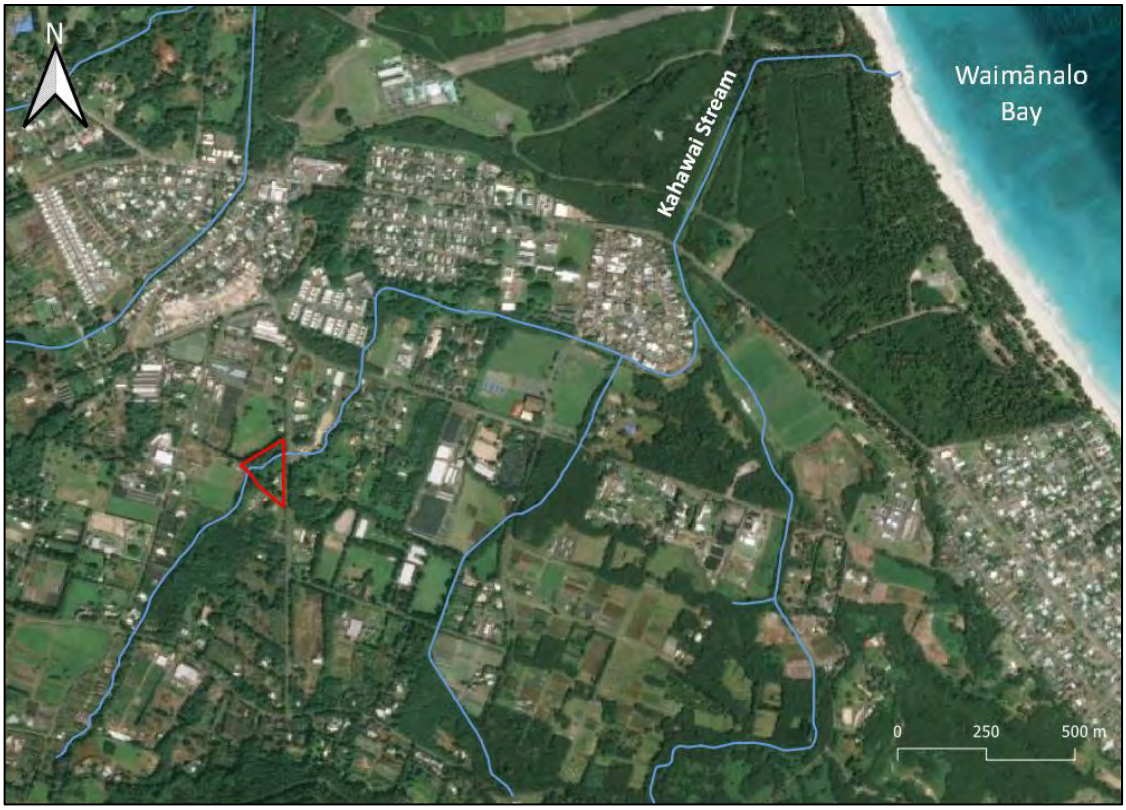


Figure 2. Location of Tai Lee Reservoir (in red outline) within the Kahawai Watershed.

series of reservoirs, flumes, ditches, tunnels, and modified stream channels that transport water throughout Waimānalo. The irrigation system was built over a hundred years ago to bring water from upper Kailua springs, Maunawili Watershed, Kawainui Marsh, and upper reaches of Waimānalo Stream to irrigate Waimānalo Sugar Company fields (Wilcox, 1996). Today, the somewhat dilapidated irrigation system provides water for diversified agriculture throughout Waimānalo, although many of its ditches and reservoirs are no longer functional. In some cases, old ditches have been replaced by pipes, in others, the ditches have simply been filled in.

In recent times, Kahawai Stream channels have been modified across the Waimānalo plain to reduce flood hazards. Habitats have been altered through the destruction of wetlands and overgrowth by introduced plants, and channels have been hardened and straightened for various road construction and flood control projects (HDOH-EPO, 2001; Laws, 2000; and Krupp, 2000).
Kahawai Stream is visible on the Hawai'i layers of the US Geological Survey

(USGS) StreamStats map-based web application (USGS, 2017); streamflow statistics computed for the mouth of Kahawai Stream include a 2-year peak flood of 1,380 cubic feet per second (cfs) and a 100-year peak flow of 7,500 cfs.

Precipitation in Waimānalo is moderate. The National Oceanographic and Atmospheric Administration National Centers for Environmental Information (NOAA-NCEI) climate normals (three-decade averages of climatological variables) for Sta. "WAIMĀNALO EXP F 795.1, HI US", located adjacent to the University of Hawai'i, Waimānalo Research Station, includes an average annual rainfall of 1,052 mm (42.43 in; NOAA-NCEI, 2020). USGS StreamStats calculates mean annual precipitation for the Kahawai Stream drainage basin (3.16 sq mi, 8.18 sq km) to be 1,249 mm (49.6 in; USGS, 2017). Most rainfall occurs during the wet season from November through April, although mean monthly rainfall is at least 33 mm (1.3 in) throughout the year (Giambelluca, 2013).

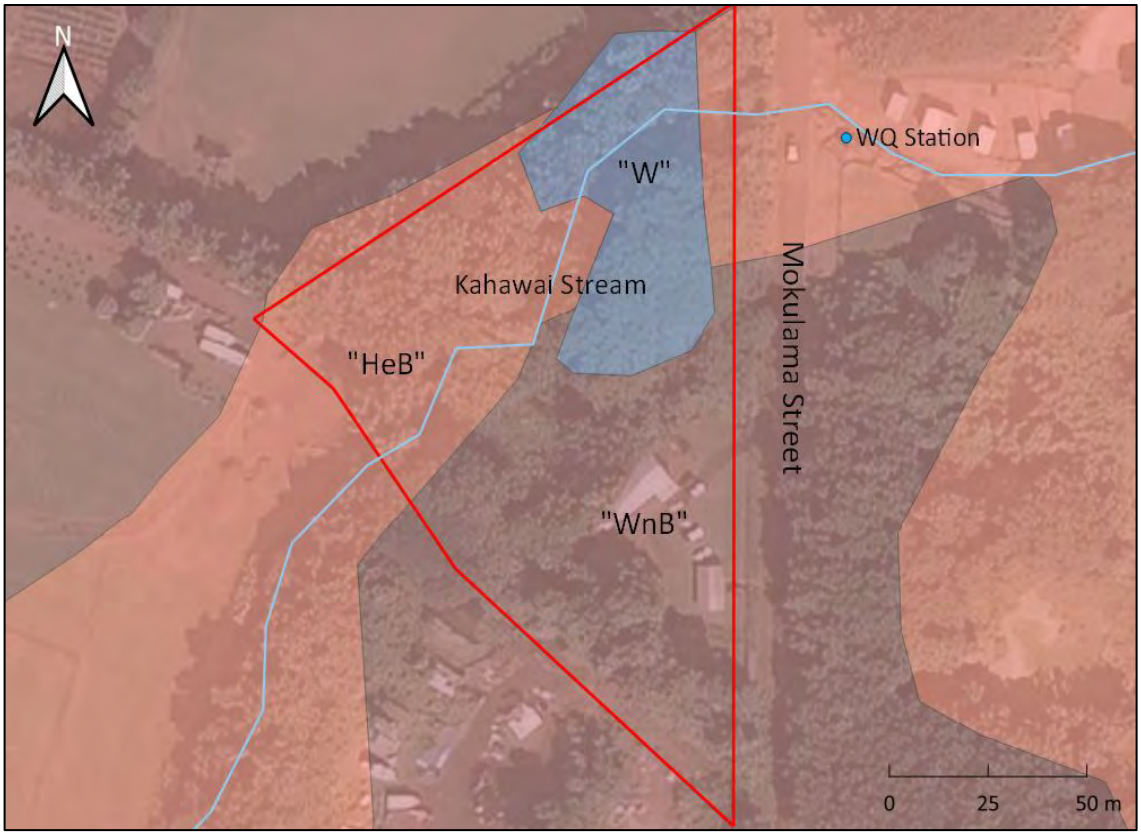


Figure 3. Mapped soils and features (USDA-NRCS, 2020a) in survey area outlined in red.

Mapped soils in the survey area (Figure 3, above) are Haleiwa silty clay, 2-6% slope ("HeB") and Waialua clay, 2-6% slope ("WnB"; USDA-NRCS, 2020a). Both soil types are listed as nonhydric soils on the U.S. Dept. of Agriculture-Natural Resources Conservation Service (USDA-NRCS), National List of Hydric Soils for O'ahu (USDA-NRCS, 2020b). Although dry, the 0.2 ha (0.7 ac) reservoir is mapped as water ("W").

Flood zones within the survey area, as identified in the Hawai'i Department of Land and Natural Resources (HDLNR) on-line flood hazard assessment tool (HDLNR, nd), are provided in Figure 4 and Table 1. Most of the Project is in the flood zone (subject to inundation by the 1% annual chance flood).

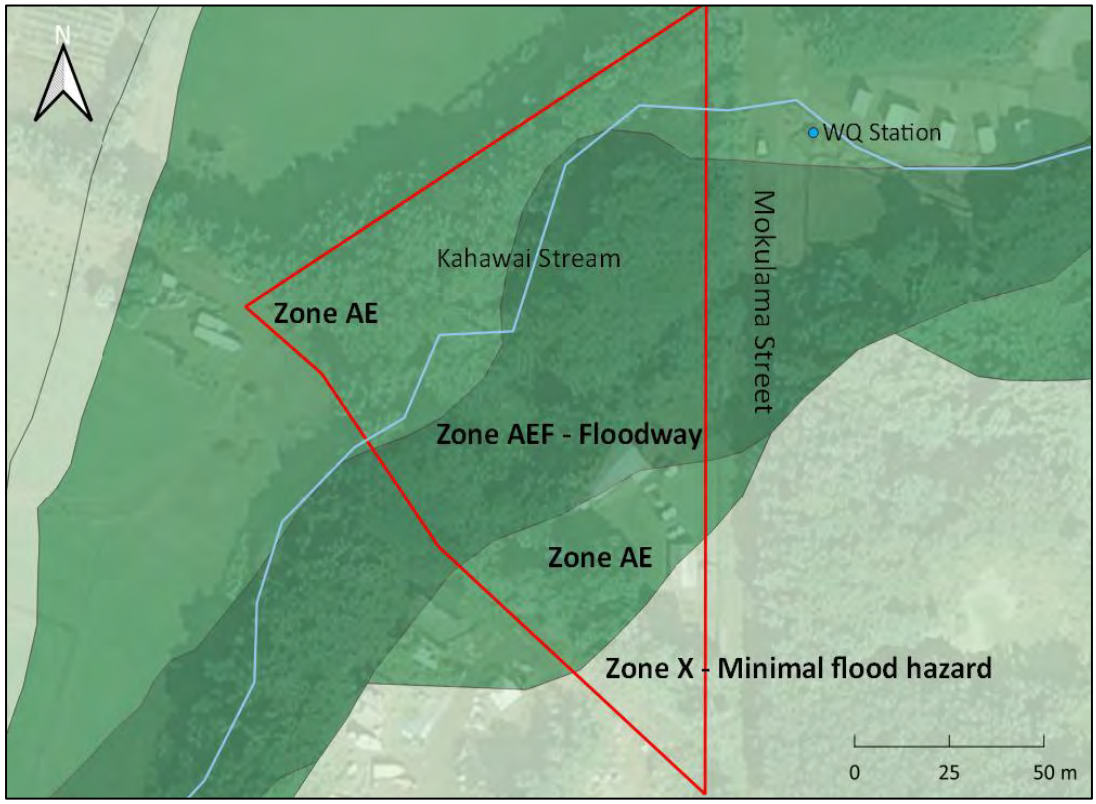


Figure 4. Mapped flood zones in survey area outlined in red (HDLNR, nd).

Table 1. Flood zones within survey area (HDLNR, nd).

Zone (CODE)	Zone Description
AEF	The floodway area; the channel or watercourse and adjacent floodplain
AE	Area subject to inundation by the 1% annual chance flood (100-year flood), also known as the base flood
X	Area of minimal flood hazard; outside of the 0.2% annual chance flood (500-year flood)

Jurisdictional Waters

Waters of the U.S. (also called "jurisdictional waters") are surface waters that come under federal jurisdiction as authorized by the Clean Water Act (CWA) and Rivers and Harbors Act (RHA). Authority over these waters is granted to various federal agencies, including the U.S. Environmental Protection Agency (USEPA), with the U.S. Army Corps of Engineers (USACE) having permit authority for actions that impact jurisdictional waters. Jurisdictional waters include all tidal waters and a subset of streams (both perennial and intermittent), lakes, reservoirs, and wetlands.

On June 22, 2020, the Navigable Waters Protection Rule (NWPR) came into effect (USACE and USEPA, 2020) and redefined the scope of waters regulated under the CWA. As applicable to the Project, the NWPR specifically identifies intermittent and perennial stream tributaries and impoundments of jurisdictional tributaries, as jurisdictional waters but excludes ephemeral tributaries and wetlands without a direct hydrologic surface connection to an otherwise jurisdictional water body.

In the NWPR, a *tributary* is defined as an intermittent or perennial surface water channel (e.g., stream) that contributes surface flow to other waters of the U.S. (e.g., ocean) in a typical year. An *intermittent* stream is one that has surface water flowing continuously during certain times of the year and more than in direct response to precipitation; a *perennial* stream has surface water flowing continuously year-round. An *ephemeral* stream has surface water flowing or pooling only in direct response to precipitation. A tributary does not lose its jurisdictional status if it flows through a channelized non-jurisdictional surface water (such as a culvert) and a perennial or intermittent ditch is jurisdictional if it is a relocated tributary or is constructed in an adjacent wetland. The jurisdictional boundary of non-tidal streams is the ordinary high water mark

(OHWM), and the jurisdictional boundary of adjacent wetlands is the wetland/upland boundary. *Wetlands* are defined as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

If a wetland is present and adjacent to a jurisdictional water, CWA and RHA jurisdiction extends to the wetland/upland boundary. Adjacent wetlands means wetlands that (i) abut a jurisdictional waterbody, (ii) are inundated by flooding from a jurisdictional waterbody, (iii) are separated from a jurisdictional waterbody only by a natural berm, bank, dune, or similar natural feature; or (iv) are physically separated from a jurisdictional waterbody by an artificial dike, barrier, or similar artificial structure so long as that structure allows for a direct hydrologic connection in a typical year, such as via a culvert, flood or tide gate, pump, or similar artificial feature (USACE and USEPA, 2020).

Methods

Water Quality

AECOS biologists measured select field parameters and collected samples to characterize water quality of Kahawai Stream (Figure 5). The sampling location was east of the Project site (Figure 7), but was the only location within 50-m of the Project that had surface water.

In situ field measurements were made for temperature, conductivity, pH, dissolved oxygen (DO), and turbidity. Water samples were collected for laboratory analysis of total suspended solids (TSS), and nutrients (nitrate+nitrite, total nitrogen, and total phosphorous). Samples were collected from just below the water surface, stored on ice, and taken to the *AECOS* laboratory in Kāne'ohe for analyses (*AECOS* Laboratory Log No. 42492). Table 2 lists analytical methods used to analyze these water samples.

Flora

AECOS biologists identified vascular plants in the Project area by conducting a wandering pedestrian survey. As the survey progressed, estimates of relative abundances were made for all ferns, fern allies, gymnosperms, and flowering plants growing in the Project area. Field notes were translated into a floral listing. Plant names given in the listing follow *Manual of the Flowering Plants of Hawai'i* (Wagner et al., 1990, 1999) for native and naturalized flowering plants,

Figure 5. Water sample collection in Kahawai Stream.

Table 2. Analytical methods used for water quality analyses.

Analysis	Method	Reference
Temperature	SM 2550 B	SM (1998)
Conductivity	SM 2510 B	SM (1998)
pH	SM 4500 H+	SM (1998)
Dissolved Oxygen	SM 4500 O G	SM (1998)
Turbidity	EPA 180.1 Rev 2.0	USEPA (1993)
Total Suspended Solids	SM 2540 D	SM (1998)
Nitrate + Nitrite	EPA 353.2	USEPA (1993)
Total Nitrogen	ASTM D5176-08	ASTM (2015)
Total Phosphorus	EPA 365.5 (Persulfate digestion)	USGS (2003), USEPA (1997)

Hawaii's Ferns and Fern Allies (Palmer, 2003) for ferns, and *A Tropical Garden Flora* (Staples and Herbst, 2005) for ornamental plants. Some names have been updated to reflect more recent taxonomic or nomenclatural changes as presented in Imada (2019).

Fauna

Avian Survey

A survey of extant birds was conducted on the morning of May 7, 2021. Birds were identified to species by visual observation aided by Leica 8 X 42 binoculars and by listening for vocalizations. Avian species abundance was estimated at two count stations. A single eight-minute avian point-count was made at each of the count stations. Additional species observed in the Project area outside of the timed counts were recorded as incidental observations. Weather conditions were ideal, with unlimited visibility, no precipitation, and winds between 1 and 10 kilometers per hour. The avian phylogenetic order and nomenclature used in this report follows the 61st supplement to the AOS *Check-List of North and Middle American Birds* (Chesser et al., 2019, 2020). A 30-minute waterbird survey was deemed unnecessary due to an absence of waterbird habitat.

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 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).

No survey was conducted for Hawaiian hoary bat or *'ōpe'ape'a* (*Lasiurus semotus*). The population of the bat on O'ahu is sparse, and detection of this bat requires night surveys and deployment of special acoustic detection equipment. Rather, forage habitat and trees that could serve as potential roost-sites for the species were noted, where present.

Jurisdictional Waters

On May 7, 2021, *AECOS* scientists conducted a survey to determine if aquatic features in the survey area are jurisdictional waters. For features deemed likely to be jurisdictional, we delineated the jurisdictional boundaries. Wetland delineations follow the methods described in the Corps of Engineers Wetland Delineation Manual ("Manual"; USACE, 1987) and Regional Supplement for Hawai'i and Pacific Islands (USACE, 2012). The wetland status of plant species

derives from the 2012 National Wetland Plant List (Lichvar, 2012) and a 2018 update (USACE, 2018). Delineated surface waters and wetlands are categorized using the Classification of Wetlands and Deepwater Habitats of the United States (FGDC, 2013), which is the classification system adapted from Cowardin et al. (1979).

Non-tidal rivers and streams are delineated at the OHWM using field observations of physical indicators of flow on the streambed and bank. The following physical characteristics are indicators of the OHWM: clear and natural line impressed on the banks, shelving, changes in the character of the soil, destruction of terrestrial vegetation, litter, debris, and other appropriate means that consider the characteristics of the surrounding areas (USACE and USEPA, 2020).

AECOS scientists marked the OHWM at paired locations along the stream channel (one on each bank) with flagging tape. Photographs at selected points were taken to document the OHWM characteristics and to illustrate the environment (Attachment C). *AECOS* marked the geospatial locations of the OHWM points using a handheld global navigation satellite system (GNSS) instrument (Trimble Geo 7X), providing, in most cases, 0.5-m accuracy in position. The resulting shapefile was processed with GPS Pathfinder, including differential correction, and exported as ArcMap shapefiles using a projected coordinate system of NAD 1983 UTM Zone 4N.

Streams

Under the 2020 NWPR, flow within tributaries must be intermittent or perennial to qualify as a federal jurisdictional tributary. Because the segment of Kahawai Stream located within the Project area does not support perennial streamflow, *AECOS* biologists applied streamflow duration assessment methods (SDAMs) to determine whether the stream had either "intermittent" or "ephemeral" streamflow. The State of Hawai'i does not have a published SDAM. We have been testing (*AECOS,* 2021a; 2021b) the applicability of the North Carolina Stream Assessment Method (NCSAM), which was developed by a team of federal and North Carolina state agencies over a period of several years (NCDWQ, 2010). The NCSAM uses stream characteristics and commonly observable geomorphic, hydrologic and biological processes as streamflow indicators to produce a numeric score. The accumulated score from all the indicators assigns a streamflow type of "ephemeral", "intermittent", or "perennial" to the stream reach under evaluation.

Wetlands

Wetlands require positive evidence of hydric soil, wetland hydrology, and hydrophytic vegetation, and all three must be present for a positive wetland determination. Wetland data determination sampling points ("SP") are used to describe vegetation type, hydrology, and soils in an area in order to confirm or refute the presence of wetlands. The boundary between jurisdictional wetland and other aquatic feature or upland is established as a line outside of which at least one of the three indicators is absent.

AECOS biologists established one SP in the center of the reservoir based on the assumption that, considering all of the Project area, this point would have the greatest potential of being classified as wetland. Photographs were taken at the SP to document existing conditions and illustrate the environment (Figure 6).

Table 3 provides plant wetland status indicators and their definitions. The wetland indicator status of each species in the plant assemblage at a SP is used to determine if a site has a "prevalence of vegetation typically adapted for life in saturated soil conditions." We identified plant assemblages in the survey area and made visual estimates at the SP of percent cover of plant species in sample plots of appropriate size and shape, depending upon the type of vegetation and size or shape of the plant community.

Table 3. Plant status indicators and their definitions (after Lichvar and Gillrich [2011, 2012]).

Status indicator (CODE)	Qualitative Description
OBL (OBL)	Almost always occurs in wetlands
Facultative wetland (FACW)	Usually occurs in wetlands, but may occur in non-wetlands
Facultative (FAC)	Occurs in wetlands and non-wetlands
Facultative upland (FACU)	Usually occurs in non-wetlands, but may occur in wetlands
Upland (ULP)	Almost never occurs in wetlands

Hydric soils are soils that are sufficiently wetted in the upper layers to develop anaerobic conditions; that is, soils that could be associated with wetlands. Soil saturation with water is what differentiates wetland soils from upland soils, as saturation greatly reduces the oxygen present between soil particles. In determining whether a soil is hydric, we look for evidence of this saturation (i.e., reducing conditions); the soil need not be water saturated at the time of

Figure 6. *Macaranga tanarius* and *Falcataria moluccana* found within 10-m radius of SP-01.

inspection, and indeed may be dry. Even though the soil types mapped in the survey area are not hydric soils (Figure 3; USDA-NRCS, 2020a; 2020b), U.S. Fish and Wildlife Service, National Wetlands Inventory mapper app classifies this area as "freshwater forest/scrub wetland" (nd-a).Inspection by soil pits is a necessary part of the wetland determination process as local conditions can deviate from a mapped soil type, and sufficient saturation or inundation can render even fill material as hydric.

Results

Water Quality

Results of the water quality sampling and analyses from Kahawai Stream are shown in Table 4. At 118% saturation, the standing water in the channelized segment of Kahawai Stream downstream of the reservoir was supersaturated with dissolved oxygen (DO). High TSS and especially turbidity reflect algal cells, (phytoplankton) in the water. The growth of these cells has greatly reduced the soluble nitrate - nitrites. Most of Total N is either ammonium (unlikely given the high DO) or organic matter.

Table 4. Water quality results for the May 7, 2021 sampling event.

Station	Time	Temp. (°C)	Conductivity (µs/cm)	pH (su)	Dissolved Oxygen (mg/L)	DO Sat (%)
Kahawai Stream	1410	27.7	948	7.03	9.32	118

	TSS (mg/l)	Turbidity (ntu)	Nitrate + Nitrite (µg N/l)	Total N (µg N/l)	Total P (µg P/l)
Kahawai Stream	21	4.58	9	168	41

Flora

A botanical listing (flora) with qualitative abundance for plant taxa encountered in the survey is provided in Table 5. Entries are arranged alphabetically under family names and include scientific name, common name, status (i.e., native or non-native; see key at end of table), and a qualitative abundance value by survey area. "Status" reflects the state-wide distribution of the species.

The total number of plant taxa recorded in the survey was 71. Only one native plant was recorded (*Solanum americanum* or *pōpolo*). Six species are regarded as early Polynesian introductions. The remaining taxa are plants introduced to the Hawaiian Islands after 1778. Included are six ornamental species and 58

Table 5. Plant species observed at the Tai Reservoir on May 7, 2021.

FAMILY Species	Common name	Status	Abundance	Notes
	FLOWERING PLANTS MONOCOTS			
AGAVACEAE				
Cordyline fruticosa (L.) A. Chev.	*ki*, ti	**Pol**	Ro	<2>
Dracaena trifasciata (Prain) Mabb.	snake plant	Nat	O	
Dracaena sanderiana M.T. Masters	sanderiana	Orn	R	
ARACEAE				
Alocasia macrorrhizos (L.) G. Don	*'ape*	**Pol**	Oa	
Colocasia esculenta (L.) Schott	*kalo*, taro	**Pol**	R	<2>
Dieffenbachia maculata (Loddiges) G. Don	dumb cane	Nat	O	
Epipremnum pinnatum (L.) Engl.	golden pothos	Nat	A	
ARECACEAE				
Cocos nucifera L.	*niu*, coconut	**Pol**	O	
Veitchia merrillii (Beccari) H. E. Moore	Manila palm	Orn	U	
Dypsis lutescens (H. Wendl.) Beentje & J. Dransfield	golden-fruited palm	Nat	O	
CYPERACEAE				
Cyperus gracilis R. Br.	McCoy grass	Nat	O	
Cyperus mindorensis (Steud.) Huygh	white kyllinga	Nat	O	
POACEAE				
Bothriochloa pertusa (L.) A. Camus	pitted beard grass	Nat	R	
Cenchrus purpureus (Schumach.) Morrone	elephant grass	Nat	C	
Chloris barbata (L.) Sw.	swollen fingergrass	Nat	O	
Cynodon dactylon (L.) Pers.	Bermuda grass	Nat	O	
Eleusine indica (L.) Gaertn.	wiregrass	Nat	O	
Megathyrsus maximus (Jacq.) B.K. Simon & W.L, Jacobs	Guinea grass	Nat	C	
Sorghum halepense (L.) Pers.	Johnson grass	Nat	Rc	
	FLOWERING PLANTS EUDICOTS			
ACANTHACEAE				
Asystasia gangetica (L.) T. Anderson	Chinese violet	Nat	R	
ANACARDIACEAE				
Mangifera indica L.	mango	Nat	R	
ARALIACEAE				
Schefflera actinophylla (Endl.) Harms	octopus or umbrella tree	Nat	O	

Table 5 (continued).

FAMILY Species	Common name	Status	Abundance	Notes
ASTERACEAE (COMPOSITAE)				
Ageratum conyzoides L.	*maile honohono*	Nat	R	
ASTERACEAE (cont.)				
Bidens alba (L.) DC.	beggartick	Nat	U	
Bidens pilosa L.	*kī nehe*	Nat	R	
Youngia japonica (L.) DC.	Oriental hawksbeard	Nat	Ra	
BIGNONIACEAE				
Spathodea campanulata P. Beauv.	African tulip tree	Nat	R	
BRASSICACEAE				
Lepidium virginicum (L.) Wagner	peppergrass	Nat	O	
BUDDLEIACEAE				
Buddleia asiatica Lour.	dog tail	Nat	R	<2>
CARICACEAE				
Carica papaya L.	papaya	Nat	R	
CONVOLVULACEAE				
Ipomoea obscura (L.) Ker-Gawl.	---	Nat	O	
Merremia tuberosa (L.) Rendle	wood rose	Nat	O	
EUPHORBIACEAE				
Aleurites moluccana (L.) Willd.	*kukui*	**Pol**	O	
Alysicarpus vaginalis (L.) DC.	Alyce clover	Nat	R	
Euphorbia hirta L.	garden spurge	Nat	Rc	<2>
Euphorbia hypericifolia (L.) Millsp.	graceful spurge	Nat	U	
Euphorbia hyssopifolia L.	---	Nat	U	<2>
Euphorbia prostrata Aiton	prostrate spurge	Nat	Uo	
Macaranga tanarius (L.) Müll. Arg.	---	Nat	R	
Ricinus communis L.	castor bean	Nat	Oa	
FABACEAE				
Chamaecrista nictitans (L.) Moench	partridge pea	Nat	R	
Desmanthus pernambucanus (L.) Thell.	virgate mimosa	Nat	C	
Falcataria moluccana (Miq.) Barneby & J.W. Grimes	Moluccan albizia	Nat	O	
Leucaena leucocephala (Lam.) deWit	*koa haole*	Nat	C	
Pithecellobium dulce (Roxb.) Benth.	*'opiuma*	Nat	R	
LOGANIACEAE				
Fagraea berteroana A. Gray ex Benth.	*pua kenikeni*	Orn	R	<2>
MELIACEAE				
Melia azedarach L.	Chinaberry	Nat	R	
MORACEAE				
Artocarpus altilis (Parkinson ex Z) Fosberg	*'ulu*, breadfruit	**Pol**	R	<2>
Ficus microcarpa L. fil.	Chinese banyan	Nat	O	

Table 5 (continued).

FAMILY Species	Common name	Status	Abundance	Notes
MYRSINACEAE				
Ardisia cf. *escallonioides*	island marlberry	Orn	O	
MYRTACEAE				
Psidium guajava Burm	guava	Nat	R	
Syzygium cumini (L.) Skeels	Java plum	Nat	A	
OXALIDACEAE				
Oxalis corymbosa DC.	pink wood sorrel	Nat	R	
PASSIFLORACEAE				
Passiflora suberosa L.	*huehue haole*	Nat	R	
PLANTAGINACEAE				
Plantago lanceolata L.	nrw-leaved plantain	Nat	O	
PHYTOLACCACEAE				
Rivina humilis L.	coral berry	Nat	O	
PIPERACEAE				
Piper lolot C. de Candolle.	lolot	Orn	Rc	
PRIMULACEAE				
Anagallis arvensis L.	scarlet pimpernel	Nat	R	
RUBIACEAE				
Paederia foetida L.	*maile pilau*	Nat	R	
RUTACEAE				
Murraya paniculata (L.) W. Jack	mock orange	Nat	Oc	
SAPINDACEAE				
Filicium decipiens (Wight & Arn.) Thwaites	fern tree	Nat	R	
Cardiospermum grandiflorum L.	balloon vine	Nat	A	
SAPOTACEAE				
Chrysophyllum oliviforme L.	satin leaf	Nat	R	
SOLANACEAE				
Solanum lycopersicum L.	tomato	Nat	R	
Solanum americanum Mill	*pōpolo*	Ind	R	
VERBENACEAE				
Citharexylum cf. *spinosum* L.	fiddlewood	Nat	R	<1>
Verbena litoralis Kunth	*ōwī*	Nat	R	
VITACEAE				
Cissus verticillata (L.) Nicolson & C.E. Jarris	princess vine	Orn	Oa	
ULMACEAE				
Trema orientalis (L.) Blume	gunpowder tree	Nat	O	

Table 5 (continued).

Legend to Table 5:

Status = distributional status
- **End** = Endemic; native and unique to the Hawaiian Islands.
- **Ind** = indigenous; native to Hawai'i, 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.
- Orn = ornamental; crop or landscape plant not established outside of cultivation.
- **Pol** = Early Polynesian introduction; canoe plant.

Abundance = occurrence ratings for plants on property in May 7, 2021.
- R - Rare - only one or two plants seen.
- U - Uncommon - several to a dozen plants observed.
- O - Occasional - found regularly, but not abundant anywhere.
- C - Common - considered an important part of the vegetation and observed numerous times.
- A - Abundant - found in large numbers; may be locally dominant.
- Lower case letters (as in Oc) offset occurrence ratings (o – several plants; c – many plants; a – abundant in a limited area) in cases where distribution across the survey area may be limited, but individuals seen are more than indicated by the occurrence rating alone (i.e., clustered or limited to specific areas).

Notes:
- <1> Plant lacking flowers or fruit at time of survey; identification uncertain.
- <2> Plant located within HDOA baseyard only.

naturalized species (i.e., introduced plants that grow naturally in the wild). Most plant species observed in the Project area are common plants in the Hawaiian Islands.

Avian Fauna

A total of 97 individual birds of 15 species, representing 12 separate families, was recorded during station counts on May 7, 2021 (see Table 6). All of the 16 species recorded during the course of the point-count surveys and incidental sightings are common alien species well-established in the Hawaiian Islands.

Table 6. Avian species detected, May 7, 2021.

Common Name	*Scientific Name*	**ST**	***RA***
	GALLIFORMES		
	PHASIANIDAE – Pheasants & Chickens		
Domestic Chicken	*Gallus gallus*	A	6

Table 6 (continued).

Common Name	*Scientific Name*	ST	*RA*
	PSITTACIFORMES		
	PSITTACULIDAE – Old World parrots		
Rose-ringed Parakeet	*Psittacula krameria*	A	2
	COLUMBIFORMES		
	COLUMBIDAE - Pigeons & Doves		
Spotted Dove	*Streptopelia chinensis*	A	2
Zebra Dove	*Geopelia striata*	A	1
	PASSERIFORMES		
	PYCNONOTIDAE - Bulbuls		
Red-vented Bulbul	*Pycnonotus cafer*	A	4.5
Red-whiskered Bulbul	*Pycnonotus jocosus*	A	1.5
	TIMALIIDAE – Old World Babblers		
Chinese Hwamei	*Garrulax canorus*	A	1
Red-billed Leiothrix	*Leiothrix lutea*	A	3.5
	ZOSTEROPIDAE - White-eyes		
Warbling White-eye	*Zosterops japonicus*	A	8.5
	MUSCICAPIDAE		
White-rumped Shama	*Copsychus malabaricus*	A	8.5
	STURNIDAE - Starlings		
Common Myna	*Acridotheres tristis*	A	5.5
	CARDINALIDAE		
Northern Cardinal	*Cardinalis cardinalis*	A	†
	FRINGILLIDAE – Fringilline and Carduline Finches & Allies		
House Finch	*Haemorhous mexicanus*	A	3
	THRAUPIDAE - Tanagers		
Red-crested Cardinal	*Paroaria coronata*	A	2
	ESTRILDIDAE - Estrildid Finches		
Common Waxbill	*Estrilda astrild*	A	6
Chestnut Munia	*Lonchura atricapilla*	A	3

Key to Table 6.

Status:

I = Indigenous to the Hawaiian Islands.

A= Alien, naturalized, non-native species (introduced).

Relative Abundance (RA): Species count / number of point-count stations (n=2).

† = Incidental observation, observed beyond the timed count.

Mammals

The only mammalian species recorded was small Indian mongoose (*Herpestes javanicus*). No other mammals were observed, though it is highly probable that one or more of the four alien rodent species (Family Muridae) use resources on the property on a seasonal or temporal basis. The four species currently established on the Island of O'ahu are: roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mouse (*Mus musculus*). Aside from Hawaiian hoary bat, all terrestrial mammalian species present on O'ahu are non-native and deleterious to Hawaiian native ecosystems and native species within them.

Aquatic Fauna

No aquatic animals were recorded in the survey area. Aquatic fauna observed at the water quality station located outside of the survey area (Figure 7) are poeciliid fishes, cane toad tadpoles (*Rhinella marina*), American bullfrog (*Lithobates catesbeianus*), and a red-eared slider (*Trachemys scripta elegans*).

Jurisdictional Waters

The jurisdictional waters survey results are depicted in Figure 7. Photographs to document conditions and delineated boundaries are provided in Attachments A, B, and C. Our survey confirmed that Kahawai Stream has a surface connection to Waimanālo Bay, a traditional navigable water (TNW; jurisdictional by rule) and, therefore, may be considered to be a tributary and jurisdictional by rule. The physical separation of the *muliwai* from the bay by a natural sand dune does not sever jurisdiction.

Streams

AECOS scientists delineated a total of approximately 177 m (1581 ft) of stream OHWM (Figure 7). Based on the SDAM, found in Attachment D, the reach scored 19 out of 62 possible points[4] on NCSAM, and rates as "intermittent", with noticeable rounded cobbles and drift deposits on the streambed (NCDWQ, 2010). Therefore, we conclude that this reach of Kahawai Stream is an "intermittent tributary" and does qualify as jurisdictional under the NWPR.

[4] The NCSAM rates streamflow in tributary reaches as follows: values less than or equal to 19 are rated as "ephemeral"; those greater than 19 are rated as "intermittent"; and those greater than or equal to 30 are rated as "perennial" (NCDWQ, 2010).

Figure 7. Ordinary high water mark (in green) indicating the delineation of Kahawai Stream within the Tai Lee Reservoir (outlined in red).

Wetlands

One SP was established in the flood zone of Kahawai Stream in the center of the reservoir (Figure 7). The reservoir is hummocky and drift deposits are present, indicating stream flow had extended into the reservoir relatively recently. The wetland data determination sheet for the SP is provided in Attachment B. Photographs to document conditions near the SP are provided in Attachment C.

Wetland indicators of all three parameters (vegetation, hydrology, and soils) were not present at SP-01. The tree stratum within a 10-m radius was dominated by parasol leaf tree, *Macaranga tanarius* (UPL), and Moluccan albizia, *Falcataria moluccana* (FACU; Figure 6). There were no saplings, shrubs or woody vines present and the herb stratum covered only 4% of the square meter plot. All

vegetation in the herb stratum were upland or facultative upland species indicating non-hydrophytic vegetation.

The soil pedon at SP-01 is a single dark brown layer (7.5 YR 2.5/1, Figure 8a & 8b); 20% cobbles and gravel were present on the surface and throughout the pit. This soil characteristic is not indicative of reducing conditions. Reduced iron (Fe^{++}) was not present in the soil, as indicated by a negative alpha, alpha'-Dipyridyl test.

Figure 8a (left) SP-01 located in the reservoir; soil not indicative of wetland. Figure 8b (right) presence of cobble and gravel on surface.

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 listed species to the maximum extent practicable.

Water quality

Kahawai Stream is classified as a Class 2 inland water body in Hawai'i water quality standards (HDOH, 2014). As stated in the standards, the objective of Class 2 waters is to protect their use for recreational purposes, to support and propagate aquatic life, agricultural and industrial water supplies, shipping, and navigation. Kahawai Stream is not listed on the HDOH 2018 list of impaired waters in Hawai'i, prepared under Clean Water Act §303(d) (HDOH, 2018).

Despite the lack of flow in Kahawai Stream at the time of our sample collection, water quality was fair. The water was supersaturated with dissolved oxygen, which can occur under conditions of high algal productivity (as seen by the green color in Figure 5); conditions may be eutrophic, with a swing towards low DO after sunset. Water quality impacts generated during construction of the Project should be temporary and minimal if effective best management practices (BMPs) are employed.

- Construction should be conducted during the dry season or when the stream is not flowing. Construction plans should incorporate best management practices (BMPs) such as separating stream flow from construction sites, to prevent degradation of water in Kahawai Stream.

Jurisdictional Waters

Within the Project area, the OHWM of Kahawai Stream is along the stream bank as depicted in Figure 7 and Attachment A. Pursuant to the final Navigable Waters Protection Rule: Definition of Waters of the United States (USACE and USEPA, 2020b), the entire stream within the Project area is jurisdictional.

Floral Resources

A floristic composition of 1% native species (and 7% early Polynesian introductions) is less than is typical for disturbed tropical forest on O'ahu, but not unusual. Given the long history of disturbances, the site cannot be expected to support remnants of a native forest flora.

No plant species proposed for listing or listed as endangered or threatened under either federal or state of Hawai'i endangered species statutes (DLNR, 1998; USFWS, nd-b) was recorded during the course of this survey. No trees listed under the City and County of Honolulu, Dept. of Parks and Recreation, Exceptional Tree Program are present in the Project area (C&C, 2017).

Avian Resources

Waterbirds

Habitat for endangered waterbird species is not present in the Tai Lee Reservoir.

Owls

No owl species were recorded during this survey. Two owl species occur on O'ahu: the introduced Barn Owl (*Tyto alba*) and the endemic sub-species of the Short-eared Owl (*Asio flammeus sandwichesis*) or *pueo*. This latter species has become increasingly scarce on the island, and the O'ahu population is listed as endangered by the State of Hawai'i, although not listed under federal statute. Short-eared Owl is not habitat-restricted on O'ahu, though there certainly is less suitable nesting habitat than there once was. As a ground-nesting, diurnal species, Short-eared Owl faces daunting odds on an island as heavily populated as O'ahu. The sheer numbers and densities of mammalian predators on the island make it very difficult for this species to successfully nest, except within protected areas with a strong predator control program in-place. No suitable nesting habitat for this species exists on the Project site.

Mammalian Resources

Hawaiian hoary bat

It is possible that Hawaiian hoary bat (*Lasiurus semotus)* or *'ōpe'ape'a*, may overfly or roost in the Project area on a seasonal basis. The principal impact that rehabilitation of Tai Lee Reservoir potentially poses to bats is during clearing and grubbing when vegetation is removed. Removal of trees within the Project site may temporarily displace individual bats using a tree as a roosting place. However, this species of bat uses multiple roosts within a home territory, so the disturbance associated with removal of the vegetation would be minimal. An exception would be during pupping season, when females carrying pups may be less able to rapidly vacate a roost tree that is being felled. Further, adult female bats sometimes leave their pups in the roost tree when they forage. Very small pups may be unable to flee a tree that is being felled.

- Potential adverse effects from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 m (15 ft) between June 1 and September 15, the bat pup rearing season (USFWS, 1998).

Other Resources of Potential Concerns

Critical Habitat

Federally delineated Critical Habitat is not present in the Project area (USFWS, nd-c). No equivalent designation exists under state law.

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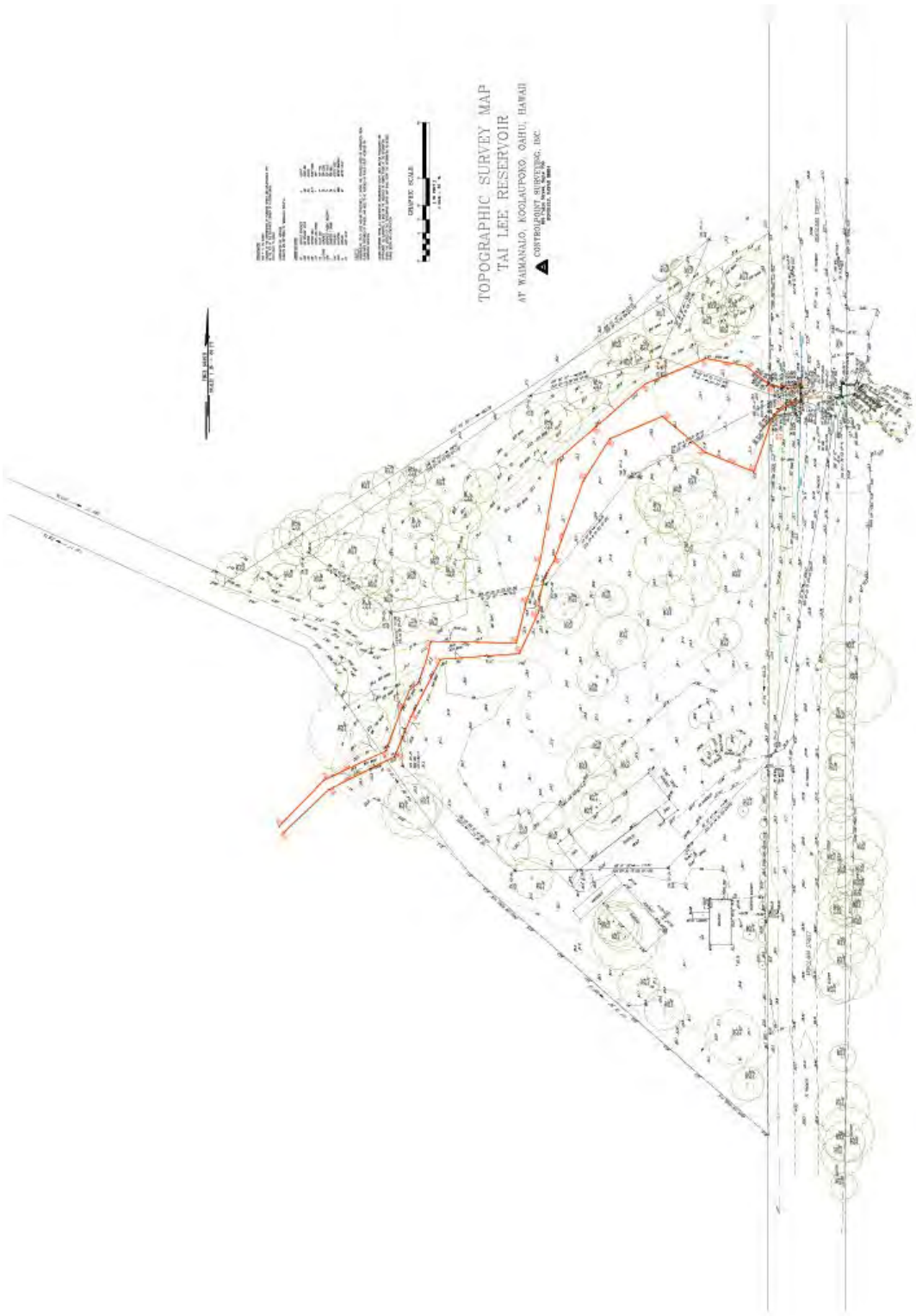
Attachment A

Topographic Survey Map of Tai Lee Reservoir


TOPOGRAPHIC SURVEY MAP
TAI LEE RESERVOIR
AT WAIMANALO, KOOLAUPOKO, OAHU, HAWAII

Attachment B

Wetland delineation data forms

Reset Form

WETLAND DETERMINATION DATA FORM—Hawai'i and Pacific Islands

Project/Site: Tai Lee Reservoir City: Honolulu Sampling Date: 05/07/2021 Time: 12:03 pm

Applicant/Owner: The State of Hawaii State/Terr./Comm.: Hawaii Island: Oahu Sampling Point: SP-01

Investigator 1: Other Investigator 2: Other TMK/Parcel: 4-1-024:068

Landform: other Local relief: none

Lat: 21.340553159457254 Long: -157.72323345160822 Datum: WSG 84 Slope (%): 0

Soil Map Unit Name: HeB - Haleiwa Silty Clay 2-6% slope NWI classification: Upland

Are climactic/hydrologic conditions on the site typical for this time of year: Yes ☑ No ☐ (If no, explain in Remarks)

Are Vegetation ☐, Soil ☑, or Hydrology ☑ significantly disturbed? Are "Normal Circumstances" present? Yes ☑ No ☐

Are Vegetation ☐, Soil ☐, or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS—Attach a site map showing sampling point locations transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ☐	No ☑		
Hydric Soil Present?	Yes ☐	No ☑	Is the Sampled Area	
Wetland Hydrology Present?	Yes ☑	No ☐	within a Wetland? Yes ☐	No ☑

Remarks: SP-01 was most likely to be the wettest place

VEGETATION—Use scientific names of plants.

Tree Stratum (Plot size: 10-m)	Absolute % Cover	Dominant Species?	Indicator Status
1. Macaranga tanaious	45	Yes	UPL
2. Falcataria moluccana	20	Yes	FACU
3. Syzgium cumini	15	No	FAC
4. Aleurites moluccana	10	No	FACU
5. Leucaena leucocephala	5	No	UPL
	95	=Total Cover (sum)	
Sapling/Shrub Stratum (Plot size:)			
1.		No	Select
2.		No	Select
3.		No	Select
4.		No	Select
5.		No	Select
	0	=Total Cover (sum)	
Herb Stratum (Plot size: 1-m)			
1. Aleurites moluccana	2	No	FACU
2. Cardiospermum halicacabum	1	No	UPL
3. Leucaena leucocephala	1	No	UPL
4.		No	Select
5.		No	Select
6.		No	Select
7.		No	Select
8.		No	Select
	4	=Total Cover	
Woody Vine Stratum (Plot size:)			
1.		No	Select
2.		No	Select
	0	=Total Cover	

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 8 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	0	x 1 =	0
FACW species	0	x 2 =	0
FAC species	17	x 3 =	51
FACU species	30	x 4 =	120
UPL species	52	x 5 =	260
Column Totals:	99 (A)		431 (B)

Prevalence Index = B/A= 4.35

Hydrophytic Vegetation Indicators:

☐ 1 - Rapid Test for Hydrophytic Vegetation

☐ 2 - Dominance Test is >50%

☐ 3 - Prevalence Index is ≤3.0[1]

☐ Problematic Hydrophytic Vegetation [1] (Explain in Remarks or in the delineation report)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes ☐ No ☑

Remarks Alocasia macrorrhizos is near but out of the plot.

US Army Corps of Engineers

Hawai'i and Pacific Islands Region—Version 2.0

Modified for tablet (R.Gladstein Consulting, LLC) 12/2015

SOIL

Sampling Point: SP-01

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture	Remarks
0-18	7.5 YR2.5	2	100% NONE		Select	Select	Sandy Clay Loam	
					Select	Select	Select	
					Select	Select	Select	
					Select	Select	Select	
					Select	Select	Select	
					Select	Select	Select	
					Select	Select	Select	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains [2]Location: PL=Pore Lining, M=Matrix

Hydric Soil Indicators:

- select
- Histisols (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Muck Presence (A8)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Gleyed Matrix (S4)

- select
- Sandy Redox (S5)
- Dark-Surface (S7)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)

Indicators for Problematic Hydric Soils[3]:

- select
- Stratified Layers (A5)
- Sandy Mucky Mineral (S1)
- Red Parent Material (TF2)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:

Depth (inches):

Hydric Soil Present: Yes ☐ No ☑

Remarks:

Thin folistic on surface

20% rounded cobbles and gravel on surface and in the pit

HYDROLOGY

Wetland Hydrology Indicators: (Explain observations in Remarks, if needed.)

Primary Indicators (minimum of one required: check all that apply)

- select
- Surface Water (A1
- High Water Table (A2)
- Saturation (A3)
- Water Marks (B1)
- Sediment Deposits (B2)
- Drift Deposits (B3)
- Algal Mat or Crust (B4)
- Iron Deposits (B5)
- Inundation Visible on Aerial Imagery (B7)
- Water Stained Leaves (B9)

- select
- Aquatic Fauna (B13)
- Tilapia Nests (B17)
- Hydrogen Sulfide Odor (C1)
- Oxidized Rhizospheres on Living Roots (C3)
- Presence of Reduced Iron (C4)
- Recent Iron Reduction in Tiled Soils (C6)
- Thin Muck Surface (C7)
- Fiddler Crab Burrows (C10) (Guam, CNMI, a
- Other (Explain in Remarks)

Secondary Indicators (minimum of two required)

- select
- Surface Soil Cracks (B6)
- Sparsely Vegetated Concave Surface (B8)
- Drainage Patterns (B10)
- Dry-Season Water Table (C2)
- Salt Deposits (C5)
- Stunted or Stressed Plants (D1)
- Geomorphic Position (D2)
- Shallow Aquitard (D3)
- FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ☐	No ☑	Depth (inches):	None
Water Table Present?	Yes ☐	No ☑	Depth (inches):	>18
Saturation Present? (includes capillary fringe)	Yes ☐	No ☑	Depth (inches):	None

Wetland Hydrology Present? Yes ☑ No ☐

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Hummocky
Negative iron depletion test

Attachment C

Stream delineation photos

OHWM 01- Facing left bank

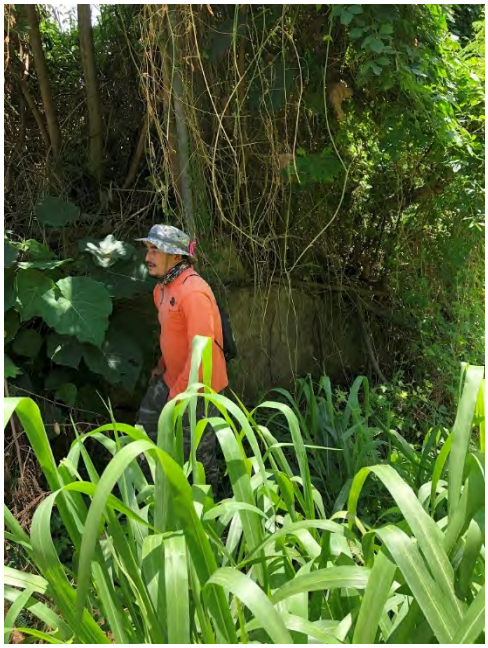
OHWM 01 – Facing down stream

OHWM 01– Facing Right Bank

OHWM 01 – Facing up stream

OHWM 02- Facing Left Bank

OHWM 02 – Facing down stream



OHWM 02 – Facing Right Bank

OHWM 02 – Facing up stream

OHWM 03- Facing left bank

OHWM 03 – Facing down stream

OHWM 03- Facing right bank

OHWM 03 – Facing up stream

OHWM 04- Facing left bank

OHWM 04 – Facing down stream

OHWM 04- Facing right bank

OHWM 04 – Facing up stream

OHWM 05- Facing left bank	OHWM 05 – Facing down stream

OHWM 05- Facing right bank	OHWM 05 – Facing up stream

OHWM 06 - Facing left bank	OHWM 06 – Facing down stream

OHWM 06- Facing right bank	OHWM 06 – Facing up stream

OHWM 07 - Facing left bank	OHWM 07 – Facing down stream

OHWM 07- Facing right bank	OHWM 07 – Facing up stream

OHWM 08 - Facing left bank	OHWM 08 – Facing down stream

OHWM 08 - Facing right bank	OHWM 08 – Facing up stream

OHWM 09 - Facing left bank

OHWM 09 – Facing down stream

OHWM 09 - Facing right bank

OHWM 09 – Facing up stream

OHWM 10 - Facing left bank	OHWM 10 – Facing down stream

OHWM 10 - Facing right bank	OHWM 10 – Facing up stream

OHWM 11 - Facing left bank	OHWM 11 – Facing down stream

OHWM 11 - Facing right bank	OHWM 11 – Facing up stream

OHWM 12 - Facing left bank	OHWM 12 – Facing down stream

OHWM 12 - Facing right bank	OHWM 12 – Facing up stream

OHWM 13 - Facing left bank	OHWM 13 – Facing down stream

OHWM 13 - Facing right bank	OHWM 13 – Facing up stream

OHWM 14 - Facing left bank	OHWM 14 – Facing down stream

OHWM 13 - Facing right bank

Attachment D

Kahawai stream determination form

NC Division of Water Quality - Methodology for Identification of Intermittent and Perennial Streams and Their Origins v. 4.11

NC DWQ Stream Identification Form Version 4.11

Date: May 7, 2021	Project/Site: Tai Lee Reservoir	Latitude: 21.30404916°
Evaluator: 44.205-m	County: Honolulu County	Longitude: -157.722291°
Total Points: *(Stream is at least intermittent if ≥ 19 or perennial if ≥ 30)* 19	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other e.g. *Kahawai Stream*

A. Geomorphology (Subtotal = 13.5)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	(2)	3
2. Sinuosity of channel along thalweg	0	1	(2)	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	(1)	2	3
4. Particle size of stream substrate	0	1	2	(3)
5. Active/relict floodplain	0	1	(2)	3
6. Depositional bars or benches	0	(1)	2	3
7. Recent alluvial deposits	(0)	1	2	3
8. Headcuts	0	(1)	2	3
9. Grade control	0	0.5	(1)	1.5
10. Natural valley	0	(0.5)	1	1.5
11. Second or greater order channel	(No) = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 2.5)				
12. Presence of Baseflow	(0)	1	2	3
13. Iron oxidizing bacteria	(0)	1	2	3
14. Leaf litter	1.5	1	(0.5)	0
15. Sediment on plants or debris	0	(0.5)	1	1.5
16. Organic debris lines or piles	0	0.5	1	(1.5)
17. Soil-based evidence of high water table?	(No) = 0		Yes = 3	

C. Biology (Subtotal = 3)				
18. Fibrous roots in streambed	3	2	(1)	0
19. Rooted upland plants in streambed	3	(2)	1	0
20. Macroberthos (note diversity and abundance)	(0)	1	2	3
21. Aquatic Mollusks	(0)	1	2	3
22. Fish	(0)	0.5	1	1.5
23. Crayfish	(0)	0.5	1	1.5
24. Amphibians	(0)	0.5	1	1.5
25. Algae	(0)	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = (0)			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes:

Sketch:

Appendix D

Draft Archaeological Literature Review and Field Inspection Report

(Cultural Surveys Hawai‘i, March 2022)

Draft

Archaeological Literature Review and Field Inspection Report to Support Consultation with SHPD for the Tai Lee Reservoir Rehabilitation Project, Waimānalo Ahupuaʻa, Koʻolaupoko District, Oʻahu

TMK: [1] 4-1-024:068 por.

Prepared for
Townscape, Inc.
on behalf of the
Hawaii Department of Agriculture (HDOA)

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

Cultural Surveys Hawaiʻi, Inc.
Kailua, Hawaiʻi
(Job Code: WAIMANALO 45)

March 2022

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Management Summary

Reference	Archaeological Literature Review and Field Inspection Report to Support Consultation with SHPD for the Tai Lee Reservoir Rehabilitation Project, Waimānalo Ahupua‘a, Ko‘olaupoko District, O‘ahu, TMK: [1] 4-1-024:068 por. (Shideler and Hammatt 2022)
Date	March 2022
Project Number(s)	Cultural Surveys Hawai‘i, Inc. (CSH) Job Code: WAIMANALO 45
Investigation Permit Number	CSH completed the fieldwork component of this study under archaeological fieldwork permit number 22-02, issued by the Hawai‘i State Historic Preservation Division (SHPD) per Hawai‘i Administrative Rules (HAR) §13-13-282.
Agencies	Hawai‘i Department of Agriculture (HDOA); SHPD
Land Jurisdiction	State of Hawai‘i
Project Proponent	HDOA
Project Funding	HDOA
Project Location	The project area is located at 41-645 Mokulama Street (Waimanalo, HI 96795) in *mauka* (inland), central Waimānalo, encompassing a portion of TMK [1] 4-1-024:068. The project area is depicted on a 1999 Koko Head U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle.
Project Description	The proposed Tai Lee Reservoir Rehabilitation project is described as follows: • The decommissioned Tai Lee Reservoir occasionally clogs with debris at a culvert crossing on Mokulama Street causing stormwater to overtop the roadway. The spillway rehabilitation will be entirely contained within the property boundary. Two rows of staggered bollards are proposed and are intended to capture debris. The approximate water elevation during the 100-year event from available Federal Emergency Management Agency (FEMA) maps is 1.2 m (4 feet [ft] above the ground elevation of the reservoir. The height of the bollards is anticipated to be 1.5 m (5 ft). • Water ponds in a portion of the property during a flooding event. Grading will be required to address this flooding. The graded area will be grassed and then maintained. • Current vegetation is well established within the decommissioned reservoir. Vegetation, including all trees within the property, will be cleared.
Project Acreage	3.037 acres (1.229 hectares)

Document Purpose	This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the project 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 document is intended to support the proposed project's historic preservation review under Hawai‘i Revised Statutes (HRS) §6E-8 and HAR §13-275, as well as the project's environmental review under HRS §343.
Fieldwork Effort	Fieldwork was accomplished on 21 January 2020 by David W. Shideler, M.A., and Tyler Turran B.A. This work required approximately 1 person-day to complete.
Results Summary	We understand the Tai Lee Reservoir was built by one Tai Lee for Chinese rice growers in Waimānalo in the late 1800s (Enoka 1978:35 and *Honolulu Advertiser* 18 November 1931:1). It is understood that commercial sugarcane cultivation in Waimānalo was very much a Chinese enterprise between 1876 and 1898 when many Chinese moved out of rice cultivation into sugar cane cultivation. > Tai Lee's plantation was increased until he had about 800 acres in cane. Following his success as a cane grower, other Chinese took up other nearby sections until the total area cropped was perhaps 1200 acres, or about half as much as the present [1931] cane area. [*Honolulu Advertiser* 18 November 1931:1] There was an unusual arrangement in which Chinese-harvested cane was processed by the (Native Hawaiian) John Adams Kuakini Cummins's Waimanalo Sugar Company that was chartered in 1880. > The company built and operated a mill, purchasing the cane grown by the Chinese farmers. This arrangement lasted fifteen or twenty years and it was not until after annexation [1898] that the milling company commenced growing cane on its own account. [*Honolulu Advertiser* 18 November 1931:1] The Tai Lee Reservoir was built as an earthen dam reservoir and served the Waimanalo Sugar Company as a component of the Waimānalo Ditch System through to the end of the enterprise in 1947. Subsequently the Tai Lee Reservoir was effectively repurposed to support diversified agriculture with a new "Tai Lee" ditch created to distribute water to the east by 1952.

Results Summary (cont.)	The Tai Lee Reservoir has been transformed by grading and infilling since the Department of Agriculture concluded an Environmental Assessment (EA) for abandonment of the Waimanalo Ditch Irrigation System in August 1993; it is suggested in this study to be an archaeological historic property. It is understood that the substantial fill observed within the interior of the former reservoir was deposited after decommissioning. The character-defining features of this archaeological historic property are suggested to be the perimeter low and wide earthen walls on the northwest and east sides of the former reservoir. The Tai Lee Reservoir is suggested to be significant under HAR §13-284-6 Criterion a, as associated with events that have made an important contribution to the broad patterns of our history, specifically Chinese rice growing and Chinese sugarcane growing transitioning into sugar plantation cultivation. The Tai Lee Reservoir is suggested to be significant under HAR §13-284-6 Criterion d, for having yielded information important for research on history of Chinese agriculture in Waimānalo. This study suggests the Tai Lee Reservoir remnant lacks sufficient integrity (of setting, feeling, and association) to be considered eligible for listing on the National Register of Historic Places (NRHP) or on the Hawai‘i Register of Historic Places (HRHP).
Recommendations	None of the aspects of the project are expected to have a significant impact on the character-defining features of the reservoir, which is evaluated as the perimeter’s low and wide earthen walls on the northwest and east sides of the former reservoir. It is recommended that care be taken in the course of this Tai Lee Reservoir Rehabilitation project to minimize degradation of the earthen walls of the reservoir. It is evaluated that if care is taken to minimize degradation of the earthen walls of the long-abandoned reservoir, a determination by HDOA (as per HAR §13-275-7) of “No historic properties affected” is warranted. It is recommended that this supporting study be submitted to the SHPD with a request for an SHPD determination letter that concurs with the HDOA determination of “No historic properties affected.”

Table of Contents

List of Figures

List of Tables

Section 1 Introduction

1.1 Project Background

At the request of Townscape, Inc., on behalf of the Hawai‘i Department of Agriculture (HDOA), Cultural Surveys Hawai‘i, Inc. (CSH) has prepared this literature review and field inspection report (LRFI) to support consultation with the State Historic Preservation Division (SHPD) for the Tai Lee Reservoir Rehabilitation Project, Waimānalo Ahupua‘a, Ko‘olaupoko District, O‘ahu, TMK: [1] 4-1-024:068 por.. The approximately 3.037-acre (1.229-hectare) project area is located at 41-645 Mokulama Street (Waimānalo, Hawai‘i 96795) in central Waimānalo approximately 0.5 km (1,700 feet [ft]) south of Kalaniana‘ole Highway. Mokulama Street is a major access road to *mauka* (inland, toward the mountains) Waimānalo, connecting Hīhīmanu Street to Waikupanaha Street. The project area is depicted on a portion of the 1999 Koko Head U.S. Geological Survey (USGS) 7.5-minute topographic quadrangle (Figure 1), a tax map plat (Figure 2), and a 2019 aerial photograph (Figure 3).

The proposed Tai Lee Reservoir Rehabilitation project is described as follows:

- The decommissioned Tai Lee Reservoir occasionally clogs with debris at a culvert crossing on Mokulama Street causing stormwater to overtop the roadway.
- Water ponds in a portion of the property during a flooding event. Grading will be required in area highlighted in purple (Figure 4). The graded area will be grassed and then maintained.
- Current vegetation is well established within the decommissioned reservoir. Vegetation, including all trees within the property, will be cleared. See highlighted area in green area (Figure 4).
- The spillway rehabilitation will be entirely contained within the property boundary. Two rows of staggered bollards are proposed. See magenta lines (Figure 4). Bollards are intended to capture debris. The approximate water elevation during the 100-year event from available Federal Emergency Management Agency (FEMA) maps is 1.2 m (4 ft) above the ground elevation of the reservoir. The height of the bollards is anticipated to be 1.5 m (5 ft).
- The project area is within a defined Flood Zone. Okahara intends to contain and change to flood boundary within the property boundary.

If hydraulic analysis of post-construction conditions changes the 100-year flood boundary, submittal of a Conditional Letter of Map Revision (CLOMR) and Letter of Map Revision (LOMR) to FEMA will be required.

This document is intended to support the proposed project’s historic preservation review under Hawai‘i Revised Statutes (HRS) §6E-8 and HAR §13-275, as well as the project’s environmental review under HRS §343.

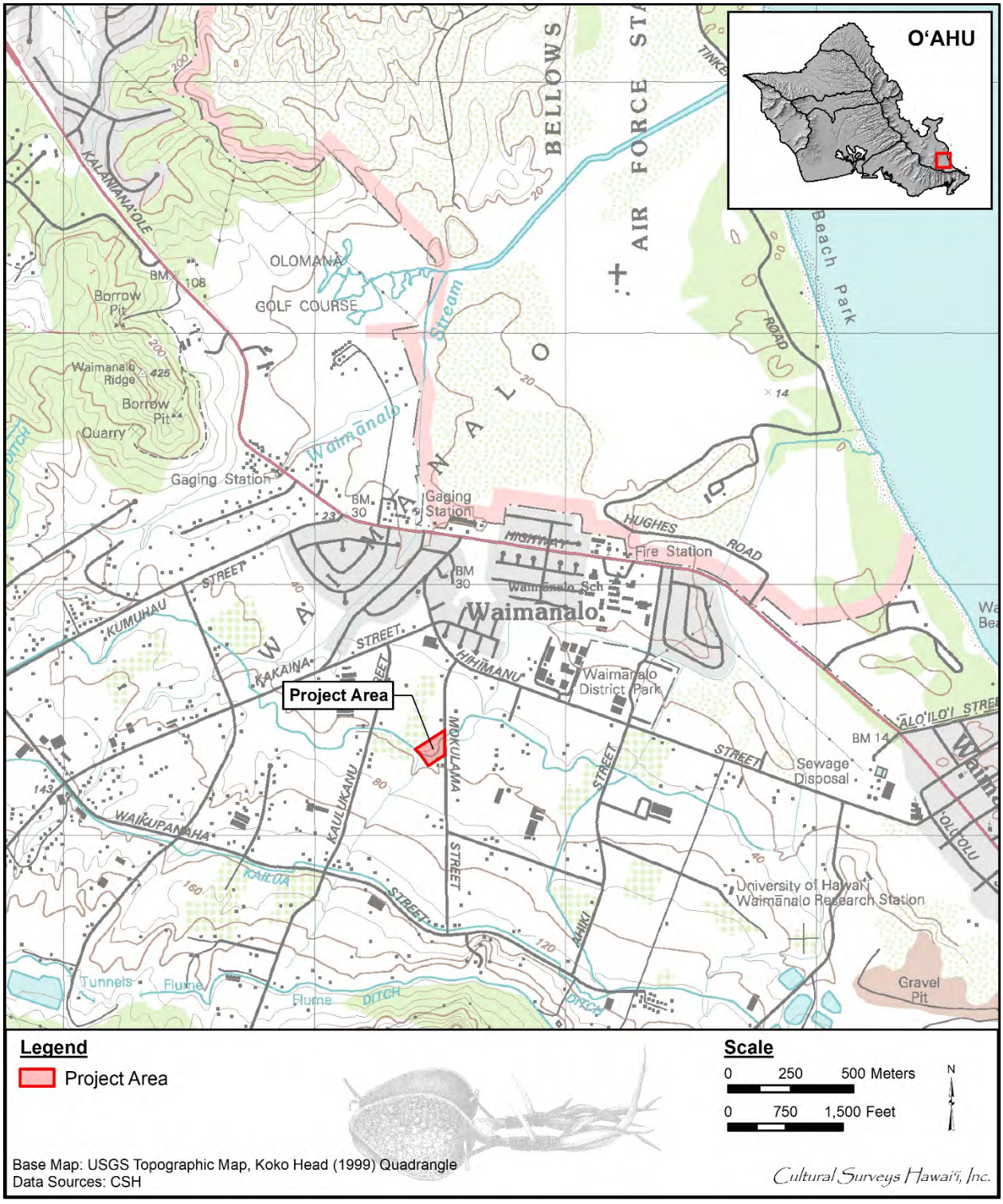

Figure 1. Portion of the 1999 Koko Head USGS 7.5-minute topographic quadrangle showing the location of the Tai Lee Reservoir Rehabilitation project area

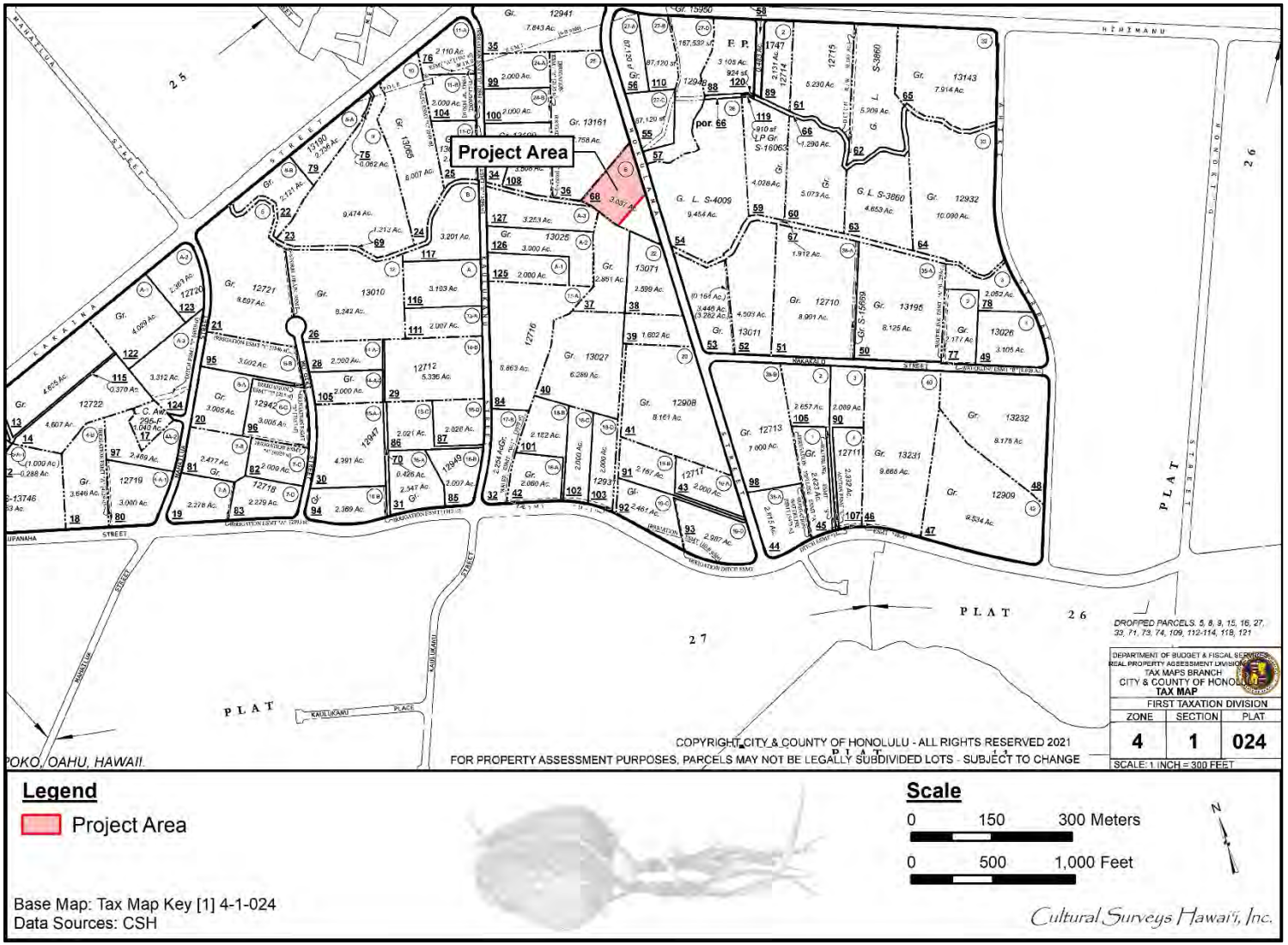

Figure 2. Tax Map Key (TMK) [1] 4-1-024 showing the location of the Tai Lee Reservoir Rehabilitation project area (Hawai‘i TMK Service 2019)

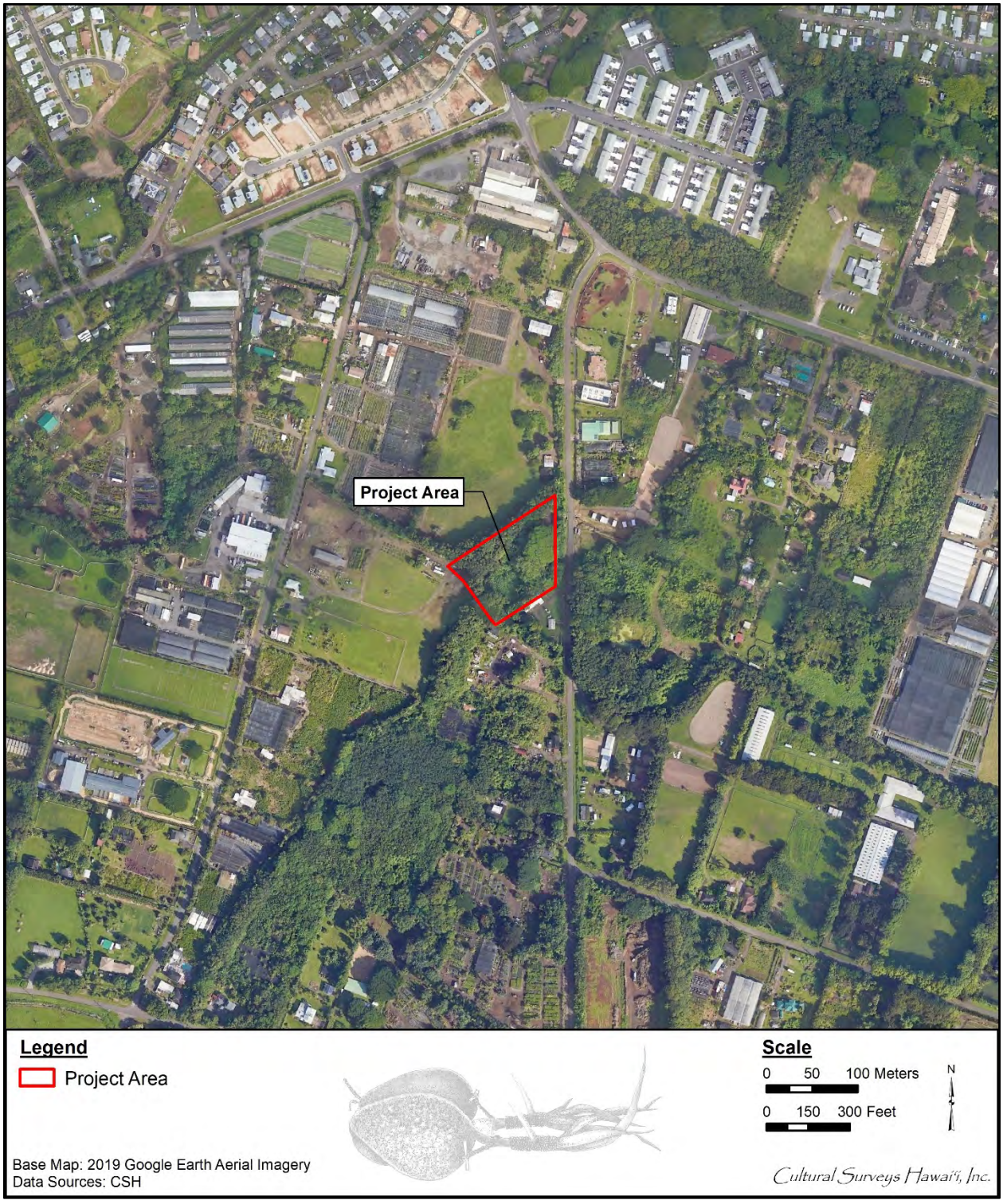

Figure 3. 2019 Google Earth Aerial Imagery showing the Tai Lee Reservoir Rehabilitation project area

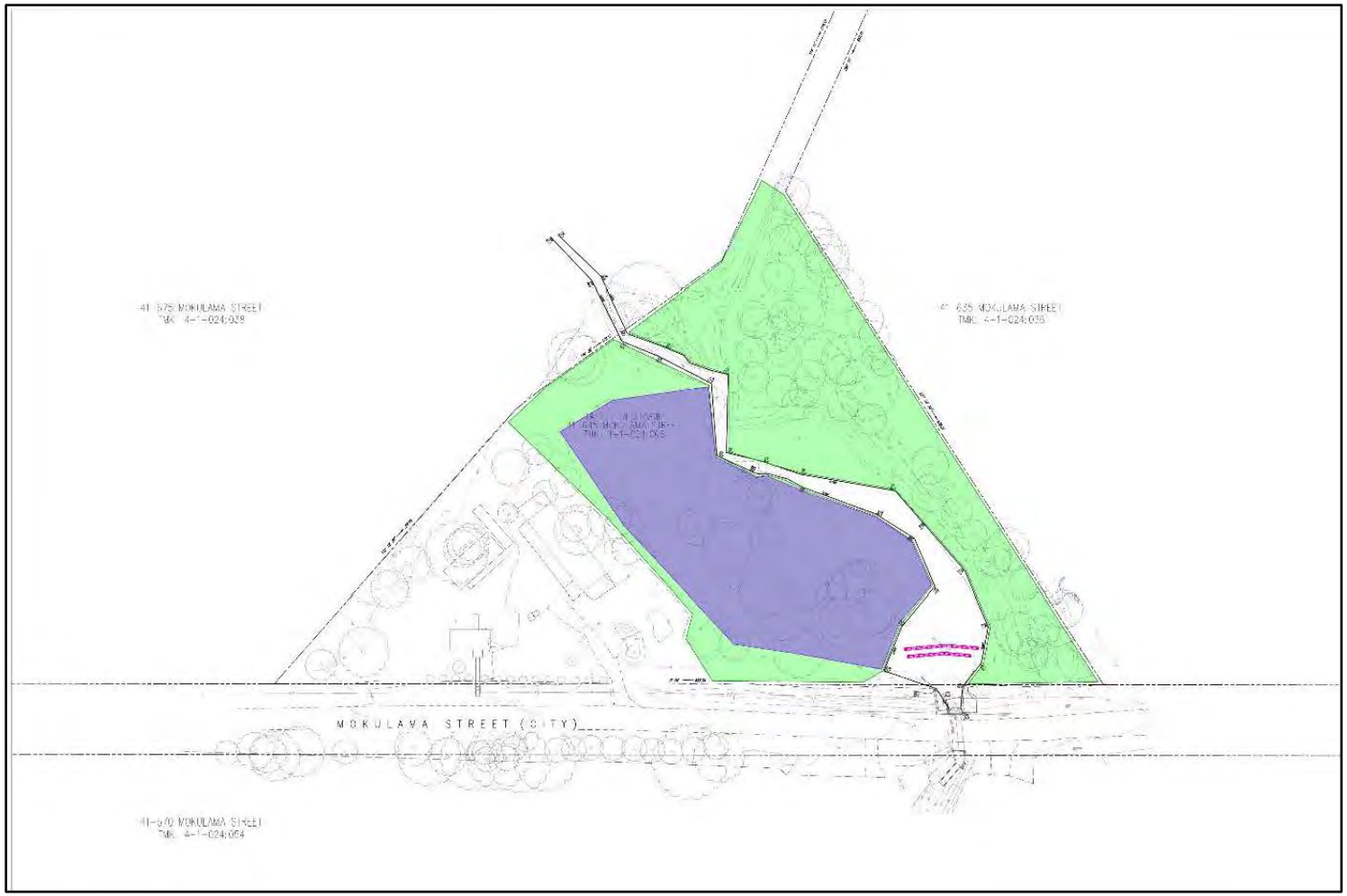

Figure 4. Project map (supplied by Okahara and Associates, Inc. 2022) with north to the right and Mokulama Street, which is to the east, at bottom. Grading will be required in the area highlighted purple within the interior of the reservoir which will then be grassed and maintained. Vegetation, including all trees within the property, will be cleared within the area highlighted green. Two rows of staggered bollards intended to capture debris are proposed and depicted with the magenta lines near the reservoir spillway (close to Mokulama Street).

1.2 Document Purpose

This investigation was designed—through detailed historical, cultural, and archaeological background research and a field inspection of the project area—to determine the likelihood that cultural resources/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.

1.3 Environmental Setting

1.3.1 Natural Environment

The project area is approximately 1.9 km inland (southwest) from the coast and is approximately 1.5 km south of the main perennial stream, Waimānalo Stream (also called Puhā Stream) at approximately 50 to 70 ft elevation.

The Tai Lee Reservoir Rehabilitation project area (Figure 5) lies on a broad, gentle slope. 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 project area's soils are Waialua clay, 2 to 6% slope (WnB) soils but is within a shallow drainage dominated by Haleiwa silty clay, 2 to 6% slope (HeB) soils.

Haleiwa series soils are described as follows:

> This series consists of well-drained soils on fans and in drainageways along the coastal plains. These soils are on the islands of Oahu and Molokai. They developed in alluvium derived from basic igneous material. They are nearly level to strongly sloping. Elevations range from sea level to 250 feet. […] These soils are used for sugarcane, truck crops, and pasture. The natural vegetation consists of koa haole, lantana, guava, Christmas berry, bermudagrass, and fingergrass. [Foote et al. 1972:33]

HeB soils are further described as follows: "On this soil, runoff is slow and the erosion hazard is slight" (Foote et al. 1972:34).

Waialua series soils are described as follows:

> This series consists of moderately well drained soils on alluvial fans on the island of Oahu. These soils developed in alluvium weathered from basic igneous rock. They are nearly level to steep. Elevations range from 10 to 100 feet. […] These soils are used for sugarcane, truck crops, orchards, and pasture. The natural vegetation is swollen fingergrass, koa haole, and uhaloa. [Foote et al. 1972:128]

WnB soils are further described as, "On this soil runoff is slow and the erosion hazard is slight" (Foote et al. 1972:129).

The mean annual rainfall at the neighboring "Mokulama Station" (observer "DOWALD") is 1,800 mm (70.9 inches) falling mainly in October through March (Giambelluca et al. 2013) which is suggested as sufficient for non-irrigated agriculture.

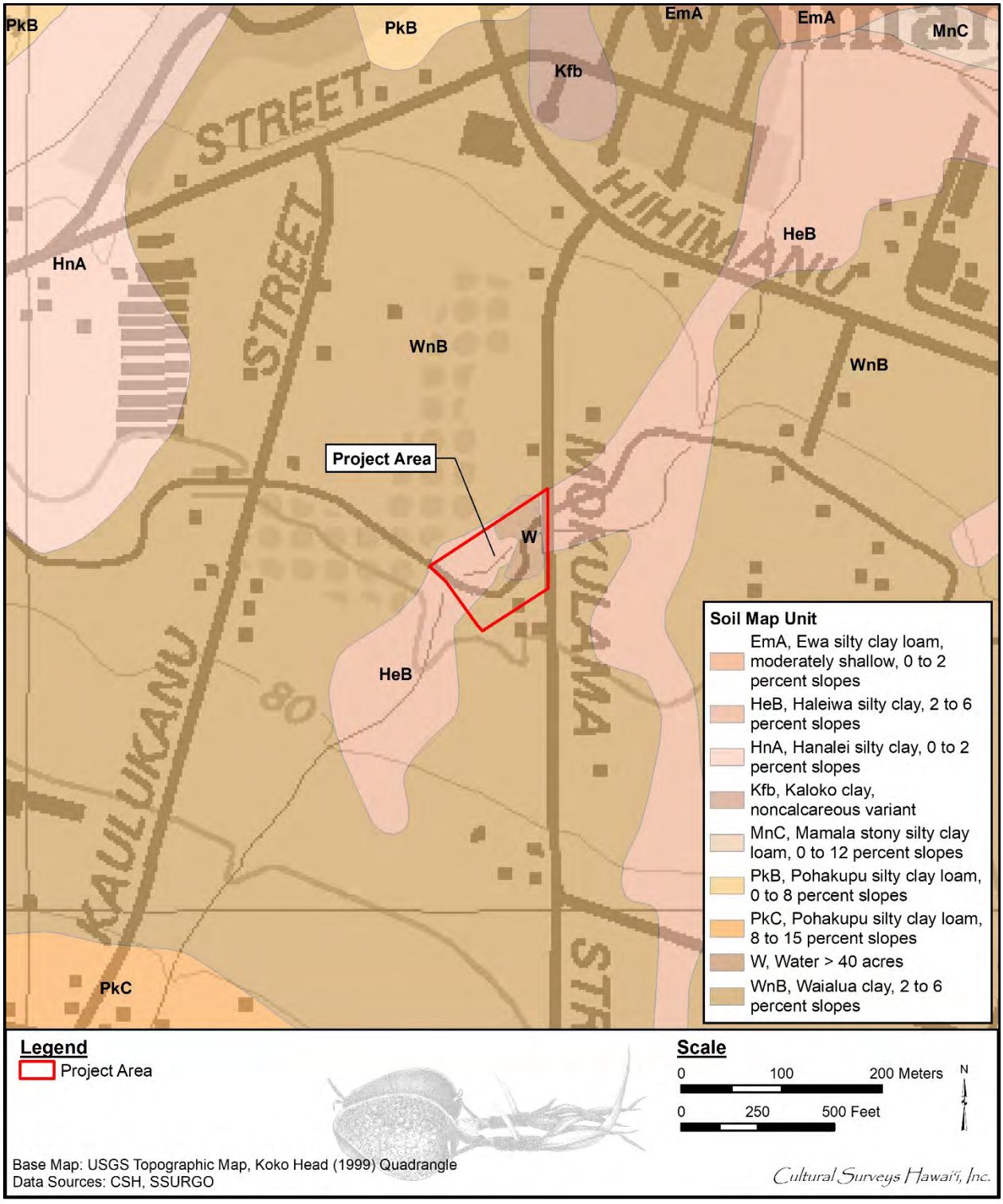

Figure 5. 1999 Koko Head USGS topographic quadrangle with overlay of *Soil Survey of the Islands of Kauai, Oahu, Maui, Molokai, and Lanai, State of Hawaii* (Foote et al. 1972; USDA SSURGO 2001), indicating soil types within and surrounding the Tai Lee Reservoir Rehabilitation project area

Vegetation in the Tai Lee Reservoir Rehabilitation Project includes *kukui* (*Aleurites moluccanus*), white monkey pod (*Albezia* sp.), *koa haole* (*Leucana glauca*), castor bean (*Ricinus communis*), *opiuma* (*Pithecellobium dulce*), *‘ape* (*Alocasia* sp.) and a variety of exotic grasses and vines.

1.3.1 Built Environment

The built environment consists of the Tai Lee Reservoir with Mokulama Street, a major access road to *mauka* Waimānalo, connecting Hīhīmanu Street to Waikupanaha Street immediately to the east.

The Tai Lee Reservoir connects near its northeast corner at Mokulama Street with the Tai Lee irrigation ditch that follows the contour, extending roughly west to east.

Kalaniana‘ole Highway, the main vehicular artery for Waimānalo, is approximately 0.5 km (1,700 ft) to the north. This area of Waimānalo, well-back from Kalaniana‘ole, is characterized by scattered homes and relatively small agricultural lots in an agricultural land use district (Figure 6). Residential subdivisions lie 300 m to the north, to the north of Hīhīmanu and Kakaina streets (see Figure 6).

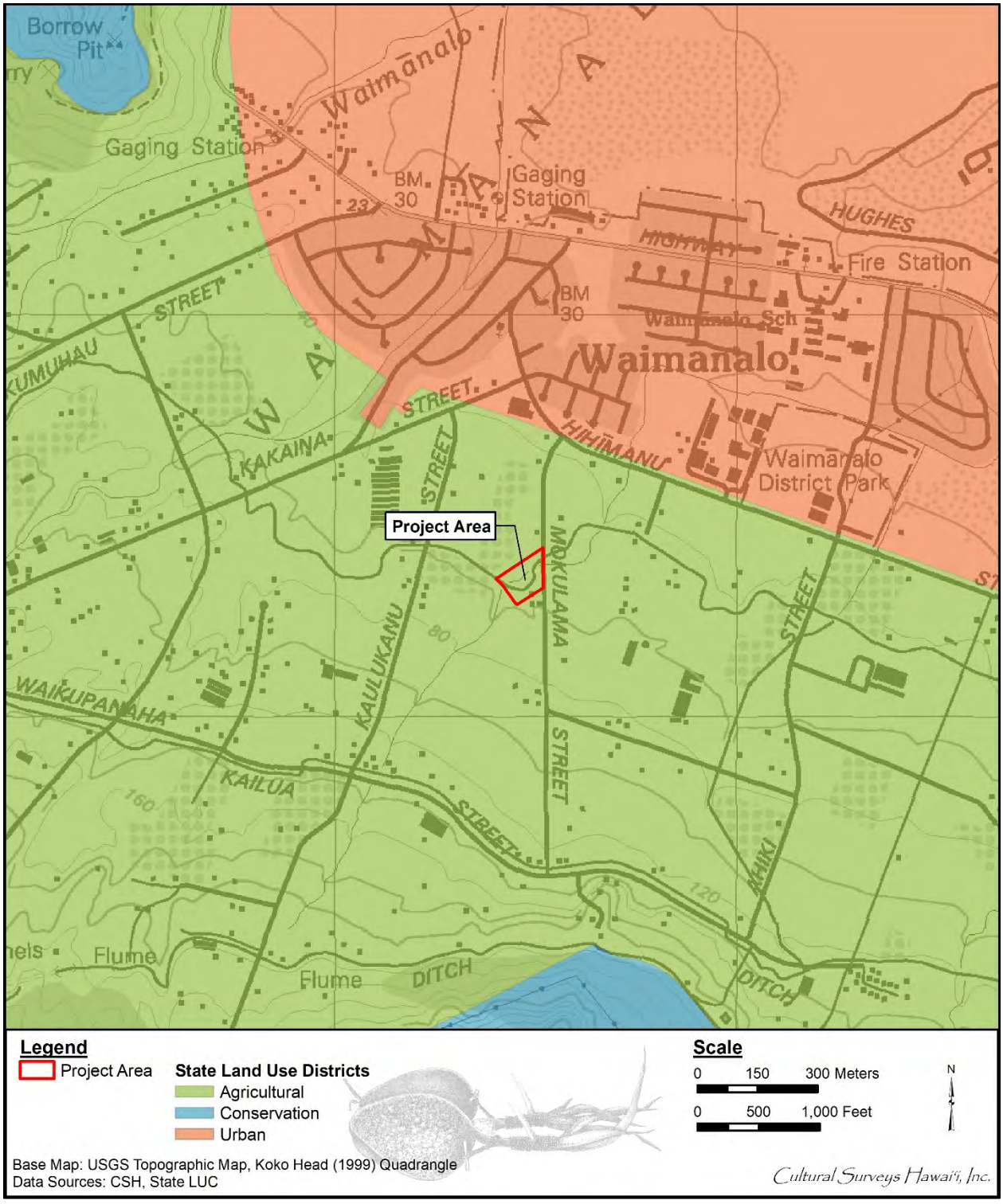

Figure 6. Portion of the 1999 Koko Head USGS 7.5-minute topographic quadrangle showing State Land Use Districts in the vicinity of the Tai Lee Reservoir Rehabilitation project area

Section 2 Methods

2.1 Field Methods

CSH completed the fieldwork component of this study under archaeological fieldwork permit number 22-02, issued by the SHPD pursuant to HAR §13-282. Fieldwork was conducted on 21 January 2022 by CSH archaeologists David W. Shideler, M.A., and Tyler Turran B.A. This work required approximately 1 person-day to complete.

In general, fieldwork included 100% pedestrian inspection of the project area, GPS data collection, and representative photography of the reservoir.

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 Accounting and General Services. Historic maps and photographs from the CSH library were also consulted. In addition, Māhele records were examined from the Waihona ‘Aina database (Waihona ‘Aina 2022).

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

Section 3 Traditional and Historical Background Research

3.1 Mythological and Traditional Accounts

Traditional accounts present some generally recurring themes about Waimānalo including the scarcity of water, except for small springs and Waimānalo Stream; the abundance of food crops along Waimānalo Stream; the broad reef and good fishing resources in the ocean fronting Waimānalo; and the somewhat isolated nature of Waimānalo, especially in terms of land routes, but with a sandy beach frontage allowing easy access by sea. An example of the mythological references to Waimānalo occurs in the Pele and Hi‘iaka epic. During her travels to locations throughout the Hawaiian Islands, Hi‘iaka arrived on O‘ahu at Makapu‘u (Figure 7), in southeastern Waimānalo Ahupua‘a:

> As they [Hi‘iaka and her companion Malei] traveled on, Makapu‘u and its neighbor hills passed out of sight. Arriving at Ka-ala-pueo, they caught view of the desolate hill Pohaku-loa, faint, famished, forlorn […] ‘It [southeastern Waimānalo] is indeed a barren land. Fish is the only food it produces. Our vegetables come from Waimanalo. When the people of that district bring down bundles of food we barter for it our fish.’ [Emerson 1915:89]

Another theme associated with Hi‘iaka’s traverse of Waimānalo is her interactions with the local beauty ‘Āpuakea. Fornander (1919:4:343) relates, “At Kapua in Koolau Muliwaiolena and her daughter Apuakea were killed because the latter compared herself to Hiiaka in beauty.” A more comprehensive account is given in a rendition of the story of Hi‘iaka-i-ka-poli-o-Pele in the Hawaiian language newspaper *Ka Leo o Ka Lāhui*:

> They traveled past Kuhui (Kukui?) and Pahonu where the people shouted at the beauty of Hiiaka. The news reached the ears of Apuakea and she said to her mother, Muliwaiolena, ‘Oh, Muliwaiolena, go and take a look at the women whose beauty the people are shouting about and see if they are as beautiful as I am.’ Muliwaiolena came out and looked. Never had she seen anything on O‘ahu to equal the beauty of these women. Turning to Apuakea she said, ‘Daughter, your beauty does not compare with their great beauty. You are like the soles of their feet.’ Hearing this the expression on Apuakea’s face changed and she fainted away.
>
> Hi‘iaka overheard the words of the woman to her daughter and she uttered this chant:
>
> > O Apuakea-nui, you beautiful woman,
> > Comparisons have been made of your charms,
> > You are beautiful, beautiful indeed.
>
> Muliwaiolena then called out to Hi‘iaka and her friend, ‘Come in, eat and drink and when you are full then continue on your long journey.’ But the travelers did not accept as they did not like the embarrassing comparison that had been made between themselves and the young girl, Apuakea.

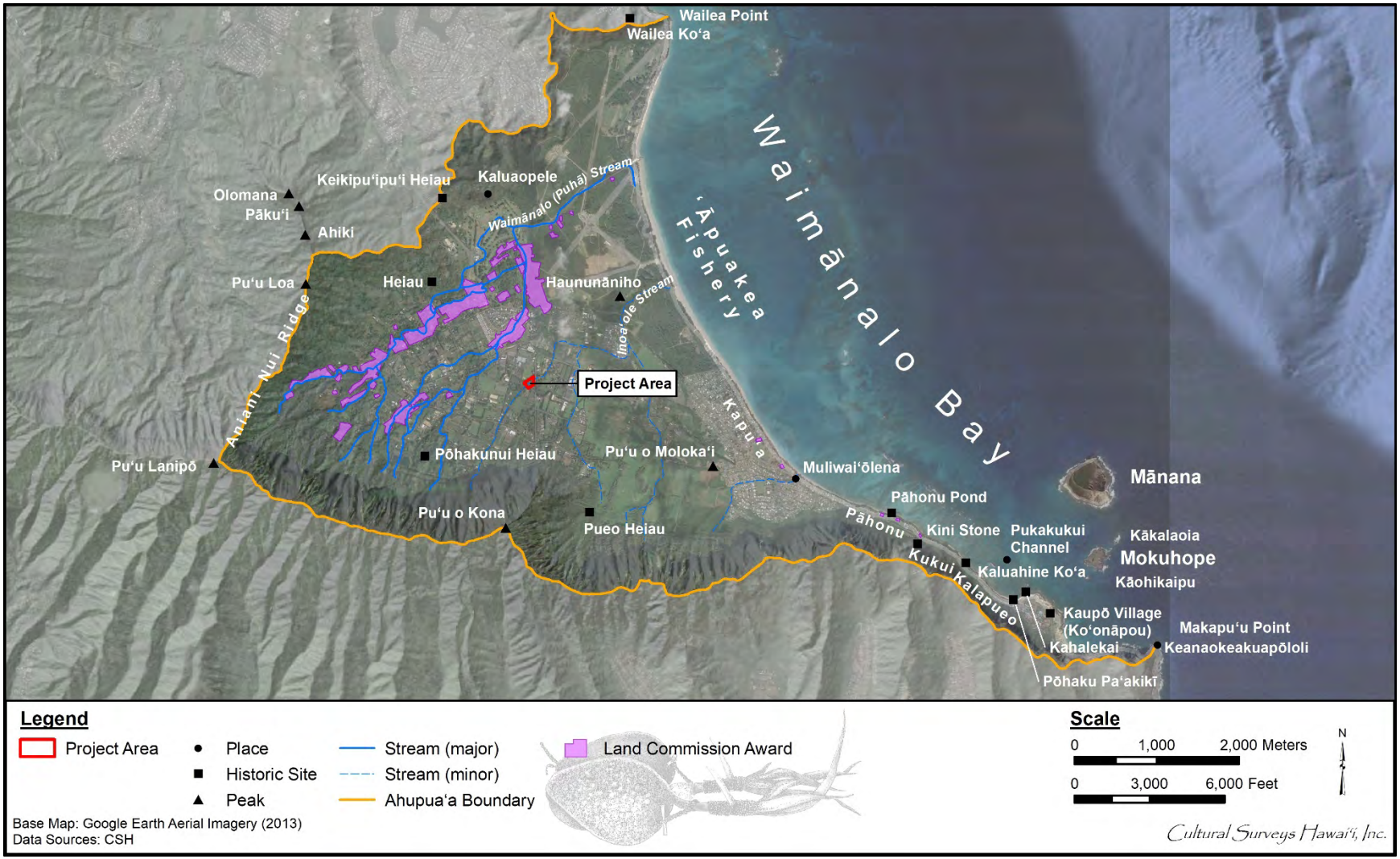

Figure 7. Aerial photograph (Google Earth 2013) with traditional Hawaiian place names in Waimānalo in relation to the Tai Lee Reservoir Rehabilitation project area

> As the travelers went off Muliwaiolena suddenly fell dead. Shortly afterwards Apuakea died. [*Ka Leo o Ka Lāhui* 14, 15 March 1893 in Sterling and Summers 1978:248–249]

It is said the coastal area of central Waimānalo, *makai* (seaward) of the current project area, was named ‘Āpuakea (see Figure 7), or Fair ‘Āpua, for the maiden “whose skin was very fair and whose behavior was so loveable that the people named the place for her and for her fair skin” (Alona 1939 in Sterling and Summers 1978:245). The ancient village of Kapu‘a, the setting of the ‘Āpuakea story, was also said to have been the location of the legendary Muliwai‘ōlena Stream:

> When Kauholokahiki, sister of Kanehunamoku, came ashore from Ulukaa she landed at Ulupau in Mōkapu. There she built a shrine on which to lay her offerings, and there she was found by some women who went to gather sea weeds on the shore and made friends with her. The native women admired the beauty of the stranger who was covered only by a skirt of green pahapaha sea weeds. One of the women removed her own body covering and draped it around the hips of the stranger and invited her to her home. Her beauty glowed like a light in the house and many people came with gifts of tapas, skirts, dogs, hogs and poi. One day the chief Ilauhoe took Kauholokahiki, the stranger, to be his wife. She was so beautiful that even the palms of her hands were lovely. When the chief Ilauhoe married her, the chief wanted her to go bathing with him but she answered, ‘I am kapu and can bathe in no other water unless you go yourself and fetch my bathing water from Muliwaiolena.’ The husband said, ‘It may be in Kahiki and is too far. We do not know where this water is.’ She replied, ‘If you love me, O Chief, go yourself for my bathing water that I mentioned. It is in Waimanalo, at Kapua, a village belonging to the chief Lupe. It is the stream with the yellow water that runs quietly. That is the one.’ The chief ran at once with a container and in no time he dipped up the water and returned. It was indeed yellowish color and that was the first time that it was known that this was Muliwaiolena. It is there to this day. [Uaua 1870 in Sterling and Summers 1978:248]

An additional locality of coastal Waimānalo mentioned in the Hi‘iaka story is Pāhonu:

> There was once a chief who was so fond of turtle meat that he ordered a sea wall built to keep captured turtles from escaping. Every turtle caught by a fisherman was put into this enclosure. No one else was allowed to partake of turtle meat under penalty of death. No one dared to eat turtle as long as the old chief lived. [Alona 1939 in Sterling and Summers 1978:249]

In the mid-valley area of Waimānalo, *mauka* of Muliwai‘ōlena and *makai* of the current project area, was a low hill known as Pu‘u o Moloka‘i:

> Long ago a Molokai man came here and went to live on a low hill not far from Muliwai-olena. The reason for his coming from Molokai to Oahu was forgotten long ago but others followed and dwelt with him. This hill was called Puu-o-Molokai or Molokai’s-hill. The newcomers made their homes on the hill itself and kept very much to themselves. When a boy married one of the girls of Waimanalo, he had to leave his own people to dwell with his wife’s. If a girl married a

> Waimanalo man she too left her own people. Gradually the Molokai people were absorbed by those of Waimanalo. [Alona 1939 in Sterling and Summers 1978:247]

There are also traditional accounts of two springs in Waimānalo Valley:

> The one called Kupunakane is away up in the mountains. The spring called Kupunawahine is a spring way down on the level land. The strange, strange thing about these ponds was that on calm, sunny days they begin to cry out to each other. Their voices were soft and sounded very much like a woman mourning her husband. On days that were over cast with clouds in the sky, then the water of the mountain spring changed. The water of the mountain spring came warm and when you drank the water in the lowland spring it was cool, according to their legend. [*Hoku o Hawaii* 11 March 1930 in Sterling and Summers 1978:247]

3.2 Early Historic Period

Waimānalo was a frequent point of arrival and departure from O‘ahu in the late pre-Contact and early post-Contact periods, as in the following account of the loss of O‘ahu sovereignty:

> When King Kahekili of Maui heard of the death of the priest, Kaopulupulu, by Kahahana (a chief appointed by Kahekili to govern Oahu), he sent some of his men thither by canoe, who landed at Waimanalo, Koolau, where as spies, they learned from the people respecting Kaopulupulu and his death, with that of his son; therefore they returned and told the King the truth of these reports, at which the affection of Kahekili welled up for the dead priest, and he condemned the King he had established. Coming with an army from Maui, he landed at Waikiki without meeting Kahahana, and took back the government of Oahu under his own kingship. The chiefs and people of Oahu all joined under Kahekili for Kahahana had been a chief of wrong-doing. [Thrum 1907:212–213]

In 1875, Native Hawaiian historian Samuel Kamakau related the following: “The ahupua‘a [traditional land division] of Waimanalo, including the fish pond at Maunalua and the traveling uhu of Makapu‘u belonged to Maui-mua (First Maui)” (*Kuokoa* 27 November 1875 in Sterling and Summers 1978:244).

During Kamehameha’s conquest of O‘ahu, part of his fleet landed near Makapu‘u and then joined with Kamehameha’s other forces, finally conquering O‘ahu. Prior to the invasion, Kamehameha sent a messenger to Kahekili:

> Ki-kane, Kamehameha’s messenger to Kahekili, threw down two *maika* stones, a black one and a white one. Ka-hekili said when he saw these stones, ‘This stone (the white) brings life through farming and fishing, rearing men, and providing them with food; this other stone (the black) brings war.’ Let the reader ponder the meaning of this answer. Kahekili asked, ‘Is Kamehameha coming to Oahu to fight?’ ‘Yes,’ answered Ki-hane. ‘What harbor will he choose?’ ‘It was Kiko‘o’s counsel to make Waimanalo the harbor and battle site.’ ‘It is too low there to cast sling stones to reach the heights. It is good only for food and fish. If stones are thrown from above nothing can save the battlefield […] ’ [Kamakau 1961:150]

After Kamehameha’s conquest of O‘ahu and his division of the island among his chiefs, Waimānalo was apparently retained as Kamehameha’s personal property. This seems to be the case as in 1845, Kamehameha III, Kauikeaouli, who had “inherited” the land as a son of Kamehameha I, claimed the *ahupua‘a* of Waimānalo “to be the private lands of his Majesty Kamehameha III, to have and to hold to himself, his heirs and successors, forever; and said lands shall be regulated and disposed of according to his Royal will and pleasure, subject only to the rights of tenants” (Commissioner of Public Lands 1929:28).

Two early foreign visitors, both missionaries, visited Waimānalo. In 1828, Levi Chamberlain commented on Waimānalo as being a “considerable settlement.” While there, Chamberlain stayed in a native house, which he described as “a miserable place for the abode of human beings and presented a motley group of children and women, dogs, hogs and fowls.” Chamberlain also noted “though there are a good many inhabitants in the settlement, yet but very few seemed to give any attention to instruction” (Chamberlain 1957:30). In 1838, Edwin Hall wrote the following:

> We could not however, but notice, that most of the inhabitants on the eastern end of the island were much more degraded, and exhibited far less evidence of improvement than any we saw on other parts of the island; a fact calling for our sympathy and pity, and for our endeavors to enlighten and elevate them. [Hall 1839:111]

3.3 Ranching in Waimānalo

An article in the *Honolulu Star-Bulletin* reported that “Thomas Cummins, out of England, obtained a lease of the crown lands at Waimānalo and established a cattle ranch in the early 1840’s” (*Honolulu Star-Bulletin* 22 June 1935:9) While Thomas A. Cummins (1802–1885) was born in England, he was raised in Massachusetts, arriving in the Hawaiian Islands in 1828 (Williams 1996). Thomas Cummins married the High Chiefess Kaumakaokane Papali‘ai‘aina (1810–1849) of Puna, Hawai‘i Island who gave birth to John Adams Kuakini Cummins (1835–1913), the major figure in the history of the Waimānalo Ranch, on 17 March 1835 in Honolulu.

It seems likely that the ranch started in a somewhat informal manner. The initial 50-year lease of 970 acres of Crown lands granted by Kamehameha III to Thomas Cummins began in 1850 and lasted until 1900. The Cummins family paid $350 a year (Hawai‘i State Archives, Interior Department Files). “Cummins imported fine bulls and heifers from California and brought in Southdown Sheep around the horn from Boston” (Harland, Bartholomew and Associates 1959:13). In June 1854, Charles Gordon Hopkins reported “the importation from California of two young bulls of the Durham breed by Thomas Cummins. These have for some months past [been] running with his herd in Waimānalo.” (Brundage 1971:12)

The 1860 *Tax Assessment and Collection Records* for 1st Taxation Division, Ko‘olaupoko District, Island of O‘ahu provides a line entry for “Armstrong & Cummins” as having $600 worth of real estate (*Ka Huina nui o ka Waiwai Pa‘a*) and a $9,000 valuation for personal property/ personal estate (*Waiwai lewa*). This valuation probably related primarily to the enumerated holdings including 1,180 head of cattle (*pipi*), a wooden house (*hale la‘au*), and an unspecified number of sheep (*hipa*). This evaluation of wealth may be contrasted with that established for the approximately 133 named Hawaiians and two named Chinese (“Kui” and “Am Young,” both conveniently identified as “Pake” (*Pākē* = Chinese) who were each assessed in 1860 as possessing

between $50 and $500 total wealth (*Waiwai Pa‘a + Waiwai lewa*). Although the name Armstrong is cited first, no one by that name appears to have been a resident in Waimānalo at that time. The Cummins interest was presumably largely or entirely held by the listed residents John Cummins and Thos. Cummins. Given the significant number of cattle it seems probable that several of the residents of Waimānalo worked for the Cummins ranch. The ranch population could have included several of the Hawaiians, one or both of the Chinese, and some of the six other individuals listed with Caucasian surnames (Wm. Beckley, John Paty, John Brown, John Hobbs, Capt. Smith, and W.C. Parke).

Of note is the 1860s tax records reference to “Armstrong” as an indicated co-owner of the ranch. The *Pacific Commercial Advertiser* (28 June 1860:2) relates that Mr. Richard Baxter Armstrong “has bought out one-half of Waimānalo, in Koolaupoko, from Mr. T. Cummings [*sic*], who we regret to learn leaves the country to seek another climate to re-establish his health.” R. Baxter Armstrong (1837–1871) was the son of missionary Richard Armstrong (Minister of Education and President of the Board of Education of the Kingdom). R. Baxter Armstrong appears to have sold his interest back to the Cummins family before moving to California where he resided for some time before his death in 1871.

The 1870 *Tax Assessment and Collection Records* lists the ranch under the “Waimānalo Stock Ranch” associated with the name Thos. Cummins. The valuation for personal property/personal estate (*Waiwai lewa*) was now $20,000, an increase of 222% in value over the previous decade. The number of cattle and sheep is unspecified but the livestock of the stock ranch included 44 horses and three mules (*miula*). Again for purposes of contrast, the documented total wealth for each of the 97 Hawaiians noted varied between $100 and $2,000. No Chinese are noted specifically by race but it seems likely the individual recorded as “Asiu at John Cummins” was of Chinese ethnicity in the employ of the Cummins ranch. In 1870 there was another major *haole* interest entered for Waimānalo (C.H. Judd), listed as having personal property/personal estate in the *ahupua‘a* worth $1,500 including 46 horses and three mules. It appears likely the horses and mules accounted for virtually all of the personal estate and the Judd family interest was largely focused on raising these horses.

In general, the introduction of livestock to Hawai‘i had an exceedingly negative impact on the natural environment and contributed to the demise of traditional Hawaiian life. Lacking walls and fences to contain the vast herds of cattle, sheep, and horses, the animals trampled the small scattered homesteads and stripped the land of native vegetation. The relationship between cattle and the natural environment of Hawai‘i has been described by William A. Bryan:

> Since the coming of the whites there have been many causes […] that have been at work bringing about a change in the natural conditions. Chief among the disturbing elements, however, have been the cattle. As early as 1815 they were recognized as a serious menace to the native forests. Roaming at will through the forests they and other animals, as goats and pigs, have done untold damage, and brought about conditions that have been most serious in many places. [Bryan 1915:226–227]

The following account describing Waimānalo ca. 1847 illustrates the damage to the natural landscape caused by the development of the Cummins Ranch:

> *Ia manawa. me he la, ke nana aku, ua piha pono oloko o ke awawa me ka u-lu. ka ohi‘a. ke kukui, ame ka niu. E waiho mai ana hoi na lo‘i kalo, me na kuauna i hele*

> *a paa pono i ka la-i ame ka wauke; a e kuku ana na kauhale mauu ma na aina maloo, he haneri ka nui, a ma keia mau wahi no hoi ka uala ame ke ko i kanu nui ia ai i mau mea kokua mai i ka noho ana. […]*
>
> *Ua hoolimalimaia aku ke Ahupuaa holookoa o Waimanalo i ka haole, a koe nae na pono kuleana o na kanaka, a ma ka hele wale ana o ka pipi iluna o ka aina holookoa, ua hookikina ia aku na kanaka e pa i ko lakou wahi, i ole ai e hoopilikiaia mai. O na lo‘i kalo i hana maiau ia i ke au e noho mana ana na 'lii maluna o na kanaka ame ka aina, ua hoohioloia, a o na ko aki ka, la-i ame ka wauke, ua hooneoneoia. Na kumu laau nunui oia mau la, ua pau i ka maloo mamuli o ka loaa ole i ko lakou mau aa ka ma-u kupono, a ua lilo maoli ke awawa i kula holoholona. […]* [*Kuokoa* 26 October 1906]
>
> At that time, it seemed that the valley was filled with breadfruit, mountain apples, kukui and coconut trees. There were taro patches, with banks covered with ti and wauke plants. Grass houses occupied the dry lands, a hundred of them here and sweet potatoes and sugar cane were much grown. It was a great help toward their livelihood […]
>
> The whole ahupua‘a of Waimanalo was leased to white men except the native kuleana and because the cattle wandered over them, they were compelled to build fences for protection. The taro patches that were neatly built in the time when chiefs ruled over the people and the land, were broken up. The sugar cane, ti and wauke plants were destroyed. The big trees that grew in those days, died because the roots could not get moisture. The valley became a place for animals. [English translation follows Sterling and Summers 1978:244]

The Cummins family eventually began to buy up the *kuleana* of the native farmers, gaining some 200 acres in fee. By the early 1870s, Chinese rice farmers were using some of these lands under agreement with John A. Cummins.

By 1880 the “Waimānalo Stock Ranch” had been replaced by Cummins’ Waimānalo Sugar Company showing a very substantial investment of $45,000 in “Mill and Machinery.” At this time, however, the Cummins’ interests were still in transition and the holdings of the “Sugar Co.” included 260 head of cattle and 1,000 sheep. The role of sheep in the Waimānalo landscape may have been under appreciated as they were worth (in 1880) an average of $1.50 per sheep compared to an average $10.00 per head of cattle.

By 1890 sugar had eclipsed ranching. A popular account noted the original stock ranch “was celebrated for its racing stock, some of the most prominent winners having come from here […] ” (Whitney 1890:27–28).

An odd feature of the Waimanalo Sugar Company was its continuing use of mules even long after many miles of train tracks were established. As late as 1931 the Waimanalo Sugar Company had 32 mules working in soil preparation “for plowing odd corners and steep hillsides, hauling cane cars on the portable track, making level ditches and packing for fertilizer and seed cane” (Condé and Best 1973:366).

3.4 Land Commission Award Documentation

In 1845, the Board of Commissioners to Quiet Land Titles, also called the Land Commission, was established “for the investigation and final ascertainment or rejection of all claims of private individuals, whether natives or foreigners, to any landed property” (Chinen 1958:8). This led to the Māhele, the division of lands among the king of Hawai‘i, the *ali‘i* (chiefs), and the common people, and which introduced the concept of private property into Hawaiian society. In 1848, Kamehameha III divided the land into four categories: Crown Lands reserved for himself and the royal house; Government Lands set aside to generate revenue for the government; Konohiki Lands claimed by *ali‘i* and their *konohiki* (supervisors); and *kuleana,* habitation and agricultural plots claimed by the common people (Chinen 1958:8–15). Ralph Kuykendall notes the concept of private land ownership was a radical departure from the local traditional land tenure system: “The old feudal arrangement of joint and undivided ownership had given place to the system of individual allodial tenures, and aliens had been admitted to the enjoyment of the same rights as Hawaiian subjects in the ownership and use of land” (Kuykendall 1967:298).

The *ahupua‘a* of Waimānalo was awarded to Victoria Kamāmalu, subject to the *kuleana* claims of the commoners. She received the third largest share of lands among the *ali‘i nui* (high chiefs) of the Kingdom of Hawai‘i, including 47 *ahupua‘a*-sized parcels in addition to Waimānalo. Approximately 113 *kuleana* land claims were awarded in Waimānalo. Nearly all of these Land Commission Awards (LCA) were located along Waimānalo Stream or its upper tributaries, in the northwestern portion of the *ahupua‘a* (Figure 8). While the Hawaiian population of Waimānalo was likely much larger and more dispersed in pre-Contact times, it nevertheless appears the traditional Hawaiian population of Waimānalo was always clustered along Waimānalo Stream and its upper tributaries, focused on wetland taro and sweet potato cultivation. A few additional *kuleana* LCAs, primarily consisting of house lots, were scattered along the coastal areas of central and southeastern Waimānalo, likely focused on the procurement of marine resources. No *kuleana* LCAs were located in the vicinity of the current project area.

LCA data indicates it was common for *kuleana* awards to have a parcel along the coast as well as a parcel in the upland area. The following account describes the traditional utilization of both land and sea:

> A spring called Wai-kupanaha was pointed out to us, (in valley mauka of Mill), surrounded by tall taro plants, banana trees and fragrant white gingers. According to Mr. Alona, the Wai-kupanaha on the west side of Mr. Castle’s place was a lele, or a part of this kuleana, so both were given the same name. The upland piece was for taro growing and the piece near the sea was for fishing. The former owners of Wai-kupanaha went inland to raise taro and then to their land by the shore to fish. Both places had water but today only the upland Wai-kupanaha has water. [Alona 1939 in Sterling and Summers 1978:246]

3.5 Tai Lee and Chinese Endeavors in Waimānalo

As noted above, the total number of Chinese in Waimānalo Ahupua‘a in 1860 was two and in 1870 appears to have been one (“Asiu at John Cummins”) (Table 1). Many Chinese had the spelling of their family names “Hawaiianized”; it is certainly possible some of the listed names

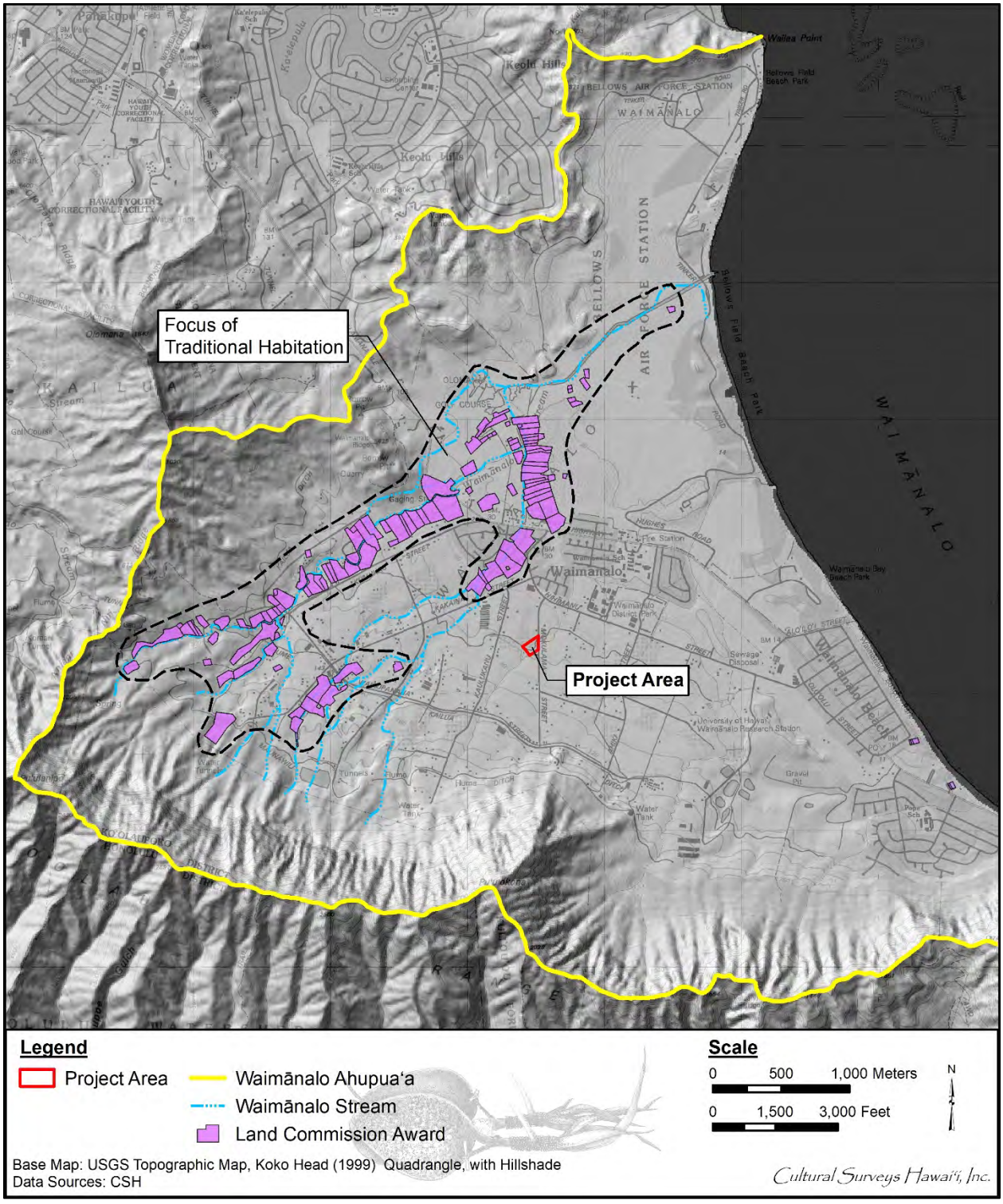

Figure 8. 1999 Koko Head USGS topographic quadrangle, showing the focus of traditional Hawaiian habitation along Waimānalo Stream and its tributaries (based on Land Commission Award data), in relation to the Tai Lee Reservoir Rehabilitation project area

that appear to be Hawaiian were in fact Chinese. Chinese were often listed separately and the very low numbers of Chinese present in 1860 and 1870 appears at least approximately correct. It seems “A number of Chinese rice farmers had settled in the valley by the early 1870s, probably leasing lands from Cummins, though the records are hazy as to the type of tenure they held” (Harland Bartholomew and Associates 1959:13).

Table 1. Tax records for Waimānalo Ahupua‘a (decadal for 1860-1880)

Year	No. of People in Tax Record	Seemingly Hawaiian No. (% of total)	Seemingly Caucasian No. (% of total)	Seemingly Chinese No. (% of total)	Seemingly “Other” No. (% of total)
1860	144	133 (92)	9 (6)	2 (1)	0 (0)
1870	106	97 (92)	8 (8)	1 (1)	0 (0)
1880	235	52 (22)	15 (6)	150 (64)	18 (8)

Opportunity for profit in rice cultivation was the main impetus behind Chinese enterprise in Waimānalo. At its inception, the cultivation of rice in O‘ahu was initially a slow moving process. As early as 1857, laborers working on sugarcane plantations whose contracts expired were given the opportunity to transition into the growing of rice, however, only sparse interest was shown. King Kamehameha IV even offered land grants for rice cultivation but no one accepted the offer (Coulter and Chun 1937:7).

The catalyst for the eventual growth of rice cultivation on O‘ahu was the importation of Chinese laborers to work on sugarcane plantations. In 1852, a relatively miniscule cargo of workers from China arrived on the island. “In 1853 there were 364 Chinese in the islands. In 1860 their number had risen to 700, and by 1866 to 1,200” (Coulter and Chun 1937:9). As their contracts for laboring on the sugar plantations expired, the Chinese workers had the option to extend their contract and continue farming sugarcane, or to seek employment elsewhere. Many chose to leave the sugarcane plantations in order that they might, “find employment raising a crop to which they had long been accustomed” (Coulter and Chun 1937:9).

Due to the overwhelming lack of interest from the Hawaiians and whites in growing rice, both of whom favored to instead lease the lands for the rice to be grown, those workers that had arrived from China were left, unimpeded, as the sole propagators of the rice industry on the island.

With the formation of Chinese-owned companies in Hawai‘i, the need for labor became ever increasing. Coupled with lax immigration laws, the incentive to bring in cheap labor from China for both rice and sugarcane farming increased to the point where, “the Board of Immigration and the sugar cane planters induced more and more Chinese to come to Hawai‘i by paying their steamer fares wholly or in part” (Coulter and Chun 1937:11).

This mass influx of immigrants from China led to an obvious explosion in the population of Chinese on O‘ahu. According to Coulter, “In 1878 there were 6,045 Chinese in Hawaii; by 1884 their number had reached 18,254. Tales of success of Chinese in the rice industry in Hawaii were an incentive for many Chinese to come to the islands to enter directly into rice cultivation” (Coulter 1931:11). Having previous experience growing the same crop in their native country, the Chinese rice farmers now residing in Hawai‘i were fervent in their efforts to make the most of this unique opportunity.

> Such was the desire of the Chinese to use every piece of land to its fullest extent for paddy that they cut away the paths which the Hawaiians had used between taro patches to strips so narrow that a man could walk along them only with difficulty. Such a circumstance made it very difficult later on to mark exactly the boundaries between *kuleanas* and gave rise to legal troubles in courts. [Coulter and Chun 1937:11]

The increase in rice production in Hawai‘i would not plateau until 1900 to 1910 when federal exclusion laws led to a precipitous loss of rice laborers and the collapse of rice farming (Coulter and Chun 1937:53). While the shift to sugar cultivation at Waimānalo may have led to increased costs for land, water, and fertilizer, it appears that at least at Waimānalo the transition was due to sugar cultivation just being far more lucrative.

In 1876, the Hawaiian Kingdom entered into a Reciprocity Treaty with the United States. This allowed the growing Hawaiian sugar industry a free market and the potential for great profits. One of the Chinese rice farmers, Tai Lee, began sugar cultivation on Cummins' Waimānalo lands.

By 1880 the population of Waimānalo was much changed. The Chinese names were lumped seemingly under their agricultural employer—the Kwong Fook Company is associated with 33 Chinese names, the Mau Sing Company is associated with 17 Chinese names, the Tai Sing Company is associated with six Chinese names, the Kwong Lee Company is associated with nine Chinese names, the Wing Jay Kee Company is associated with seven, the Akau and Company W.P. with 16 Chinese names, the Rose and Company (the ethnicity of ownership is inferred here on the basis of all workers having Chinese names) is associated with 33 Chinese names, and the Waimānalo Sugar Company is associated with 29 Chinese names. Thus in 1880 in Waimānalo Ahupua‘a there appear to have been eight agricultural companies including the Cummins' Waimānalo Sugar Company and seven Chinese firms (Table 2). The duration of the Chinese firms is uncertain. Dorrance and Morgan's (2000:41) *Story of Sugar* makes only a passing reference to one, "Rose & Company," documented in the sources cited in the period from 1882-1883. These eight companies each employed between six and 33 Chinese (averaging 19 Chinese workers) for a total Waimānalo Chinese population of approximately 150. This stands in contrast to the Hawaiian taxed population of 52 the time. There are at least a couple of important caveats here. The Waimānalo Sugar Company in 1880 was associated with 62 names, 15 of which appear to be Caucasian and 29 that appear to be Chinese. Some 18 names of individuals (including "Tabona," "Tikila," "Tom," "Tabob," and "Tebuto") are of uncertain ethnicity (and may in fact have been "South Seas Islanders" from today's Kiribati) but certainly could conceivably have been Hawaiian or Chinese. Another point is that typically adult heads of households were taxed and women and children may be largely or entirely underrepresented. On the other hand, there appear to be reasonable grounds to conclude that in 1880 close to two-thirds of all men in Waimānalo were Chinese. This population trend was in keeping with the wider trend in the Kingdom. Schmitt (1977:90) presents data that in 1853 the 364 people living in the Kingdom born in China accounted for 0.5% of the population; by 1884 the 17,939 people living in the Kingdom born in China accounted for 22% of the population. The Chinese would have been almost exclusively adult males so their percentage of the adult male population would have been close to 50%.

Curiously in the 1880 Commercial Agricultural Holdings in Waimānalo listing (Table 2) of the seven companies listed that are believed to be "Chinese" there is no "Tai Lee." Five of these seven companies for which there is data have similar-sized holdings (between 50 and 64 acres in

sugarcane). And yet in an account of Chinese in rural O‘ahu we read that “Most well known of the rice farmers (who later became the largest sugar cane grower in acreage) was Tai LEE” (Enoka 1978:35).

A newspaper search on “Tai Lee” identified 33 references (between 1882 and 1907) to “Tai Lee”, “Tai Lee & Co.” and “Tai Lee Wai Co.” that are thought to address this entity (see Appendix A). In 1882 and 1892 the newspaper references associate “Tai Lee “ with Waimānalo but the references after 1892 associate the Tai Lee Wai Co. with rice cultivation in Kahana, O‘ahu. This suggests Tai Lee (and other Chinese sugarcane firms) were out of Waimānalo cane production soon after 1892.

Table 2. 1880 commercial agricultural holdings in Waimānalo Ahupua‘a by individual or company and crop

Company	**Acreage in Cane**	**Acreage in Rice**	**Acreage Unclear**
Kane	3.5	–	–
Kapoi	3	–	–
Opiopio	10	–	–
Waialeale	4	–	–
Total Hawaiian	**20.5**	**–**	–
Kwong Fook Company	64	44	–
Mau Sing Company	54	–	–
Tai Sing Company	51	–	–
Kwong Lee Company	–	8	–
Wing Jay Kee Company	–	–	Penciled in “cane or rice?”
Akau and Company W.P.	50	–	–
Rose and Company	55	–	–
Total Chinese	**274**	**52**	–
Waimānalo Sugar Company	11	–	–
Total *Haole*	**11***	**–**	–

A 1931 article in the *Honolulu Advertiser* relates the history of Chinese sugarcane cultivation in Waimānalo which notably emphasizes that sugarcane cultivation was “Started by Chinese who worked the Paddies” and notes that “Fields [were] named for Pioneers” (*Honolulu Advertiser* 18 November 1931:1):

> […] The plantation [at Waimānalo] dates back to 1876, the Reciprocity Year. when one Tai Lee, a Chinese rice planter, lured away from paddy by the promise of greater profits from sugar commenced the cultivation of cane on the fields immediately southwest and mauka of the present Waimanalo Village.
>
> Tai Lee’s plantation was increased until he had about 800 acres in cane. Following his success as a cane grower, other Chinese took up other nearby sections until the

> total area cropped was perhaps 1200 acres, or about half as much as the present [1931] cane area.
>
> In the meantime the Waimanalo Sugar Company was organized. The company built and operated a mill, purchasing the cane grown by the Chinese farmers. This arrangement lasted fifteen or twenty years and it was not until after annexation [1898] that the milling company commenced growing cane on its own account. The plantation is probably the only one in Hawaii where the sections and fields are known by the names of the original Chinese cane farmers. The ‘Tai Lee’ section is still the heart of the plantation, comprising its richest lands. […] [*Honolulu Advertiser* 18 November 1931:1]

The article notes that times had changed, and at that time [1931] the “Waimanalo Sugar Co. hasn’t a single Chinese laborer on its pay-roll” *(Honolulu Advertiser* 18 November 1931:1). Thus both the references in newspaper articles of the time and this 1931 account suggest the Chinese were largely or completely out of sugarcane production in Waimānalo around annexation (1898).

The Chinese role in the development of the Waimānalo irrigation system is not well documented. A *General Plan for Waimanalo Valley* (Harland Bartholomew and Associates 1959) with a substantial discussion of water systems of Waimānalo, the National Register of Historic Places (NRHP) Registration Form for the Waimānalo Irrigation System (Creed 1992), and the major study on Hawai‘i’s plantation ditches (Wilcox 1996:111–113) make no mention of the Chinese or of a “Tai Lee” at all.

It seems probable, given the modest rainfall (70.9 inches at the neighboring “Mokulama Station”), that Chinese sugar cultivation between 1876 and 1898 developed a substantial irrigation system to water their 1,200 acres but few particulars have been found.

We read in an account of Chinese in rural O‘ahu that:

> Water was very important to the Chinese since rice is grown in specially irrigated or flooded fields. Their main source of water came from two reservoirs built by the Chinese—one located close to the Hawaii Irrigation Office called Tai Lee and the other just below Foremost Dairy called Wing Kee. These reservoirs still maintain their original names. [Enoka 1978:35]

Thus the Tai Lee Reservoir is understood to have been built by Tai Lee and to have originated in Chinese rice growing in Waimānalo and to have supported Chinese sugarcane growing in Waimānalo until ca. 1900 when it was effectively taken over by the Waimanalo Sugar Company.

We learn that:

> The Chinese who first farmed it [Waimānalo commercial sugarcane] started digging a drainage canal off through what are now [1931] the Waimanalo homestead lots but gave it up as a bad job after spending all his money. [*Honolulu Advertiser* 18 November 1931:6]

The present research supports that the Reservoir Ditch extending east from the downslope side of the Tai Lee Reservoir was built between 1943 and 1952. This ditch descending from the Tai Lee Reservoir has been popularly called the “Tai Lee Ditch” but it seems clear the post-1943 ditch had nothing directly to do with the Chinese rice and cane growing period. The delivery system for

irrigation water from the Tai Lee Reservoir to Chinese rice fields and later Chinese sugar fields is unclear.

3.6 Waimanalo Sugar Company (John Cummins Years 1877–1894)

As noted in the 1931 article above, one of the most momentous dates in the history of Hawai‘i was approval of a Reciprocity Treaty by the U.S. Senate, ratification by King David Kalākaua and U.S. President Ulysses S. Grant on 31 May 1876. This was “a simple agreement for the reciprocal admission into the two countries, free of duty, of numerous specified products listed in two schedules […]” (Kuykendall 1967:26), including admission of Hawai‘i sugar into the U.S. free of tariff. The Reciprocity Treaty had vast political, social, and cultural consequences for good and ill and converted Hawai‘i to a virtual one-crop economy. Between 1876 and 1898 sugar exports increased more than 17-fold in an expansion that brought modern sugarcane cultivation into Waimānalo.

John Adams Kuakini Cummins (1835–1913, Figure 9) was the son of Thomas Cummins, an English American settler in Hawai‘i. He was named after the governor of O‘ahu, John Adams Kuakini (1789–1844) who had been named after U.S. President John Quincy Adams. His Hawaiian mother was distantly related to Kamehameha I (Day 1984:29). After attending the Royal School with many of the future monarchs of the Kingdom he went to work on his father’s Waimanalo Ranch, becoming manager in 1855. John Cummins was appointed minister of Foreign Affairs by King David Kalākaua in 1890 and was head of the king’s cabinet. That same year John Cummins founded the “Native Sons of Hawaii,” organized to sustain “a monarchical form of government” and “the perpetuity of Hawaii as an independent state” with the adoption of the moto “Hawaii for the Hawaiians” (Kuykendall 1967:517). He became a leading monarchist in the counter-revolution of 1895 for which he was fined for conspiracy to overthrow the Republic of Hawaii. He was famous as a bon vivant particularly known for his love of horse racing and was a charter member of the Hawaiian Jockey Club in 1885 (Day 1984:30). Cummins was given a 10-ton pilot boat by friends in Boston, in which he cruised from his 700-foot pier at Waimānalo (located near Huli Street and Kalaniana‘ole Highway) to “every port and inlet in the islands” (Day 1984:30).

In the context of preparing for a visit from Queen Emma in 1875, John Cummins referred to himself as “the konohiki, or lord of Waimānalo, and owner of hundreds of horses and cattle” (Cummins 1913:11). One vignette in particular that was arranged for Queen Emma’s visit at Puhā Stream may have influenced subsequent irrigation practices. As Cummins would report it 38 years later:

> I had a gang of men at work preparing to open the bar at the mouth of the Puha river. This bar or dam had accumulated for some years and much water was backed up. I had seen this opened on a former occasion, and the sports of the natives in swimming the raging waters, and determined to give her Majesty and party a view of this ancient sport. To this end I had a gang of men cut and carry away much of the embankment so that but little would be required to bring down the flood. An opening of 20 feet or more having been made in the dam the water rushed out at the rate of 30 knots or more. The bore or surge caused was very high, and only two men and two women dared to play in this watersurf, called Pue-wai. One strong

Figure 9. John Adams Kuakini Cummins (1835–1913) (from Williams 1996:155)

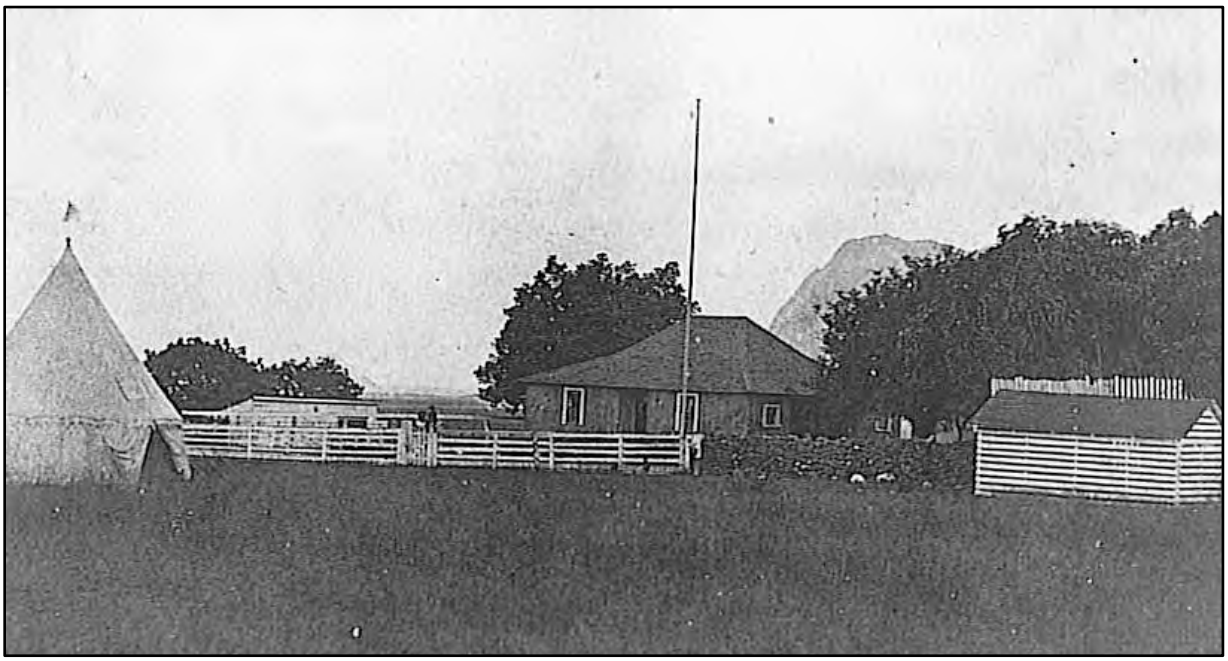

Figure 10. John Adams Kuakini Cummins' residence named "Mauna Lole" or "Rose Mont" at Waimānalo, O‘ahu (from Williams 1996:161)

> man of fine form went across and back holding up the top end of his malo. This was the grand sport of the day […] [Cummins 1913:235–236]

Cummins became known as “the prince of entertainers” (Williams 1996), putting on several extraordinary displays of hospitality for Kamehameha II, IV, and V, King Kalākaua, Queen Lili‘uokalani, American, French, British, and Russian officers, and the Duke of Edinburgh at his Waimānalo home named Mauna Loke (“Rose Mount”) (*Honolulu Star-Bulletin* 22 June 1935:9 in Silva 1981:A-22) (see Figure 10) located near Pō‘alima Street behind present-day Shima’s Market. The mill was quite close to his home as noted on the 1884 Jackson map (Figure 11).

Cummins constructed a landing at Waimānalo Bay, as access to Waimānalo prior to the construction of the Nu‘uanu Pali road was primarily by sea (Condé and Best 1973:364). A railroad line was also constructed to connect the landing to the Cummins Estate:

> Kamehameha V often visited the [Cummins’] plantation. When he grew too heavy to make the trip over the Pali on horseback, he is said to have acquired a small steamboat to transport him around the southern tip of Oahu to Waimanalo. A railroad track was laid to carry the rotund monarch from the landing to the Cummins home. [Thomas 1983:77]

In 1877 John A. Cummins conceived a plan to convert the family ranch into a commercial sugarcane venture. In 1877, orders were placed for needed infrastructure and the Waimanalo Sugar Company (W.S. Co.) was chartered on 5 May 1880 (Condé and Best 1973:364).

John A. Cummins:

> […] enlarged the acreage. He sent to Scotland for a two-roller, eight ton mill with a capacity of from eight to 10 tons of sugar per day. By January, 1881, cane grinding was started. For four months mule teams were used for transporting cane to the mill. After that locomotives were in operation. Moveable tracks were shifted constantly from field to field as the work of grinding progressed. Between 900 and 1,000 acres were planted to cane.
>
> Clusters of plantation houses sprang up where once the grass huts of the Hawaiians had stood. Chinese laborers gradually replaced the native population. [*Honolulu Star-Bulletin,* 22 June 1935:9]

In the mid-1870s and 1880s the Waimanalo Sugar Company would purchase cane from Chinese growers in a system unique to Waimanalo Plantation (*Honolulu Advertiser,* 8 November 1931:1). Work began on a sugar mill in January 1880 and the sugarcane railroad commenced the same year. “For four months the work of carting cane to the [Waimānalo] mill was performed by mule teams” (*Pacific Commercial Advertiser,* 2 February 1882) but a new locomotive, the Thos. Cummins, started hauling Waimānalo sugarcane to the mill 23 April 1881.

The vast majority of the W.S. Co. lands were leased. The initial 50-year lease began in 1850 and lasted until 1900. The Cummins family paid $350 (Hawai‘i State Archives, Interior Department Files). A new lease was negotiated commencing 22 November 1890 and expiring 22 November 1920 for 6,835.00 acres (Hawai‘i State Archives, Interior Department Files). The transition from buying cane from Chinese growers appears to have been gradual; as late as 1900 the plantation “concentrates on growing more of its own cane for its mill” (*Honolulu Advertiser*

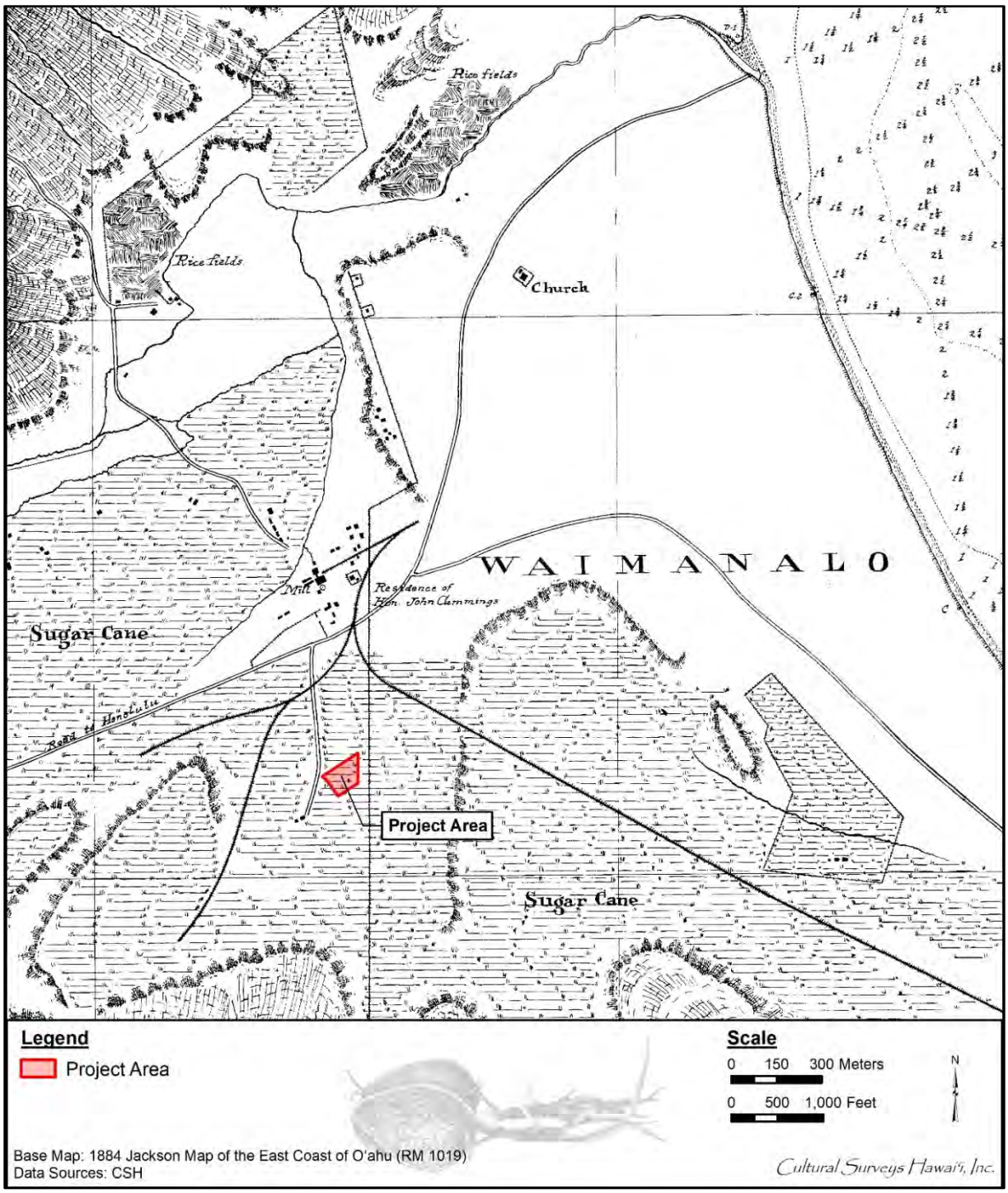

Figure 11. Portion of the 1884 Jackson map of the east coast of O‘ahu (RM 1019) showing the location of the Tai Lee Reservoir Rehabilitation project area within a sea of sugarcane, a spur road extending roughly north/south is close to the west corner of the project area, no reservoir is indicated at the project area, and the “Residence of Hon. John Cummings” is 500 m north of the project area by the “Mill” that started grinding in 1881

8 November 1931:1). A marker of a plantation's growing success is their rate of acquisition of locomotives. The first locomotive, the *Thos. Cummins* (named after John Cummins' father), later renamed *Nalo* (a contraction of Waimānalo), started work in 1881. In 1883 a second locomotive, the *Puaalii* (a Hawaiian nickname for John A. Cummins, "*pua ali‘i* meaning "descendant of royalty"), was at work. Eventually the name was changed to the *Olomana*, (named after the mountain peak that dominates the landscape). The *Olomana* (a Baldwin Class 6-8 1/3C16 locomotive) came to O‘ahu in 1883 by sailing ship around Cape Horn from the Baldwin Locomotive Works of Philadelphia, Pennsylvania; it operated into the 1940s (Figure 12). The *Olomana* was restored by Gerald M. Best and Ward Kimball and was donated to the Smithsonian Institution in 1977 (Maunalua.net 2014). The third locomotive would not be acquired for 24 years (Condé and Best 1973:371).

Figure 12. The *Olomana* steam locomotive at work at the Waimanalo Sugar Company (Maunalua.net 2014)

3.7 **Waimanalo Sugar Company (1885-1910)**

For approximately 25 years (1885–1910) the Waimanalo Sugar Company was under changing management. In 1885 William G. Irwin and Company took over the company as part of a pattern in which leading factors (solidified later as the "Big Five," discussed further below) that initially provided various services to the plantations became more and more involved in management until they ended up taking the plantations over. Irwin and Company kept John Cummins on as manager.

In 1894 we read of further changes in management:

> The sale of the Waimanalo Plantation to San Francisco parties was reported on the arrival of the China Wednesday morning, but the facts could not be ascertained until in the evening. Colonel Macfarlane, whom it was said had negotiated the sale, was seen. A short interview had with this gentleman elicited the information that arrangements had been effected for the purchase of a majority of the shares of the plantation owned by Mr. John A. Cummins at a price a little above par, and that at the head of the purchasing syndicate was Mr. R.P. Rithet of Welch &Co., Mr. R.R. Hind, the Kohala Sugar Planter, and Mr. J.E. Miller of the California Fertilizer Company […] The transaction with the syndicate for the sale of the property will bring about $250,000 of foreign capital into the country at the start […] [*Hawaiian Star,* 14 November 1894:3]

During this time, sugar and most other goods were transported between Honolulu and Waimānalo by steamer via the Waimanalo Landing. The Cummins Estate was still renowned for its extravagant hospitality. Lavish weeklong *lū‘au* were given for Hawaiian royalty. In 1883, King Kalākaua visited Waimānalo for John Cummins’ birthday celebration:

> After landing from the SS *Waimanalo*, a train of six cars was waiting to convey the party to Waimanalo proper. The spectacle was a magnificent one. The wharf was lined with evergreens; the locomotive and cars were ornamented with flags and banners, the Royal cars being commodiously fitted up with sofa, arm chairs and a canopy. When it was reported ‘All Aboard,’ away we went, booming along thru’ the cane fields, towards the mill. On arrival at Mr. Cummins’ house, hundreds of natives flocked to welcome His Majesty. A noticeable feature was the respectful manner in which the Chinese laborers uncovered their heads as the train went by them in the cane fields. [*Honolulu Advertiser* 1883 in Condé and Best 1973:365]

In 1885, W.G. Irwin & Company (which later merged with C. Brewer & Company) became agents for the Waimanalo Sugar Company, with John Cummins remaining as manager.

The Waimanalo Sugar Company continued to grow, with increasing lands being put under cultivation. As the plantation grew, former ranch lands were converted to cane fields. New irrigation ditches and railroad lines were constructed, and improvements were made to the mill and Waimanalo Landing.

The 1906 map (Figure 13) depicts the very extensive area under cultivation by the Waimanalo Sugar Company (including the present project area) in the area bounded in red on leased “Public Lands.” The present Kalaniana‘ole alignment to Kailua and around Makapu‘u were unimproved tracks. Most transport was by sea via the Waimanalo landing. The main connection to Kailua and Honolulu was quite far *mauka* at that time. No irrigation ditch and reservoir infrastructure is depicted on this 1906 map (see Figure 13).

3.8 **Waimanalo Sugar Company (1910–1947)**

John Cummins died in 1913 and his estate sold the remaining fee simple lands and the unexpired lease of Waimānalo lands to the Waimanalo Sugar Company.

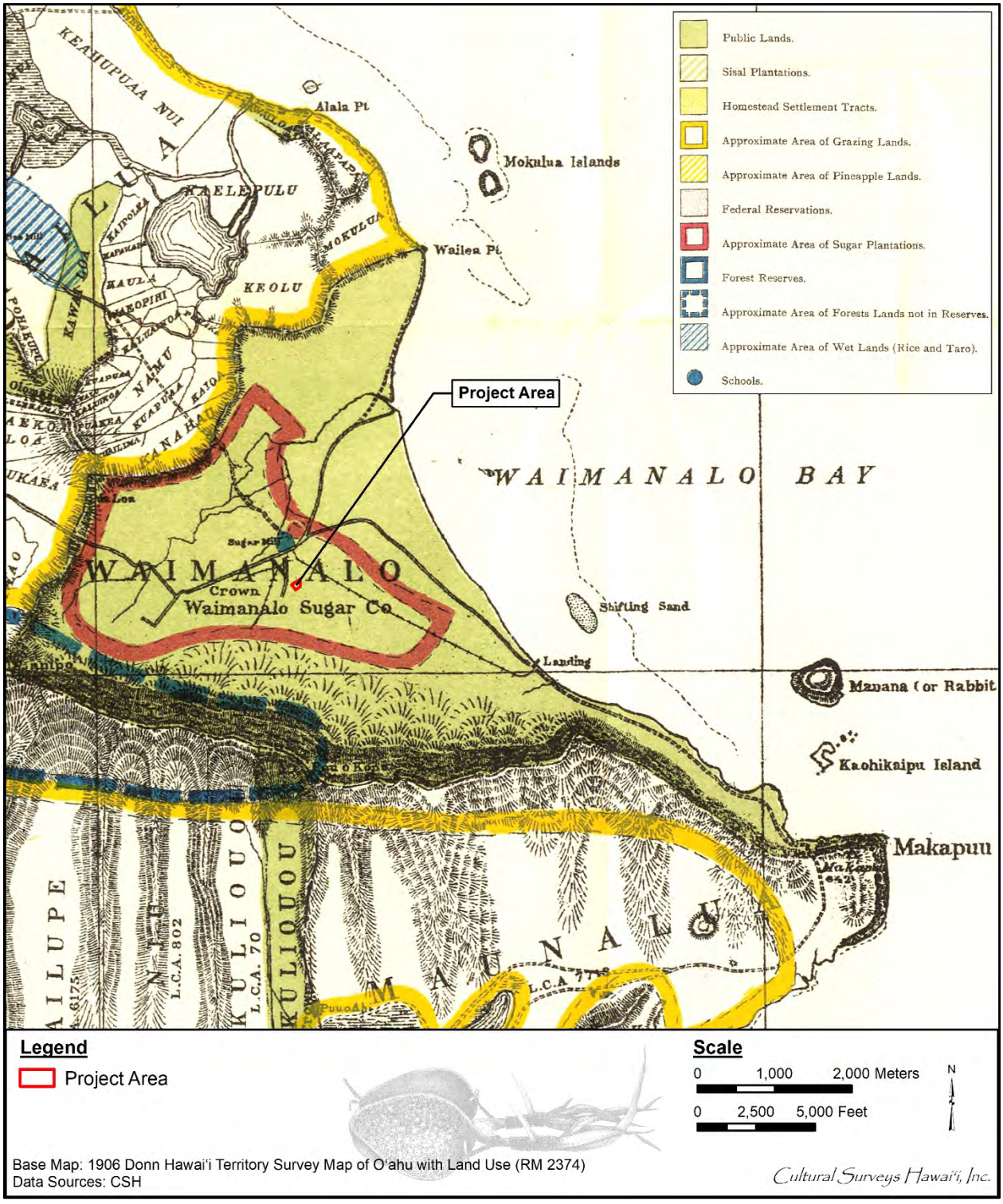

Figure 13. Portion of the 1906 Donn Hawaii Territory Survey map of O‘ahu (RM 2374) showing the location of the Tai Lee Reservoir Rehabilitation project area

A 1916 map of Waimānalo (Figure 14), compiled from surveys in 1880 and 1884, shows the extent of plantation development in Waimānalo. The map also shows Waimanalo Landing, the plantation railroad connecting the landing to the mill, and the coastal government road. The 1916 map (see Figure 14) shows a “Proposed Kamehameha Highway” alignment approximating the present-day Kalaniana‘ole Highway alignment. The configuration of roads and railroads in the vicinity of the present project area in 1916 is very much as it was 32 years earlier in 1884 (see Figure 11). A “Pipeline to Lighthouse” is depicted, understood as a 1½-inch diameter water pipe that ran all the way to the Makapu‘u lighthouse (for which funding was appropriated by the U.S. Congress in 1906 and which began operations in 1909), but no irrigation infrastructure is depicted.

The 1919 map of Waimānalo (Figure 15) shows a much different scene. The road and railroad configuration in the vicinity of the project area that had been shown as static from 1884 (see Figure 11) to 1916 (see Figure 14) is now inexplicably changed. The 1919 map shows the (Tai Lee) reservoir and infrastructure in the vicinity. It seems pretty clear that a spur of the Waimanalo Sugar Company plantation railroad extended due south to just south of the reservoir and that the present-day Mokulama Street alignment approximates this railroad spur alignment. A community of approximately a dozen houses (almost certainly a plantation camp) is indicated on the east side of this railroad spur just east of the Tai Lee Reservoir (see Figure 15). Curiously this plantation camp is not depicted three years previously (see Figure 14), is not shown nine years later on a 1928 map (see Figure 17), and is not shown on any subsequent map. It seems probable there was a plantation camp of a dozen homes as indicated on the 1919 map but that it was dismantled by 1928.

On the 1919 map (see Figure 15) no ditch is indicated in the vicinity of the reservoir following the contour, but the reservoir is indicated as connected to a watercourse that proceeds east from the reservoir a short distance (approximately 70 m) and then turns sharply north-northeast following what appears to be a natural drainage. This appears to connect with the ditch alignment labeled on the 1919 map as “Ditch” that appears to continue north connecting with a marshy area of Puhā/ Waimānalo Stream understood as the Waimānalo Stream lagoon. This 1919 map (see Figure 15) portrayal is something of a mystery; it is not clear how water entered or exited the reservoir. The only “Ditch” annotation on the figure does not conform to subsequent documentation of ditch systems and may in fact be the indicated “Bad job” ditch indicated as started by the Chinese but abandoned (*Honolulu Advertiser* 18 November 1931:6).

The fact that we do not see a reservoir at this location depicted until 1919 (see Figure 15), long after the Chinese cane-growing period, seems odd but given that the Tai Lee Reservoir is understood to have been built by Tai Lee (perhaps as early as 1876) and to have originated in Chinese rice growing in Waimānalo and to have supported Chinese sugarcane growing in Waimānalo until ca. 1900 when it was effectively taken over by the Waimanalo Sugar Company (Enoka 1978:35), it appears the absence of the reservoir being depicted on the 1884 Jackson map (see Figure 11), the 1906 Donn map (see Figure 13), and the 1916 Wall map (see Figure 14) are just omissions.

A 1922 map of the Waimanalo Sugar Company’s fields (Figure 16) shows the extent of plantation development in the early 1920s. The plantation cane fields stretch across the floor of Waimānalo Valley to the base of the Ko‘olau Range. Four reservoirs are depicted including the Tai Lee Reservoir in the project area. The “Legend” to the 1922 map is a little confusing in defining ditch symbols as two thin parallel white lines (of which none are clearly shown) but it

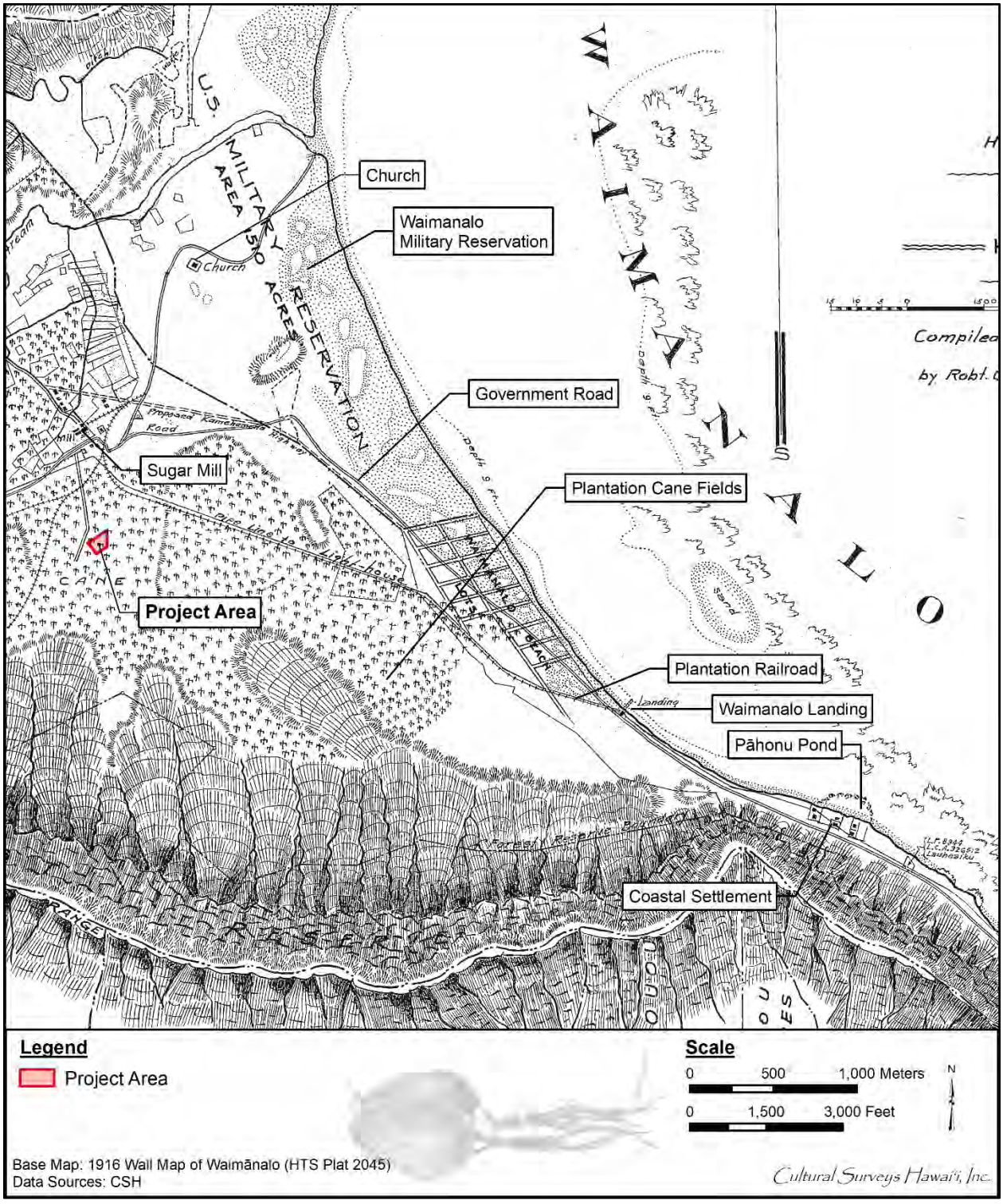

Figure 14. Portion of the 1916 Wall map of Waimānalo (HTS Plat 2045), Walter E. Wall Surveyor, showing the location of the Tai Lee Reservoir Rehabilitation project area and features discussed in the text

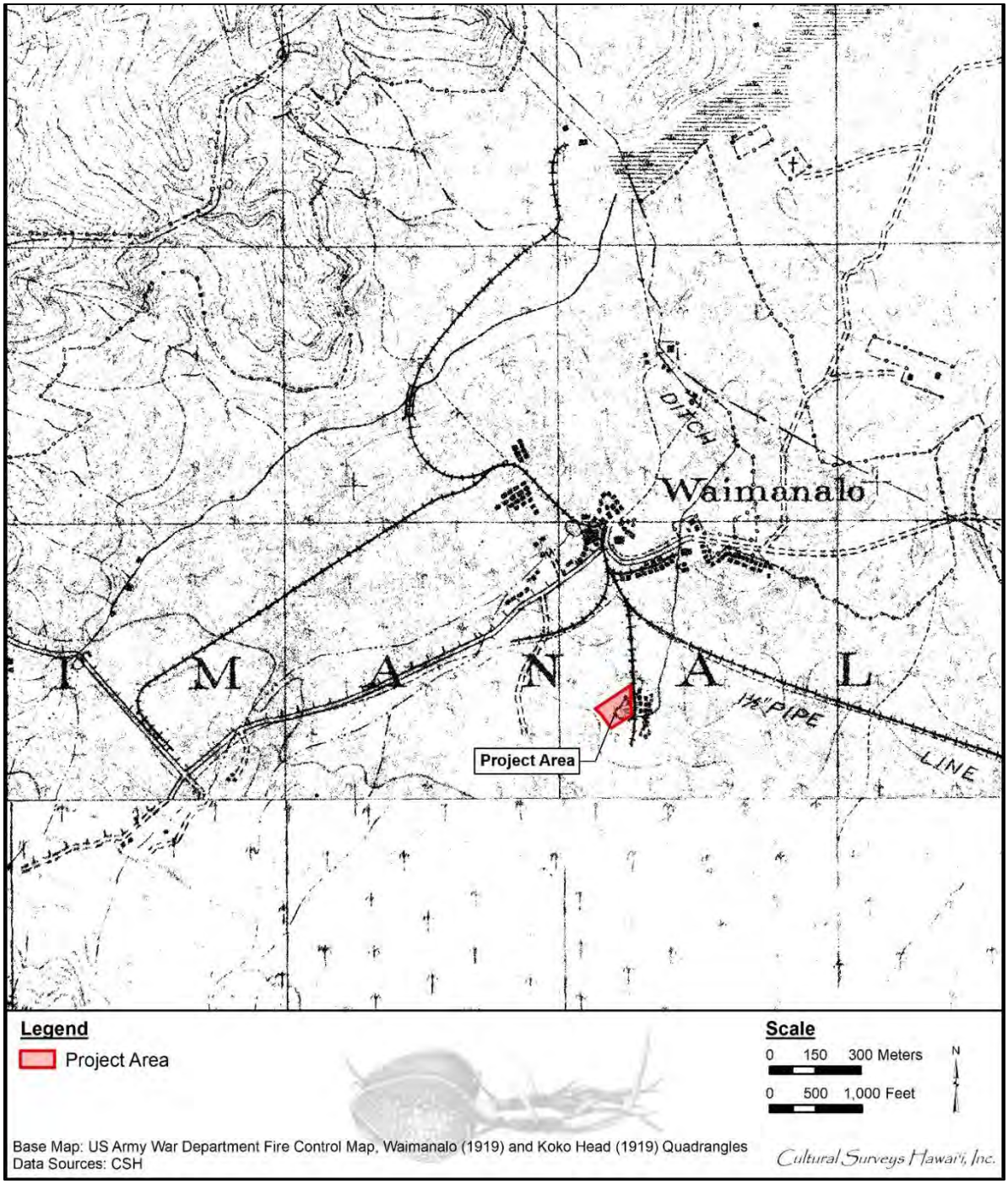

Figure 15. Portion of the 1919 U.S. Army War Department fire control map of Waimanalo and Koko Head quadrangles showing the location of the Tai Lee Reservoir Rehabilitation project area at a reservoir extant at the time. A spur of the Waimanalo Sugar Company's railroad extends along the east side of the project area with a small plantation camp indicated just east of that. The indicated "Ditch" appears to connect to the lagoonal backwater marsh of Waimanalo/Puhā Stream but may not have been completed.

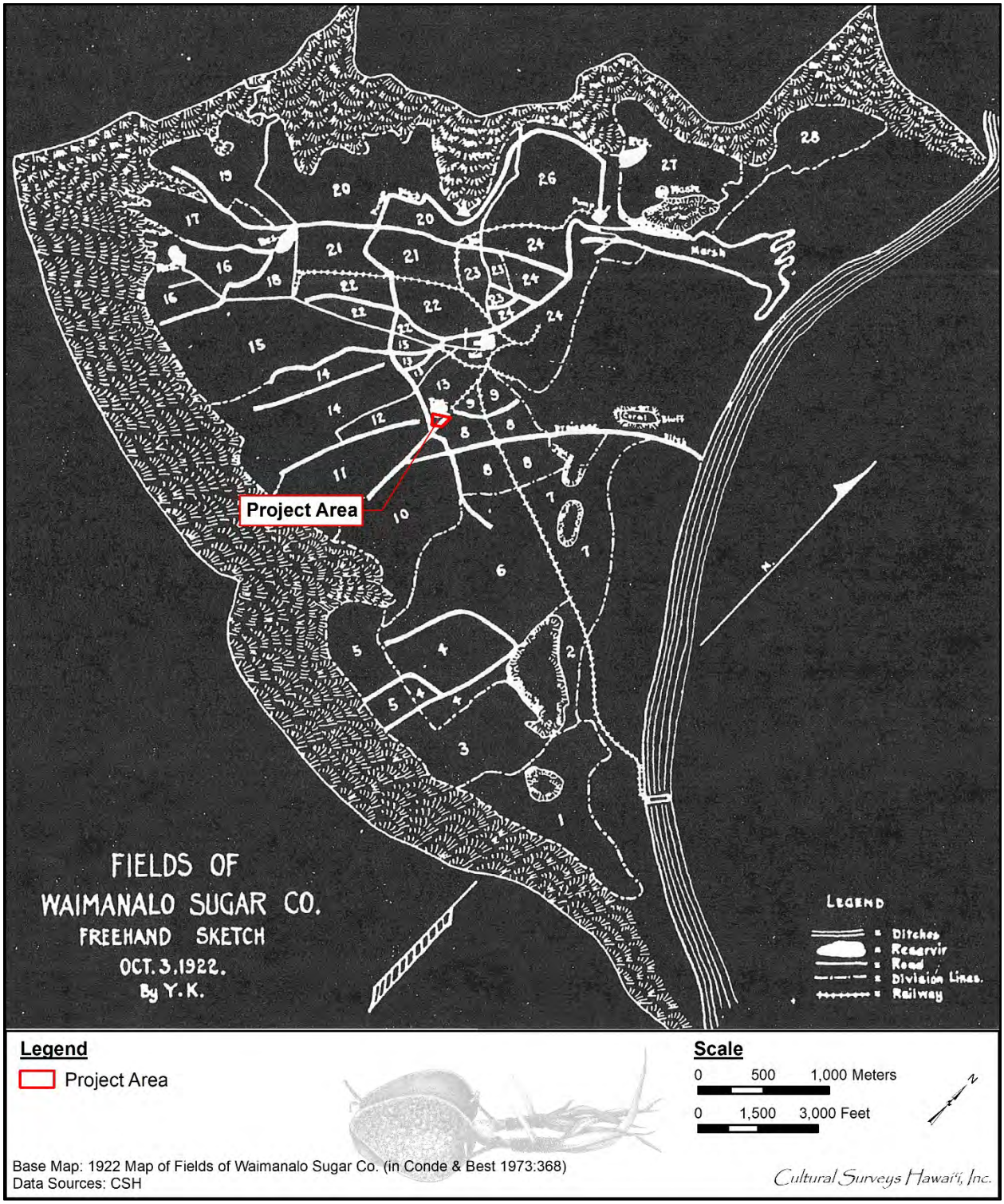

Figure 16. Map from 1922 of fields of Waimanalo Sugar Company, showing the location of the Tai Lee Reservoir Rehabilitation project area (Conde and Best 1973:368)

seems clear ditches are indeed depicted as the thick white lines. A major ditch system begins on the northwest corner of the “marsh” understood as a lagoonal backwater of Waimānalo/Puhā Stream where there is a “Pump” building indicated. Somewhat counterintuitively the water is pumped due north to gain elevation and then flows into the indicated “Pump Ditch” that makes a long meandering arc to the west and then south (well upslope of the mill) extending along the upslope side of the Tai Lee Reservoir (present project area) and continuing on, near the contour to the south for another kilometer. Several (seemingly six) ditches further *mauka* appear to have had potential to feed water into the Pump Ditch. Another ditch is indicated descending from the Tai Lee Reservoir in an arc to the northeast between sugarcane fields “8” and “9”. This depicted irrigation pattern makes sense in that water could be diverted from the Pump Ditch on the *mauka* side of the Tai Lee Reservoir through a water control structure and then water from the reservoir could flow by gravity to the northeast irrigating Field 8, Field 9, and possibly Field 13. Given that this appears to be the only reservoir east of the mill, it seems remarkable how small an area of cultivated cane could have been irrigated from this reservoir. It appears the Pump Ditch is upslope of the reservoir and thus for the Tai Lee Reservoir to have supplied water to the Pump Ditch the water would again have had to be pumped. Whether water ever moved from the Tai Lee Reservoir into the Pump Ditch is unclear. Neither the Kailua Ditch nor the Maunawili Ditch are depicted.

The 1922 map (see Figure 16) also depicts the spur rail line approaching the east side of the Tai Lee Reservoir, understood as approximating the present-day alignment of Mokulama Street.

The 1928 map (Figure 17) shows considerable irrigation development with the new “Kailua Ditch” approximating the 140-ft contour in the vicinity of the project area. The Kailua Ditch would have greatly increased the irrigation potential for the Waimanalo Sugar Company’s fields. Three straight dashed lines are depicted extending downslope intersecting the Pump Ditch in the vicinity of the Tai Lee Reservoir (clearly labeled “Reservoir” on the 1928 map); these are understood as irrigation ditches bringing additional water to the Pump Ditch (and probably the Kailua Ditch as well) from the Waimānalo uplands. No outflow ditch is depicted for the Tai Lee Reservoir clearly depicted on the 1928 map (Figure 17) as straddling a minor natural drainage flowing from southwest to northeast. The comma-shaped outflow ditch indicated on the 1922 map (see Figure 16) is just shown as the minor natural drainage. Again the straight railroad spur (approximating the present-day Mokulama Street alignment) is depicted on the east side of the Tai Lee Reservoir and as extending slightly further *mauka*.

The 1934 map (Figure 18) shows much the same scene with the Pump Ditch and the Kailua Ditch more clearly depicted. Again the Tai Lee Reservoir (clearly labeled “Reservoir” on the 1934 map) is depicted as downslope of the Pump Ditch (with no connection to the Pump Ditch depicted) and with no ditches flowing out of the reservoir. The straight railroad spur (approximating the present-day Mokulama Street alignment) on the east side of the reservoir is prominent.

The 1943 map (Figure 19) shows much the same scene. Again the Tai Lee Reservoir (clearly labeled “Reservoir” on the 1943 map) is depicted as downslope of the Pump Ditch (with no connection to the Pump Ditch depicted) and with no ditches flowing out of the reservoir. While the railroad spur on the present-day Mokulama Street alignment still ends in the same place, an adjacent, unimproved vehicular road continues further to the south along the present-day Mokulama Street alignment.

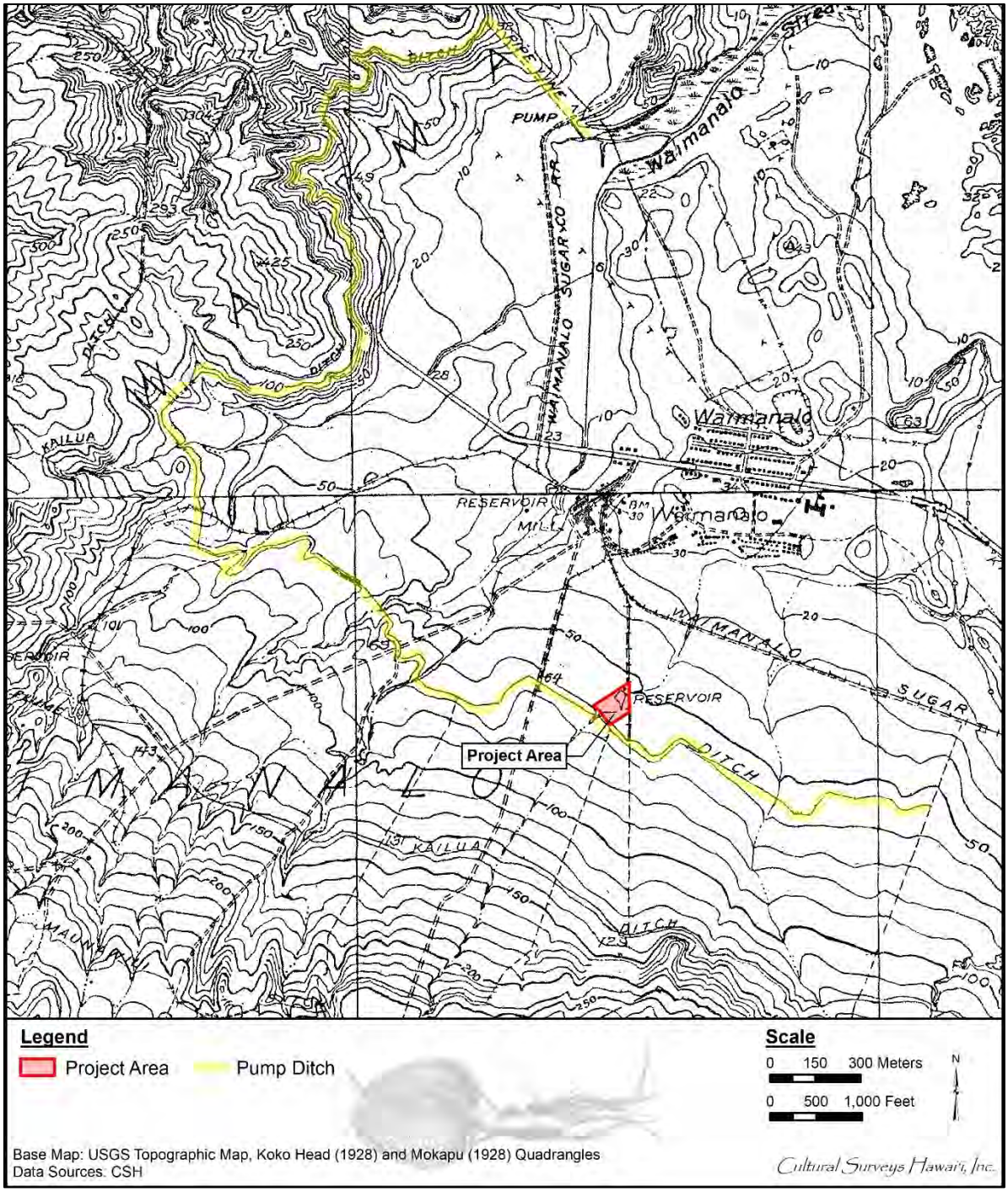

Figure 17. Portion of the 1928 Koko Head and Mokapu USGS topographic quadrangles showing the location of the Tai Lee Reservoir Rehabilitation project area centered on the depicted reservoir. The Waimanalo Sugar Company railroad spur is straight north/south but no plantation camp in the area is depicted. The Pump Ditch (highlighted) is prominent following the contour just upslope from the reservoir arcing around to the west and north to where water was pumped out of the Waimānalo/Puhā stream lagoonal backwater.

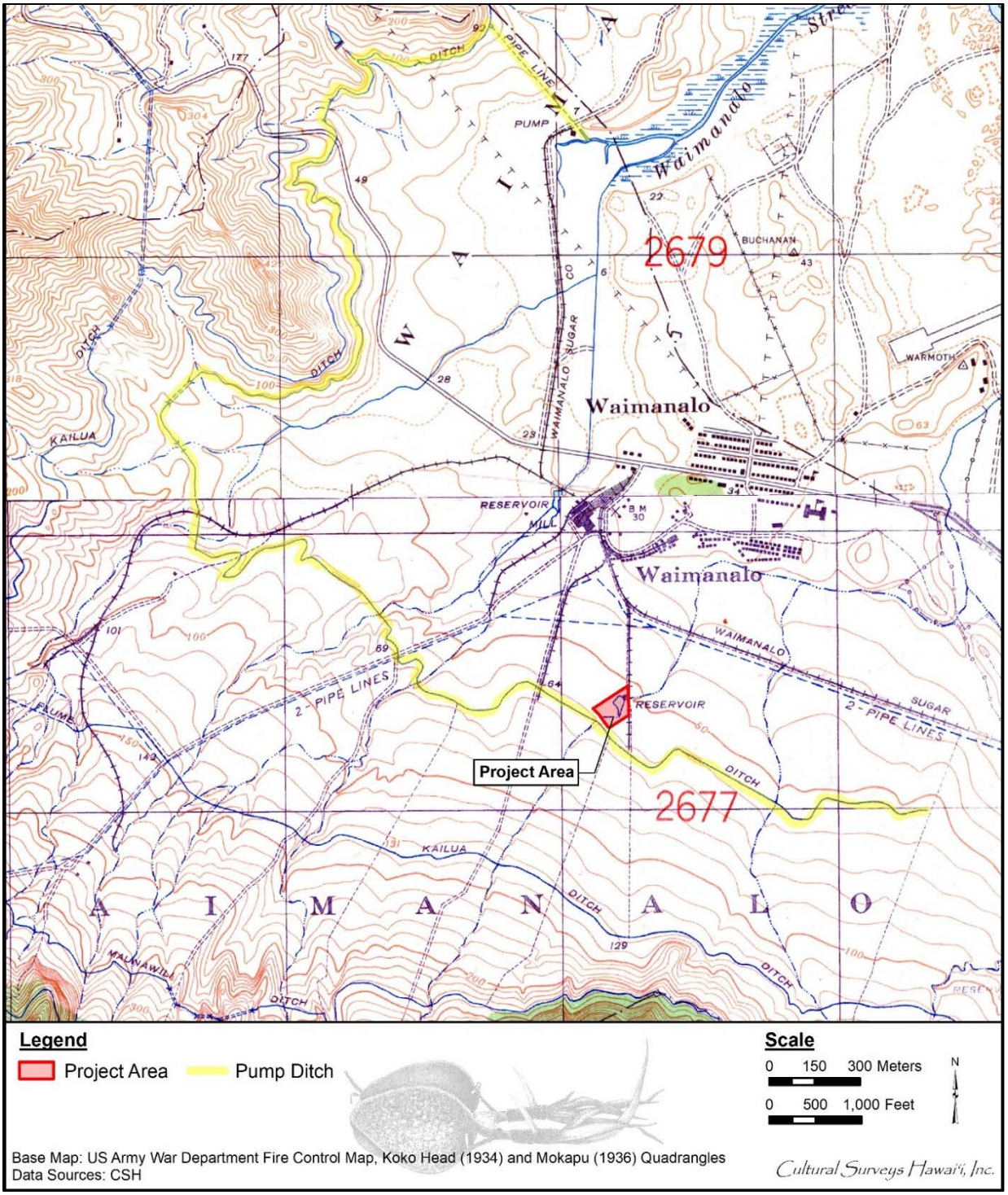

Figure 18. Portion of 1934 (Koko Head) and 1936 (Mokapu) U.S. Army War Department fire control map, showing the location of the Tai Lee Reservoir Rehabilitation project area centered on the depicted reservoir. The Waimanalo Sugar Company railroad spur is straight north/south but no plantation camp in the area is depicted. The Pump Ditch (highlighted) is prominent following the contour just upslope from the reservoir.

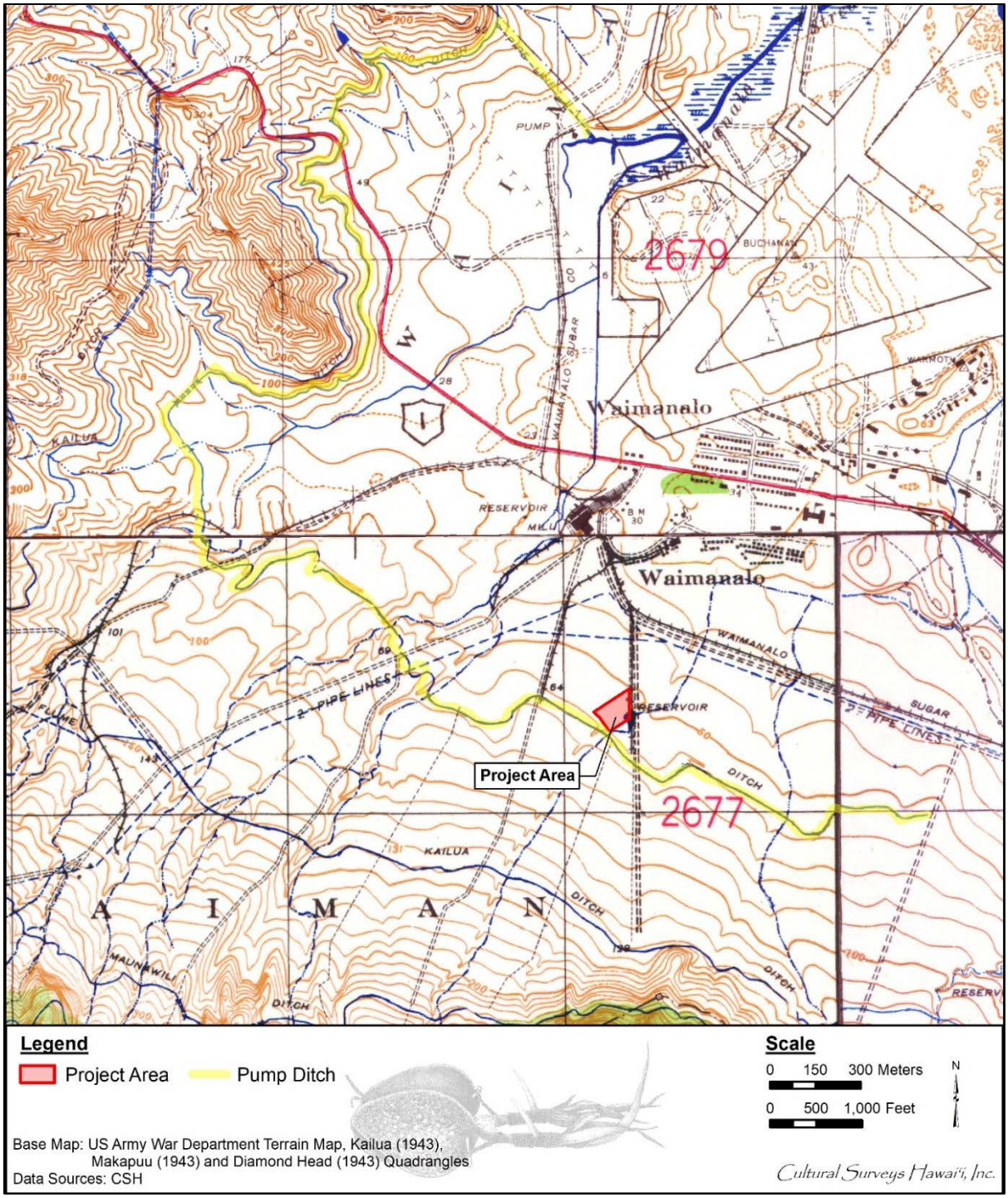

Figure 19. Portion of 1943 U.S. Army War Department terrain map, Kailua, Makapuu, and Diamond Head quadrangles showing the location of the Tai Lee Reservoir Rehabilitation project area centered on the indicated reservoir. The Waimanalo Sugar Company railroad spur is straight north/south but no plantation camp in the area is depicted. The Pump Ditch (highlighted) is prominent following the contour just upslope from the reservoir.

The Waimanalo Sugar Company closed in 1947 (after 69 years in business), "[…] after several years of losses […] (Dorrance and Morgan 2000:43) as "[…] Operational costs rapidly overwhelmed returns[…]" (Condé and Best 1973:368).

3.9 Overview of the Waimanalo Irrigation System

Water was a continuous problem for most sugar companies, including the Waimanalo Sugar Company. Irrigation for the Waimānalo cane lands was developed from three sources: springs and water tunnels in neighboring Maunawili Valley; Kawainui Swamp in Kailua; and a swampy area near the mouth of Waimānalo Stream, known as the Waimānalo Lagoon (Harland Bartholomew and Associates 1959:17). Water from these sources was transported to the Waimānalo cane lands via the Kailua Ditch, Maunawili Ditch, and the Pump Ditch, respectively.

Carol Wilcox (1996) summarizes the company's irrigation system:

> Kailua Ditch, the earliest of Waimanalo Sugar's three ditches, diverted water from upper Kailua springs in the Waimanalo basin and emptied into the Waimanalo Reservoir. A second ditch, built in 1924, had its source in the Kawainui Swamp. Two pumps lifted water from that swamp and took it to the head of a 10,000-foot system of small tunnels, mostly through stone or hard earth, into a reservoir. This ditch cost $220,000.
>
> The ditch most associated with the Waimanalo Sugar Company is the Maunawili Ditch. Its source is high-level tunnels, springs, and streams in Maunawili and Waimanalo Valley. The dirt- and cement-lined ditch includes about twenty flumes, many measuring no more than a foot and a half each way, before it crosses through the Olomana Tunnel to Waimanalo. During dry seasons this ditch delivered less than 2 mgd [million gallons per day]. Waimanalo Sugar eventually had 99 percent of its sugar under irrigation—and nearly 25 percent of that came from surface water sources. [Wilcox 1996:111]

The Maunawili Ditch, Kailua Ditch, and Pump Ditch transported irrigation water across Waimānalo Valley, generally from northwest to southeast, along high, mid-, and low level elevation contours well upslope of the project area (Figure 20).

Reconstruction of the Waimanalo Sugar Company's irrigation system was undertaken in the 1930s, under the management of George Bennett:

> During the last five years Mr. Bennett has rebuilt all the old flumes which bring the Maunawili water to the fields using redwood, good for 15 years or more; concreted the open ditches; and has replaced the old wooden pipes with concrete siphons. [*Honolulu Advertiser* 31 March 1940 in Condé and Best 1973:367]

The rebuilding of the water system was part of a general modernization of the plantation. Other facets of modernization included mechanized land clearing and the opening of the Nu‘uanu Pali Road and the Koko Head to Waimānalo road. Mechanized land preparation enabled more land to be cleared in a shorter amount of time, and the paved roads to Honolulu ended the need to ship sugar products to the Honolulu Plantation Refinery by steamer.

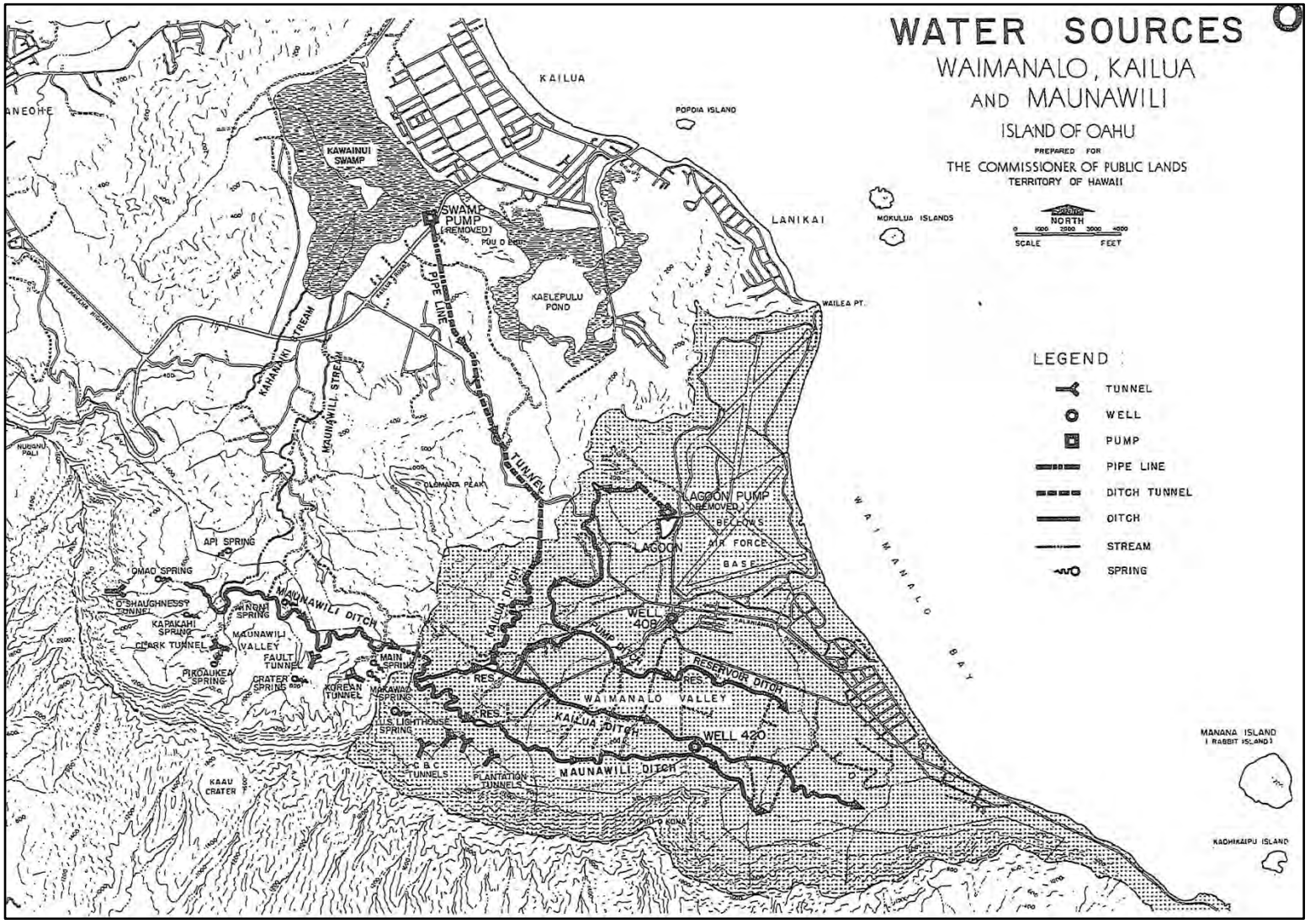

Figure 20. Map of Waimānalo water sources showing the lower elevation Pump ditch, the middle elevation Kailua Ditch, and the upper elevation Maunawili Ditch (Harland Bartholomew and Associates 1959:Plate 16)

Wilcox (1996) noted of the Maunawili Ditch System:

> Visually, this was a gem of a system up until recent times. Although small, it had all the components of a typical ditch system: flumes, ditches, tunnel. Its particular charm was its redwood flumes, which were in remarkably good condition in 1984. These have since been abandoned in favor of PVC pipe. [Wilcox 1996:113

3.10 Agricultural Developments Following the Closure of the Waimanalo Sugar Company in 1947

Following the closure of the Waimanalo Sugar Company, the plantation's water license and irrigation ditch system reverted to the Territory of Hawaii.

The 1952 map (Figure 21) shows the Pump Ditch and Tai Lee Reservoir but neither the ditch nor the reservoir are labeled. Of note is the labeled *mauka* "Kailua Ditch." Prior maps from 1922 (see Figure 16), 1928 (see Figure 17), 1934 (see Figure 18), and 1943 (see Figure 19) all labeled the "pump" on the northwest side of the Waimānalo Lagoon on the Waimānalo/Puhā Stream and depicted the Pump Ditch as winding its way in a big curving arc from the pump site; the 1952 map shows neither the pump nor the north portion of the former Pump Ditch. In fact the north portion of the former Pump Ditch appears to have been cut by a new "Quarry," hence that northern portion of the former ditch could no longer have functioned at all. It seems highly probable the prior source of pumped Waimānalo Lagoon water has been terminated and now the former Pump Ditch is fed solely by linking irrigation channels descending from the Kailua Ditch and Maunawili Ditch to the south.

Another major change depicted on the 1952 map (Figure 22) is a reconfiguration of the ditch east of the Tai Lee Reservoir. Prior maps from 1922 (see Figure 16), 1928 (see Figure 17), 1934 (see Figure 18), and 1943 (see Figure 19) all indicate the ditch extending east from the Tai Lee Reservoir as upslope from the reservoir, close to the 60-ft contour in the vicinity of the reservoir. The 1952 map (see Figure 22) shows a new ditch alignment exiting the Tai Lee Reservoir at its downslope end and continuing east at a significantly lower elevation near the 40-ft contour. This makes sense as gravity-fed irrigation exiting the Tai Lee Reservoir. Logically this new ditch east of the Tai Lee Reservoir, seemingly excavated between 1943 (see Figure 19) and 1952 (see Figure 21), is not called the Pump Ditch (as the water does not come from the former Waimānalo Lagoon pump) but is referred to as the Reservoir Ditch as it comes from the Tai Lee Reservoir.

The 1952 map (see Figure 21) shows the very extensive network of train tracks that had crossed Waimānalo from prior to 1916 see (Figure 14) are all gone. Plantation trains were given up nearly everywhere in Hawai‘i quickly following World War II but this reflects the closure of the Waimanalo Sugar Company in 1947.

A companion to the 1952 USGS map (see Figure 21) is a 1952 aerial photograph (see Figure 22) that more clearly shows the landscape in the vicinity following the closure of the Waimanalo Sugar Company in 1947. Some of the former sugarcane fields appear fallow but most appear to be in a patchwork of truck crops. The depiction of the project area reservoir in the 1952 aerial photograph (see Figure 22) seems notable for showing a crescent of water on the downslope side of the reservoir at some remove from the former Pump Ditch on the upslope side.

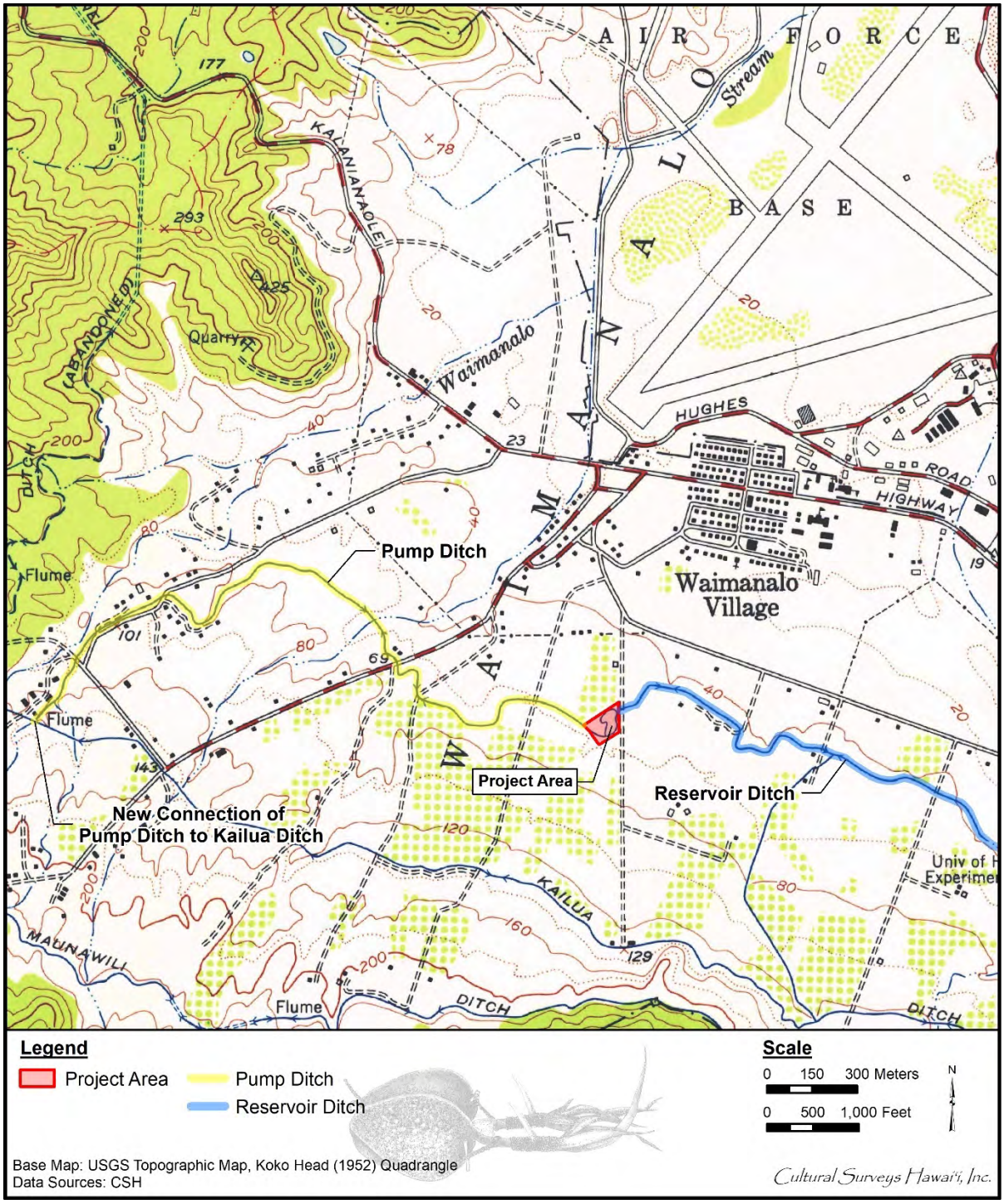

Figure 21. Portion of 1952 Koko Head USGS topographic quadrangle showing the location of the Tai Lee Reservoir Rehabilitation project area centered on the depicted reservoir. Note the ditch to the west of the reservoir (highlighted in yellow) connects with the Kailua Ditch (the northern portion of the pump ditch is no longer extant); the ditch to the east of the reservoir (highlighted in blue) now appears at a lower elevation than previously depicted (and all the plantation railroads are gone).

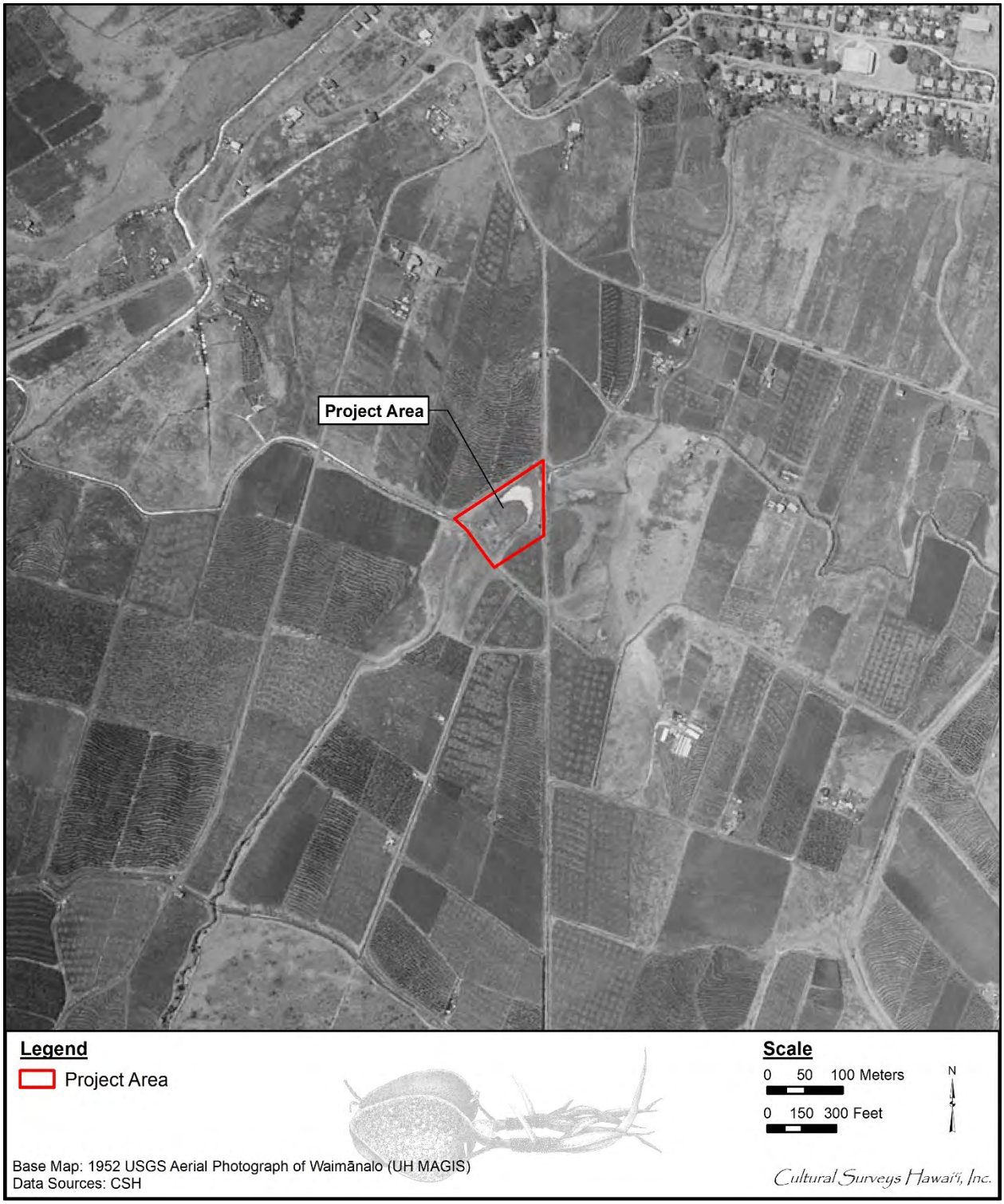

Figure 22. 1952 USGS aerial photograph of Waimānalo (UH MAGIS) showing the location of the Tai Lee Reservoir Rehabilitation project area, and the alignments of the Pump Ditch and Reservoir Ditch

3.11 Military Development in Waimānalo

The Waimanalo Military Reservation, including approximately 1,500 acres along the northern, coastal portion of Waimānalo, was established in 1917 (although it is prominent on the 1916 map, see Figure 14). Limited development and little activity occurred on the military reservation through the 1920s. In 1933, Waimanalo Military Reservation was renamed Bellows Field. Bellows Field then consisted of an infantry and artillery training area, also including a runway for the Air Corps. The rapidity of the development of the Bellows lands just seaward of the project area is clear in a comparison of the 1934/1936 map (see Figure 18) with the 1943 map (see Figure 19). Bellows Field became a permanent military post in 1941. The 1943 War Department map (see Figure 19) shows the additional roads, structures, and runways constructed at Bellows Field and a major facility arranged around an oval road 5,300 m northeast of the project area.

Following World War II, activity at Bellows Field declined with much of the area only being used for military recreational purposes and as an emergency landing field. Bellows Field was subsequently renamed Bellows Air Force Base and later, Bellows Air Force Station. A 1952 map (see Figure 21) shows the layout of military infrastructure just seaward of the project area including a church and the development of Waimanalo Village immediately to the west. Seemingly two schools are shown on the *makai* side of Kalaniana‘ole Highway just north of the project area.

In 1956, an Air Force communications facility was constructed with extensive antennae installations. Bellows Air Force Station continues to be used for military training and recreational purposes.

3.12 Diversified Agriculture in Waimānalo

The Waimanalo Sugar Company sold its fee-simple land holdings and the remaining years of its lease of government-owned lands to the Waimanalo Agricultural Development Company (Harland Bartholomew and Associates 1959:17). The Waimanalo Agricultural Development Company then sublet 1- to 20-acre farm lots and up to 150-acre pastoral lots to individual farmers in Waimānalo Valley for diversified agriculture. This pattern of small farm lots is clearly shown on the 1952 aerial (see Figure 22). Following the expiration of the agricultural leases in 1953, the Territorial Government began selling approximately 9-acre agricultural parcels in the central valley, known as the Waimanalo Farm Lots subdivision. Seven chicken farms, one dairy, and one piggery, as well as papaya and flower farms, were established in the Farm Lots area (Harland Bartholomew and Associates 1959:17). Portions of the former plantation irrigation system, with some modifications, continued to be used to provide water to the Farm Lots.

Circa 1950, the University of Hawai‘i established an approximately 30-acre agricultural research farm known as the Waimanalo Agricultural Experiment Station in the central valley, south of the current project area. Research conducted at the experiment station provided local farmers with scientific knowledge about crops and agricultural practices to improve agricultural production in Hawai‘i. The Waimanalo Agricultural Experiment Station was later expanded to approximately 130 acres; it is located approximately 1 km southeast of the project area (Figure 23). The 1959 aerial photograph (Figure 24) and the 1968 aerial (Figure 25) show a burst of development in large agricultural buildings in the vicinity when compared to the 1952 aerial photograph, (see Figure 22) at the time of statehood.

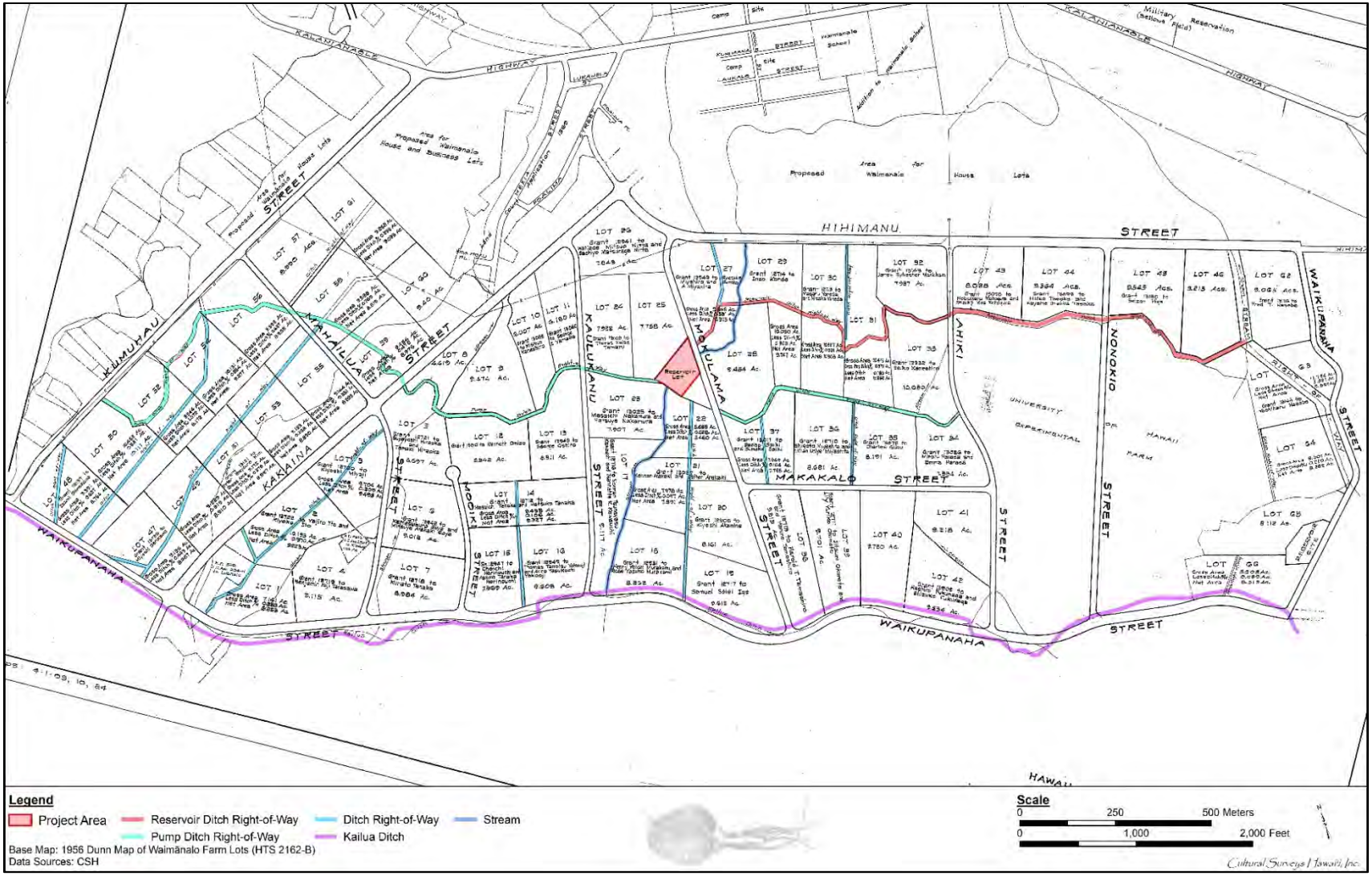

Figure 23. 1956 Dunn map of Waimanalo (HTS Plat 2162B) showing the location of the Tai Lee Reservoir Rehabilitation project area with the ditches in the vicinity labeled

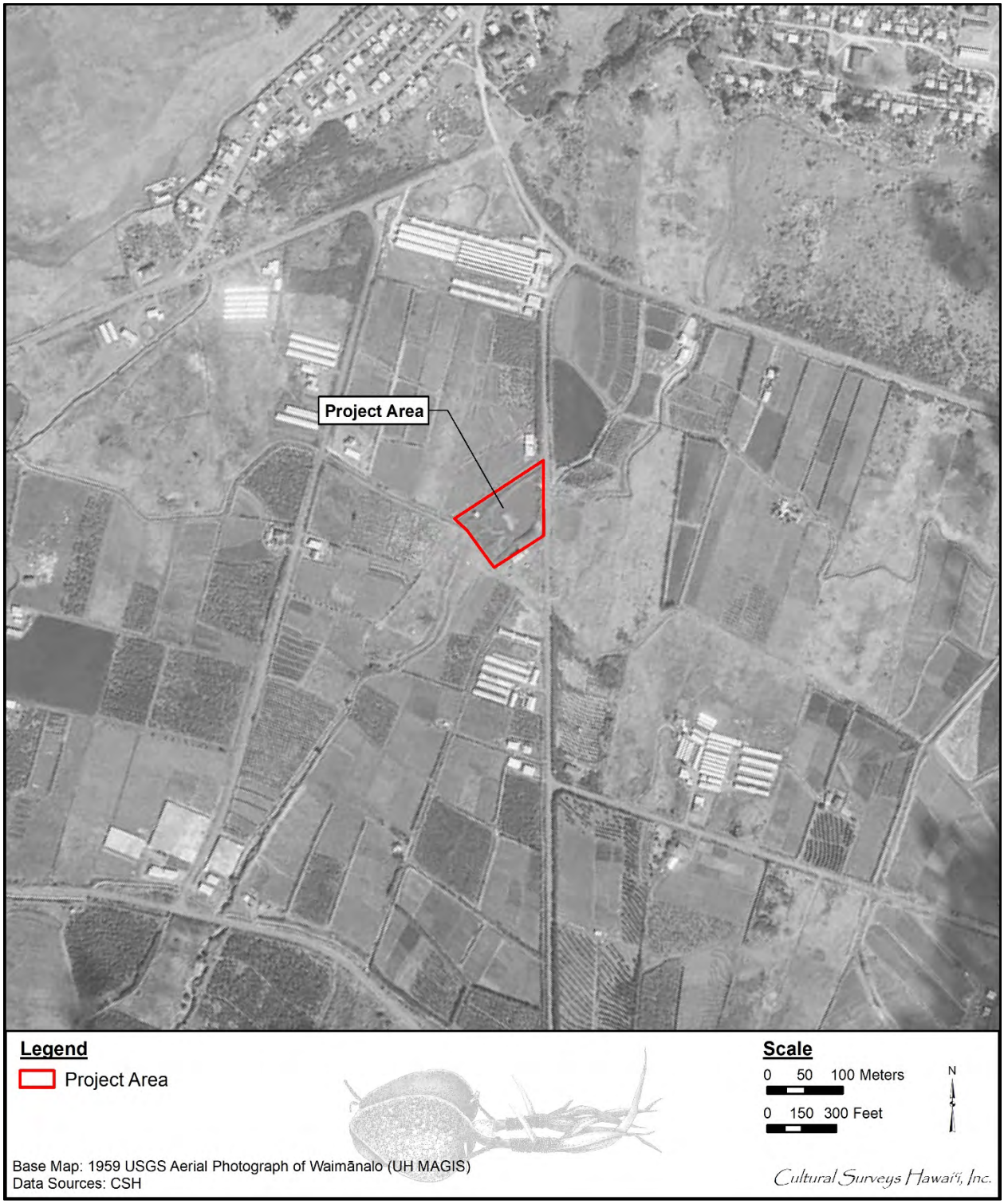

Figure 24. 1959 USGS aerial photograph of Waimānalo (UH MAGIS) showing the location of the Tai Lee Reservoir Rehabilitation project area

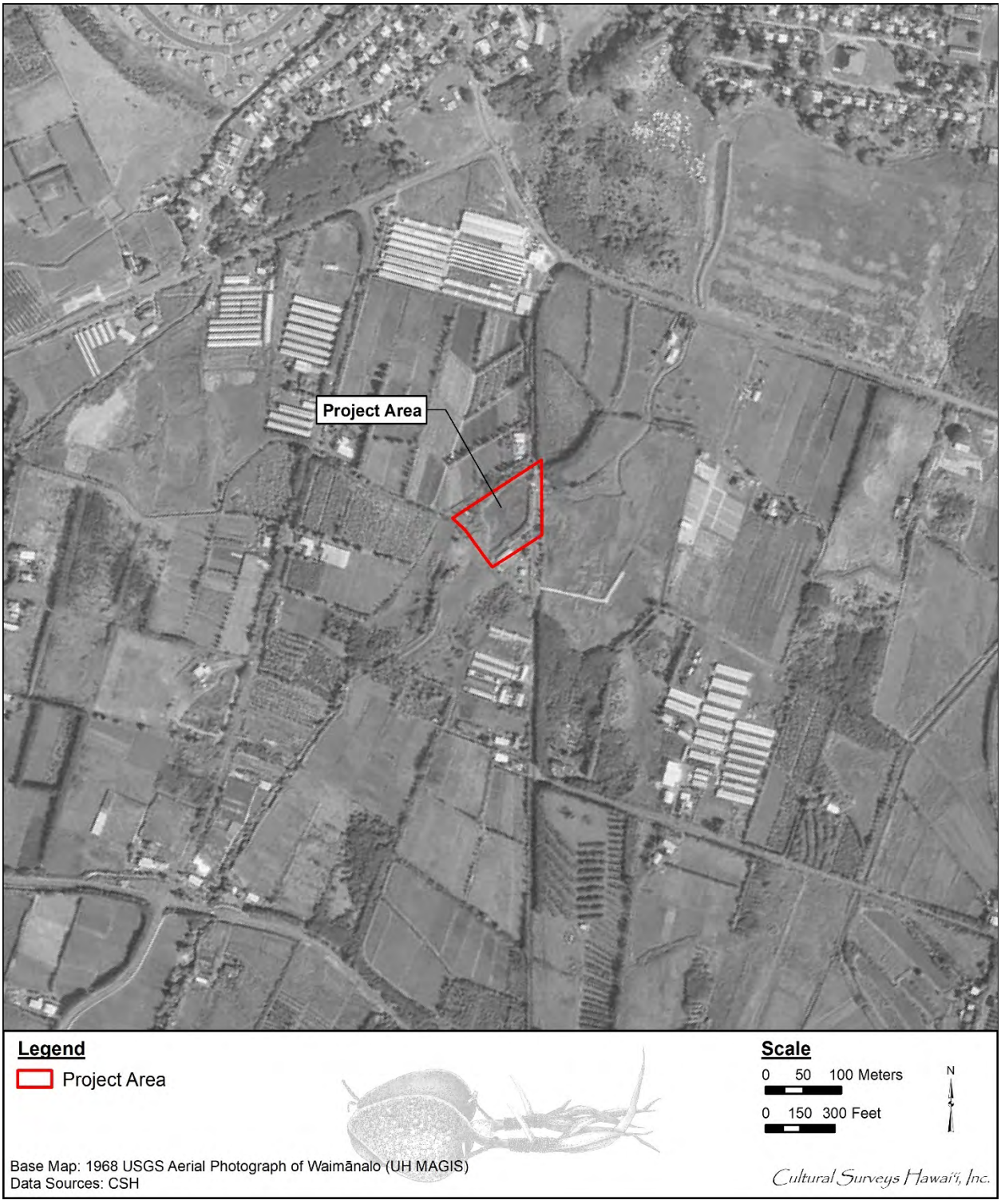

Figure 25. 1968 USGS aerial photograph of Waimānalo (UH MAGIS) showing the location of the Tai Lee Reservoir Rehabilitation project area

In 1967, the L.W. Campos Ranch relocated from Kailua to Waimānalo, establishing an approximately 200-acre dairy farm. Campos Ranch was purchased by Foremost Dairies in 1969, which expanded the dairy by acquiring an additional approximately 140 acres for pasture. In 1984, the dairy sub-leased an approximately 21-acre parcel to Universal Synergetics (Unisyn). Unisyn was established to research and develop a commercial anaerobic digestion technology for manure and organic waste conversion into agricultural products or other products to be used by farmers. Unisyn developed a full-scale facility and began converting biomass such as trees, grasses, agricultural wastes, animal manures, ocean plants, garbage, and other wet organic wastes into renewable resources such as soil amendments, irrigation water, heat, steam, electricity, or liquid or gas fuels for transportation (e.g., ethanol) (Hammatt et al. 1999:10–11).

3.13 Residential Development in Waimānalo

The primary residential area in Waimānalo in the early 1900s was located in the vicinity of the Waimanalo Sugar Company’s sugar mill. Waimanalo Village was established as housing for plantation workers and their families. In 1925, the first large-scale sale of Waimānalo lands to the public occurred with the establishment of the Waimanalo Beach Lots subdivision. The subdivision, located 900 m southeast of the present project area, included 266 lots on 90 acres of land (Harland Bartholomew and Associates 1959:16). Kalaniana‘ole Highway, which opened in 1924, greatly improved transportation to Waimānalo (see Figure 17).

Additional residential development occurred in the coastal portion of central Waimānalo with the establishment of Waimanalo Homestead by the Hawaiian Homes Commission in 1925. Qualified homesteaders with 50% or more Hawaiian blood were awarded residential lots located inland of Kalaniana‘ole Highway, in the vicinity of Waimanalo Landing. In modern times, additional residential development has occurred in the Waimanalo Village, Waimanalo Beach Lots, and Waimanalo Hawaiian Homelands subdivisions. Residential growth on the *mauka* side of Kalaniana‘ole Highway is clear in comparing the 1952 aerial (see Figure 22) with the 1959 aerial (see Figure 24), 1968 map (see Figure 25), 1969 map (Figure 26), and 1978 aerial (Figure 27).

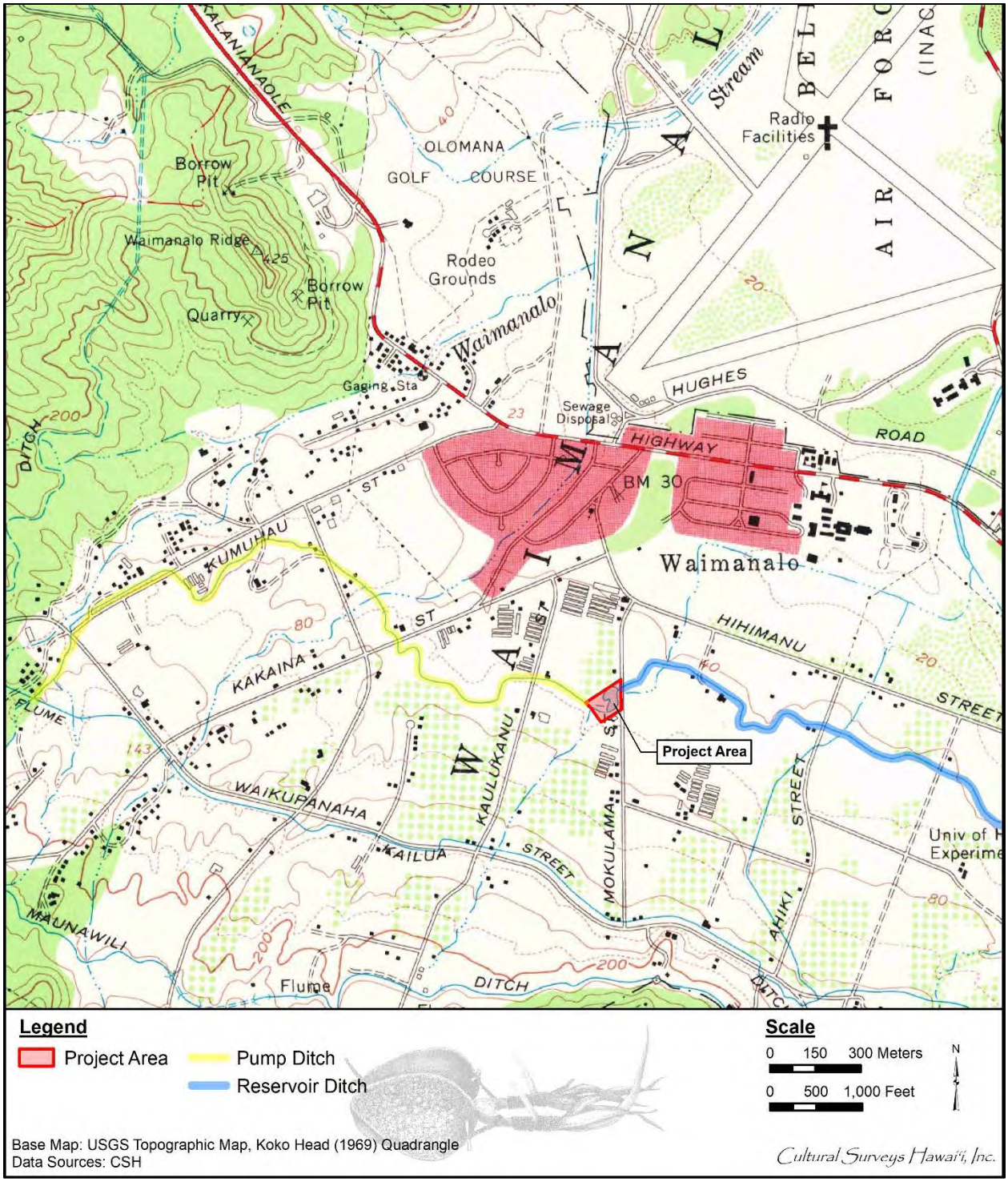

Figure 26. Portion of 1969 Koko Head USGS topographic quadrangle showing the location of the Tai Lee Reservoir Rehabilitation project area centered on the depicted reservoir. Note the ditch to the west of the reservoir (highlighted in yellow) connects with the Kailua Ditch; the ditch to the east of the reservoir (highlighted in blue) now appears at a lower elevation than depicted prior to 1952.

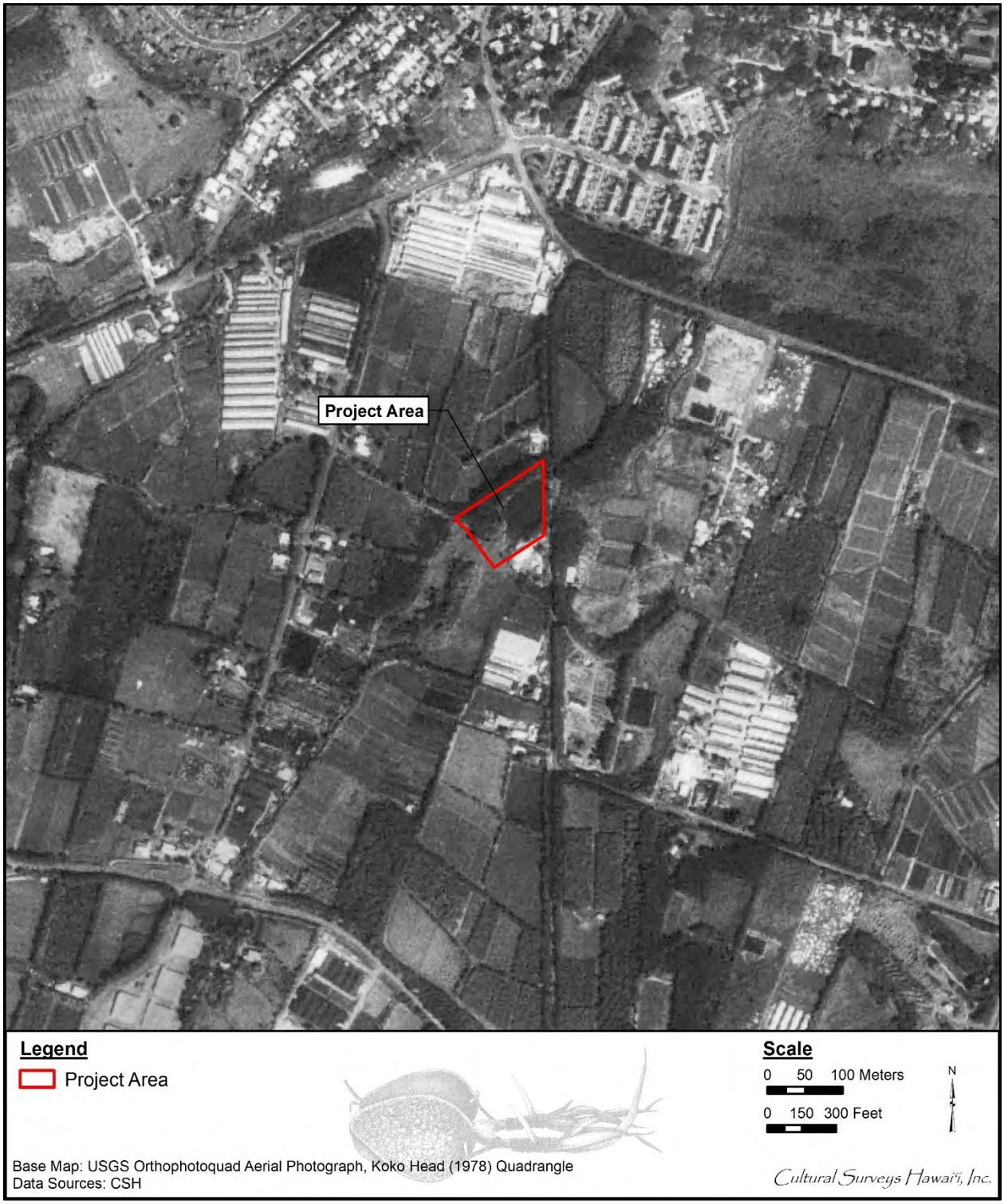

Figure 27. 1978 Koko Head USGS orthophotograph quadrangle showing the location of the Tai Lee Reservoir Rehabilitation project area

Section 4 Previous Archaeological Research

4.1 Early Studies

4.1.1 McAllister 1933

J. Gilbert McAllister began formal documentation of Waimānalo archaeological sites in his island-wide study of the archaeology of O‘ahu published in 1933 (largely based on fieldwork conducted in 1931). The six sites he reported for Waimānalo are summarized in Table 3. The nearest site he documented, Pōhakunui Heiau (McAllister Site 382), is approximately 1.4 km to the southwest (see Figure 29).

4.1.2 Handy 1940

Handy discusses taro cultivation at Waimānalo as follows:

> Waimanalo. This *ahupua‘a* has only one large stream, from which it takes its name, the water of which irrigates the sugar cane now [1940] grown on the lower slopes and lowlands. Much of the lowland now under cane was formerly in taro. But wet taro was by no means limited to the lowlands irrigated from the main stream. The old *kamaaina* mentioned above named nine terrace sections whose water came from small streams and springs flowing out of the high mountain range. These sections ran for 1.5 miles in a semicircle at the foot of the mountains round the broad base of Waimanalo Valley, from below Puu Loa well toward Puu o Kona. Several of these, now covered with brush, were examined and found to be well preserved. The only taro grown in the district in 1934 was that planted by Edward Niaupio. [Handy 1940:100]

The “semi-circle at the foot of the mountains” described by Handy as a locus of taro cultivation is understood as at a higher elevation than the present Tai Lee Reservoir Rehabilitation project area. Whether there was ever traditional Hawaiian cultivation in the vicinity of the present project area is unclear.

4.2 Modern Archaeological Studies

Modern archaeological studies in the vicinity of the Tai Lee Reservoir (within approximately 1 km) are depicted in Figure 28 and summarized in Table 4. The location of previously identified historic properties in the vicinity of the project area are depicted in Figure 29 and summarized in Table 5. These studies are discussed in more detail below.

4.2.1 Neller 1981

Earl “Buddy” Neller (1981), then of the SHPD, produced a study entitled *Waimanalo Irrigation System Maunawili Valley Collection System: Black and White Photos taken in September 1980* bundled with *Waimanalo Irrigation System Waimanalo Hawaii Color Slides Taken September 1980 and January 1981.* Neller attempted to photo document components of the Waimānalo Ditch System, including the three, roughly parallel ditches in Waimānalo (the lower elevation Tai Lee Ditch, the mid-elevation Kailua Ditch—approximating the Waikupanaha Street alignment—and the upper elevation “Maunawili Ditch”). These images have brief captions and are keyed into various maps. Neller cites Color Slide 18 as depicting the “Tai-Lee Reservoir” but the draft of

Table 3. McAllister (1933) documented sites in Waimānalo

McAllister Site #	Type of Site	Summary Description	References
380	*Heiau* (Keikipuipui Heiau)	"[…] said to have crowned the small hill near the present road on the dividing line between Kailua and Waimanalo […] traces of a heiau have been obliterated."	McAllister 1933:190–191, Thrum
381	*Heiau* ("the name is not known")	"Heiau. Waimanalo side of Olomanu. on the edge of the Waimanalo cane field facing Koolau Range. […] Remains indicate that the heiau was probably 250 feet long and 130 feet wide, of two terraces. […]"	McAllister 1933:191
382	*Heiau* (Pōhakunui Heiau)	"Heiau on the land known as Pohakunui. Waimanalo. A small heiau, approximating 50 by 90 feet in extent, built on the crown of a little hill, at the foot of the palis on the mountainward edge of the cane field just back of the Waimanalo mill [….]"	McAllister 1933:191
383	Haununaniho (*pu‘uhonua*)	"Haununaniho, near the sea side of the mill, Waimanalo. A small hill said to have been famous in olden days as a place of refuge (*pu‘uhonua*). […]" In a 1985 archaeological survey, McNeill (1985:8) did not find any structures on this hill, and recommended subsurface testing of the slopes.	McAllister 1933:191, McNeill 1985:8
383-A	Pāhonu (turtle kraal)	Pahonu, adjacent to the E.O. Halland, Waimanalo. Pahonu is said to be the name of a pond 500 feet long and approximately 50 feet wide. A line of stones submerged at high tide but visible at low tide indicates its former extent. Turtles are said to have been kept in the pond for use of the alii.	McAllister 1933:192
384	So-called "Kaupo Village"	"Because of the local interest in this 'deserted village' the area has been set aside as a public park. This site has probably neither the great antiquity nor the importance commonly attributed to it. In its prime, it consisted of a few fishing huts, a fishing shrine (ko‘a), and possibly a small heiau. […]"	McAllister 1933:193–195, Mathison 1825:381–387, Loomis nd:100-101

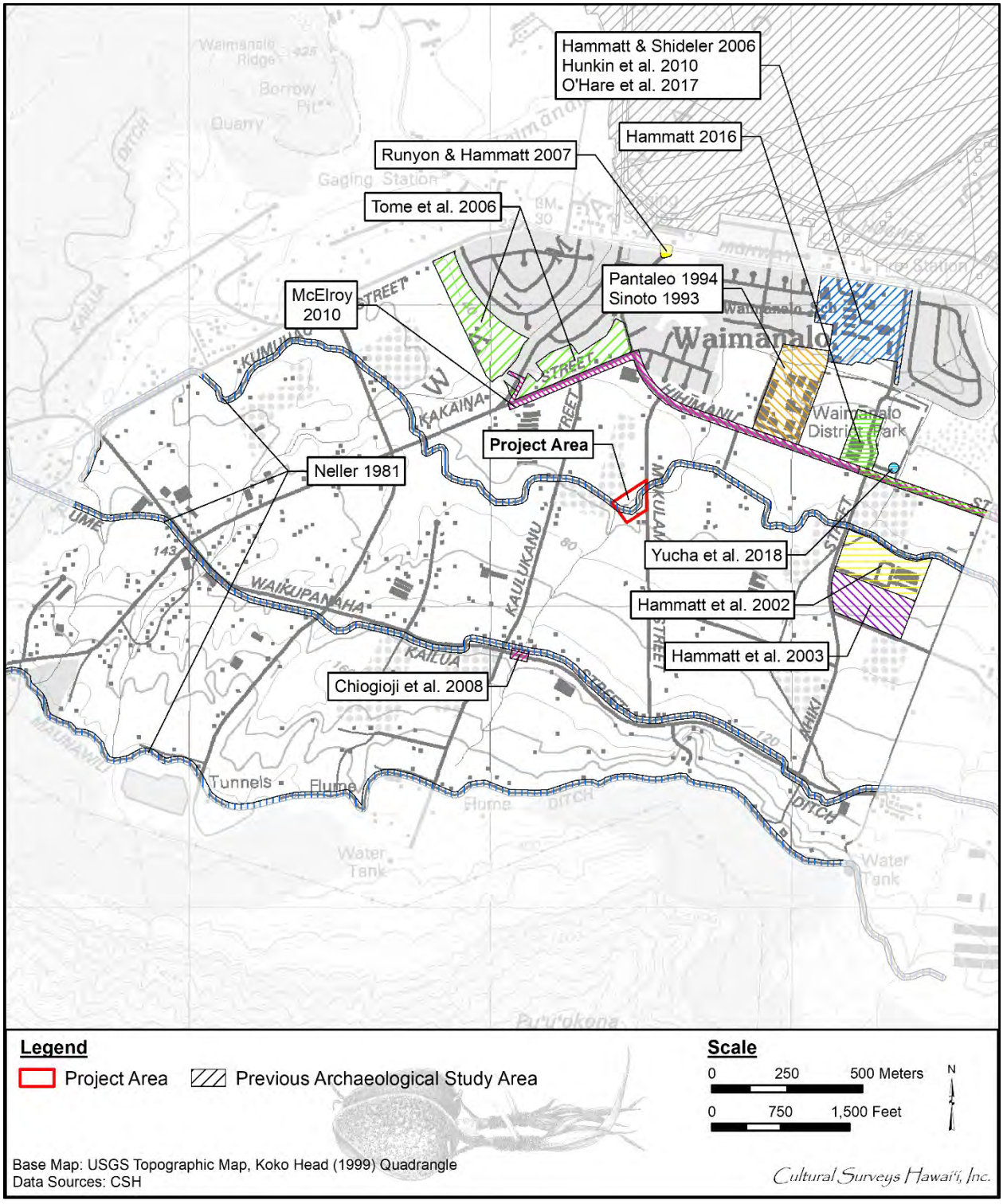

Figure 28. Showing the location of previous archaeological studies in the vicinity of the Tai Lee Reservoir project area (base map: portion of the 1999 Koko Head USGS 7.5-minute topographic quadrangle)

Table 4. Previous archaeological studies in the vicinity of the project area

Reference	Type of Study	Location	Results (SIHP # 50-80-15****)
McAllister 1933	Island-wide survey	Near old sugar mill	SIHP # -383, Haununāniho is a hill described as a *pu‘uhonua*, or place of refuge
Handy 1940	Archipelago-wide study	Taro cultivation along Puhā Stream and in a “semi-circle at the foot of the mountains”	Notes widespread traditional taro cultivation but only one taro grower in Waimānalo in 1934
Neller 1981	Photographic study	Waimānalo Sugar Co. irrigation system	Photographic survey of former Waimanalo Sugar Co. irrigation system (SIHP # -4042)
Sinoto 1993	Archaeological inventory survey (recorded as archaeological assessment)	Hawaii Job Corp Center	No significant finds
Pantaleo 1994	Archaeological monitoring	Hawaii Job Corp Center	No significant finds
Hammatt et al. 2002	Archaeological inventory survey	U.S. Department of Agriculture Fruit Fly Production Facility	Plantation-era irrigation ditch, known as Tai-Lee Ditch (SIHP # -6427) observed along *makai* edge of study area
Hammatt et al. 2003	Addendum archaeological inventory survey	U.S. Department of Agriculture Fruit Fly Production Facility	No historic properties identified
Hammatt and Shideler 2006	Archaeological literature review and field inspection	Study of six DOE schools, including Waimanalo Elementary and Intermediate School	Archaeological monitoring program recommended for Waimānalo Elementary and Intermediate School due to proximity to National Register archaeological area and loam soils
Tome et al. 2006	Archaeological inventory survey	Waimānalo Residence Lots subdivision	No historic properties identified
Runyon and Hammatt 2007	Archaeological monitoring	Intersection of Kalaniana‘ole Hwy and Pō‘alima St, TMKs: [1] 4-1-009 and 022	No historic properties identified

Reference	Type of Study	Location	Results (SIHP # 50-80-15****)
Chiogioji et al. 2008	Archaeological inventory survey	Waikupanaha St Box Culvert #5	Documented segment of Waimanalo Sugar Co. Waimānalo Ditch System Kailua Ditch (SIHP # -4042) along *makai* side of Waikupanaha St
Hunkin et al. 2010	Archaeological monitoring	Waimānalo Elementary and Intermediate School, TMK: [1] 4-1-009:012	No historic properties identified; glass bottles and containers recovered in field dated to time period of construction of the campus (1940s and 1950s)
McElroy 2010	Archaeological monitoring	Waimānalo town streets	No historic properties identified
Hammatt 2016	Archaeological monitoring	Waimānalo District Park	No historic properties identified
O’Hare et al. 2017	Archaeological literature review and field inspection	Waimānalo Elementary and Intermediate School STEM Building	Noted no historic properties previously designated within project area but on-site archaeological monitoring recommended for any future subsurface activities based on school being more than 50 years old (built in 1950) and potential for historic subsurface remains associated with its early foundation
Yucha et al. 2018	Archaeological evaluation and archaeological monitoring plan	14 O‘ahu locations including at Waimānalo District Park	No further archaeological work recommended for Waimānalo District Park location

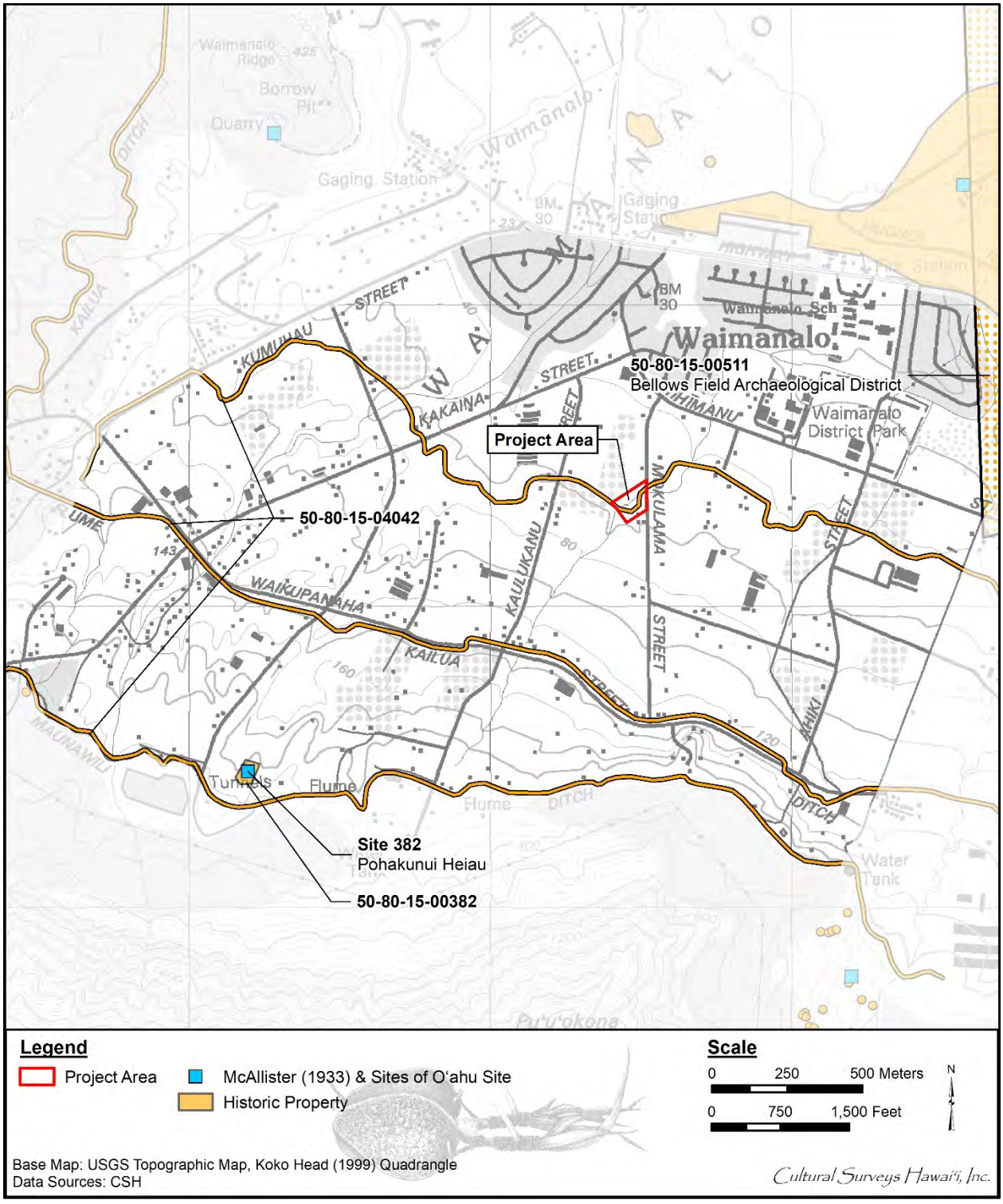

Figure 29. Previously identified historic properties in the vicinity of the Tai Lee Reservoir project area (base map: portion of 1999 Koko Head USGS 7.5-minute topographic quadrangle)

Table 5. Previously identified historic properties in the vicinity of the Tai Lee Reservoir project area

Site Designation	Nature of Site	Source	Comments
SIHP # 50-80-15-382	*Heiau* (Pōhakunui Heiau)	McAllister 1933:191	"Heiau on the land known as Pohakunui. Waimanalo. A small heiau, approximating 50 by 90 feet in extent, built on the crown of a little hill, at the foot of the palis on the mountainward edge of the cane field just back of the Waimanalo mill [….]"
SIHP # 50-80-15-511	Bellows Field Archaeological District	—	—
SIHP # 50-80-15-4042	Waimanalo Sugar Company infrastructure	McDermott et al. 2000, Drolet and Sinoto 2001, Chiogioji et al. 2008, Dagher and Spear 2014	—
SIHP # 50-80-15-6427	Tai Lee Ditch	Hammatt et al. 2002	Portion of Tai Lee Ditch identified in Hammatt et al. 2002 is well east of present project area (not labeled on Fig. 29)

the report in the possession of CSH ends with Slide 17. Most of Neller's photo documentation concerns the two ditches at higher elevations (and not the Tai-Lee Ditch). One image of the Tai-Lee Ditch showing a straight, concrete-lined ditch at Ahiki Street is included.

4.2.2 Sinoto 1993, Pantaleo 1994

In 1993, archaeologists from Aki Sinoto Consulting (Sinoto 1993) conducted a pedestrian survey of the proposed site for the Hawaii Job Corps Center. This property was located on the *makai* side of Hihimanu Street, behind (south of) the Waimānalo Elementary and Intermediate School. No sites were noted during the field survey. Subsequently, archaeologists monitoring construction at the site noted the stratigraphy indicated the project area had been used for farming and no cultural remains or deposits were noted (Pantaleo 1994).

4.2.3 Hammatt et al. 2002, 2003

In support of a proposed expansion of the USDA Hawai‘i Fruitfly Production Facility, CSH carried out an archaeological inventory survey of a 6-acre parcel in *mauka* Waimānalo in September 2002 (Hammatt et al. 2002) and an additional archaeological inventory survey of an adjacent 9-acre parcel immediately *mauka* (Hammatt et al. 2003). No historic properties were identified in either project area per se. The *makai* or north edge of the 6-acre (Hammatt et al. 2002) project area, however, was demarcated by a ditch understood as the Tai Lee Ditch associated with the individual of that name and the Chinese sugarcane growing period of 1876–1900. This Tai Lee Ditch was understood as a historic property and had been designated as State Inventory of Historic Places (SIHP) # 50-80-15-6427. Much of the ditch is earthen without improvements although portions were noted as lined with concrete and some water diversion and engineering constructions were noted as present.

4.2.4 Hammatt and Shideler 2006

CSH (Hammatt and Shideler 2006) carried out an archaeological literature review and field check study of six Department of Education (DOE) schools for an island of O‘ahu Hawai‘i Inter-Island DOE Cesspool project including Waimānalo Elementary and Intermediate School. An archaeological monitoring program was recommended for the school because of the close proximity to a National Register archaeological area and because of the loam soils.

4.2.5 Tome et al. 2006

Scientific Consultant Services (Tome et al. 2006) carried out an archaeological inventory survey which included ten test excavations (called an archaeological assessment in the absence of finds) of two discrete parcels, one southeast of Kumuhau Street and one northwest of Kakaina Street, totaling approximately 20 acres in *mauka* Waimānalo. No archaeological sites were identified on either of the two parcels.

4.2.6 Runyon and Hammatt 2007

CSH (Runyon and Hammatt 2007) conducted archaeological monitoring for traffic control signal work at the intersection of Kalaniana‘ole Highway and Pō‘alima Street, approximately 1 km inland from the coast in central Waimānalo on the southwest (*mauka*) side of Kalaniana‘ole Highway (TMKs: [1] 4-1-009 and 022). Project related ground disturbance was quite minimal and fieldwork required one-half day to complete. No archaeological cultural deposits were identified as a result of the project's monitoring program. The project area's subsurface deposits appear to

have been disturbed by utility installation, which included extensive earthmoving activity and importation of fill sediments into the project area.

4.2.7 Chiogioji et al. 2008

CSH (Chiogioji et al. 2008) carried out an archaeological inventory survey for a Waikupanaha Street Box Culvert #5 Improvements project. One feature, a component of the Waimanalo Sugar Company's Kailua Ditch, previously identified as SIHP # 50-80-15-4042, was noted as extending along the *makai* side of the section of Waikupanaha Street that Culvert #5 crosses. The adjacent section of ditch (an earthen ditch with a concrete or masonry trough in the immediate vicinity of the culvert) was documented.

4.2.8 Hunkin et al. 2010

CSH (Hunkin et al. 2010) reported on archaeological monitoring for the reconstruction of wastewater systems at the present Waimānalo Elementary and Intermediate School project area (TMK: [1] 4-1-009:012). Excavation for these wastewater improvements at Waimānalo Elementary School included extensive trenching (depths ranging to approximately 2 mbs); pit excavations for cesspools and pump stations (approximately 2 mbs); and probing activities to very shallow depths (<1 mbs) to locate existing utilities. Approximately 670 m of trenching was conducted. No historic properties were documented during the monitoring fieldwork but historic artifacts were recovered from an imported fill stratum, containing dates that coincide with the modern (ca. 1950) renovation of the school campus.

4.2.9 McElroy 2010

Garcia and Associates conducted monitoring from December 2009 to February 2010 for the Sandwich Isles Communication's Fiber Optic project from ‘Olu‘olu to Mekia Street in the Waimānalo Town Center area. The archaeologists monitored backhoe excavation, horizontal directional drilling, trenching, and grubbing. Typical stratigraphy consisted of a sandy fill with marine sand below for the ‘Olu‘olu Street sections. The Waikupunaha section had pockets of red fill over the coral shelf. No cultural deposits or historic properties were noted during the monitoring.

4.2.10 Hammatt 2016

CSH conducted monitoring for the Waimānalo District Park Sewer Improvements project from August to September 2012. No cultural deposits or historic properties were observed during the monitoring. In general, the observed stratigraphy consisted of imported fill sediments overlying alluvium, or naturally weathered, stream-deposited soils. The imported fill consisted predominantly of imported crushed coral and sand associated with modern urban development (i.e., construction of roads and installation of utilities).

4.2.11 O'Hare et al. 2017

This CSH (O'Hare et al. 2017) archaeological literature review and field inspection report for a Waimānalo Elementary and Intermediate School STEM Building project noted no historic properties have been previously designated within the project area. The nearest Bellows Air Force Station designated sites are approximately 250 m to the northeast. Although no historic properties were discovered during a previous study in the project area (Hunkin et al. 2010), on-site archaeological monitoring was recommended for any future subsurface activities based on the

knowledge that the school is more than 50 years old (built in 1950) and has the potential for historic subsurface remains associated with its early foundation.

4.2.12 Yucha et al. 2018

CSH (Yucha et al. 2018) prepared an archaeological evaluation and archaeological monitoring plan for a State Department of Defense Emergency Siren Modernization program at 14 O‘ahu locations including a location at Waimānalo District Park. In consideration of the geographic location, known cultural history at this specific geographic location, absence of any indication of prior finds at this specific location, and indication of land alteration, no further archaeological work was recommended for the Waimānalo District Park location.

4.3 Background Summary and Predictive Model

Relatively few historic properties have been previously identified in the vicinity of the Tai Lee Reservoir and none within 800 m other than Waimanalo Sugar Company irrigation infrastructure.

SIHP # -4042 is understood as a general designation for all Waimanalo Sugar Company infrastructure including the lower elevation Pump Ditch (including the Tai Lee Reservoir), the middle elevation Kailua Ditch, and the upper elevation Maunawili Ditch (see Figure 20 and the National Register of Historic Places Registration Form in Appendix B). This SIHP # has historically been applied particularly to studies of the mid-level “Kailua Ditch” (approximating the Waikupanaha Street road alignment, see Chiogioji et al. 2008, Dagher and Spear 2014, Drolet and Sinoto 2001).

No historic properties other than those relating to commercial agricultural operations would be expected in this project area. This study notes that a former Waimanalo Sugar Company railroad extended along the east side of the present project area from at least as early as 1919 (see Figure 15) until after 1943 (see Figure 19) and that a small plantation camp existed just east across Mokulama Street from the present project area (see Figure 15) but no remnant of this railroad or plantation camp would be expected in the present project area.

We understand the Tai Lee Reservoir was built by one Tai Lee in the context of Chinese rice planters who soon moved to commercial sugarcane production (Enoka 1978:35). Although no maps showing a reservoir at the Tai Lee Reservoir location have been identified before 1919 (see Figure 15) it is possible the Tai Lee Reservoir was built soon after 1876 when the Reciprocity Treaty created a burst of commercial agricultural activity. The Tai Lee Reservoir is understood to have been decommissioned shortly after the Department of Agriculture concluded an Environmental Assessment for abandonment of the Waimanalo Ditch Irrigation System in August 1993. The reservoir is now regarded as a potential historic property as are the inflow Pump Ditch, the outflow Pump Ditch, and Tai Lee Ditch (or Reservoir Ditch).

Section 5 Results of Fieldwork

A pedestrian inspection of the Tai Lee Reservoir project area was undertaken by two CSH archaeologists, David W. Shideler, M.A., and Tyler Turran, B.A., on 21 January 2022. The fieldwork took approximately 10 archaeologist-hours to complete. A tracklog for one of the archaeologists with a key to the following photographs indicating approximate location and direction of view is provided in Figure 30.

The Tai Lee Reservoir was approached from the north via paved Mokulama Street which bounds the parcel on the east side. An initial foray was taken on the opposite east side of Mokulama Street to see if an eastern extension of the former “Pump Ditch” could be discerned. East of the Mokulama Street right-of-way, behind a chain link fence and in an area of dense vegetation, this eastern extension of the Pump Ditch was clearly discernable as a strip of standing water extending to the southeast of Mokulama Street. It is understood that this eastern stretch of Pump Ditch was connected with the southeast corner of the Tai Lee Reservoir Lot from prior to 1922 until after 1943 (see Figure 16, Figure 17, Figure 18, and Figure 19). Between 1943 (see Figure 19) and 1952 (see Figure 21), a new “Reservoir Ditch” was developed from the northeast corner of the Tai Lee Reservoir Lot, which would have had the advantage of gravity as an outflow from the Tai Lee Reservoir transporting irrigation water to the east. It is understood that with the establishment of the new “Reservoir Ditch” ca. 1950, the *mauka*, eastern extension of the Pump Ditch fell into disuse.

The fieldwork then inspected the south portion of the Reservoir Lot (TMK: [1] 4-1-024:068) that is presently a Department of Agriculture office and base yard area; this is an exclusion from the present study. Inspection of the southwest side of this base yard indicated the former Pump Ditch alignment (understood as previously forming the southwest side of the parcel) was no longer extant. It is understood that prior grading for this Department of Agriculture base yard effectively filled in that portion of the Pump Ditch.

Consultation with Department of Agriculture personnel emphasized that the only extant concrete portion of Tai Lee Reservoir infrastructure was an outflow spillway near the northeast corner of the project area. This effectively runs through a culvert under Mokulama Street connecting with the Reservoir Ditch on the east side of Mokulama Street which extends to the northeast.

Historic maps and aerial photos show the Pump Ditch approached the reservoir from the northwest entering the west corner of the project area. This is still visible as a dry earthen ditch approximately 3.5 m across by 1.0 m deep (Figure 31 and Figure 32). Water is understood to have flowed into the Tai Lee Reservoir both from natural flow down the dry gulch in which the reservoir is situated and from this Pump Ditch which is depicted on maps of 1922 (see Figure 16), 1928 (see Figure 17), 1934 (see Figure 18), 1943 (see Figure 19) as transporting water via a pump (hence the name) at the Waimanalo Lagoon (a backwater on Puha Stream) keeping the water high, approximating a contour along the back of the Tai Lee Reservoir and on to the east (see also Figure 20). After the pump on the lower course of Puhā Stream and the northern portion of the Pump Ditch was abandoned, new intercepts of water from the Kailua Ditch and Maunawili Ditch continued to supply water along the upslope side of the Tai Lee Reservoir (see the 1952 map,

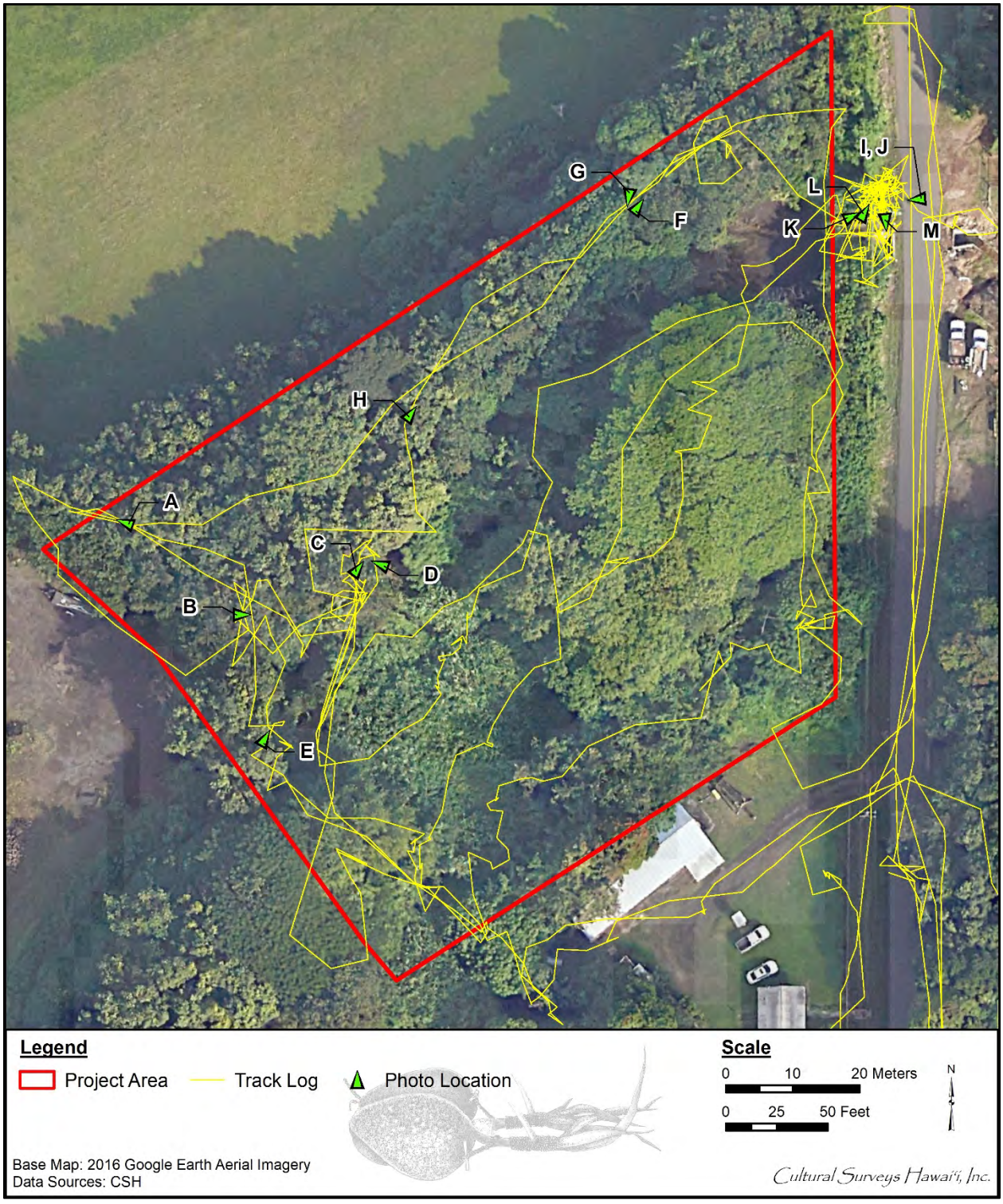

Figure 30. Tracklog of one of the two archaeologists, with a photo key indicating the approximate location and orientation of the following photographs (base map: Google Earth 2016)

Figure 31. Photo A: View of earthen Pump Ditch as it enters the west corner of the project area, view to northwest

Figure 32. Photo B: View of earthen Pump Ditch as it enters the west corner of the project area, view to east

Figure 21). A notable feature in the fieldwork was a pile of concrete water infrastructure remnants (Figure 33 and Figure 34) understood as remnants of water diversion infrastructure that could allow irrigation water to enter the Tai Lee Reservoir and keep the water flowing to the east in the Pump Ditch. This system of water diversions may also have diverted water coming down the small drainage above the reservoir into the Pump ditch flowing east. A minor mystery is whether water ever flowed out of the Tai Lee Reservoir into the Pump Ditch—which appears to have been at a slightly higher elevation. This may have been possible when the reservoir was “full” by pumping.

A dry stream channel appears to enter the Tai Lee Reservoir from the northeast (Figure 35) supporting the supposition that reservoir may have been originally designed in Chinese rice farming days simply to capture water from occasional freshets in this small stream channel. It is unclear whether the apparent stream channel was always there or if it has effectively reasserted itself since ditch systems and diversions have stopped.

The actual structure of the reservoir is subtle within the dense vegetation (Figure 36, Figure 37, and Figure 38 are representative). On the most pronounced northwest side, the reservoir wall was approximately 8.8 m wide, approximately 2.0 m high on the interior, and approximately 1.15 m high on the exterior side (for a representative cross-section see Figure 44). The reservoir wall on the east side is less clear but seems to have been at least partially composed of heaped earth in the course of the development of the plantation railroad spur along what would become Mokulama Street. It seems probable that much of the earth forming the low earthen reservoir wall was from a shallow excavation within the reservoir interior but this has been obscured by significant fill episodes within the floor of the reservoir understood to have occurred shortly after the reservoir was decommissioned.

The main feature of the reservoir is the concrete “spillway” along Mokulama Street near the north corner of the project area (see plan view in Figure 45). Most of this construction is understood to relate to the creation of a new, lower elevation “Reservoir” or “Tai Lee” ditch between 1943 (see Figure 19) and 1952 (see Figure 20). Figure 39 through Figure 43 depict this spillway which transports reservoir water under Mokulama Street into the Reservoir Ditch and on to the east. Sluice gate slots (see Figure 42) indicate this outflow could be regulated. A noted feature on the south side of the spillway was an upper wall section believed to be older and possibly to relate to the original construction of the reservoir while the lower wall is believed to relate to renovations ca. 1950 (see Figure 43). At the time of the fieldwork, a trickle of water passed out of the Tai Lee Reservoir through a conduit under Mokulana Road and into the (former ?) Tai Lee Ditch heading east.

Figure 33. Photo C: View of Concrete remnants believed to have been related to water control as the Pump Ditch entered the Tai Lee Reservoir, view to northwest

Figure 34. Photo D: Close-up view of concrete remnants believed to have been related to water control as the Pump Ditch entered the Tai Lee Reservoir, view to west

Figure 35. Photo E: Overview of dry stream entering the reservoir, view to northeast

Figure 36. Photo F: View along dam berm along northwest side of reservoir (reservoir at left), view to northeast

Figure 37. Photo G: Overview of dam berm from on top of the berm looking into the reservoir, view to south

Figure 38. Photo H: Overview of reservoir berm along northwest side of reservoir (reservoir at right), view to northeast

Figure 39. Photo I: Photo of spillway from Mokulama Street, view to west

Figure 40. Photo J: Close-up of spillway from Mokulama Street, view to west

Figure 41. Photo K: View of spillway, view to northeast (Mokulama Street in background)

Figure 42. Photo L: View of the north side of the spillway with sluice gate slot, view to north

Figure 43. Photo M: Retaining wall(s) on south side of spillway, the upper wall is believed to be older and relate to the original construction of the reservoir and the lower wall is believed to relate to renovations ca. 1950, view to south

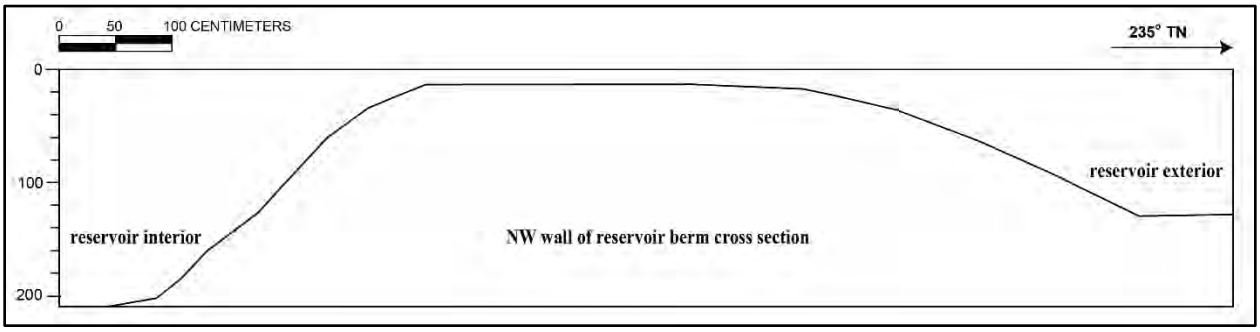

Figure 44. Representative cross-section of the northwest berm of the Tai Lee Reservoir, the reservoir wall was approximately 8.8 m wide, approximately 2.0 m high on the interior (at left), and approximately 1.15 m high on the exterior side (at right)

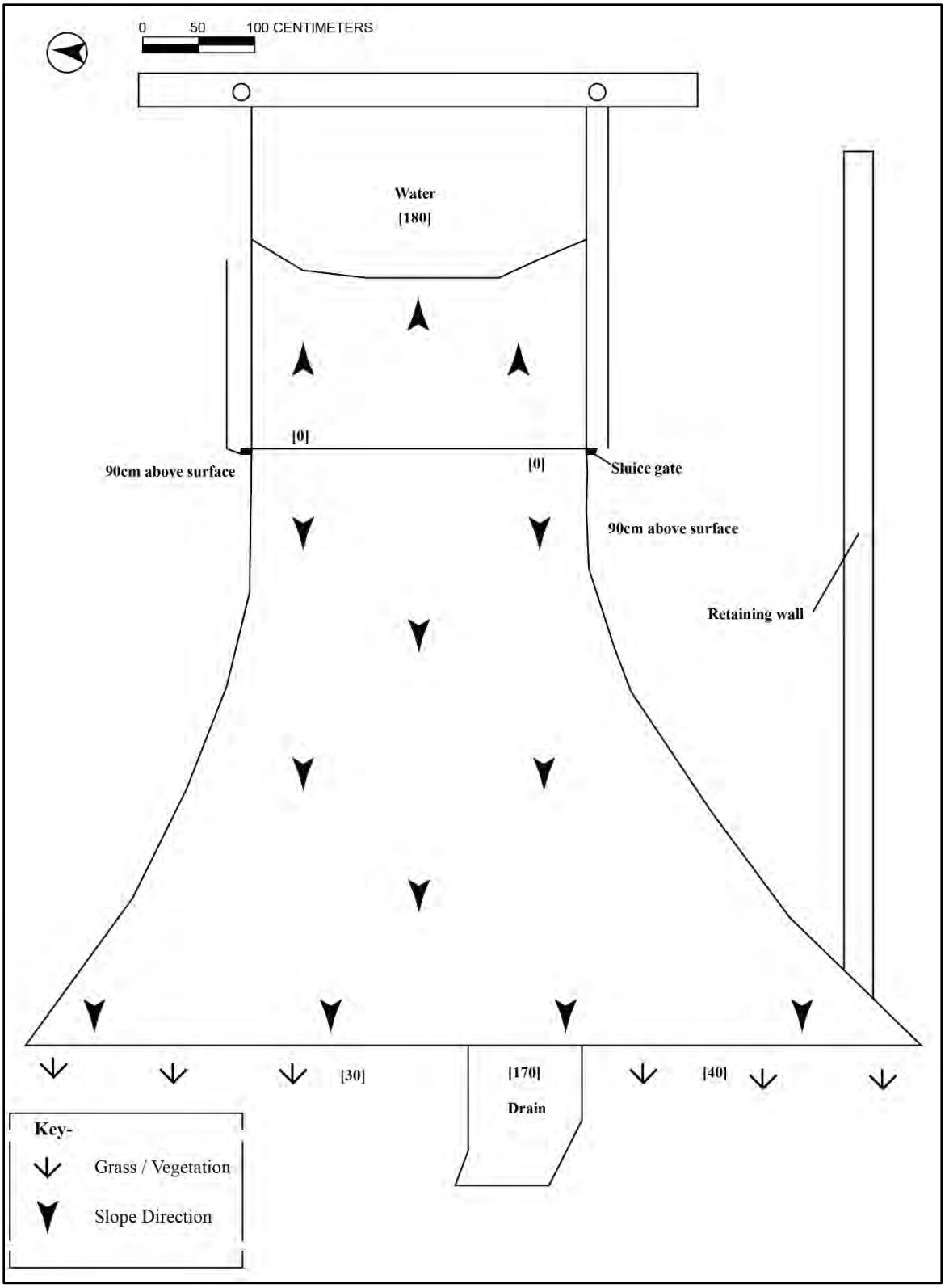

Figure 45. Tai Lee Reservoir spillway plan view (Mokulama Street at top)

Section 6 Tai Lee Reservoir Discussion

The following is a discussion of the Tai Lee Reservoir, its significance, and its association with other previously designated historic properties.

6.1 Tai Lee Reservoir

We read in an account of Chinese in rural O‘ahu that:

> Water was very important to the Chinese since rice is grown in specially irrigated or flooded fields. Their main source of water came from two reservoirs built by the Chinese—one located close to the Hawaii Irrigation Office called Tai Lee and the other just below Foremost Dairy called Wing Kee. These reservoirs still maintain their original names. [Enoka 1978:35]

Thus, the Tai Lee Reservoir is understood to have been built by Tai Lee and to have originated in Chinese rice growing in Waimānalo and to have supported Chinese sugarcane growing in Waimānalo until ca. 1900 when it was effectively taken over by the Waimanalo Sugar Company. The Waimanalo Sugar Company would have used the Tai Lee Reservoir until it closed in 1947 and shortly thereafter (by 1952, see Figure 21) the Tai Lee Reservoir was repurposed with a new irrigation ditch (the “Tai Lee” or “Reservoir” Ditch) to support diversified agriculture.

The Tai Lee Reservoir is understood to have been a component of SIHP # -4042, understood as a general designation for all Waimanalo Sugar Company infrastructure (and as specifically a component of the Pump Ditch system) during the days of the Waimanalo Sugar Company (from at least as early as 1919 (see Figure 15) until its closure in 1947 (see Figure 19).

Subsequently, it is understood that the Tai Lee Reservoir was repurposed to support diversified agriculture, and was effectively a component of a new, lower elevation ditch system (called the Tai Lee or Reservoir Ditch) (designated SIHP # -4042) exiting the Tai Lee Reservoir near its south corner and flowing to the east at a lower elevation than the former eastern extension of the Pump Ditch.

Thus, the Tai Lee Reservoir may be regarded as a component of both of these historic properties but in origin and function (built by Tai Lee for Chinese rice-growing, possibly as early as ca. 1876, and subsequently supporting Chinese sugarcane growing until ca. 1900) but this historic property is different. Because its origin and function are different it may be appropriate to regard the Tai Lee Ditch as a discrete historic property.

The Tai Lee Reservoir is composed of broad earthen dams on its east and northwest sides that are typically 8.8 m wide, approximately 2.0 m high on the interior, and approximately 1.15 m high on the exterior side (see Figure 44). Historic maps indicate the former Pump Ditch skirted the upslope (southwest) side of the reservoir and remnants of what appears to be former concrete water diversion infrastructure appear to have regulated water flow from this ditch into the reservoir. It seems likely there was never a dam wall on the upslope side but this area has been transformed by grading and infilling since the Department of Agriculture concluded an Environmental Assessment (EA) for abandonment of the Waimanalo Ditch Irrigation System in August 1993. The only other reservoir infrastructure is at the northeast corner of the reservoir (and project area) fronting Mokulama Street where there is a spillway that still sends water from the reservoir under Mokulama Street into the former Tai Lee or Reservoir Ditch. There appears to be evidence of two

phases of spillway work (see Figure 43); the upper wall is believed to be older and perhaps to relate to the original construction of the reservoir and the lower wall is believed to relate to renovations ca. 1950.

6.2 SIHP # 50-80-15-4042 Waimanalo Sugar Company Infrastructure

SIHP # -4042 is understood as a general designation for all Waimanalo Sugar Company infrastructure which is understood to include the lower elevation Pump Ditch (including the Tai Lee Reservoir), the middle elevation Kailua Ditch, and the upper elevation Maunawili Ditch (see Figure 20 and the National Register of Historic Places Registration Form in Appendix B). This SIHP # has historically been applied particularly to studies of the mid-level Kailua Ditch (approximating the Waikupanaha Street alignment, see Drolet and Sinoto 2001, Chiogioji et al. 2008, Dagher and Spear 2014).

CSH has been unable to ascertain that Waimanalo Sugar Company infrastructure or the Waimanalo Ditch Irrigation System were ever placed on the NRHP or on the Hawai‘i Register of Historic Places (HRHP) but we understand neither is presently on either register. However, given comments by state agencies and SHPD-accepted archaeological studies over time, a discussion of prior formal findings seems appropriate.

The 1984 *(Final) Environmental Impact Statement: Maunawili Ditch Improvements* promulgated by the State of Hawai‘i Department of Land and Natural Resources (DLNR) addresses historic properties relevant to the project in a brief paragraph as follows:

> No archaeological sites are believed to be endangered by the proposed project. Any sites or artifacts which may have been present at the project area were probably destroyed during the initial construction of the Maunawili Ditch System. [Department of Land and Natural Resources 1984:19]

Given that in the 1993 discussion quoted below it is asserted “that on September 18, 1981, the ditch system was determined eligible for listing in the National Register by the Keeper of the Register” Department of Land and Natural Resources, 3 June 1999 [File No.:93-569, Doc. No. 2816]) it seems remarkable that three years after the determination of eligibility that DLNR would not have mentioned it.

Dr. Victoria Creed prepared a National Register of Historic Places (NRHP) Registration Form for the Waimānalo Irrigation System in 1992 (see present Appendix B) but how this relates to the determination of the keeper of the Register 11 years earlier is not altogether clear.

In 1993 the State of Hawai‘i Department of Agriculture promulgated an *Environmental Assessment* [EA] *for Abandonment of the Waimanalo Ditch Irrigation System* including the Pump Ditch and the Tai Lee Reservoir. This EA generated a good deal of discussion regarding the historic significance of the ditch system but leaves us little the wiser.

That study notes:

> On September 18, 1981, the ditch system was deemed eligible for listing in the National Register for its historic significance in Hawaii's agriculture industry. However, the State Department of Agriculture has provided numerous reasons to the Department of Land and Natural Resources and testimony before the Hawaii Historic Places Review Board for not designating the ditch system as a historic site. [Department of Agriculture 1991:4]

The SHPD review responded,

> The Historic Preservation Division (HPD) comments that on September 18, 1981, the ditch system was determined eligible for listing in the National Register by the Keeper of the Register. HPD therefore believes that the proposed project will have an adverse effect on the historic character of the ditch system. This system is significant for its association with the development of the sugar industry. Prior to permitting the demolition of the wooden flumes, HPD needs to know if there are other wooden flume systems in the State and their degree of preservation. In addition, mitigative measures would need to be established. [Department of Land and Natural Resources, 3 June 1999 (File No.:93-569, Doc. No. 2816)]

The State of Hawai‘i Department of Agriculture response to the Historic Preservation Division was “Comments are noted in the EA.”—seemingly referring to the reference quoted above (Department of Agriculture 1993:4) to the Department of Agriculture having previously “provided numerous reasons.”

The State of Hawai‘i, Office of Environmental Quality Control (9 June 1993) asked for clarification: “Is the Waimanalo Ditch archaeologically or historically significant?” The State of Hawai‘i Department of Agriculture response to the Office of Environmental Quality Control was, “All comments are noted and will be incorporated into the EA,” seemingly a reference to including their comment letter in the EA.

Carol Wilcox (author of *Sugar Water, Hawai‘i’s Plantation Ditches* and an expert on plantation ditches) wrote an “Objection to Negative Declaration Determination” (6 July 1993) and Hawaii’s Thousand Friends (27 July 1993) comments to the EA noted their objections to the HDOA’s characterization of the historical value of the ditch system but the HDOA does not appear to have substantively addressed either of these comments.

The Department of Agriculture informed the Office of Environmental Quality Control in a letter dated 5 August 1993 that they had reviewed the comments received and determined the project will not have significant environmental effect and issued a negative declaration (Department of Agriculture 1993).

Regarding the original assignation of SIHP # -4042, Chiogioji et al. (2008:40) assert, “The Waimānalo Ditch System was entered on the State Inventory of Historic Properties as SIHP # 50-80-15-4042 (Neller 1981).” Earl (“Buddy”) Neller’s (1981) study was a “Waimanalo Ditch System: Photo Survey” consisting of photographs with brief associated captions and locations shown on maps. There is no other discussion of this historic property but we note the number “4042” is annotated by hand on six maps near the end of his study. Neller provides no written description of the historic property at all (other than photo captions) and no assessment of significance.

Drolet and Sinoto (2001:29) reflect an element of uncertainty regarding the significance of this historic property: “The Kailua Ditch is part of the Waimanalo Irrigation System (Site 4042), an extensive complex that appears to be eligible for nomination to the National Register.” They concluded, “The existing segments of the Kailua Ditch, as an integral part of the Waimanalo Irrigation System, are considered significant under multiple criteria, Criterion A, C, and D [of the HRHP].”

Chiogioji et al. (2008:40) concluded the portion of SIHP # -4042 under their purview “falls under criteria A and D [of the HRHP].”

Dagher and Spear (2014:1) conducted an archaeological inventory survey (AIS) for a proposed main line extension of a Waimānalo Irrigation System Project identifying “five exposures of the Historic Kailua Ditch (State Site 50-80-15-4042).” They concluded:

> The five newly identified exposures of State Site 50-80-15-4042 have been evaluated in accordance with criteria established for the Hawai‘i State Register of Historic Places (HAR§13-276 and HAR§13-284) and found to be significant under the following criteria: Criterion ‘a’, associated with events [e.g., Plantation-Era] (that have made an important contribution to the broad pattern of Hawaiian history) and Criterion ‘d’ (for information content). [Dagher and Spear 2014:50]

Thus it appears at least three prior archaeological studies (Drolet and Sinoto 2001:29; Chiogioji et al. 2008:40; and Dagher and Spear 2014:50) have determined portions of SIHP # -4042 as significant under multiple criterion of the HRHP.

6.3 SIHP # 50-80-15-6427 “Tai Lee Ditch” also known as “Reservoir Ditch"

A lower elevation “Tai-Lee ditch” (also known as the “Reservoir Ditch"), used to draw water from the Tai-Lee Reservoir. That Tai Lee Ditch is believed to date from between 1943 and 1952 (see Figure 19 and Figure 20) and has been addressed as SIHP # 50-80-15-6427 (Hammatt et al. 2002). That 2002 study relates that: “In consultation with the State Historic Preservation Division it was decided to give the [Tai-Lee] ditch State Inventory of Historic Places Site # 50-80-15-6427” (Hammatt et al. 2002:41). Consideration was given to including the ditch within a general designation for Waimanalo Sugar Company infrastructure (SIHP # 50-80-15-4042), but the origins of the ditch are understood to be different (Hammatt et al. 2002:41) The Hammatt et al. (2002) study regarded a segment of this ditch as bounding (or outside) of their approximately 6-acre USDA Hawaii Fruit Fly Production Facility project area and only a very short segment of the ditch was addressed (and this was very heavily vegetated). That study did however conclude that SIHP # 50-80-15-6427:

> […] is understood to be significant under State and National Register of Historic Places significance criteria: A Site reflects major trends or events in the history of the state or nation. B Site is associated with the lives of persons significant to our past, and D Site may be likely to yield information important in prehistory or history.” [Hammatt et al. 2002:41]

6.4 Significance of the Tai Lee Reservoir

The Tai Lee Reservoir is regarded as a component of the Pump Ditch, one of three ditch systems of the Waimanalo Ditch System, and as part of the Waimanalo Sugar Company infrastructure designated as SIHP # 50-80-15-4042) but also is suggested as integral to the Tai Lee Ditch (also known as “Reservoir Ditch" designated as SIHP # 50-80-15-6427, for which it was a water source.

Both of these historic properties have been previously regarded as significant under multiple criteria. Three prior archaeological studies (Drolet and Sinoto 2001:29; Chiogioji et al. 2008:40; and Dagher and Spear 2014:50) have determined portions of SIHP # 50-80-15-4042 as significant

under multiple criterion of the HRHP and “on September 18, 1981, the ditch system was determined eligible for listing in the National Register by the Keeper of the Register. (Department of Land and Natural Resources, June 3, 1999, File No.:93-569, Doc. No. 2816). The Tai Lee Ditch has been suggested to be significant under three criterion of the HRHP and NRHP (Hammatt et al. 2002:41).

While the Tai Lee Reservoir is understood as a contributing feature to both the Waimanalo Sugar Company infrastructure and to the Tai Lee Ditch, it is also understood as predating both. The Tai Lee Reservoir is understood to have been built by Tai Lee and to have originated in Chinese rice growing in Waimānalo and to have supported Chinese sugarcane growing in Waimānalo until ca. 1900 when it was effectively taken over by the Waimanalo Sugar Co. (Enoka 1978:35). The Tai Lee Reservoir is suggested to be significant under HAR §13-284-6 Criterion a, as associated with events that have made an important contribution to the broad patterns of our history, specifically Chinese rice growing and Chinese sugarcane growing transitioning into sugar plantation cultivation. The Tai Lee Reservoir is suggested to be significant under HAR §13-284-6 Criterion d, for having yielded information important for research on history of Chinese agriculture in Waimānalo.

This historic property is evaluated as possessing integrity of location, design, materials, and workmanship. Tai Lee Reservoir possesses integrity of location. The reservoir is located where it was originally constructed by Tai Lee within a small drainage way in the late 1800s. Integrity of design and materials is maintained in the form of the low and wide earthen walls on the northwest and east sides of the former reservoir. However, sediment has accumulated within the feature since its abandonment. It should be noted that the workmanship of piling the earthen walls was fairly minimal but remains much as when it was built.

The historic property is evaluated as lacking integrity of setting, feeling, and/or association. The Integrity of setting is understood as addressing whether the setting relates to how it appeared historically compared to how it appears now. The historical setting at construction is understood to have been in a very large expanse of rice paddies, and subsequently within a much larger sea of sugar cane. These features of the landscape are long gone. Integrity of feeling is understood to relate to a “property’s expression of the aesthetic or historic sense of a particular period of time.” In its present state, the Tai Lee Reservoir does not express its historic character and does not allow the visitor to experience an awareness of its history and importance. Regarding integrity of association, there is no remaining relationship between the remnant of the reservoir and the Chinese enterprise in rice- and cane-cultivation in the late 1800s.

Section 7 Summary and Recommendations

7.1 Summary

We understand: that for Chinese rice growers in Waimānalo in the late 1800s, “Their main source of water came from two reservoirs built by the Chinese—one located close to the Hawaii Irrigation Office called Tai Lee and the other just below Foremost Dairy called Wing Kee. These reservoirs still maintain their original names” (Enoka 1978:35).

The Tai Lee Reservoir is depicted on a 1919 US Army War Department map (see Figure 15) but is not depicted on available earlier maps including the 1884 Jackson Map (see Figure 11), the 1906 Donn map (see Figure 13), or the 1916 Wall map (see Figure 14). This appears to be an omission that earlier maps simply did not show the reservoir which may have been built shortly after the Reciprocity Treaty of 1876 which created a spike in agricultural production.

It is understood that commercial sugarcane cultivation in Waimānalo was very much a Chinese enterprise between 1876 and 1898 when many Chinese moved out of rice cultivation into sugar cane cultivation:

> Tai Lee’s plantation was increased until he had about 800 acres in cane. Following his success as a cane grower, other Chinese took up other nearby sections until the total area cropped was perhaps 1200 acres, or about half as much as the present [1931] cane area. [*Honolulu Advertiser* 18 November 1931:1]

There was an unusual arrangement in which Chinese harvested cane was processed by the (native Hawaiian) John Adams Kuakini Cummins’s Waimanalo Sugar Company that was chartered in 1880:

> The company built and operated a mill, purchasing the cane grown by the Chinese farmers. This arrangement lasted fifteen or twenty years and it was not until after annexation [1898] that the milling company commenced growing cane on its own account. [*Honolulu Advertiser* 18 November 1931:1]

It is understood that commercial sugarcane cultivation in Waimānalo was “Started by Chinese who worked the Paddies” and that “Fields [were] named for Pioneers” (*Honolulu Advertiser* 18 November 1931:1):

> […] The plantation [at Waimānalo] dates back to 1876, the Reciprocity Year. when one Tai Lee, a Chinese rice planter, lured away from paddy by the promise of greater profits from sugar commenced the cultivation of cane on the fields immediately southwest and mauka of the present Waimanalo Village.
>
> In the meantime the Waimanalo Sugar Company was organized. The plantation is probably the only one in Hawaii where the sections and fields are known by the names of the original Chinese cane farmers. The “Tai Lee” section is still [1931] the heart of the plantation, comprising its richest lands. […] [*Honolulu Advertiser* 18 November 1931:1]

The Tai Lee Reservoir was built as an earthen dam reservoir and served the Waimanalo Sugar Co. as a component of the Waimānalo Ditch System through to the end of the enterprise in 1947.

Subsequently the Tai Lee Reservoir was effectively repurposed to support diversified agriculture with a new “Tai Lee” ditch created to distribute water to the east by 1952 (see Figure 21).

The Tai Lee Reservoir has been transformed by grading and infilling since the Department of Agriculture concluded an Environmental Assessment (EA) for abandonment of the Waimanalo Ditch Irrigation System in August 1993 and is suggested in this study to be an archaeological historic property. It is understood that the substantial fill observed within the interior of the former reservoir was deposited after decommissioning. The character-defining features of this archaeological historic property are suggested to be the perimeter low and wide earthen walls on the northwest and east sides of the former reservoir.

The Tai Lee Reservoir is suggested to be significant under HAR §13-284-6 Criterion a, as associated with events that have made an important contribution to the broad patterns of our history, specifically Chinese rice growing and Chinese sugarcane growing transitioning into sugar plantation cultivation. The Tai Lee Reservoir is suggested to be significant under HAR §13-284-6 Criterion d, for having yielded information important for research on history of Chinese agriculture in Waimānalo.

7.2 Recommendation

The Tai Lee Reservoir Rehabilitation project is understood to have three major components (see Figure 4)

- Two rows of staggered bollards are proposed within the spillway and are intended to capture debris with the height of the bollards anticipated to be 5 feet [1.5 m].
- Grading will be required to address water ponding during flooding events. The graded area will be grassed and then maintained. This grading activity is understood as within the interior of the reservoir which has been subject to prior infilling efforts following decommissioning (August 1993)
- Vegetation, including all trees within the property, will be cleared.

None of these aspects of the project are expected to have a major impact on the character-defining feature of the reservoir which is evaluated as the perimeter low and wide earthen walls on the northwest and east sides of the former reservoir.

It is recommended that care be taken in the course of this Tai Lee Reservoir Rehabilitation project to minimize degradation of the earthen walls of the reservoir.

It is evaluated that if care is taken to minimize degradation of the earthen walls of the long-abandoned reservoir that a determination by HDOA (as per HAR §13-275-7) of “No historic properties affected” is warranted. It is recommended that this supporting study be submitted to the SHPD with a request for an SHPD determination letter and for SHPD concurrence with the HDOA determination of “No historic properties affected.”

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Appendix A References to Tai Lee in Newspaper Articles (through 1918)

Date	Newspaper	Title	Gist
1882 18 March	*Pacific Commercial Advertiser*	Notice	L. Akau held "[…] powers of attorney of the Koong Hook, Mau Sing, Quong Lee, Wing Joy Kee, Tai Lee, and Tai Sing Companies of Waimanalo […]"
1892 9 June	*The Daily Bulletin*	"Receiver's Sale on Foreclosure"	"Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881."
1892 9 June	*Pacific Commercial Advertiser*	"Receiver's Sale on Foreclosure"	"Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881."
1892 10 June	*The Daily Bulletin*	"Receiver's Sale on Foreclosure"	"Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881."
1892 10 June	*Pacific Commercial Advertiser*	"Receiver's Sale on Foreclosure"	"Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881."
1892 13 June	*Pacific Commercial Advertiser*	"Receiver's Sale on Foreclosure"	"Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881."
1892 14 June	*The Daily Bulletin*	"Receiver's Sale on Foreclosure"	"Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881."
1892 14 June	*Pacific Commercial Advertiser*	"Receiver's Sale on Foreclosure"	"Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881."
1892 15 June	*The Daily Bulletin*	"Receiver's Sale on Foreclosure"	"Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881."

Date	Newspaper	Title	Gist
1892 15 June	*Pacific Commercial Advertiser*	“Receiver’s Sale on Foreclosure”	“Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881.”
1892 16 June	*Pacific Commercial Advertiser*	“This Day: Receiver’s Sale on Foreclosure”	“Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881.”
1892 17 June	*The Daily Bulletin*	“Receiver’s Sale on Foreclosure”	“Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881.”
1892 18 June	*Pacific Commercial Advertiser*	“This Day: Receiver’s Sale on Foreclosure”	“Lease from the Waimanalo Sugar Co. to Tai Lee & Co., dated January 1, 1881, of record in Book 08, page 470, for the term of eighteen years from January 1, 1881.”
1899 10 May	*The Independent*	“Mortgages”	“Hop Lee Wai Co. to Tai Lee Wai Co. dated March 29, 18999; consideration $4,000 at 12% […] Leasehold, buildings, etc. situate at Kahana, Koolauloa, Oahu.”
1899 11 May	*The Independent*	“Leases Recorded April 3 1899”	“Tai Lee Wai co. to Hop Lee Wai Co. dated March 29, 1899; term 12 years from July 1, 1899; rental, $20 per annum; Liber 190, folio 88 40 acres land situate at Kahana, Koolauloa, Oahu.”
1899 20 May	*The Independent*	“Recorded April 13, 1899”	“Hui Lands of Kahana to Tai Lee Wai Co. […] 20 years; rental $5 per acre per annum […] Wet land at Kahana, Koolauloa, Oahu.”
1899 23 May	*The Independent*	“Leases”	“W.L. Peterson, Trustee, of Honolulu to Tai Lee Wai Co. […] term 15 years; rental $12 per annum […] L.C.A. 9961 at Kahana, Koolau, Oahu”
1899, 23 June	*The Independent*	“Leases”	“H. Kauaihilo, of Koolauloa, Oahu, to Tai Lee Wai Co. […] one acre of taro land at Kahana, Koolauloa,.”
1899 28 October	*The Independent*	“Conveyances”	“Sarah Waipa and husband, of Honolulu to Tai Lee Wai, Co. […] L.C.A. 7658 at Kahana, Koolauloa.”

Date	Newspaper	Title	Gist
1900, 2 February	*The Hawaiian Gazette*	"Co-Partnership Notice"	"[…] That Tai Lee Wai Company, A co-partnership of Kahana, Koolauloa […] has been formed to conduct the business of growing and milling and dealing in rice, and all business incident thereto, at said Kahana […]"
1900, 9 February	*The Hawaiian Gazette*	"Co-Partnership Notice"	"[…] That Tai Lee Wai Company, A co-partnership of Kahana, Koolauloa […] has been formed to conduct the business of growing and milling and dealing in rice, and all business incident thereto, at said Kahana […]"
1900, 17 February	*Pacific Commercial Advertiser*	"Co-Partnerships"	[long list of companies including W.C. Cummings & Co.…] Tai Lee Wai Co., Koolauloa, Oahu […]
1903, 20 February	*The Hawaiian Gazette*	"Mortagee's Notice of Intention to Foreclose and of Sale"	[…] to Tai Hop Wai and Lee Wai of said Kahana Valley, co-partners doing business under the firm Tai Lee Wai Company […]
1903, 27 February	*The Hawaiian Gazette*	"Mortagee's Notice of Intention to Foreclose and of Sale"	[…] to Tai Hop Wai and Lee Wai of said Kahana Valley, co-partners doing business under the firm Tai Lee Wai Company […]
1903, 30 September	*Pacific Commercial Advertiser*	"The Rice Depression"	"Mary E. Foster has brought a bill to foreclose mortgage against the Tai Lee Wai Co., rice planters and others for a debt of $50000 […]"
1903, 15 October	*Pacific Commercial Advertiser*	"Commissioner's Sale of Valuable Real Estate"	"Leaseholds and Rice Mill Situate at Kahana […] a cause entitled Mary E. Foster vs. Lum Kin, Trustee, Lum Kin and Lum Siu Kai, Co-partners doing business under the firm name of Tai Lee Wai & Company
1903, 22 October	*Pacific Commercial Advertiser*	"Commissioner's Sale of Valuable Real Estate"	"Leaseholds and Rice Mill Situate at Kahana […] a cause entitled Mary E. Foster vs. Lum Kin, Trustee, Lum Kin and Lum Siu Kai, Co-partners doing business under the firm name of Tai Lee Wai & Company

Date	Newspaper	Title	Gist
1903, 29 October	*Pacific Commercial Advertiser*	“Commissioner’s Sale of Valuable Real Estate”	“Leaseholds and Rice Mill Situate at Kahana […] a cause entitled Mary E. Foster vs. Lum Kin, Trustee, Lum Kin and Lum Siu Kai, Co-partners doing business under the firm name of Tai Lee Wai & Company
1903, 5 November	*Pacific Commercial Advertiser*	“Commissioner’s Sale of Valuable Real Estate”	“Leaseholds and Rice Mill Situate at Kahana […] a cause entitled Mary E. Foster vs. Lum Kin, Trustee, Lum Kin and Lum Siu Kai, Co-partners doing business under the firm name of Tai Lee Wai & Company
1903, 12 November	*Pacific Commercial Advertiser*	“Commissioner’s Sale of Valuable Real Estate”	“Leaseholds and Rice Mill Situate at Kahana […] a cause entitled Mary E. Foster vs. Lum Kin, Trustee, Lum Kin and Lum Siu Kai, Co-partners doing business under the firm name of Tai Lee Wai & Company
1903, 14 November	*Pacific Commercial Advertiser*	“Commissioner’s Sale of Valuable Real Estate”	“Leaseholds and Rice Mill Situate at Kahana […] a cause entitled Mary E. Foster vs. Lum Kin, Trustee, Lum Kin and Lum Siu Kai, Co-partners doing business under the firm name of Tai Lee Wai & Company
1903 14 December	*Pacific Commercial Advertiser*	“Real Estate Transactions”	“Tai Lee Wai Co., by Comr to Mary E. Foster; D; lands, leaseholds, bldgs., rice mill, &c, Kahana, Koolau Oahu; $60000 […]
1907, 26 January	*Pacific Commercial Advertiser*	“Realty Transactions”	“W.R. Castle, tr, to Seu Tin Yee, A.M.; mtg Tr of Tai Lee Wai Co et al on rice plantn of Tai Lee Wai Co, Kahana […]

Appendix B NRHP Registration Form for the Waimānalo Irrigation System

NPS Form 10-900 OMB No.10024-0018

(Oct. 1990)

United States Department Of the Interior
National Park Service

National Register of Historic Places Registration Form

This form is for use in nominating or requesting determinations for individual properties and districts. See instructions in *How to Complete the National Register of Historic Places Registration Form* (National Register Bulletin 16A). Complete each item by marking "x" in the appropriate box or by entering the information requested. If an item does not apply to the property being documented, enter "N/A" for "not applicable." For functions, architectural classification, materials, and areas of significance, enter only categories and subcategories from the instructions. Place additional entries and narrative items on continuation sheets (NPS Form 10-900a). Use a typewriter, word processor, or computer, to complete all items.

1. Name of Property

historic name Waimānalo Irrigation System

other names/site number Maunawili Ditch System/Kailua Ditch System

2. Location

street & number portions of TMK 4-2-09 & 4-2-10 and 4-1-8; 4-1-10; 4-1-11; 4-1-13; 4-2-27 ☐ not for publication

city or town Kailua & Waimānalo ☐ vicinity

state Hawaii code HI county City & County of Honolulu code 045 zip code 96734 & 96795

3. State/Federal Agency Certification

As the designated authority under the National Historic Preservation Act, as amended, I hereby certify that this ☐ nomination ☐ request for determination of eligibility meets the documentation standards for registering properties in the National Register of Historic Places and meets the procedural and professional requirements set forth in 36 CFR Part 60. In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. I recommend that this property be considered significant ☐ nationally ☐ statewide ☐ locally. (☐ See continuation sheet for additional comments.).

Signature of certifying official/Title Date

State or Federal agency and bureau

In my opinion, the property ☐ meets ☐ does not meet the National Register criteria. (☐ See continuation sheet for additional comments.)

Signature of certifying official/Title Date

State or Federal agency and bureau

4. National Park Service Certification

I hereby certify that the property is: Signature of the Keeper Date of Action

☐ entered in the National Register.
☐ See continuation sheet.
☐ determined eligible for the National Register
☐ See continuation sheet.
☐ determined not eligible for the National Register.
☐ removed from the National Register.
☐ other, (explain:)

73

Waimānalo Irrigation System
Name of Property

City & County of Honolulu, Hawaii
County and State

5. Classification

Ownership of Property
(Check as many boxes as apply)

- ☐ private
- ☐ public-local
- ☐ public-State
- ☐ public-Federal

Category of Property
(Check only one box)

- ☐ building(s)
- ☐ district
- ☐ site
- ☐ structure
- ☐ object

Number of Resources within Property
(Do not include previously listed resources in the count.)

Contributing	Noncontributing	
		buildings
		sites
7 types (see narrative description)		structure
		Total

Name of related multiple property listing
(Enter "N/A" if property is not part of a multiple property listing)
NA

Number of contributing resources previously listed in the National Register
1) taro terraces 50-80-15-516

6. Function or Use

Historic Functions
(Enter categories from instructions)
AGRICULTURE/irrigation facility

Current Functions
(Enter categories from instructions)
AGRICULTURE/irrigation facility

7. Description

Architectural Classification
(Enter categories from instructions)
Other/irrigation structures

Materials
(Enter categories from instructions)
foundation earth, concrete piers
walls wooden, concrete
roof
other earthen ditches, flumes, (cont' narrative description)

Narrative Description
(Describe the historic and current condition of the property on one or more continuation sheets.)

The 114-year old Waimānalo Irrigation System is a 17+ mile-long water collection and conveyance system in a 1,170-acre area, which has been in continuous operation since 1878 when it was first designed and built for providing water to the Waimānalo Sugar Company. The Waimānalo Irrigation System is comprised of three subdivisions: The Maunawili Ditch system, the Kailua Ditch system Waimānalo Pump Ditch system. All three are continuous lines of ditches and flumes leading from the tunnel, spring or reservoir sources to the farms in Waimānalo where the water is provided for agriculture.

The ditches, flumes and tunnels of the Waimānalo Irrigation System are located in the lush vegetation on the southern slopes of the Waimānalo Forest Reserve in Maunawili and Waimānalo Valleys under the awe-inspiring cliffs (*pali*) of the Ko'olau Ridge in the Ko'olaupoko District on the Island of O'ahu. The Maunawili system is generally at the 400 ft. elevation along the heavily wooded cliffs while much of the Waimānalo system descends onto the fertile farming valley at the 50 ft. elevation in Waimānalo Valley. Geographically, the Waimānalo Irrigation System carries water from the nearby mountainous Maunawili Valley where rainfall is between 83 to 100 inches per year and where numerous springs and streams provide an ample water supply to Waimānalo Valley where agricultural lands are flatter, broader and soils deeper, but where rainfall (41 inches per year), springs and Waimānalo Stream are insufficient for the agricultural needs of the land.
74 (continued)

NPS Form 900a *CMB Approval No. 1024-0018*

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 7 Page 1

Waimānalo Irrigation System
City & County of Honolulu, Hawaii

Other (#7) continued

The structure of the irrigation system is made up of 17+ miles of built-up earthen embankments for reservoirs, blasted-out earth/rock tunnel, cement-lined tunnel, earth-lined ditches, stone faced ditches, cement lined ditches, a few redwood flumes on trestles traversing gullies, and low plastic-lined redwood flumes at ground level, blasted-out tunnels, and iron pipes inserted into dike tunnels.

The structures include :

A) unlined and plastic lined open earthen ditches, stone-lined ditches and cement ditches: 1) 13.68 miles of supply ditches, 2) 17.48 miles of distribution ditches, 3) 2.11 miles distribution pipes, 4) 3.8 other ditches

B) 6 tunnels in Maunawili Valley: 1) The Clark Tunnel built on the "left branch" feeder stream to Maunawili Stream by Dr. W.O. Clark, C. Brewer and Co. geologist who supervised the construction of the Clark, Cooke, and Korean Tunnels between 1922 and 1926 (Takasaki et al, 1969), 2) Cooke Tunnel built on the Omao Stream and named after Cooke, 3) the Korean Tunnel located where the feeder streams come together to form Makawao Stream. The name suggests that Korean laborers built the tunnel, however, no supporting documentation has yet been found, 4) The Fault Tunnel located above the ditch in Makawao Valley unlike the other tunnels this is just a pipe sunk into the dike system and not part of a stream system, 4)
5) Aniani Tunnel under Anianinui Ridge conveys water between Maunawili and Waimānalo Valleys; and 6 wells in Waimānalo: 1 and 2) Plantation tunnels, 3 and 4 "City and County" Tunnels, and Wells no. 408 and 420. A tunnel and flume system was completed in 1923 to tap water from Kawainui Marsh and pumps were installed to deliver water to Waimānalo.

C) Excess flow from Waimānalo Stream, the only stream in the Waimānalo Valley which approaches perennial flow - was diverted and stored in an area called "Waimānalo Lagoon." Intermittent flow from other streams, drainage from irrigated fields, and even domestic sewage were stored in this lagoon, which was an important source of irrigation water during the dry summer months. Presently, this Lagoon system is not being used.

D) 33 redwood flumes still exist of a former 52 flumes in 1985. Only 1 of these flumes is in Maunawili Valley, the other 32 are in Waimānalo.

E) 3 earthen embankment reservoirs feed the system (Maunawili Reservoir, Kailua Reservoir, and Wing King Reservoir), all in Waimānalo.

Description (#7) continued

The irrigation flume system was extended from 1920-1926 integrating additional surface and ground water. Between 1900 and 1924, five water development tunnels were driven in upper Maunawili Valley to supplement the flow of the ditch.

The Waimānalo Irrigation system was first constructed in 1878 by the Waimānalo Sugar Company for Waimānalo Plantation, which at one time had twenty-six hundred acres planted in sugar cane. However, the practice of transporting water from one location to another for agriculture is a continuation of pre-historic agricultural practices in Hawaii. In both Waimānalo (NRHP Nomination Form 50-80-15-516) and Maunawili Valleys there are extant stone-faced and earthen ditches from pre-Contact days which were used to transport water from springs and streams to irrigate taro fields.

There are access 4-wheel drive right-of-ways along most the Ditch system in Maunawili Valley. The golf course development underway there are plans to relocate the access road in Maunawili Valley. In Waimānalo, rural paved roads parallel many of the ditches and provide easy access for maintenance. Water is delivered through the system on Monday, Wednesday and Friday. On Tuesday and Thursday a five-man team walks the open ditch system for cleaning and repairs.

The Kailua Ditch is only partially in use now, and the most northwest part of the Maunawili Valley Ditch has also been temporarily abandoned and water is no longer pumped from Kawainui Marsh. But 75% of the original system is still in use. The system underwent its first set of major repairs in the 1930s and some fifty years later, following an overall general plan for encouraging and maintaining diversified agricultural development in Waimānalo (Bartholomew and Assoc., 1959) another major set of repairs was undertaken. Basically, the most recent repairs (1988-1989) was done to improve the efficiency of the system, primarily by replacing leaky flumes. Most of the wooden flumes are prone to weather deterioration and vandalism. These improvements allowed Waimānalo

Waimānalo Irrigation System
Name of Property

City & County of Honolulu, Hawaii
County and State

8. Statement of Significance

Applicable National Register Criteria
(Mark "x" in one or more boxes for the criteria qualifying for National Register listing.)

☐ A Property is associated with events that have to made a significant contribution to the broad patterns of our history.

☐ B Property is associated with the lives of persons significant in our past.

☐ C Property embodies the distinctive characteristics of a type period or method of construction or represents the work of a master or possesses high artistic values or represents a significant at distinguishable entity whose components lack individual distinction

☐ D Property has yielded or is likely to yield information important in prehistory or history

Criteria Considerations
(Mark "x" in all boxes that apply

Property is:

☐ A owned by a religious institution or used for religious purposes.

☐ B removed from its original location

☐ C a birthplace or grave

☐ D a cemetery

☐ E a reconstructed building object or Structure

☐ F a commemorative property

☐ G less than 50 years of age or achieved significance within the past 50 years

Areas of Significance
(Enter categories from instructions)

Agriculture, Conservation, Engineering
Transportation

Period of Significance
1878 - present

Significant Dates
1878-1913 Thomas & John Cummins sugar plantation
1918-1947 Waimānalo Sugar Company
1920-1941 C. Brewer & Co run sugar company
1947 sugar plantation liquidated
1947-1953 Waimānalo Agricultural Development Co.
1953-present Hawaii Irrigation Authority/State Dept. of Ag.

Significant Person
(Complete if Criterion B is marked above)
Thomas Cummins

Cultural Affiliation
sugar plantation, declaration of Waimānalo as an agricultural district

Architect/Builder
Dr. W.O. Clark, C. Brewer and Co. geologist who supervised the construction of the Clark, Cooke, and Korean Tunnels

Narrative Statement of Significance
(Explain the significance of the property on one or more continuation sheets)

9. Major Bibliographical Reference

Bibliography
(Cite the books, articles, and other sources used in preparing this form on one or more continuation sheets)

Previous documentation on file (NPS):
☐ preliminary determination of individual listing (36 CFR 67) has been requested
☐ previously listed in the National Register
☐ previously determined eligible by the National Register
☐ designated a National Historic Landmark
☐ recorded by Historic American Buildings Survey # _____
☐ recorded by Historic American Engineering Record # _____

Primary location of additional data:
☐ State Historic Preservation Office
☐ Other State agency
☐ Federal agency
☐ Local government
☐ University
☐ Other
Name of repository

_____

75

NPS Form 900a *CMB Approval No. 1024-0018*

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 1

Waimānalo Irrigation System
City & County of Honolulu, Hawaii

Statement of Significance (continued)

> The Maunawili Ditch system itself has a definite historic interest as an illustration of water engineering associated with the sugar industry in Hawaii... Generally, the Ditch runs along slopes with a simple bank and ditch construction with occasional dressed and mortared rock lining... It is certainly not the oldest or longest sugar ditch in Hawaii, but it may be one of the few still operating and is maintained at or near its original design (Hammatt and Borthwick, 1988).

The Waimānalo Irrigation System has integrity of use, being in continuous use since at least 1878. The historic context for Waimānalo Irrigation system provides background information about the pattern of history and development of agriculture in Hawaii.

> A key to understanding stream-related cultural resources in Hawaii is the realization that in prehistoric and historic times, Hawaiians were as much farmers as they were fishermen, and stream water was crucial to successful farming... Historic patterns of settlement tended to duplicate the prehistoric, and thus a close physical relationship with the water was maintained, even if the dependency on riparian cultivation was diminished (DLNR et al., 1990:234,235)

Hawaiian agriculture has shaped its history both in prehistoric and historic times. And Hawaii's water supply has determined its agricultural history too. The orographic effect of air masses rising and cooling as they rise over the mountains create localized rain in the windward valleys and especially at the back of Maunawili Valley, where Konahuanui stands as the highest of the peaks of the Koʻolau Range producing an annual rainfall between 83 and 100 inches per year. Transportation of water over distances such as the 17 miles of the Waimānalo Irrigation System, is not unusual in Hawaii. A more primitve version of this system was in use before Captain Cook arrived in these islands. Both Maunawili and Waimānalo Valleys both retain portions of their ancient irrigation systems (*'auwai*). In prehistoric times the water was diverted from the streams to grow wet taro in ponded areas. Several sites are not too far from the present modern ditch system. The modern ditches still link the valleys as they did in the past and in particular, the irrigation system emphasizes the importance of the great era of sugar cane cultivation. Cane cultivation by Thomas Cummins and his son James produced great wealth in Waimānalo and this affluence appears to have been amply distributed by great parties for which the Cummins were famous. King Kalakaua was a frequent guest at the Waimānalo plantation. More recently, diversified agricultural production adapting Hawaiian climate, soils and water supplies to the cultivation of fruit and vegetable crops and in particular, of flowering plants and decorative shrubbery for the local and foreign market.

The first sugar irrigation ditch was built by William H. Rice on Kauai in 1856. Many systems were built in the 1870s. They were the key to the success of sugar in Hawaii. The first great ditch, the Hamakua, was built on Maui, in 1878 by Alexander and Baldwin, the same year as we first have information concerning the Waimānalo Irrigation System. The East Maui Irrigation system may be the largest system with 394 diversions and 17 cubic feet per second (cfs) making it the largest waterway in Hawaii (DLNR et al, 1990:83). The repairs over the years have not substantially changed the system. Its location and use are the same as when it was first built. The earthen ditches - which in practice serve the same purpose as prehistoric Hawaiian *'auwai*, that is, to transport water from a plentiful source to an area with insufficient water resources. While modern improvements to the system consist of covering or enclosing ditches, this makes the system more efficient and more healthful but does not substantially alter the system. The Maunawili Ditch is forecast to potentially carry more than 4.5 Million gallons daily for periods of high demand (DLNR, 1985:17

> Listing in the National Register by the secretary of the interior cannot be overstressed as a key step in the protection of the rural area. The Advisory Council on Historic Preservation has established a working relationship with all other federal agencies, and the register and the council remain the most positive direct force for preservation at the federal level. They provide a process to assess the potential effect when proposals are made that can be deemed deleterious to the rural

NPS Form 900a CMB Approval No. 1024-0018

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 8 Page 2

Waimānalo Irrigation System
City & County of Honolulu, Hawaii

Statement of Significance (continued)

Geographical Data (#10) continued.

The Maunawili Ditch System lies within land within tax map key numbers 4-2-10:1 and 4-2-10:4 within the Waimānalo Forest Reserve. In Waimānalo Valley the Kailua Ditch System and the Waimānalo Pump System lie within tax map key numbers 4-1-8; 4-1-10; 4-1-11; 4-1-13; 4-2-27. The boundaries for the purpose of this nomination are corridors which outline the general directions of the ditch systems which wind around alot following the contours of the valley walls.

Bibliography

Austin, H.A.R.
1953 *Report to the Commissioner of Public Lands Territory of Hawaii covering the Availability of an Adequate Supply of Water for the Proposed House Lot and Farm Lot Subdivisions in Waimanalo*, Honolulu.

Bartholomew and Associates
1959 "A General Plan for Waimanalo Valley, Island of Oahu, Territory of Hawaii, Honolulu, Hawaii."

Condé, Jesse C. and Gerald M. Best
1973 *Sugar Trains: Narrow Gauge Rails of Hawaii*, Glenwood Publishers, Felton Calif.

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1985 *Maunawili Ditch Improvements: Environmental Impact Statement*, A Draft, Honolulu.

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1990 *Hawaii Stream Assessment: Hawaii's Streams and their Instream and Riparian Resources: A conservation Point of View*, A Draft, Honolulu.

Hammatt, Hallett H. and Douglas Borthwick
1988 Archaeological Reconnaissance of the Mauka Portion of Phase II Waimanalo Agricultural Park Waimanalo, O'ahu, Cultural Surveys Hawaii.

Murtagh, William
1990 *Keeping Time: The History and Theory of Preservation in America*, Sterling Publishing Co., Inc., New York.

Verbal boundary description

The Maunawili Ditch System lies within land within tax map key numbers 4-2-10:1 and 4-2-10:4 within the Waimānalo Forest Reserve. In Waimānalo Valley the Kailua Ditch System and the Waimānalo Pump System lie within tax map key numbers 4-1-8; 4-1-10; 4-1-11; 4-1-13; 4-2-27. The boundaries for the purpose of this nomination are the corridors which confine the winding ditches and flumes which follow the contours of the valley walls. These boundaries do not accurately reflect the 1173 acres in which the Waimānalo Irrigation System is situated.

Verbal boundary justification
The Ditch System in Maunawili Valley lies at the back of the valley along the 400' elevation. Once the water has breached the Anianinui Ridge the irrigation system descends to between the 50 and 100 ft. elevation following along the back roads of Waimānalo and which is distributed at each farm. Since there are so many branches it is not appropriate to draw a trapezoidal area encompassing all these branches because it would give one the wrong impression about how much land belongs with the system. 80

NPS Form 900a *CMB Approval No. 1024-0018*

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 10 Page 2

Waimānalo Irrigation System
City & County of Honolulu, Hawaii

Verbal boundary description
The Maunawili Ditch System lies within land within tax map key numbers 4-2-10:1 and 4-2-10:4 within the Waimānalo Forest Reserve. In Waimānalo Valley the Kailua Ditch System and the Waimānalo Pump System lie within tax map key numbers 4-1-8; 4-1-10; 4-1-11; 4-1-13; 4-2-27. The boundaries for the purpose of this nomination are the corridors which confine the winding ditches and flumes which follow the contours of the valley walls. These boundaries do not accurately reflect the 1173 acres in which the Waimānalo Irrigation System is situated.

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NPS Form 900a *CMB Approval No. 1024-0018*

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 10 Page 2

Waimānalo Irrigation System
City & County of Honolulu, Hawaii

A list of photos accompanying this nomination for the Waimānalo Irrigation System in Waimānalo Valley Hawai'i, May 1, 1992, photographs by V. Creed (Negatives in the possession of V. Creed)

1. View of Kailua Reservoir in Waimānalo with Ko'olau Mountains in the background, View to South,
2. Unlined Ditch (Fukui #3 ditch) with Cement Culvert for Driveway in Foreground, View to East
3. Unlined Ditch (Fukui #3 Ditch) with Closed Gate in Middle Ground, View to West
4. Murakami #5 Ditch with Stone and Cement Facing, View to East
5. Murakami #5 Ditch with Stone and Cement Facing with Wooden Ditch in Background Traversing a Gully, View to East
6. Redwood Flume #39 Raised Several Feet off the Ground, View to East
7. Redwood Flume #39 Showing Plastic Lining Inside, View to East
8. Redwood Flume #39 Showing Hole Temporarily Stopped up with Cloth, View to South
9. Unlined Ditch with Cement and Wood Gates and Culvert Crossings, View to West
10. Wooden Flume, View to West
11. Previous Ditch Area, Now Replaced with Pipes and Gauges, View to Northeast

NPS Form 900a *CMB Approval No. 1024-0018*

United States Department of the Interior
National Park Service

National Register of Historic Places
Continuation Sheet

Section number 10 Page 3

Waimānalo Irrigation System
City & County of Honolulu, Hawaii

List of Maps and Other Contributing Documents

1. USGS 7.5 minute series map, Koko Head Quad, Showing Majority of Waimānalo Irrigation System.
2. 1959 Map Showing Entire Waimānalo Irrigation System by Harland Bartholomew & Associates
3. 1986 Location Map of the State of Hawaii, Department of Land and Natural Resources for Maunawili Ditch Improvements, Maunawili, Koolaupoko, Oahu, Hawaii
4. Close Up of Maunawili Ditch System Improvments, 1986
5. Inventory of Ditch System, 1992
6. Newspaper Clipping Showing Waimanalo Sugar Mill and High Chiefess Kahalewai, first wife of John A. Cummins from *Historic Hawai'i News*, November 1978, p. 5 and 6
7. Xerox of 1987 photo by V. Creed of Flume #19 in Maunawili Valley at time of its Deconstruction

A list of photos accompanying this nomination.

1. View of Kailua Reservoir in Waimānalo with Ko'olau Mountains in the background, View to South
2. Unlined Ditch (Fukui #3 ditch) with Cement Culvert for Driveway in Foreground, View to East
3. Unlined Ditch (Fukui #3 Ditch) with Closed Gate in Middle Ground, View to West
4. Murakami #5 Ditch with Stone and Cement Facing, View to East
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