

BOARD OF WATER SUPPLY

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



November 7, 2014

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NOV 23 2014

Ms. Jessica Wooley, Director
State of Hawaii
Department of Health
Office of Environmental Quality Control
235 South Beretania Street, Room 702
Honolulu, Hawaii 96813

Dear Ms. Wooley:

Subject: Draft Environmental Assessment, Mākaha Valley Lo'i Restoration Project, TMK: 8-4-02: Portion 14, Alahele Street, Wai'anae, O'ahu

We transmit the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) for the proposed Mākaha Valley Lo'i Restoration Project by Mohala I Ka Wai, for publication in the next available edition of the Environmental Notice.

Enclosed is a completed Office of Environmental Quality Control Publication Form, two (2) copies of the DEA-AFONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to your office.

If you have any questions, please contact Barry Usagawa, Water Resources Division, at 748-5900.

Very truly yours,

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

Enclosures

cc: Mohala I Ka Wai

**APPLICANT ACTIONS
SECTION 343-5(C), HRS
PUBLICATION FORM (JANUARY 2013 REVISION)**

Project Name: Mākaha Valley Lo'i Restoration Project
Island: O'ahu
District: Wai'anae
TMK: 8-4-002 por. 014
Permits: City & County DPP: Building Permit, Grading and Grubbing Permit/Soil Conservation Plan. State DLNR: Archaeological Preservation Plan. State DOH: NPDES Discharge Permit. U.S. Fish and Wildlife Service: Incidental Take Permit.

Approving Agency:

Board of Water Supply, 630 S. Beretania St., Honolulu, HI 96843

Contact: Barry Usagawa , Telephone: (808) 748-5900, Email: busagawa@hbws.org

Applicant:

Mohala I Ka Wai, 87-149 Maipela St., Wai'anae, HI 96792

Contact: Cynthia K. L. Rezendes, Telephone: (808) 497-1432, Email: rezentesc@aol.com

Consultant:

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

Contact: Gabrielle Sham, Telephone: (808) 536-6999, Email: gabrielle@townscapeinc.com

Status (check one only):

- X**DEA-AFONSI Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day comment period ensues upon publication in the periodic bulletin.
- __**FEA-FONSI Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov; no comment period ensues upon publication in the periodic bulletin.
- __**FEA-EISPN Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day consultation period ensues upon publication in the periodic bulletin.
- __**Act 172-12 EISPN Submit the approving agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov. NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.
- __**DEIS The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.
- __**FEIS The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.
- __** Section 11-200-23 Determination The approving agency simultaneous transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the applicant. No comment period ensues upon publication in the periodic bulletin.
- __** Statutory hammer Acceptance The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it failed to timely make a determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and that the applicant's FEIS is deemed accepted as a matter of law.
- __** Section 11-200-27 Determination The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.
- __** Withdrawal (explain)

Summary (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page):

The non-profit organization Mohala I Ka Wai has obtained conditional approval of a land license from the City and County of Honolulu, Board of Water Supply to develop the Mākaha Valley Lo'i Restoration (MVLN) project. The MVLN project is located on a 13-acre parcel, located within TMK 8-4-002:014, in Mākaha Valley, O'ahu. The project parcel is situated in the mid-valley just southwest of Kāne'ākī Heiau. The MVLN project will restore ancient lo'i kalo and traditional Native Hawaiian agriculture, protect archaeological sites, and conduct watershed management and community education activities that will benefit the BWS's Mākaha Valley watershed.

The proposed project is not expected to have a cumulative negative effect upon the environment. The proposed project will result in the removal of non-native vegetation and restoration of natural and cultural resources, thus returning the project area to its natural environmental condition and enhancing the biodiversity of the area. More importantly, the proposed project will enhance and perpetuate Native Hawaiian traditional and cultural practices.

Draft Environmental Assessment for the
Mākaha Valley Lo‘i Restoration Project

Mākaha Valley, District of Wai‘anae, Island of O‘ahu, Hawai‘i



Prepared for:
Mohala I Ka Wai

Prepared by:
 Townscape, Inc.

November 2014

Draft Environmental Assessment for the
Mākaha Valley Lo‘i Restoration Project

Mākaha Valley, District of Wai‘anae, Island of O‘ahu, Hawai‘i

Prepared for:

Mohala I Ka Wai

Prepared by:



Townscape, Inc.

November 2014

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Project Summary

Project Name: Mākaha Valley Lo‘i Restoration Project (MVLRL)

Applicant: Mohala I Ka Wai (MIKW)

Approving Agency: Board of Water Supply (BWS)

Project Location: Mākaha Valley, Wai‘anae, O‘ahu

TMKs: 8-4-002 por. 014

Anticipated Determination: Finding of No Significant Impact (FONSI)

Contact: Gabrielle Sham, Townscape, Inc.
(808) 536-6999, gabrielle@townscapeinc.com

Agencies and Parties Consulted:

Federal: U.S. Fish and Wildlife Service (USFWS)

State: Department of Health (DOH)
Environmental Management Division
Department of Land and Natural Resources (DLNR)
Commission on Water Resource Management
Division of Aquatic Resources
Division of Forestry and Wildlife
Engineering Division
Historic Preservation Division
Land Division
Office of Conservation and Coastal Lands
State House of Representatives and State Senate
Office of Hawaiian Affairs

City: Board of Water Supply (BWS)
Department of Environmental Services
Department of Planning and Permitting (DPP)
Honolulu City Council

Other: Mauna ‘Olu Estates Homeowners Association
Wai‘anae Neighborhood Board No. 24
Wai‘anae Mountains Watershed Partnership (WMWP)

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List of Acronyms

BMPs	Best Management Practices
BWS	Board of Water Supply
DLNR	Department of Land and Natural Resources
DOH	Department of Health
DPP	Department of Planning and Permitting
EA	Environmental Assessment
GAP	Gap Analysis Program
HRS	Hawai'i Revised Statutes
HSG	Hydrologic Soil Groups
MHI	Median Household Income
MIKW	Mohala I Ka Wai
MVLR	Mākaha Valley Lo'i Restoration
NPDES	National Pollutant Discharge Elimination System
ROH	Revised Ordinances of Honolulu
SAP	Special Area Plan
SCP	Sustainable Communities Plan
SIHP	State Inventory of Historical Properties
TMK	Tax Map Key
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WMWP	Wai'anae Mountains Watershed Partnership
WWMP	Wai'anae Watershed Management Plan

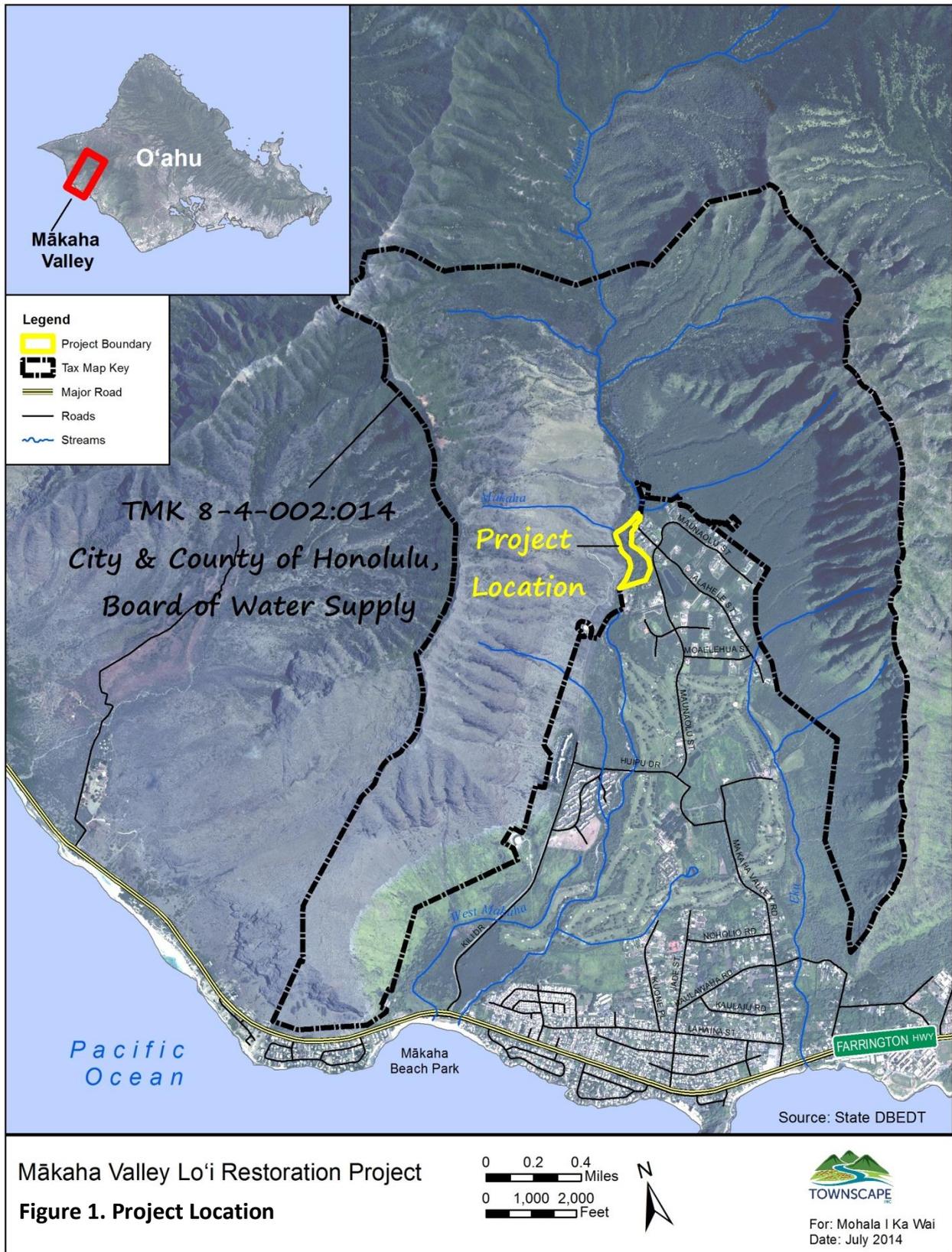
1. INTRODUCTION

1.1 Project Overview and Purpose

The non-profit organization Mohala I Ka Wai (MIKW) has obtained conditional approval of a land license from the City and County of Honolulu Board of Water Supply (BWS) to develop the Mākaha Valley Lo'i Restoration (MVLRL) project. The MVLRL project will restore ancient lo'i kalo and traditional Native Hawaiian agriculture, protect archaeological sites, and conduct watershed management and community education activities that will benefit the BWS's Mākaha Valley watershed. This Environmental Assessment (EA) is required under Chapter 343, HRS and meets the BWS land license conditions.

Established in 1999, MIKW is a community-based organization committed to protecting the water resources and the watersheds of the Wai'anae moku. MIKW is focused on conservation and environmental quality. The MVLRL project will be developed as a Hawaiian farm and cultural learning center, using 'āina based hands-on learning to cultivate native wetland and dryland plantings and restore historic sites. Ka'ala Farm Inc., with over 30 years of lo'i restoration and cultural education experience, will serve as a template for this project.

The proposed land license with the BWS includes an agreement with MIKW to incorporate forest restoration activities into the MVLRL project. This will include clearing invasive plants and planting native trees and shrubs on the MVLRL parcel and in the upper-third of the valley, which provides most of Mākaha's aquifer recharge. The BWS supports watershed protection and management as a proactive initiative to ensure water resource sustainability in support of its primary mission to provide a safe, dependable and affordable water supply. The BWS owns approximately 4,000 acres in the Mākaha watershed, Tax Map Key (TMK) 8-4-002:014 and 001. The BWS maintains major potable and non-potable water sources, reservoirs, and pipelines that serve residential and commercial developments in the valley. Small pockets of the valley consist of native forests, but the majority of the valley is covered with invasive species such as strawberry guava and coffee. Mākaha's dike aquifers have limited storage capacity and are susceptible to droughts, which may become more severe with future climate change. Mākaha Valley is relatively dry, receiving only 20 to 65 inches of annual rainfall and evapotranspiration rates of almost 50% (Ground Water in Hawaii, 2000). Due to these conditions, watershed management activities to sustain Mākaha's water resources are critical.

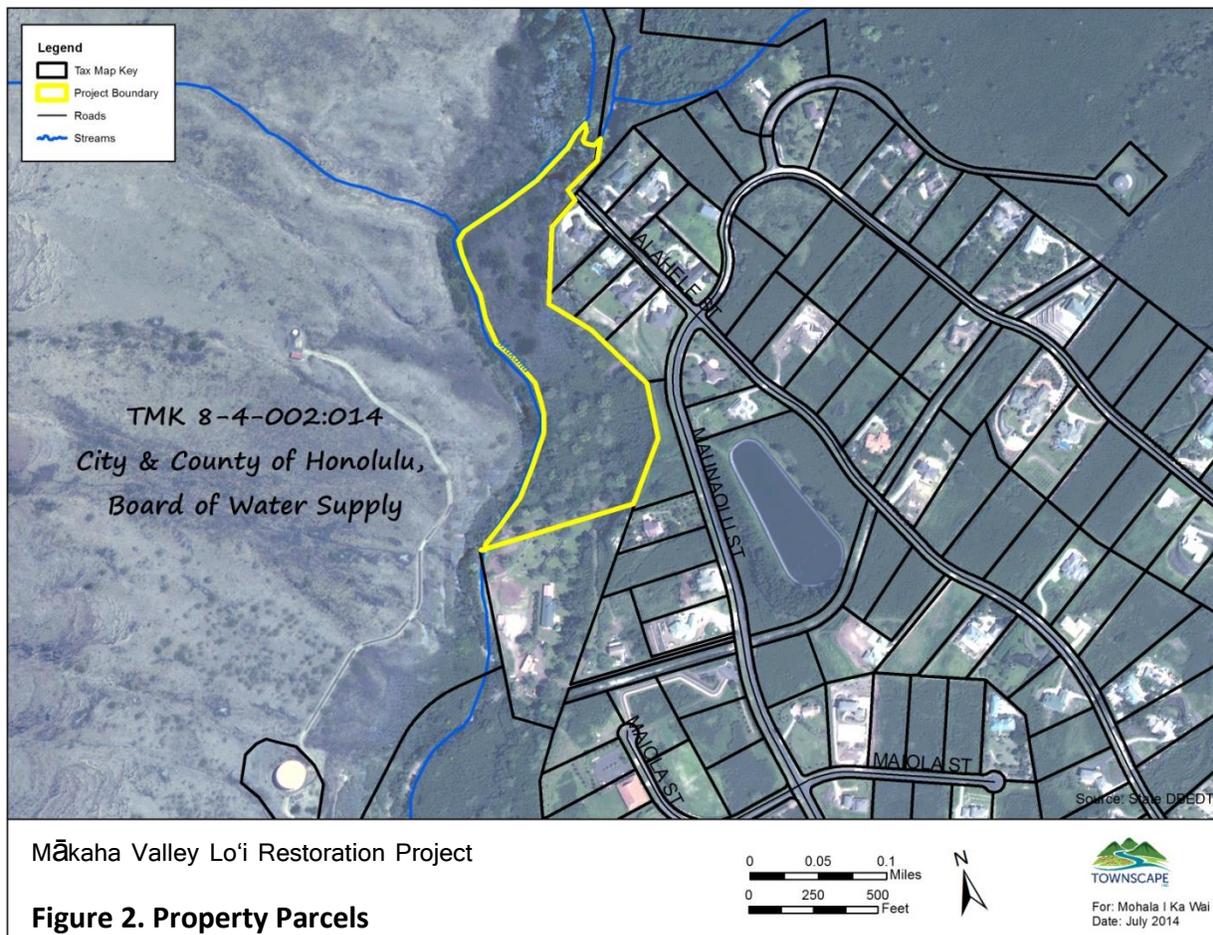


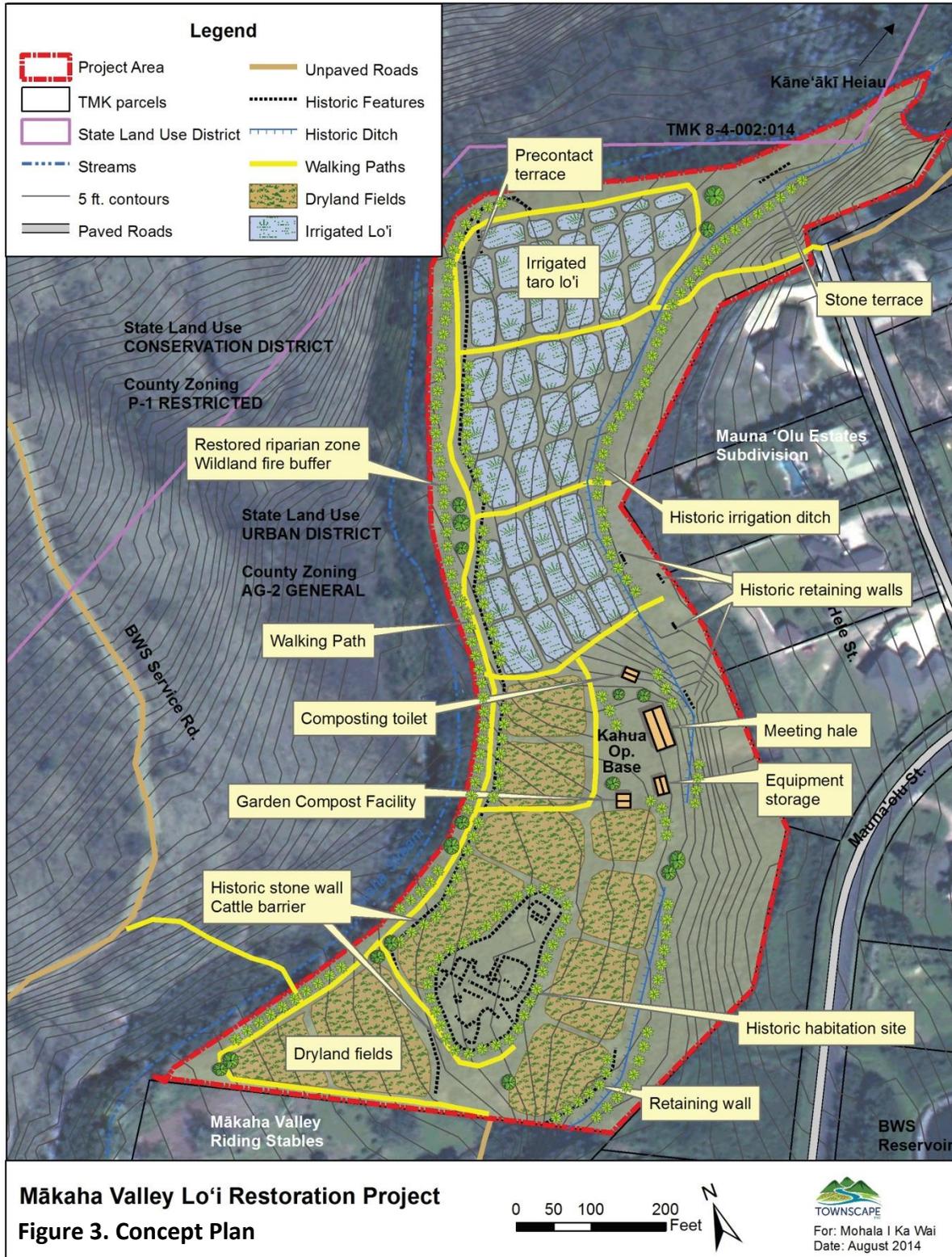
Mākaha Valley Lo'i Restoration Project

Figure 1. Project Location

1.2 Project Location

Mākaha Valley, located on the leeward side of O‘ahu, was ranked as first priority in the Wai‘anae Mountain Range for need of watershed restoration because of its contribution to the local potable water supply (Matsumoto & Tsuneyoshi). The 13-acre project parcel, located within TMK 8-4-002:014, is situated in the mid-valley just southwest of Kāne‘ākī Heiau. The parcel is bordered by the Mauna ‘Olu Estates subdivision to the east, the Mākaha Valley Riding Stables to the south, and Mākaha Stream to the west. The parcel is culturally rich and believed to be part of an ancient agricultural complex linked to the nearby Kāne‘ākī Heiau, which is one of O‘ahu’s largest and best preserved cultural sites (Sterling & Summers, 1978). An Archaeological Inventory Survey (June 2007) conducted for the project area found several historic and cultural sites that date back to plantation and pre-European contact times. These cultural resources, together with the large population of Native Hawaiians in the area, are the reasons why Mākaha will greatly benefit from a restored lo‘i kalo site and cultural learning center.





2. PROPOSED ACTIONS

The goals of the MVLR are to “balance resource management and efficient water use to protect and enhance water quality and quantity, promote educational opportunities and foster appreciation and awareness of the connections between land, water, and human activities, and to protect historic sites and promote traditional cultural practices that depend on healthy and sustainable land and water resources.” All construction in culturally sensitive areas will be supervised by a qualified archaeologist and cultural monitor and shall be approved by the State Office of Historic Preservation and the BWS before any site work is initiated. The proposed actions are as follows:

1. **Clearing and grubbing of invasive vegetation.**

The parcel is currently overgrown with non-native grasses, brush, and trees that must be cleared before any work can be done on the site. There are also several non-historic rock structures that will need to be dismantled. Clearing and grubbing of a section of the invasive species will be executed during the first year of the project with the help of volunteers from the community and local schools. No heavy machinery will be used for this process in order to minimize the risk of damaging historic sites.

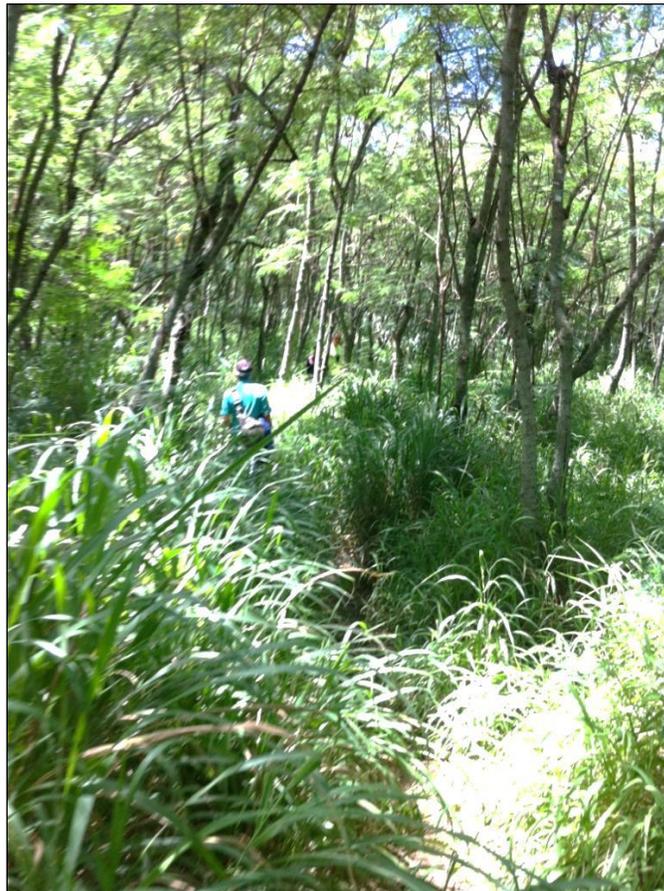


Figure 4. MVLR Site Covered with Non-Native Species

2. Scientific study of the watershed.

The proposed BWS land license includes a Consent of Entry to the upper Mākaha Valley watershed lands to aid the BWS in restoring the watershed and increasing, or at least maintaining the valley's water supply. During the first year, site research will be conducted and initial observations such as evapotranspiration rates and stream quality will be recorded, as baseline data for the later years of the watershed restoration.

3. Protect and restore historic terraces, irrigation systems, habitation sites, and other culturally significant sites.

Many of the historic sites are buried under the thick brush, and are anywhere from 50 to over 500 years old. These structures must be respected, protected from vandals, and restored to ensure that the story of this area can be shared with future generations.

4. Repair irrigation pipe, connect it to Glover Tunnel, and install spur lines.

There is a six-inch galvanized iron pipe installed in 1980 on the MVLRL site that can be used to transport non-potable water from Glover Tunnel to the site. Several patches for holes and adjustments for spur lines will be needed prior to releasing the water during year two. Shut off valves will be used to conserve water when it is not needed.



Figure 5. Hole in the 6-inch Pipe

5. Create, cultivate, and maintain lo'i kalo in the northern half of the parcel and dryland plantings in the southern half.

About three acres of lo'i kalo will be restored, while another five acres of the parcel will consist of Hawaiian dryland plantings such as 'uala (sweet potato), 'ulu (breadfruit), mai'a (banana), olonā (shrub used for rope), māmaki (tree used for tapa), wauke (paper mulberry, used for tapa), hala (pandanus tree), 'uhaloa (shrub that relieves sore throat), and kōko'olau (shrub used for medicinal tea). The cultivation and maintenance of lo'i kalo and dryland plantings will aid in the perpetuation of Native Hawaiian agricultural systems and traditional knowledge while making efficient use of water, a treasured resource in this area.

6. Establish legal access to the MVLR site.

Possible access roads are BWS Service Road via Kili Drive to the west or Mauna 'Olu Estates via Alahele Street to the east. Discussions will be needed with relevant entities to establish legal access to the MVLR site.



Figure 6. BWS Service Road Facing Mauka

7. Construct composting toilets.

To conserve water and increase self-sufficiency, the MVLR plans to use composting toilets beginning in year four. The design is a two-stall wooden structure with a tank beneath it to hold the waste. Saw-dust and other organic materials will be periodically

added to help to “digest” the waste and alleviate odor. The tank will be changed from time to time and the contents will be buried.

8. Construct the “Kahua Operation Base.”

Three building structures are proposed for the MVLR in year five: a community meeting halau, an equipment storage facility, and a garden compost facility. The 60' x 25' community meeting halau will be constructed using traditional Hawaiian woodwork and thatching with materials such as mangrove, ironwood, pili grass and loulu palm. The community meeting halau will be used for group gatherings and educational purposes. The equipment storage shed will be a secured 25' x 20' x 20' (length x width x height) shed for farm tools, equipment, and supplies that are required for the operation of the MVLR project. The garden compost facility will be a 20' x 20' x 15' open structure where plant matter will decompose and be used as organic fertilizer for the dryland plantings.

9. Create and maintain walking paths.

Walking paths are proposed for the MVLR parcel to provide access among the facilities, agricultural areas, and historic sites. The walking paths will be established by clearing invasive vegetation and using trail building best management practices (BMPs) to minimize potential erosion and account for sloped areas.

10. Install interpretive educational and safety signage.

Interpretive signage will help educate visitors about the cultural significance of archaeological sites and avoid damage to the properties within the MVLR parcel. The safety signage will warn people of steep inclines and streams.

11. Facilitate watershed restoration and preservation activities in the upper watershed.

MIKW and the MVLR community will engage in watershed management activities such as water conservation, feral ungulate control, fencing, and native species restoration. The long-term goal is to increase aquifer recharge rates and fulfill their goals of creating a more sustainable Mākaha.

12. Sale and donation of agricultural products.

Once the Native Hawaiian plants have matured on the parcel, they will be sold to generate income for the MVLR project. Kalo, vegetables, and value-added products made from hala and wauke will be sold. Wetland kalo currently averages about \$2.25 per pound. At an estimated yield of 20,000 pounds per acre per year of wetland kalo, the MVLR could potentially generate significant revenue from kalo sales (Fleming, 1994). There may also be incentives to donate kalo for work done in the lo'i by schools and organizations.

3. RELATIONSHIP TO LAND USE PLANS AND POLICIES

3.1 O'ahu General Plan

The O'ahu General Plan is the overall planning guide for the City and County of Honolulu. The original General Plan was created in 1982 and amended in 2002. The most recent update (2013) of the plan will be finalized as the 2035 O'ahu General Plan. Several of the long-range objectives and policies that pertain to the MVLR project include:

Section 3 (Objective A): To protect and preserve the natural environment

- Policy 3: Protect, restore and enhance stream flows and stream habitats to support aquatic and environmental processes and riparian, scenic, recreational, and Native Hawaiian cultural resources.
- Policy 8: Protect plants, birds, and other animals that are unique to the State of Hawai'i and the island of O'ahu, and protect their habitats.
- Policy 10: Increase public awareness and appreciation of O'ahu's land, air, and water resources.

The MVLR will preserve our island's natural environment by reshaping an area overgrown by non-native and invasive species into a functional Native Hawaiian farm and learning center. The MVLR project will protect rare and native species and promote awareness of traditional Hawaiian water usage to enhance stream and watershed health. Watershed restoration and the planting of native species will be pursued not only in the MVLR site but also in the upper valley, where most of the aquifer recharge takes place. A biological survey has identified the animal and bird species in and around the project area, and BMPs will be used to minimize the impacts to these species.

Section 10 (Objective B): To protect, preserve and enhance O'ahu's cultural, historic, architectural, and archaeological resources

- Policy 1: Encourage the restoration and preservation of early Hawaiian structures, artifacts, and landmarks.
- Policy 2: Identify, and to the extent possible, preserve and restore buildings, sites, and areas of social, cultural, historic, architectural, and archaeological significance.
- Policy 4: Promote the interpretive and educational use of cultural, historic, architectural, and archaeological sites, buildings, and artifacts.
- Policy 5: Seek public and private funds, and public participation and support, to protect, preserve and enhance social, cultural, historic, architectural, and archaeological resources.

- Policy 7: Encourage the protection of areas that are historically important to Native Hawaiian and other cultural practices, in order to further preserve and continue these practices.

The MVLR will protect O'ahu's cultural and historic resources by avoiding any development near historical sites and promoting educational awareness of these sites through signage and a learning program.

3.2 Wai'anae Sustainable Communities Plan

The Wai'anae Sustainable Communities Plan (SCP) presents a vision for the future of the rural district of Wai'anae. It addresses specific guidelines and policies to implement that vision. The goals of the MVLR project align with the Wai'anae SCP to create a community rooted in preservation and efficient use of land and natural resources, with a foundation of Native Hawaiian values including:

Section 3.5 Streams and Stream Floodplains

- 3.5.2.1: Establish stream conservation corridors.

The Wai'anae SCP proposed that stream corridors should be established to the fullest extent possible; and it includes Mākaha Stream in its list of suggested streams. The MVLR has a proposed riparian buffer zone along the section of the Mākaha Stream bordering the parcel to preserve the stream's quality and act as a wildfire buffer.

Section 3.6 Historic and Cultural Resources

- 3.6.2.1: Preserve the major concentration of cultural sites and allow access for cultural practices.
- 3.6.2.3: Government agencies should partner with community-based organizations in order to better manage Wai'anae's cultural sites.
- 3.6.2.4: Create signage for cultural sites.

The MVLR is an example of the Wai'anae SCP being put into action with the BWS partnering with the community organization MIKW and a number of other organizations to restore and preserve the many cultural and historic sites in Mākaha Valley. The MVLR project will preserve these sites by posting the appropriate interpretive signage in order to reduce vandalism and increase education about the history of the land.

Section 3.11 Parks and Recreational Areas

- 3.11.2.3: Plan for a system of Hawaiian cultural and educational parks.

The MVLR will develop a Community Meeting Halau that will serve as a central gathering and educational space for community members to receive hands-on learning about traditional Hawaiian agricultural and cultural practices.

3.3 Wai'anae Watershed Management Plan

The Wai'anae Watershed Management Plan (WWMP) is a long-range plan ongoing until 2030 for the balanced management of watershed resources for the district of Wai'anae. The Plan's main goal is to establish and maintain a sustainable watershed to serve present users and future generations. Together with seven other watershed plans for the island, the WWMP will form the O'ahu Water Management Plan, whose goal is to formulate an environmentally holistic, community-based, and economically viable plan that will provide a balance between: (1) the protection, preservation and management of Oahu's watersheds, and (2) sustainable ground water and surface water use and development to serve present users and future generations. The proposed MVLR project supports the following objectives of the WWMP:

Objective 1: Promote Sustainable Watersheds

- Strive to enhance and protect natural resources.

Objective 2: Protect and Enhance Water Quality and Quantity

- Maintain and improve sustainable quantities of ground and surface water.
- Protect the quality of ground and surface water for potable, recreational, and habitat needs.

Objective 3: Respect Native Hawaiian Rights and Traditional and Customary Practices

- Develop a working relationship with the Wai'anae Native Hawaiian Community for the sustainable management of the District's water resources.
- Incorporate traditional Hawaiian values and cultural practices into the modern context.

Objective 4: Facilitate Public Participation, Education and Project Implementation

- Partner with the community to promote a sense of kuleana, and to balance access to resources with management responsibility.

Objective 5: Meet future water demands at reasonable costs

- Efficiently meet water demands

The ground water recharge rates of invasive species have proven to be significantly lower than native species because of the invasive species' low throughfall and high evapotranspiration rates (Mair, 2009). The MVLR project will restore a small parcel in Mākaha Valley from non-native and invasive species to its native flora configuration of lo'i kalo and native plantings to potentially increase Mākaha's ground water recharge rates. The MVLR will care for water sources by efficiently using non-potable ground water from Glover Tunnel to irrigate its agriculture. Also as a learning center, the MVLR will teach the local community how to practice traditional Hawaiian water usage to conserve water and enhance stream and watershed health. Strategies include planting a riparian buffer along the Mākaha Stream, and planting the lo'i in down-sloping terraces to help soil and other sediments settle and filter contaminants before running into the stream. The MVLR will be established on traditional Hawaiian values, and will not only support, but will be a major part of the Native Hawaiian community.

3.4 Mākaha Special Area Plan

The Mākaha Special Area Plan (SAP) was created pursuant to a recommendation in the Wai'anae Sustainable Communities Plan (SCP) to balance Mākaha's rural environment with its urban zoning. This SAP focuses on a "Mākaha Rural Development Concept" to manage its unique environment. The proposed MVLR project aligns with the Mākaha SAP in these areas:

Infrastructure: "There will be increased demand for water. Drought conditions could reduce source amounts—need safety net with regard to supply."

The foundation of the MVLR is based on traditional Hawaiian values incorporated into modern cultural practices and sustainable land and water resources. At the site, community members will aim to conserve water and will not create excess wastewater through the use of dry composting toilets. The MVLR community will create a water supply safety net by restoring flora from invasive species to native species, which will increase ground water infiltration and water supply.

Gathering Place: The MVLR project will create a Hawaiian cultural center and community gathering place which is recommended by both the Wai'anae SCP and the Mākaha SAP.

Rural Development Concept: "Maintain important open spaces and view planes, preserve natural stream banks and waterways, maintain lands for agriculture, encourage energy and water conservation, and provide opportunities for residents to live, work, and play in Mākaha."

The MVLR project will implement these recommended rural development concepts through forest and stream restoration, erosion mitigation, and water conservation while cultivating a Native Hawaiian farm and learning center.

4. AFFECTED ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION MEASURES

4.1 Physical Environment

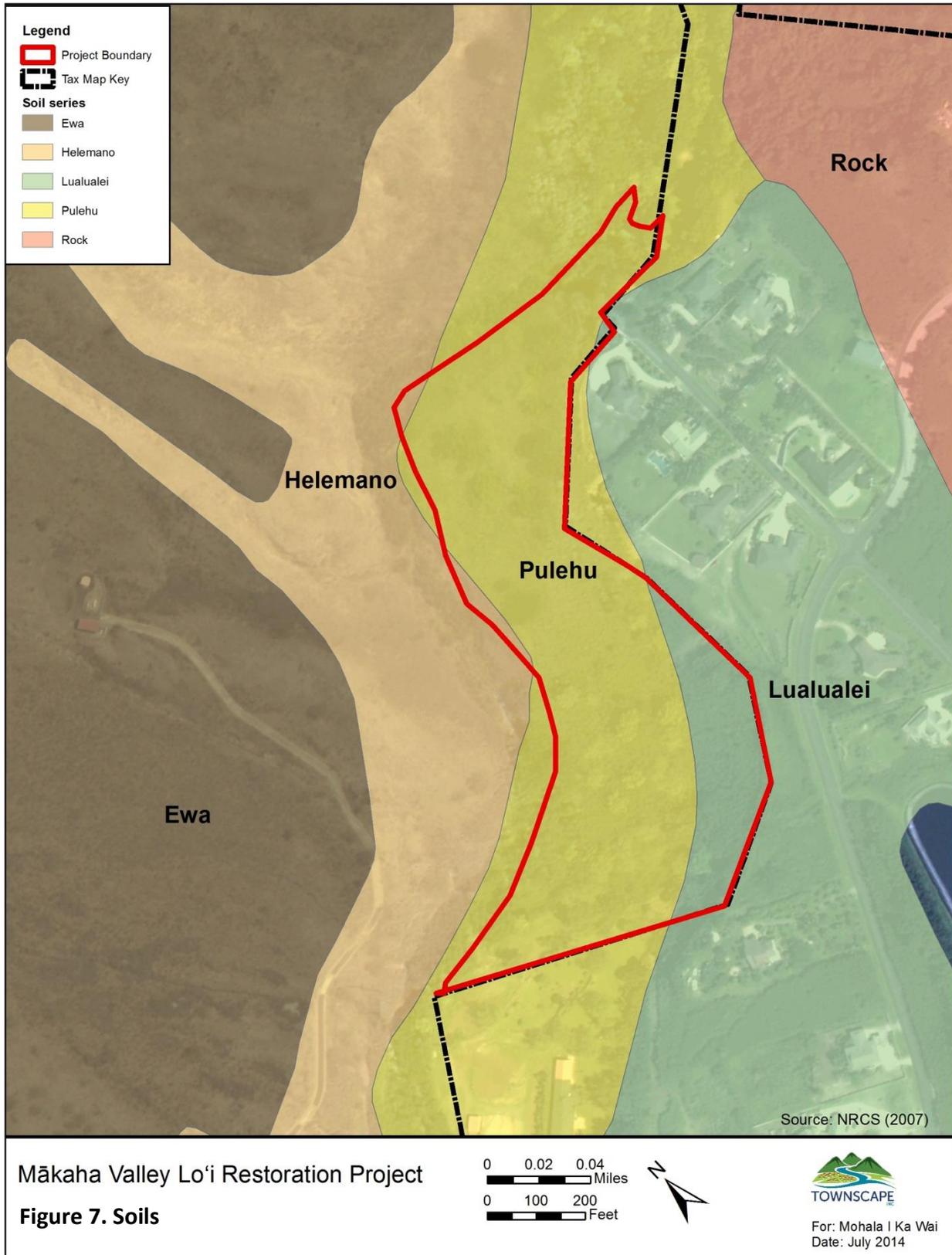
4.1.1 Climate

The climate of the MVLR site is reflective of the entire Wai'anae District which is relatively warmer and drier than the rest of the island of O'ahu. The warmer climate is due to cloud moisture from trade winds that travels from east to west. Most of the moisture is released by the time it reaches Wai'anae because of its westerly location. The precipitation that does reach the high elevations decreases as elevation decreases. Rainfall varies from an average of 65 inches per year in high mauka regions to about 25 inches per year in lower coastal areas. Precipitation is greater during winter months because of westerly Kona storms or cold fronts, while summer months are drier but have more northeasterly trade winds. Annual rainfall in upper Mākaha Valley has decreased from about 100 inches in the 1970's to 65 inches in 2011. The rainfall reduction affects the valley's water resources, forests, habitats and water users. (UH Dept. of Geography, 1983)

In its coastal regions, Wai'anae temperatures range between a low of 62°F in the winter and a high of 88°F in the summer (Townscape, Inc., 2009). According to NOAA data on climate change, temperatures have been rising at 0.3°F per decade over the past 40 years and are estimated to continue to rise over the next century (Temperature Anomalies, 2013).

Potential Impacts and Mitigation Measures

The proposed project is not anticipated to have any negative impact on climate. Instead, it will improve forest health, which is vital in mitigating climate change. Forest health improvements will include the removal of invasive species and the restoration of native plants. Some of the impacts of climate change include a decrease in rainfall and an increase in the intensity of major storms.



4.1.2 Geology and Soils

Approximately three million years ago, the island of O'ahu was created by two shield volcanoes: Wai'anae and Ko'olau. The Wai'anae volcano is the older of the two. Mākaha Valley is one of the nine ahupua'a of the Wai'anae moku.

The Wai'anae Range is composed of three lava groups: pāhoehoe (smooth lava), 'a'ā (rubbly lava), and a combination of the two. The lower coastal lava is about 2,000 feet thick and consists primarily of pāhoehoe. The mid-elevation lava is similar in thickness but consists of a combination of pāhoehoe and 'a'ā. The upper lava is about 2,300 feet thick and is mostly 'a'ā alkalic lava from cinder cones.

Soils were classified into different series by the USDA Soil Conservation Service (1972). There are three soil series found in the MVLR parcel: Pūlehu, Lualualei, and Helemano.

Soils are also classified into four hydrologic soil groups (HSG), groups A through D. These groups are classified based on minimum rates of infiltration obtained for bare soil after prolonged wetting, as in the case of long-duration storms. The ability of water to infiltrate into soil affects the likelihood of flooding—the higher the infiltration rate, the lower the risk of flooding. Pūlehu and Helemano soils are classified as HSG-B meaning that they have moderately high infiltration rates when thoroughly wetted, and moderately low runoff potential. The Lualualei soil is HSG-D classified, meaning that it has a very low infiltration rate when thoroughly wetted, and a high runoff potential.

The most abundant soil in the MVLR area is Pūlehu. It is a very dark brown clay loam with a water capacity of about 1.4 inches per foot. It has a slight erosion hazard but low areas with Pūlehu soil are subject to flooding. Research by the USDA Soil Conservation Service states that these soils are good for truck crops and pastures. The MVLR's proposed lo'i kalo and native dryland plantings will work well with these soil types.

Potential Impacts and Mitigation Measures

The proposed project is not anticipated to have any significant impacts on soils. Initial work will consist of clearing and removing invasive vegetation from the project area. Although this work will be done by hand, removal of the existing vegetation may cause minor soil erosion. The construction of the proposed Kahua Operation Base facilities will be located in a relatively level area in order to minimize grading of the site. BMPs will also be followed to minimize erosion and soil loss that may result from the removal of invasive vegetation and construction activities. Organic farming techniques will be used to conserve soil health including minimal tilling and the use of natural organic compost. There do not appear to be any hazardous materials within the project area, but soils should be tested prior to reuse. If encountered, appropriate measures such as wearing proper personal protective equipment will be taken to handle the hazardous waste.



4.1.3 Topography

The MVLR site is located in mid-Mākaha Valley. Slopes are generally moderate on most of the parcel, ranging from 6 to 15 percent, with the exception of a steep slope bordering the eastern side of the parcel. The property ranges in elevation from about 425 feet to 525 feet above mean sea level. The Mākaha Stream flows along the western boundary of the parcel. Other topographic features include historic terraces and sites.

Potential Impacts and Mitigation Measures

The proposed action is not anticipated to have a significant effect on the topography of the project area. The Kahua Operation Base facilities will be sited and designed to minimize the amount of cut and fill needed. The slope of the parcel allows the terracing of the lo'i and agricultural areas such that water use can be controlled and naturally flow by gravity, eliminating the need for pumping and promoting energy efficiency. The parcel will naturally drain into Mākaha Stream. Irrigated vegetation, lo'i kalo, berms and swales will serve to slow potential stormwater runoff in order to allow silt to settle out before the stormwater flows enter Mākaha Stream.

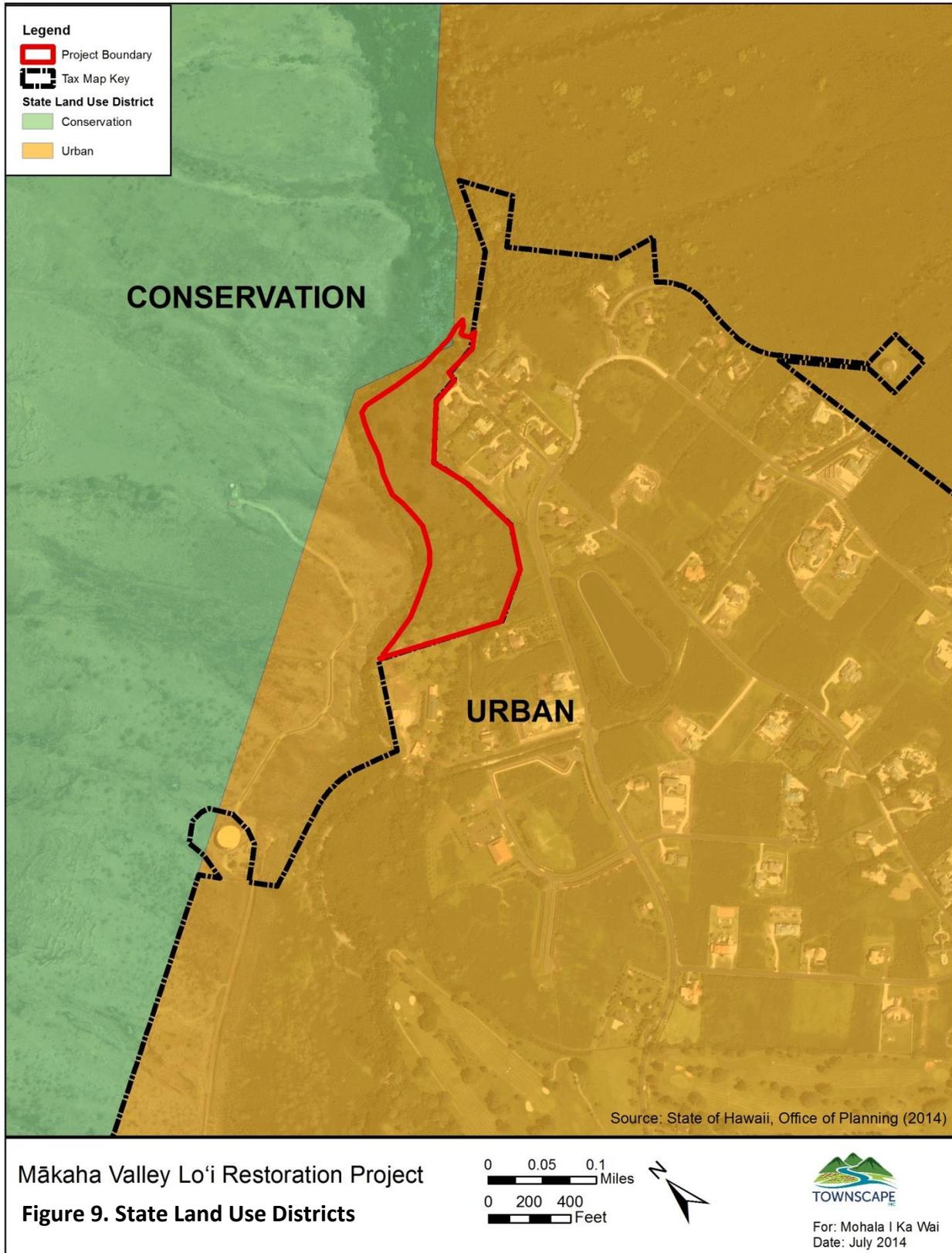
4.1.4 State Land Use and County Zoning

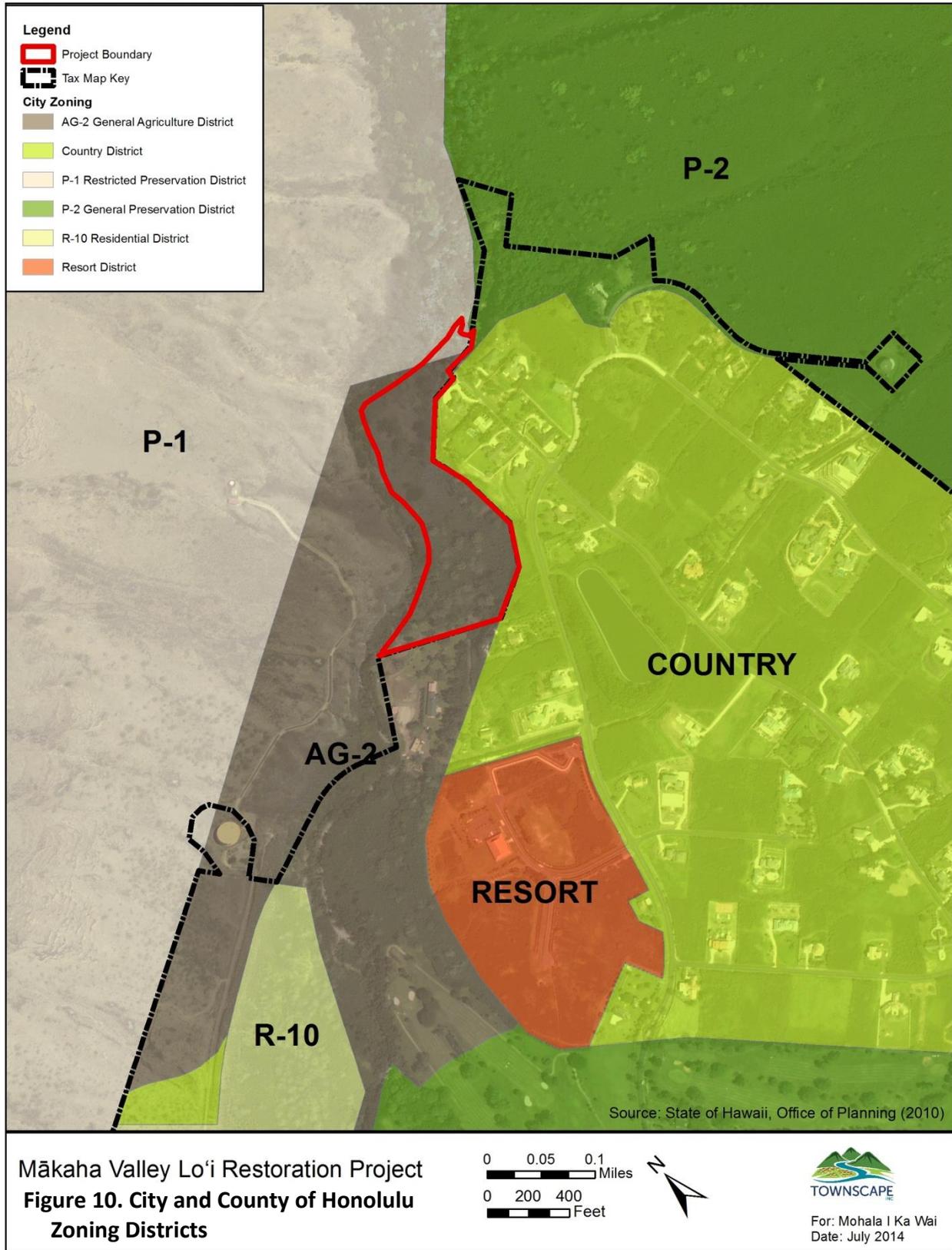
Approximately 99% of the MVLR parcel is designated as Urban under the State Land Use system, and the remainder 1% is classified as Conservation. The land classified as Conservation consists of a small area in the northwestern corner of the project area.

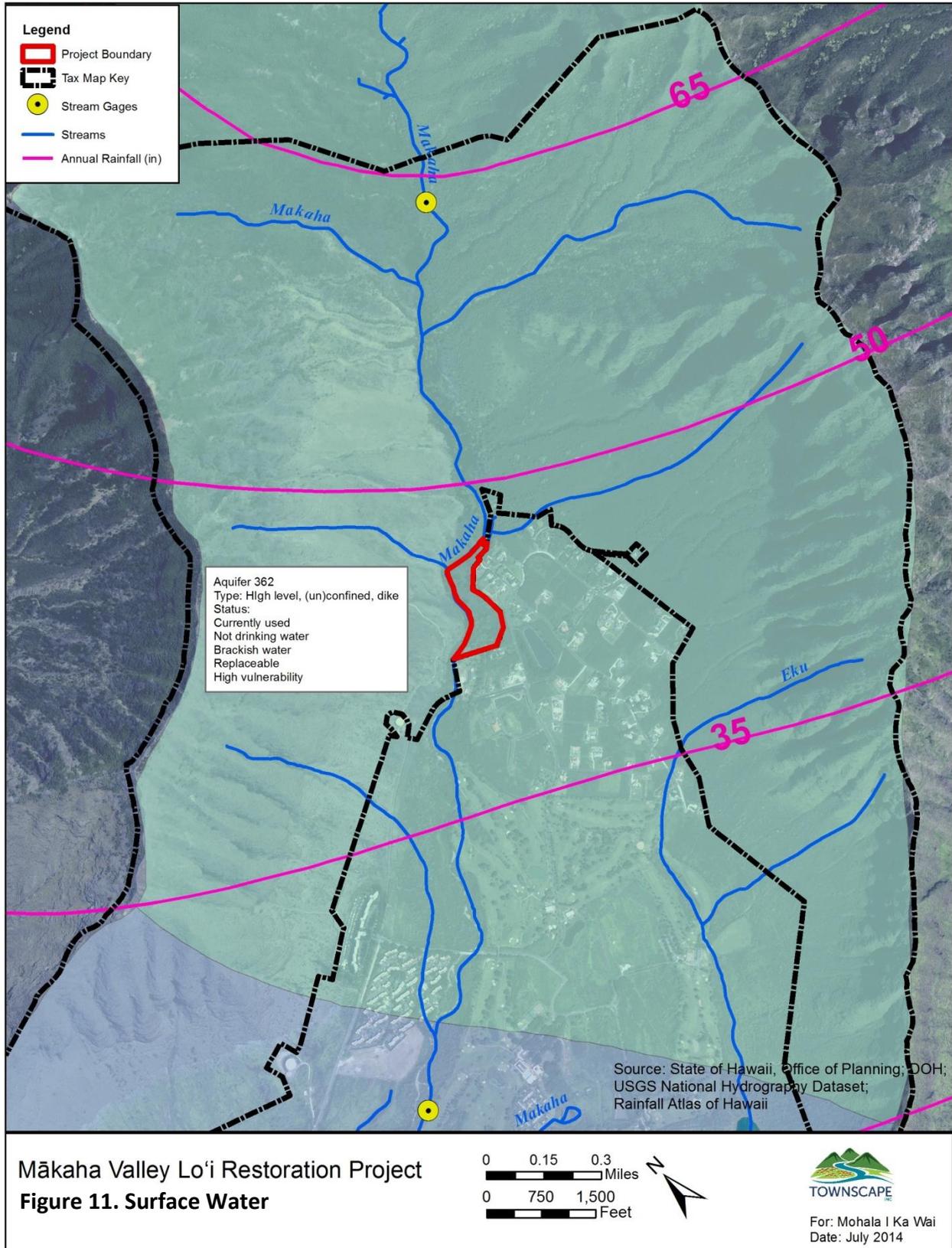
Under the City and County of Honolulu Zoning districts, the MVLR parcel is designated as AG-2 General Agriculture District (99%) and P-1 Restricted Preservation District (1%). County Zoning districts suggest and limit the type of development or activity that can take place on a parcel. The purpose of AG-2 lands is to preserve and protect agricultural activities on smaller parcels of land.

Potential Impacts and Mitigation Measures

The proposed action is consistent with the State Land Use and County Zoning designations. The land designated as Conservation will remain in its existing condition. The proposed action will only occur on the areas designated as Urban.







4.1.5 Surface and Ground Water Hydrology

There are two sources of surface water in Mākaha Valley: Mākaha Stream, and the smaller Eku Stream. Mākaha Stream originates at the back of the valley with most of the water feeding from the waterfalls of Mount Ka'ala, then it flows southwesterly and adjacent to the western boundary of the MVLR parcel. Mākaha Stream is classified by the State Commission on Water Resource Management (CWRM) as a perennial stream in the upper valley that is interrupted and becomes an intermittent stream at lower elevations. Mākaha Stream does not have a permanent connection to the ocean, but it is believed that in historic times, Mākaha Stream was a perennial stream that flowed every day from the mountain to the sea. The decrease in stream flow may be a result of climate change and stream water diverted for irrigation uses.

There are two U.S. Geological Survey (USGS) stream gage stations that monitor flow in Mākaha Stream: USGS Station Number 16211600 (located in the upper valley stream) and USGS Station Number 16211700 (located in the lower valley stream near Mākaha West Golf Course). There is also one rain gage station, State Key Number 842.1 that is located near the upper stream gage. USGS Station Number 16211600 provides average and peak stream flow data from 1959. The USGS Station Number 16211700 provides data from 1966 to 2004, when it was discontinued due to lack of funding.

Ground water in Mākaha comes from alluvial and dike aquifers in the upper valley. The sustainable yield for the Mākaha aquifer is three million gallons per day. Glover Tunnel, which will be the source of the MVLR's irrigation water, transports non-potable water from a dike aquifer. Unused tunnel flow is routed into Mākaha Stream at the Glover Tunnel portal.

Potential Impacts and Mitigation Measures

The proposed action will not significantly affect surface and ground water. The MVLR project will not require any stream diversions and is not anticipated to increase the amount of surface runoff. Instead, removal of invasive plants and restoration of native vegetation will improve ground water infiltration. Construction of the Kahua Operation Base facilities will increase the amount of impervious surface area, however, this increase will be negligible in relation to the overall drainage pattern which includes large areas mauka of the project site. Drainage from the lo'i will also be conveyed into Mākaha Stream, providing stream restoration opportunities and returning the environment to its historical condition.

Any grading activities associated with construction of the proposed Kahua Operation Base facilities will comply with County grading ordinances and include appropriate erosion control measures.

4.1.6 Biological Environment

The USGS National Gap Analysis Program (GAP) provides data on land cover, including detailed data on vegetation and land use. According to the GAP, over 63% of the land cover in Mākaha Valley is occupied by segregated alien vegetation while only about 3% or more of the land cover is covered by segregated native plants. Community organizations such as the WMWP and the Hawai'i Youth Conservation Corps have worked with the BWS to remove invasive species in Mākaha Valley. The alien species include alien grasslands, shrub lands and forests, and kiawe forests and shrub lands. The existing vegetation of the MVLr parcel is dominated by non-native species.

Based on initial consultation with U.S. Fish and Wildlife Service (USFWS), some species that may inhabit or have been documented in the general project vicinity of the MVLr are: federally endangered waterbirds (Hawaiian stilt, Hawaiian moorhen, and Hawaiian coot), the Hawaiian hoary bat (*Lasiurus cinereus semotus*), wedge-tailed shearwater (*Puffinus pacificus*) and Pacific golden plover (*Pluvialis fulva*).

A biological survey of the MVLr parcel was conducted on August 27, 2014 by AECOS, Inc. The survey concluded that there is minimal likelihood that federal or state endangered plants or animals are present in the project area as none were detected during field observations. The survey also found that there are no federally designated Critical Habitats that occur in the vicinity of the project area.

The biological survey did note that possibly one of the largest lemon gum specimen (based on the girth of the main trunk) in the State is present in the project area. The biological survey is provided in Appendix D.

In a previous biological survey by AECOS, Inc. (1997), a number of aquatic species were documented in the upper reaches of Mākaha Stream:

Table 1. Aquatic Species Found in Upper Mākaha Stream

Common Name	Scientific Name	Status	Abundance
Polychaete Worm	<i>Namalycastis Abuima</i>	Endemic ¹	Few
Leaf-litter Limpet	<i>Ferrissia Sharpi</i> (Sykes)	Endemic ¹	Common
Pond Snail	Small Sinistral Snail	Introduced ²	Common
Sow Bug	Isopoda	-----	Few
Sand Hopper	Amphipoda, Talitridae	-----	Common
Dragonfly (Adult & Nymph)	<i>Anax junius</i> (Drury)	Indigenous ³	Few
Damselfly (Adult)	<i>Ischnura sp.</i>	Introduced ²	Rare
Water Treader	Hemiptera, Mesoveliidae	Introduced ²	Common
Backswimmer	<i>Buenoa Pallipes</i>	Introduced ²	Common

(Fabricius)			
Predaceous Diving Beetle	<i>Rhantus Pacificus</i> (Boisduval)	Endemic ¹	Common
Crane Fly	Diptera, Tipulidae	-----	Few
Millipede	Diplopoda	-----	Few
Wrinkled Frog (Tadpole)	<i>Rana Rugosa</i> (Schlegel)	Introduced ²	Few

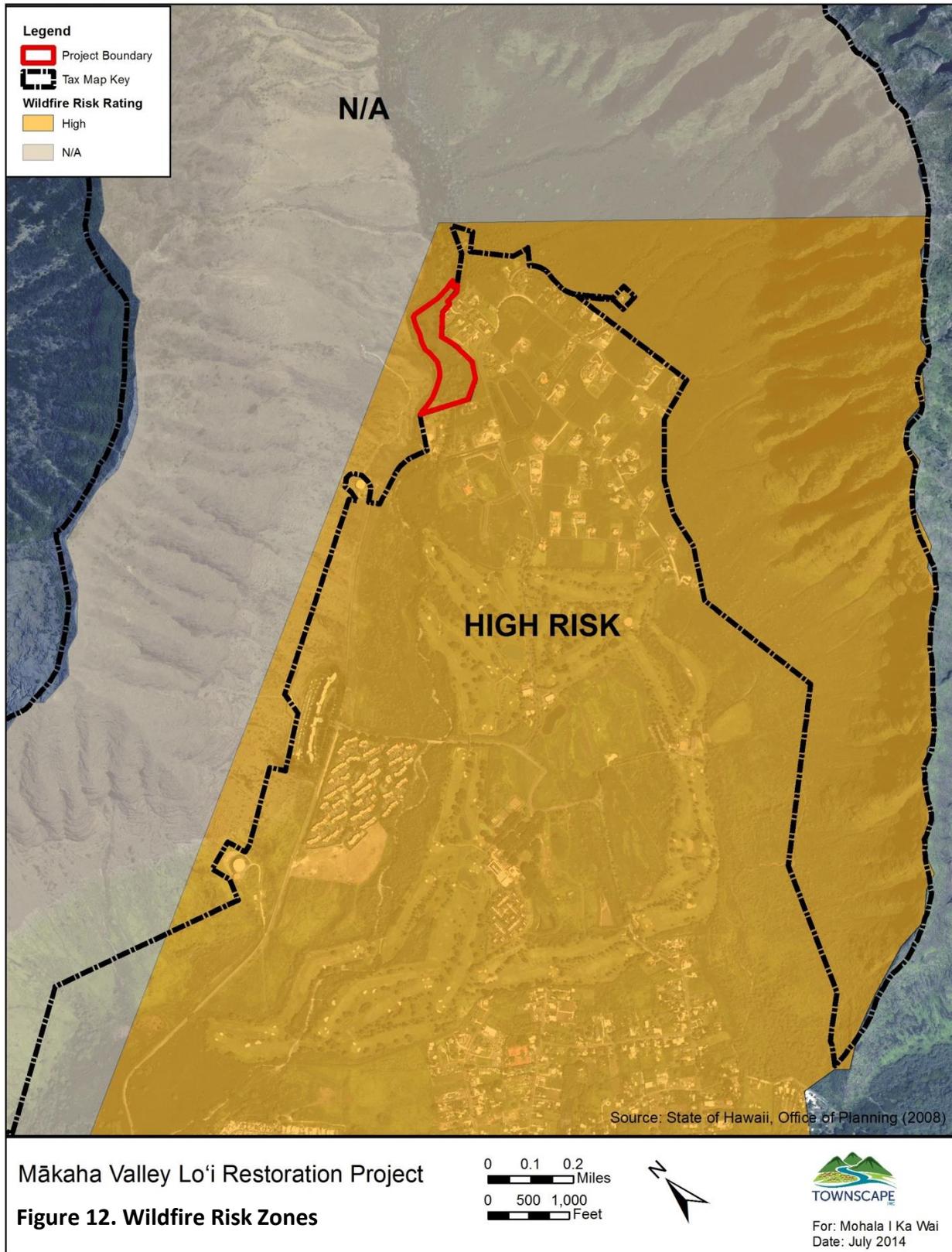
1. Species native to Hawai'i
2. Non-native species
3. Species native to the Pacific

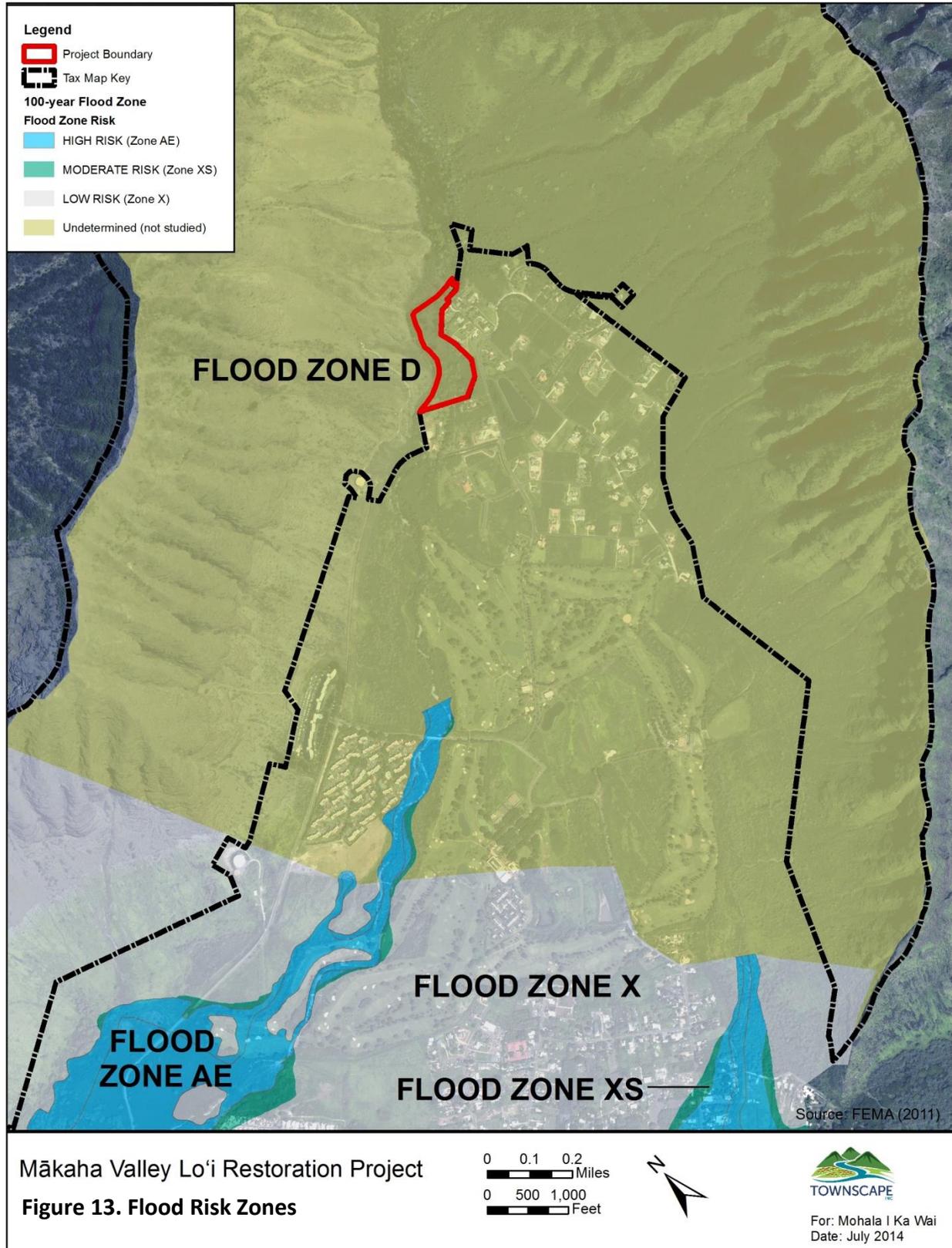
Potential Impacts and Mitigation Measures

The proposed project is not anticipated to have any negative impact on flora or fauna. Instead, the proposed project will restore native species and their habitat within the environment. Non-native vegetation will be cleared and removed, while native vegetation will be planted and restored in the project area. To prevent further growth of the invasive species, the non-native plants will be chipped, composted, and used as organic matter. This project will enhance the ecology of the area by restoring the area to a healthier and more diverse habitat for endangered animal species.

Although the Hawaiian hoary bat was not detected during the August 27, 2014 survey, USFWS has suggested that this bat may be present in the vicinity of the project area. Removal of vegetation within the project site may temporarily displace individual roosting bats. During the pupping season, females carrying their pups may not be able to rapidly vacate a roost site as vegetation is cleared. Also, adult female bats sometimes leave their pups in the roost tree while they look for food and very small pups may not be able to flee a tree after it has been felled. To prevent potential adverse effects as a result of the proposed project, clearing of woody vegetation that is taller than fifteen feet will be avoided during the pupping season from June 1 to September 15.

Restoration of the area is likely to attract native wildlife, including federally endangered species. BMPs from the USFWS will be followed to avoid and minimize adverse effects to federally endangered species. These BMPs include: using silt containment devices and curtailing work during heavy rain or flooding; inspecting equipment for pollutants before placing in an aquatic environment; and preventing erosion and covering exposed soil or under-layer materials. If a bird nest is found or a Hawaiian waterbird is observed within the project site, all activities will be temporarily suspended within a 100-foot radius and work will resume once the chicks/ducklings have fledged and the waterbirds leave on their own accord.





4.1.7 Fire and Flood Hazards

Mākaha Valley is known to be susceptible to wildfires and stream floods. The lower to mid valley, including the MVLR parcel, has been assessed as a high fire risk area by the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife. The hot and dry conditions in this area make it easy for fire to spread. In 2012, a brushfire in Mākaha burned over 500 acres within a few days.

The proposed project site is located in the Federal Emergency Management Agency's Flood Zone D which means there is an undetermined but possible flood hazard. With the MVLR parcel directly adjacent to Mākaha Stream, flash floods may occur from heavy mauka rains.

Potential Impacts and Mitigation Measures

The proposed action is not anticipated to increase fire or flood hazards. To address fire hazards, the MVLR project is proposing a riparian fire buffer which will aid in the prevention of spreading wildfires. The healthy vegetation and irrigated lo'i within the MVLR parcel will also serve as a fire buffer for residential areas located makai of the parcel.

Restoring the parcel with native vegetation will be consistent with the historical use and condition of the parcel, and will improve conditions to alleviate flooding. Native vegetation will improve storm water infiltration into the ground and reduce runoff. Grass swales will be used to prevent flood waters from damaging crops and aid in conveying flood waters into Mākaha Stream. The proposed Kahua Operation Base facilities will also be designed to minimize the amount of impervious surfaces.



Figure 14. Mākaha Brushfire in 2010

4.1.8 Air Quality and Noise

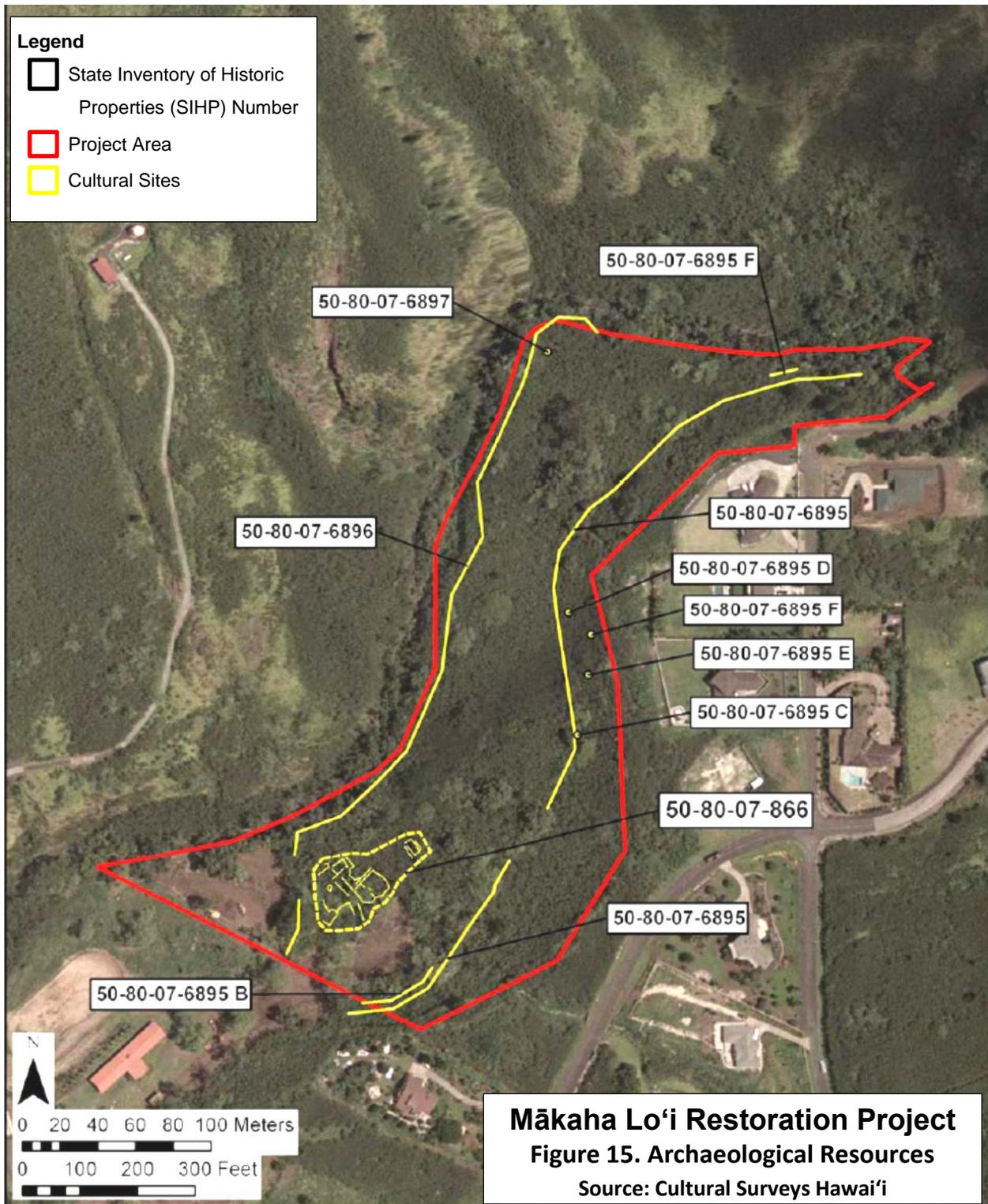
The ambient air quality around the MVLRL parcel is relatively good considering it is in a residential area in a rural town where there are no mass carbon emissions or other pollutants. Although vog drifting from Kīlauea Volcano in Hawai'i affects many residents on O'ahu, it has negligible effects in Mākaha, because most of the chemical pollutants have dissipated before it reaches there.

The amount of noise at the proposed site is minimal. Most of the noise comes from the sounds of nature: the stream, wind, and rustling trees. A small amount of noise comes from the nearby stables and residential units.

Potential Impacts and Mitigation Measures

Impacts on air quality and noise are anticipated to be minor and short-term. Short-term effects to air quality may result from the clearing and grading of the agricultural areas, which may generate dust affecting air quality in and around the MVLRL. BMPs will be used to mitigate dust generation, such as clearing and grading in smaller phases, and replanting shortly after clearing so that a wide area of soil is not exposed for long.

Short-term noise may result from construction-related activities. Unavoidable construction noise impacts will be mitigated to some degree by the contractor's compliance with provisions of the State Department of Health (DOH) Administrative Rules, Chapter 11- 46, "Community Noise Control." The proposed project is not anticipated to have significant long-term impacts on noise. Small operation equipment such as weed whackers, generators and light agricultural equipment may be used, but will be limited to day time hours between 8 a.m. and 5 p.m.



4.2 Socioeconomic and Cultural Environment

4.2.1 Historic and Cultural Resources

Mākaha Valley is rich in cultural findings and significance. Upper and mid-Mākaha Valley were extensively used before European contact—especially for kalo. There are many ancient terraces and an agricultural heiau (Kāne'ākī Heiau) dating back as early as 1400 A.D. There are also many historic remnants of the plantation era from the late 19th and early 20th century such as habitation sites and rock walls.

An archaeological survey conducted by Cultural Surveys Hawai'i Inc. (2007), found four historical properties on the proposed MVLR parcel, including two that date back to pre-European contact times:

- Plantation irrigation ditch (SIHP # 50-80-07-6895)
- Habitation site (SIHP # 50-80-07-866)
- Stone wall cattle barrier (SIHP # 50-80-07-6896)
- Pre-contact stone terrace (SIHP # 50-80-07-6897)

The **plantation irrigation ditch** dates back to the late 19th and early 20th century and is made out of concrete and rocks. It is currently filled with sediment, rocks, and overgrowth. There are retaining walls lining the irrigation ditch with four traces of the retaining walls on the upper slope and two on the lower slope. They were most likely built to reduce erosion into the ditch and support the foundation of the ditch.

The **habitation site** is composed of terraces, low walls, and enclosures. It is described by Ladd and Yen (1972) to have three small rock mounds, a probable house platform, one sunken walled pit, and a series of terraces. This site is said to be the old home of the Holt family from 1910 to 1923 based on an interview between Ladd and Yen and Mr. James Robinson Holt. This habitation site was built on a pre-contact site.

The **stone wall cattle barrier** was built almost parallel to the stream and was most likely used by the Holt family and others as a cattle barrier to restrict cows from crossing Mākaha Stream.

The **pre-contact terrace** was interpreted to be a “traditional Hawaiian agricultural terrace, whose retained soil area was used for seasonal (winter) planting.” The terrace would have collected moisture from rain and overflow from Mākaha Stream to nourish the soil and plants. Radio-carbon dating of this site ranges from 1430 to 1650 A.D.

(Hammatt, Dey, & Tulchin, 2007)

Potential Impacts and Mitigation Measures

The proposed action is not anticipated to impact the archeological resources. The MVLRL project promotes the stewardship and preservation of Native Hawaiian cultural sites and the cultural landscape of Mākaha. The archeological sites will be protected and the pre-contact terraces will be restored. Vegetation buffers will be planted around significant features to avoid ground-disturbing activities in the vicinity of the sites. Additionally, any historic features deemed appropriate for reuse will be restored under the supervision of a qualified archaeologist and cultural monitor. Educational and safety signage will be installed to educate visitors about the cultural significance of archeological sites and to help avoid damage to the sites.

The historic and cultural sites create a connection to the past, and are a guide on how to restore and recreate this ancient Hawaiian lifestyle in the 21st century. The proposed actions will result in restoration of cultural resources rather than loss, with wetland lo'i kalo and dryland plantings restored to historical conditions.

4.2.2 Traditional Cultural Practices

Mākaha is rich in its culture and history. After interviewing several kama'āina connected to the area, traditional cultural practices were identified and are summarized in this section. A further detailed summary of these practices is given in the Cultural Impact Assessment (Appendix B). These practices include gathering, hunting, aquatic resources, and heiau.

Gathering fruits, nuts, and other plants were gathered in the mid-to-upper valley. Plants such as kī, palapalai, pepeiao fungus, wauke, and mamake could be found in Mākaha.

Hunting should not be considered a "traditional" cultural practice because it was introduced by the Europeans, but it is a cultural practice that many Native Hawaiians still practice in Mākaha today. The most commonly hunted feral animal is the pig.

Aquatic Resources were once abundant in middle and upper Mākaha Stream. 'O'opu and 'opae (shrimp) could be caught in the streams.

Heiau were very significant in ancient Hawai'i and were used as temples to give offerings to the gods. Kāne'ākī Heiau was once an agricultural heiau dedicated to Lono, and was converted to a luakini (sacrificial heiau) later in pre-contact Hawaiian history. Examples of offerings that may have been given are lei, branch coral, pohaku, wai, and later animals and humans when Kāne'ākī Heiau was transformed into a luakini.

Traditional cultural practices in Mākaha are not as abundant as they were in ancient times, and are currently non-existent on the MVLR site. But there are cultural practices proposed for the MVLR site once the project is in full operation. These traditional cultural practices may include:

- Traditional construction of the Community Meeting Halau as a hale wa'a or hale halawai using traditional methods of thatching, woodwork, etc.
- Cultivation of native plantings used for food, medicine, and weaving.
- Education on sustainable and traditional practices such as watershed management, historic site preservation, and Hawaiian values.

Potential Impacts and Mitigation Measures

The proposed action is not anticipated to negatively impact traditional cultural practices. Instead, restoration of Mākaha's lo'i kalo agricultural systems will enhance and perpetuate Native Hawaiian traditional and cultural practices (including but not limited to kalo cultivation and subsistence gathering practices); and provide the means by which Native Hawaiians can practice their culture through watershed management.

4.2.3 Socioeconomic Conditions

Mākaha is a rural community with a population of about 8,300 people and a high percentage of Native Hawaiians. In the 2010 U.S. Census, 65% of Mākaha residents identified themselves as at least part Native Hawaiian, compared to 25% for the entire state of Hawai'i. The median household income (MHI) of Mākaha residents was more than 40% lower than the MHI of the state of Hawai'i of \$67,492; and the percent of persons below poverty was 20% higher than the statewide average.

Potential Impacts and Mitigation Measures

The proposed action is not expected to have any negative socioeconomic effect, but is anticipated to provide significant benefit to the Wai'anae community, and specifically Mākaha. The MVLR project will provide an opportunity for Native Hawaiian participants to enhance their cultural identity. It will also increase the capacity for traditional cultivation of lo'i taro and promote self-sufficiency. In the near-term, the MVLR project will rely on volunteer labor. In the long-term, the MVLR project may employ several staff members to work in the lo'i thereby creating jobs and benefiting the local economy.

4.3 Infrastructure

4.3.1 Roadways and Traffic

While there are several possible routes to enter into the MVLR project area, the primary access route has yet to be determined. Possible access routes and/or parking include the BWS Service Road via the gated fence on Kili Drive, through the gated subdivision Mauna 'Olu Estates via Alahale Street, or via the Mākaha West Golf Course and through the existing privately-owned parcel (TMK 8-4-029: 142) that is used as the horseback riding stables. Access via the aforementioned options is dependent on the respective landowners' willingness to work with MIKW. Possible access from the BWS Service Road will require a stream crossing, which may pose a challenge to some visitors. Further coordination with surrounding entities will be required in order to designate parking areas in the vicinity of the project area. Alternatives such as possible use of shuttles from existing off-site parking areas, including the golf course, will be explored.

Potential Impacts and Mitigation Measures

The proposed project is not anticipated to significantly affect traffic. The proposed project is located in a residential area in the mid-valley. Traffic in this area is mostly from residential use and is generally light. Mākaha residents may be temporarily affected by a slight increase in truck traffic and construction-related activities, but these short-term impacts to Mākaha residents may be mitigated by restricting transfer of construction materials and equipment to off-peak hours. Residents and landowners in the vicinity of the project area will be informed about the timing of construction work.

Visitors are anticipated to visit during non-peak traffic hours and will not significantly impact daily traffic. Visitors to the MVLR site will be informed to not park near homes to avoid negative impacts to the neighborhood. In the near-term, no more than 300 to 500 participants are anticipated annually to visit the project area. In the long-term, visitors to the project area are expected to increase to the thousands annually. Even in the long-term, large crowds are not expected to visit the site all at one time, but will be staggered throughout the day.

4.3.2 Water Supply

The BWS's Glover Tunnel produces on average 500,000 to 550,000 gallons of water per day and is the planned source for non-potable irrigation water for the MVLR project. The cost and amount of water available from Glover Tunnel for the MVLR project are yet to be determined. In the past, Glover Tunnel served as the main water source for Mākaha West Golf Course and the Mākaha Resort & Golf Club. Although some of the Glover Tunnel water is allocated to the Mākaha West Golf Course and Mākaha Resort & Golf Club, the only current water use is for some of Mauna 'Olu Estates landscaping, due to the temporary closing of the golf course and

resort. Whether the golf course or resort will use water from the Glover Tunnel in the future is yet to be determined.

Water will be used for the irrigation of plants and lo'i kalo and will be transported via a six-inch pipeline from the tunnel to the site. For potable water for visitors and volunteers, bottles of water will be provided.



Figure 16. Glover Tunnel Portal

Potential Impacts and Mitigation Measures

Water demand for the proposed action in the near-term will be minimal. There will be no water needed for the removal of invasive plants on the parcel which will take one to two years to complete, and no more than one acre of lo'i kalo is anticipated to be restored in the near-term. In the long-term, the MVLR site will make use of any available water. Results from a USGS Wetland Kalo Study found that at least 100,000 gallons of water per acre per day is needed for successful lo'i kalo returns (Gingerich et. al., 2007). Less water can be used but will produce less taro returns. The lo'i discharge water will be used to water native dryland plantings. The long-term environmental impacts are also expected to be minimal because although the project will be consuming water, it is water that may have otherwise been released into Mākaha Stream from Glover Tunnel. This lo'i restoration project will make great use of Mākaha's water supply and will recharge the underlying aquifer through percolation and return excess water to Mākaha Stream to support aquatic life. The MVLR project will incorporate water conservation

BMPs to ensure efficient water use throughout the lo'i and dry land planting irrigation. Water use will be metered and controlled through valves in the pipelines and will be monitored and managed.

4.3.3 Wastewater and Solid Waste

Composting toilets are proposed for the MVLR site in order to reduce water usage and eliminate the need for waste transportation. Two wood-frame composting toilets are proposed, which will each lead to a tank where saw-dust or other organic materials will be periodically added to soak up liquid waste and naturally decompose solid waste. The contents will be buried and covered when the tank is full.

Potential Impacts and Mitigation Measures

Environmental impacts of the proposed action are expected to be minimal. Waste material will be buried shallow enough where it will not affect Mākaha's ground water quality. The proposed action does not involve the construction of new sewer infrastructure, therefore eliminating the need for excess grubbing. Composting toilets will be located makai of the lo'i kalo and dryland fields, but in the vicinity of the Kahua Operation Base facilities. The toilets will be periodically maintained.

4.3.4 Power and Communication

There are currently no proposed sources of electricity or communication. Generators will be used if needed during construction. If power is necessary in the long-term, the MVLR site may acquire photovoltaic solar panels.

Potential Impacts and Mitigation Measures

The proposed action does not include use of electricity or wire-based communications.

4.4 Cumulative Impacts

The proposed project is not expected to have a cumulative negative effect upon the environment. The proposed project will result in the removal of non-native vegetation and restoration of natural and cultural resources, thus returning the project area to its natural environmental condition and enhancing the biodiversity of the area. More importantly, the proposed project will enhance and perpetuate Native Hawaiian traditional and cultural practices. The proposed actions are consistent with the vision expressed by the City and County of Honolulu's General Plan and Wai'anae Sustainable Communities Plan to protect and preserve the natural environment, as well as the cultural, historic, and archaeological resources. This proposed project also supports the objectives set forth in the Wai'anae Watershed Management Plan to promote sustainable watersheds, including through Native Hawaiian customs and traditional practices.

The primary impacts of the proposed actions would occur from construction activities. These short-term impacts from construction activities will be mitigated through use of BMPs to minimize and mitigate potential negative impacts such as dust, noise, and erosion. Due to the restorative nature of this proposed project, in the long-term, restoration of the area will attract native wildlife, including federally endangered species. BMPs from the USFWS will be incorporated into the proposed MVLRL project in order to avoid and minimize adverse effects to federally listed species. The anticipated determination for this EA is a "Finding of No Significant Impact."

5. REQUIRED PERMITS AND APPROVALS

Table 2. Potential Permits or Plans

Oversight Agency	Permit or Plan
DPP: Land Use Permits Division	Building Permit (ROH Section 18-3.1)
DPP: Site Development Division	Grading and Grubbing Permit (Soil Conservation Plan* may be developed in lieu of a Grading and Grubbing permit for agriculture and related activities)
DLNR: State Historic Preservation Department	Archaeological Preservation Plan - Required to protect historical properties
State of Hawaii, DOH: Clean Water Branch	NPDES Discharge Permit - Required to discharge water from a disturbed area greater than one acre
U.S. Fish and Wildlife Service	Incidental Take Permit - Required if endangered or threatened species will be impacted

*Conservation Plan must be approved by the Soil and Water Conservation District. Approved plans are then submitted to the City DPP.

6. ALTERNATIVES TO PROPOSED ACTION

6.1 No Action Alternative

Under the No Action Alternative, the MVLR parcel would remain in its present state. The parcel would continue to be dominated by non-native species and aquifer recharge would continue at a slowly decreasing rate. With climate change resulting in less frequent rain and more intense storms, it is increasingly important to care for the valley and make sure that when it does rain, the Mākaha watershed is able to capture and utilize the water. The No Action Alternative is not the desirable alternative because nothing will be done to help preserve and restore the archaeological sites. The sites would continue to be damaged by trespassers and feral ungulates. Remaining in the current condition would create no further benefits for the watershed or the community, and would preclude all other short and long-term benefits described in this EA.

6.2 Alternative Uses of Land

An alternative action to the proposed MVLR project is to develop an interpretive cultural park consisting of a multi-purpose cultural center. With the Cultural Park alternative, there would be no active agriculture. The Cultural Park would focus on restoring historical sites and showcasing the remaining archaeological resources in the project area. These resources would include the four archaeological sites on the parcel. MIKW could also incorporate Kāne'ākī Heiau as part of the Cultural Park to educate participants about Native Hawaiian traditional and cultural practices. Although this alternative will support the preservation of some of Mākaha's significant historical sites, the Cultural Park would not focus on the restoration of the Mākaha watershed and Hawaiian agriculture. This alternative would attract more visitors, thus increasing traffic in the residential area. Development of a cultural center would also increase the amount of impervious surfaces; thus increasing stormwater runoff. Due to the anticipated effects of the Cultural Park on the environment, this alternative is not desirable.

7. REFERENCES

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APPENDIX A

Preliminary Agency Comments on Proposed Action

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 22, 2014

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

via email: gabrielle@townscapeinc.com

Dear Ms. Sham,

SUBJECT: Initial Consultation for the Development of the Proposed Makaha Valley
Lo'i Restoration Project

Thank you for the opportunity to review and comment on the subject matter. In addition to the comments sent to you dated July 17 and July 21, 2014, enclosed are additional comments from the Division of Aquatic Resources on the subject matter. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji
Land Administrator

Enclosure(s)



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809



July 2, 2014

MEMORANDUM

DAE # 4993

TO:

DLNR Agencies:

- Div. of Aquatic Resources
- Div. of Boating & Ocean Recreation
- Engineering Division
- Div. of Forestry & Wildlife
- Div. of State Parks
- Commission on Water Resource Management
- Office of Conservation & Coastal Lands
- Land Division – Oahu District
- Historic Preservation

JK ✓
AM

FROM:

Russell Y. Tsuji, Land Administrator

SUBJECT:

Initial Consultation for the Development of the Proposed Makaha Valley Lo'i Restoration Project

LOCATION:

19-acre parcel located in Makaha Valley within Tax Map Key 8-4-002:014

APPLICANT:

Mohala I Ka Wai (MIKW) by Townscape, Inc.

RECEIVED
LAND DIVISION
2014 JUL 21 PM 2:47
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

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

Please submit any comments by **July 17, 2014**. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

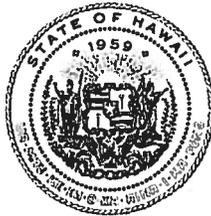
- We have no objections.
- We have no comments.
- Comments are attached.

Signed: _____

Print Name: _____

Date: _____

JUL 15 2014



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

Date: 07-08-14
DAR #4993

MEMORANDUM

TO: Frazer McGilvray, Administrator
DATE: _____
FROM: Alton Miyasaka, Aquatic Biologist
SUBJECT: Initial Consultation for Development of the Proposed Makaha Valley
Lo'i Restoration Project

Comment	Date Request	Receipt	Referral	Due Date
	07-02-14	07-03-14	07-07-14	07-17-14

Requested by: DLNR/Land Division
Russell Tsuji

RECEIVED
LAND DIVISION
2014 JUL 21 PM 2:47
DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

Summary of Proposed Project

Title: Initial Consultation for Development of Proposed Makaha Valley Lo'i
Restoration Project

Project by: Mohala I Ka Wai (MIKW) by Townscape, Inc.

Location: Makaha Valley, 19-acre parcel within Tax Map Key 8-4-002:014

Brief Description:

Mohala I Ka Wai (MIKW) is a community-based nonprofit organization dedicated to watershed protection in the District of Wai'anae, Oahu. Townscape, Inc. is preparing an Environmental Assessment (EA) for the Makaha Valley Lo'i Restoration Project proposed by MIKW.

The project site is a 19-acre parcel located in Makaha Valley within Tax Map Key 8-4-002:014, southwest of Kane aki heiau and on lands owned by the Honolulu Board of Water Supply (BWS). BWS requires completion of an EA before they issue a license to MIKW for use of the site for resource management and place-based educational activities.

The proposed Makaha Valley Lo'i Restoration Project will restore ancient lo'i kalo in the northern half of the project area and cultivate dryland fields in the southern half. A piped irrigation system to transport water from Glover Tunnel to the site will be installed. The excess water will be re-routed into Makaha Stream. The proposed plan also includes the construction of (1) the "Kahua Operation

Base”: Community Meeting Hale, Equipment Storage facility and a Garden Compost facility; (2) composting toilets; and (3) an interpretive walking path.

Comments:

DAR requests information about the biological resources in the lo’i, particularly the native resources; i.e. native fish or insect spp. noting the habitats where they are found; that is whether they inhabit the pond or the source water.

DAR also requests that the applicant identify the source of the water. The review document states that water will be supplied through Glover tunnel, but does not indicate the source of the water. Whether the water source is underground vs surface is important to know.

DAR is also requesting the applicant to identify all of the aquatic species they plan to raise in the lo’i.

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

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.honolulu.gov • CITY WEB SITE: www.honoluludpp.org

KIRK CALDWELL
MAYOR



GEORGE I. ATTA, FAICP
DIRECTOR

ARTHUR D. CHALLACOMBE
DEPUTY DIRECTOR

2014/ELOG-1179 (mh)

July 23, 2014

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

Dear Ms. Sham:

This is in response to your letter of June 25, 2014, regarding an Environmental Assessment Initial Consultation for the proposed Makaha Valley Loi Restoration Project. We offer the following comments:

1. The Draft Environmental Assessment (DEA) should include a discussion of how the proposed project is consistent with the City and County of Honolulu's General Plan, the Waianae Sustainable Communities Plan, the Waianae Watershed Management Plan, and the zoning of the project site.
2. Please provide information on the Flood Insurance Rate Map (FIRM) flood districts and base flood elevations. On a map of the site, show the floodway boundaries and actual heights above mean sea level.
3. Please show access to the area of cultivation from a public street and discuss how security will be maintained for the area being cultivated?
4. The DEA should include a complete listing of required permits and approvals.

Should you have any questions, please contact Matt Higashida of our staff at 768-8045.

Very truly yours,

A handwritten signature in blue ink, appearing to read "George I. Atta", is written over a blue ink stamp of the City and County of Honolulu seal.

George I. Atta, FAICP
Director

GIA:js

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.
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

August 11, 2014

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

via email: gabrielle@townscapeinc.com

Dear Ms. Sham,

SUBJECT: Initial Consultation for the Development of the Proposed Makaha Valley
Lo'i Restoration Project

Thank you for the opportunity to review and comment on the subject matter. In addition to the comments sent to you dated July 17, July 21 and July 22, 2014, enclosed are additional comments from the Division of Forestry & Wildlife on the subject matter. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji
Land Administrator

Enclosure(s)



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 2, 2014

MEMORANDUM

TO: *From*

- DLNR Agencies:**
- Div. of Aquatic Resources
 - Div. of Boating & Ocean Recreation
 - Engineering Division
 - Div. of Forestry & Wildlife
 - Div. of State Parks
 - Commission on Water Resource Management
 - Office of Conservation & Coastal Lands
 - Land Division – Oahu District
 - Historic Preservation

RECEIVED
 LAND DIVISION
 2014 AUG 11 PM 2:52
 DEPT. OF LAND &
 NATURAL RESOURCES
 STATE OF HAWAII

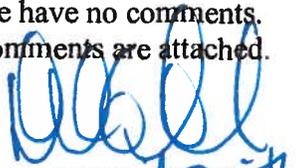
FROM: *To* → Russell Y. Tsuji, Land Administrator
 SUBJECT: Initial Consultation for the Development of the Proposed Makaha Valley Lo'i Restoration Project
 LOCATION: 19-acre parcel located in Makaha Valley within Tax Map Key 8-4-002:014
 APPLICANT: Mohala I Ka Wai (MIKW) by Townscape, Inc.

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

Please submit any comments by **July 17, 2014**. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed: 
 Print Name: David Smith
 Date: 8/1/14

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES**

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

JESSE K. SOUKI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOARDING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAIROUAWA, ISLAND PRESERVATION COMMISSION
LAND
STATE PARKS

August 4, 2014

TO: Gabrielle Sham
Project Coordinator
Townscape, Inc
900 Fort Street Mall Suite 1160
Honolulu, HI 96813

THROUGH: William J. Aila, Jr. *[Signature]*
Chairperson
Department of Land and Natural Resources

FROM: Lisa J. Hadway *[Signature]*
Administrator
Division of Forestry and Wildlife

SUBJECT: Initial consultation for the development of the proposed Makaha Valley Lo'i Restoration Project.

The Division of Forestry and Wildlife has no objections to the proposed work. In general, rehabilitation of abandoned agricultural field systems is considered an acceptable use of lands within watersheds. Special care should be exercised to maintain a vegetated condition, or employ best management practices to reduce sediment runoff from the project area. The use of vegetated bio-swales, erosion control rolls or matting, and grass seeding with non-invasive species such as annual Rye grass should improve water quality and reduce sediment transport from the work site. Multi-layered agro-forestry treatments, including ground-covers, trees and shrubs are encouraged to further aid in erosion mitigation, as appropriate. Water used for irrigation in agricultural areas should be tested prior to discharge to assure that levels of sediment and agricultural chemicals is at an acceptable level. All necessary permits should be obtained prior to the activity to assure protection of stream waters and species, protection of near-shore water quality, and compliance with existing regulations regarding stream diversion and/or discharge.

A combination of traditional agro-forestry systems with properly designed erosion control measures should generally yield the highest water quality and sediment runoff-reduction benefits. The Division of Forestry and Wildlife's Landowner Assistance Program (<http://dlnr.hawaii.gov/forestry/lap/>) may be able to assist, if such expertise is of interest to you.

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>

KIRK CALDWELL
MAYOR



LORI M.K. KAHIKINA, P.E.
DIRECTOR

TIMOTHY A. HOUGHTON
DEPUTY DIRECTOR

ROSS S. TANIMOTO, P.E.
DEPUTY DIRECTOR

IN REPLY REFER TO
PRO 14-102

July 15, 2014

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

Dear Ms. Sham:

SUBJECT: Initial Consultation for the Development of the Proposed
Mākaha Valley Lo'i Restoration Project (TMK: 8-4-002:014)

We have reviewed the subject document as transmitted to us by your letter dated June 25, 2014. We have the following comments:

1. The Department of Planning and Permitting (DPP), Wastewater Branch has the lead role in issuing sewer connection permits.
2. The subdivision off Maunaolu Street, adjacent to the project location, is currently serviced by the City and County of Honolulu wastewater system.
3. The State of Hawaii, Department of Health, Clean Water Branch will need to be consulted regarding the composing toilets proposed in your letter.
4. If the proposed project requires refuse collection service, a private refuse collection service should be contracted by the owner/operator of the proposed project.
5. The project site will be subject to the grading ordinance unless the project is excluded under Section 14-13.5 of the Revised Ordinances. The exclusion is for land managed in accordance with conservation practices acceptable to the applicable soil and water conservation district directors and for projects that a comprehensive conservation program that is being actively pursued.

Ms. Gabrielle Sham
July 15, 2014
Page 2

6. The proposed project may require a stream channel alteration permit from the Water Commission of the Department of Land and Natural Resources.

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

Sincerely,


Lori M.K. Kahikina, P.E.
Director

Attachment

cc: Department of Planning and Permitting, SDD, WWB



United States Department of the Interior



FISH AND WILDLIFE SERVICE
Pacific Islands Fish and Wildlife Office
300 Ala Moana Boulevard, Room 3-122
Honolulu, Hawai'i 96850

In Reply Refer To:
2014-TA-0363

JUL 2 8 2014

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

Subject: Technical Assistance for the Draft Environmental Assessment for the Proposed
Lo'i Restoration in Mākaha Valley, O'ahu [TMK: 1-8-4-002:014]

Dear Ms. Sham:

The U. S Fish and Wildlife Service received your letter, dated June 25, 2014, requesting our comments on the Draft Environmental Assessment (DEA) for the Mākaha Valley Lo'i Restoration, on the island of O'ahu. The proposed project will require the installation of a piped irrigation system to transport water from Glover Tunnel to the site with excess water being re-routed into Mākaha Stream. The below comments are provided in accordance with section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*), as amended (ESA); the Federal Clean Water Act [33 U.S.C. 1251 *et seq.*; 62 Stat. 1155], as amended (CWA); the Fish and Wildlife Coordination Act of 1934 (16 U.S.C. 661 *et seq.*; 48 Stat. 401) (FWCA); and the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712), as amended (MBTA).

We have reviewed the information you provided and pertinent information in our files, including data compiled by the Hawaii Biodiversity and Mapping Program as it pertains to federally listed species and designated critical habitat. Species documented within the general project vicinity include federally endangered Hawaiian waterbirds (i.e., the Hawaiian stilt (*Himantopus mexicanus knudseni*), Hawaiian moorhen (*Gallinula chloropus sandvicensis*), and Hawaiian coot (*Fulica alai*)), and the Hawaiian hoary bat (*Lasiurus cinereus semotus*). The wedge-tailed shearwater (*Puffinus pacificus*) and the Pacific golden plover (*Pluvialis fulva*), protected under the Migratory Bird Treaty Act [16 U.S.C. 703-712] (MBTA), may also occur in the project area.

Because Hawaiian waterbirds occur in the vicinity of the proposed project, we recommend you incorporate the following measures into your project description to avoid and minimize impacts to listed Hawaiian waterbirds:

**TAKE PRIDE[®]
IN AMERICA** 

- A biological monitor should conduct Hawaiian waterbird surveys if significant water features such as wetlands and large open riparian areas. If resident birds are present at the proposed project site prior to project initiation waterbird nesting surveys should be conducted.
- Any documented nests or broods within the project vicinity should be reported to the Service within 48 hours.
- A 100-foot buffer should be established and maintained around all active nests and/or broods until the chicks/ducklings have fledged. No potentially disruptive activities or habitat alteration should occur within this buffer.
- The Service should be notified immediately prior to project initiation and provided with the results of pre-construction Hawaiian waterbird surveys.
- If Hawaiian waterbirds are actively present then a biological monitor(s) should be present on the project site during all construction or earth moving activities to ensure that Hawaiian waterbirds and nests are not adversely impacted.
- If a listed Hawaiian waterbird is observed within the project site, or flies into the site while activities are occurring, all activities should be temporarily suspended within 100 feet of the individual(s). Work should not resume within that area until the Hawaiian waterbird(s) leave the area on their own accord.
- A post-construction report should be submitted to the Service with 30 days of the completion of the project. The report should include the results of Hawaiian waterbird surveys, the location and outcome of documented nests, and any other relevant information.
- Because the proposed activities may impact water resources that provide habitat for listed Hawaiian waterbirds, we are attaching the Service's recommended Best Management Practices regarding sedimentation and erosion in aquatic environments. We encourage you to incorporate the relevant practices into your project design.

In addition, because your project will result in standing water or creation of open water, thus attracting Hawaiian waterbirds to the site, we offer the below information and recommendations to assist you with preparation of your DEA. In particular, the Hawaiian stilt is known to nest in sub-optimal locations (e.g., any ponding water) if water is present. Hawaiian waterbirds attracted to sub-optimal habitat may suffer adverse impacts, such as predation and reduced reproductive success, and thus the project may create an attractive nuisance. To avoid potential adverse impacts to listed Hawaiian waterbirds, we recommend the project occur outside of the Hawaiian stilt breeding season (February through August). If the Hawaiian stilt breeding season cannot be avoided, we recommend you work with our office during project planning so that we may assist you in developing specific measures to avoid impacts to listed species. If adverse impacts to listed Hawaiian waterbirds cannot be fully avoided, the project should apply for take authorization under section 10 of the ESA or initiate formal consultation pursuant to section 7 of the ESA.

Hawaiian Hoary Bat

The Hawaiian hoary bat roosts in both exotic and native woody vegetation and, while foraging, will leave young unattended in "nursery" trees and shrubs when they forage. If trees or shrubs suitable for bat roosting are cleared during the breeding season, there is a risk that young bats could inadvertently be harmed or killed. To minimize impacts to the endangered Hawaiian hoary bat, woody plants greater than 15 feet tall should not be disturbed, removed, or trimmed

during the bat birthing and pup rearing season (June 1 through September 15). Site clearing should be timed to avoid disturbance to Hawaiian hoary bats in the project area.

Seabirds

Below we provide our guidance on wedge-tailed shearwaters, although we understand that it is unlikely that the restoration of the lo'i will involve any noteworthy lighting or other described features that most commonly negatively impact wedge-tailed shearwater.

The wedge-tailed shearwater is protected under the federal MBTA. Wedge-tailed shearwaters fly at night and are attracted to artificially-lighted areas resulting in disorientation and subsequent fallout due to exhaustion. Seabirds are also susceptible to collision with objects that protrude above the vegetation layer, such as utility lines, guy-wires, and communication towers. Additionally, once grounded, they are vulnerable to predators and are often struck by vehicles along roadways. Please be aware that the fallout dates for the wedge-tailed shearwater are from approximately November 1 until December 21.

To minimize and avoid artificial lighting impacts to seabirds, if the proposed project has a need for significant outdoor lighting than a comprehensive lighting plan should be developed and incorporated into the DEA, including educating all project staff and residents with information about seabird fallout. If lights cannot be eliminated due to safety or security concerns then they should be positioned low to the ground, be motion-triggered and be shielded and/or full cut-off. Effective light shields should be completely opaque, sufficiently large, and positioned so that the bulb is only visible from below and so that light from the shielded source cannot be seen from above. Construction activities should only occur during daylight hours whenever possible. The DEA should address all potential impacts to seabirds and outline conservation measures to minimize these impacts.

Your June 25, 2014 letter states that excess water from the lo'i will be drained into Mākaha Stream. We recommend that you conduct aquatic floral and faunal surveys within the stream for inclusion into your DEA, and how your project will avoid or minimize impacts to the aquatic habitat within the project area. In the event that unanticipated project impacts arise that are unavoidable, please discuss compensatory mitigation for aquatic resources (USACE 2008). Finally, please address invasive species that may occur within the project area and how the proposed project construction and implementation will ameliorate the expansion of invasive species beyond the project footprint.

Elements of the proposed project could result in adverse effects to federally listed species unless minimization and avoidance measures can be incorporated into your DEA. If there is a Federal action agency associated with the proposed project and adverse effects of listed species cannot be avoided, it will be necessary to consult with us pursuant to section 7(a)(2) of the ESA. If no Federal agency is involved with the proposed project and endangered or threatened species may be impacted, an "Incidental Take Permit" authorizing such take must be obtained pursuant to Section 10(a)1(B) of the ESA. Issuance of a Section 10(a)1(B) permit is contingent upon submission of an acceptable habitat conservation plan detailing the measures that will be implemented to minimize, the amount of take likely to occur, the impacts of this take, mitigation measures the applicant will implement to offset the impacts of the anticipated take, funding mechanisms to insure implementation of the mitigation measures, and a monitoring and adaptive management program that ensures the minimization and mitigation measures are effective.

We appreciate your efforts to conserve Hawaii's natural resources. If you have questions regarding information contained in this letter, please contact Carrie Harrington, Fish and Wildlife Biologist, (phone 808 792-9400, fax 808 792-9581).

Sincerely,

A handwritten signature in blue ink, appearing to read 'A. Nadig', with a stylized flourish at the end.

Aaron Nadig
Acting Assistant Field Supervisor
Oahu, Kauai, NWHI, Am. Samoa

U.S. Fish and Wildlife Service Recommended Standard Best Management Practices

The U.S. Fish and Wildlife Service (USFWS) recommends the following measures to be incorporated into project planning to avoid or minimize impacts to fish and wildlife resources. Best Management Practices (BMPs) include the incorporation of procedures or materials that may be used to reduce either direct or indirect negative impacts to aquatic habitats that result from project construction-related activities. These BMPs are recommended in addition to, and do not over-ride any terms, conditions, or other recommendations prepared by the USFWS, other federal, state or local agencies. If you have questions concerning these BMPs, please contact the USFWS Aquatic Ecosystems Conservation Program at 808-792-9400.

1. Authorized dredging and filling-related activities that may result in the temporary or permanent loss of aquatic habitats should be designed to avoid indirect, negative impacts to aquatic habitats beyond the planned project area.
2. Dredging/filling in the marine environment should be scheduled to avoid coral spawning and recruitment periods, and sea turtle nesting and hatching periods. Because these periods are variable throughout the Pacific islands, we recommend contacting the relevant local, state, or federal fish and wildlife resource agency for site specific guidance.
3. Turbidity and siltation from project-related work should be minimized and contained within the project area by silt containment devices and curtailing work during flooding or adverse tidal and weather conditions. BMPs should be maintained for the life of the construction period until turbidity and siltation within the project area is stabilized. All project construction-related debris and sediment containment devices should be removed and disposed of at an approved site.
4. All project construction-related materials and equipment (dredges, vessels, backhoes, silt curtains, etc.) to be placed in an aquatic environment should be inspected for pollutants including, but not limited to; marine fouling organisms, grease, oil, etc., and cleaned to remove pollutants prior to use. Project related activities should not result in any debris disposal, non-native species introductions, or attraction of non-native pests to the affected or adjacent aquatic or terrestrial habitats. Implementing both a litter-control plan and a Hazard Analysis and Critical Control Point plan (HACCP – see <http://www.haccp-nrm.org/Wizard/default.asp>) can help to prevent attraction and introduction of non-native species.
5. Project construction-related materials (fill, revetment rock, pipe, etc.) should not be stockpiled in, or in close proximity to aquatic habitats and should be protected from erosion (e.g., with filter fabric, etc.), to prevent materials from being carried into waters by wind, rain, or high surf.
6. Fueling of project-related vehicles and equipment should take place away from the aquatic environment and a contingency plan to control petroleum products accidentally spilled during the project should be developed. The plan should be retained on site with the person responsible for compliance with the plan. Absorbent pads and containment booms should be stored on-site to facilitate the clean-up of accidental petroleum releases.
7. All deliberately exposed soil or under-layer materials used in the project near water should be protected from erosion and stabilized as soon as possible with geotextile, filter fabric or native or non-invasive vegetation matting, hydro-seeding, etc.



NEIL ABERCROMBIE
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 17, 2014

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

via email: gabrielle@townscapeinc.com

Dear Ms. Sham,

SUBJECT: Initial Consultation for the Development of the Proposed Makaha Valley
Lo'i Restoration Project

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from (1) Land Division – Oahu District; (2) Office of Conservation and Coastal Lands; and (3) Engineering Division. No other comments were received as of our suspense date. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at 587-0439. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji
Land Administrator

Enclosure(s)



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 2, 2014

MEMORANDUM

TO: **DLNR Agencies:**
 Div. of Aquatic Resources
 Div. of Boating & Ocean Recreation
 Engineering Division
 Div. of Forestry & Wildlife
 Div. of State Parks
 Commission on Water Resource Management
 Office of Conservation & Coastal Lands
 Land Division – Oahu District
 Historic Preservation

FROM: Russell Y. Tsuji, Land Administrator

SUBJECT: Initial Consultation for the Development of the Proposed Makaha Valley Lo'i Restoration Project

LOCATION: 19-acre parcel located in Makaha Valley within Tax Map Key 8-4-002:014

APPLICANT: Mohala I Ka Wai (MIKW) by Townscape, Inc.

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

Please submit any comments by **July 17, 2014**. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed: *[Signature]*
 Print Name: James Chee
 Date: 7/3/14

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

JESSE K. SOUKI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVIYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAIHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

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

Ref: OCCL:LY

CORR: OA 15-02

MEMORANDUM

JUL - 9 2014

TO: Russell Tsuji, Administrator
Land Division

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

SUBJECT: Initial Consultation for the Development of the Proposed Mākaha Valley Lo'i
Restoration Project

TMK: (1) 8-4-002:014

LOCATION: Mākaha Valley, O'ahu, Hawai'i

Based on the information provided, it is not apparent whether or not the project is located within the Conservation District. More information needs to be provided for OCCL to make a proper determination. Otherwise, it is suggested that the consultant request a boundary interpretation from the State Land Use Commission.

RECEIVED
LAND DIVISION
2014 JUL 10 AM 10:07
DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

14 JUL -3 AM 10:05 ENGINEERING



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 2, 2014

MEMORANDUM

TO: FR:

DLNR Agencies:

- Div. of Aquatic Resources
- Div. of Boating & Ocean Recreation
- Engineering Division
- Div. of Forestry & Wildlife
- Div. of State Parks
- Commission on Water Resource Management
- Office of Conservation & Coastal Lands
- Land Division – Oahu District
- Historic Preservation

RECEIVED
LAND DIVISION
2014 JUL 14 PM 2:57
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

TO: FROM:

FROM: Russell Y. Tsuji, Land Administrator

SUBJECT: Initial Consultation for the Development of the Proposed Makaha Valley Lo'i Restoration Project

LOCATION: 19-acre parcel located in Makaha Valley within Tax Map Key 8-4-002:014

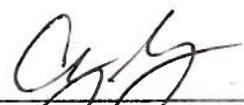
APPLICANT: Mohala I Ka Wai (MIKW) by Townscape, Inc.

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

Please submit any comments by **July 17, 2014**. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed: 

Print Name: Cory S. Chang, Chief Engineer

Date: 7/14/14

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji

REF: Initial Consultation for the Development of the Proposed Makaha Valley Lo'i Restoration Project

Oahu 039

COMMENTS

- () We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ____.
- (X) **Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone D, an area where flood hazards are undetermined.**
- () Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ____.
- () Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

Please be advised that 44CFR indicates the minimum standards set forth by the NFIP. Your Community's local flood ordinance may prove to be more restrictive and thus take precedence over the minimum NFIP standards. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

- () Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.
 - () Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.
 - () Mr. Carolyn Cortez at (808) 270-7253 of the County of Maui, Department of Planning.
 - () Mr. Stanford Iwamoto at (808) 241-4896 of the County of Kauai, Department of Public Works.
- () The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.
 - () The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.
 - () Additional Comments: _____

 - () Other: _____

Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed: 
CARTY S. CHANG, CHIEF ENGINEER

Date: 7/14/14



FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD – The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, V, and VE. The Base Flood Elevation (BFE) is the water-surface elevation of the 1% annual chance flood. Mandatory flood insurance purchase applies in these zones:

- Zone A:** No BFE determined.
- Zone AE:** BFE determined.
- Zone AH:** Flood depths of 1 to 3 feet (usually areas of ponding); BFE determined.
- Zone AO:** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined.
- Zone V:** Coastal flood zone with velocity hazard (wave action); no BFE determined.
- Zone VE:** Coastal flood zone with velocity hazard (wave action); BFE determined.
- Zone AEF:** Floodway areas in Zone AE. The floodway is the channel of stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without increasing the BFE.

NON-SPECIAL FLOOD HAZARD AREA – An area in a low-to-moderate risk flood zone. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

- Zone XS (X shaded):** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
- Zone X:** Areas determined to be outside the 0.2% annual chance floodplain.

OTHER FLOOD AREAS

- Zone D:** Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities.

PROPERTY INFORMATION

COUNTY: HONOLULU
TMK NO: (1) 8-4-002-014
PARCEL ADDRESS: 84-800 KILI DR
 WAIANAE, HI 96792
FIRM INDEX DATE: JANUARY 19, 2011
LETTER OF MAP CHANGE(S): 12-09-1556P
FEMA FIRM PANEL(S):
 15003C0095F - PANEL NOT PRINTED
 15003C0183G - JANUARY 19, 2011
 15003C0177H - JANUARY 19, 2011
 15003C0185G - JANUARY 19, 2011

PARCEL DATA FROM: APRIL 2014
IMAGERY DATA FROM: MAY 2006

IMPORTANT PHONE NUMBERS

County NFIP Coordinator
 City and County of Honolulu
 Mario Siu-Li, CFM (808) 768-8098
State NFIP Coordinator
 Carol Tyau-Beam, P.E., CFM (808) 587-0267

Disclaimer: The Department of Land and Natural Resources (DLNR) assumes no responsibility arising from the use of the information contained in this report. Viewers/Users are responsible for verifying the accuracy of the information and agree to indemnify the DLNR from any liability, which may arise from its use.

If this map has been identified as 'PRELIMINARY' or 'UNOFFICIAL', please note that it is being provided for informational purposes and is not to be used for official/legal decisions, regulatory compliance, or flood insurance rating. Contact your county NFIP coordinator for flood zone determinations to be used for compliance with local floodplain management regulations.



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

In reply, please refer to:
EMD/CWB

07012PCTM.14

July 8, 2014

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

Dear Ms. Sham:

SUBJECT: Comments on the Environmental Assessment (EA) Initial Consultation for the Propose Makaha Valley Loi Restoration Project Waianae, Island of Oahu, Hawaii

The Department of Health (DOH), Clean Water Branch (CWB), acknowledges receipt of your letter, dated June 25, 2014, requesting comments on your project. The DOH-CWB has reviewed the subject document and offers these comments. Please note that our review is based solely on the information provided in the subject document and its compliance with the Hawaii Administrative Rules (HAR), Chapters 11-54 and 11-55. You may be responsible for fulfilling additional requirements related to our program. We recommend that you also read our standard comments on our website at: http://health.hawaii.gov/epo/files/2013/10/CWB_Oct22.pdf

1. Any project and its potential impacts to State waters must meet the following criteria:
 - a. Antidegradation policy (HAR, Section 11-54-1.1), which requires that the existing uses and the level of water quality necessary to protect the existing uses of the receiving State water be maintained and protected.
 - b. Designated uses (HAR, Section 11-54-3), as determined by the classification of the receiving State waters.
 - c. Water quality criteria (HAR, Sections 11-54-4 through 11-54-8).
2. National Pollutant Discharge Elimination System (NPDES) permit coverage is required for pollutant discharges into State surface waters and for certain situations involving storm water (HAR, Chapter 11-55).
 - a. Discharges into Class 2 or Class A State waters can be covered under an NPDES general permit only if all of the NPDES general permit requirements are met. Please see the DOH-CWB website (<http://health.hawaii.gov/cwb/>) for the NPDES general permits and instructions to request coverage.

- b. All other discharges into State surface waters and discharges into Class 1 or Class AA State waters require an NPDES individual permit. To request NPDES individual permit coverage, please see the DOH-CWB forms website located at: <http://health.hawaii.gov/cwb/site-map/clean-water-branch-home-page/forms/>
- c. NPDES permit coverage for storm water associated with construction activities is required if your project will result in the disturbance of one (1) acre or more of total land area. The total land area includes a contiguous area where multiple separate and distinct construction activities may be taking place at different times on different schedules under a larger common plan of development or sale. NPDES permit coverage is required before the start of the construction activities.

Land disturbance includes, but is not limited to clearing, grading, grubbing, uprooting of vegetation, demolition (even if leaving foundation slab), staging, stockpiling, excavation into pavement areas which go down to the base course, and storage areas (including areas on the roadway to park equipment if these areas are blocked off from public usage, grassed areas, or bare ground).

3. If your project involves work in, over, or under waters of the United States, it is highly recommend that you contact the Army Corp of Engineers, Regulatory Branch (Tel: 438-9258) regarding their permitting requirements.

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

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

Ms. Gabrielle Sham
July 8, 2014
Page 3

07012PCTM.14

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

Sincerely,


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

CTM:tg

NEIL ABERCROMBIE
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 21, 2014

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

via email: gabrielle@townscapeinc.com

Dear Ms. Sham,

SUBJECT: Initial Consultation for the Development of the Proposed Makaha Valley
Lo'i Restoration Project

Thank you for the opportunity to review and comment on the subject matter. In addition to the comments sent to you dated July 17, 2014, enclosed are additional comments from the Commission on Water Resource Management on the subject matter. Should you have any questions, please feel free to call Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji
Land Administrator

Enclosure(s)



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 2, 2014

MEMORANDUM

RECEIVED
LAND DIVISION
2014 JUL 18 PM 2:23
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII
2014 JUL -3 AM 11:45

TO:

DLNR Agencies:

- Div. of Aquatic Resources
- Div. of Boating & Ocean Recreation
- Engineering Division
- Div. of Forestry & Wildlife
- Div. of State Parks
- Commission on Water Resource Management
- Office of Conservation & Coastal Lands
- Land Division – Oahu District
- Historic Preservation

FR:
TO:

FROM:

Russell Y. Tsuji, Land Administrator

SUBJECT:

Initial Consultation for the Development of the Proposed Makaha Valley Lo'i Restoration Project

LOCATION:

19-acre parcel located in Makaha Valley within Tax Map Key 8-4-002:014

APPLICANT:

Mohala I Ka Wai (MIKW) by Townscape, Inc.

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

Please submit any comments by **July 17, 2014**. If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Supervising Land Agent Steve Molmen at (808) 587-0439. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed:

William M. Tan

Print Name: William M. Tan, Deputy Director

Date:

JUL 17 2014

FILE ID:	RFD. 4006.3
DOC ID:	116851



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT
P.O. BOX 621
HONOLULU, HAWAII 96809

July 17, 2014

REF: RFD.4006.3

TO: Russell Tsuji, Administrator
Land Division

FROM: William M. Tam, Deputy Director 
Commission on Water Resource Management

SUBJECT: Proposed Makaha Valley Loi Restoration Project, Waianae, Oahu

FILE NO.:

TMK NO.: 8-4-002:014

Thank you for the opportunity to review the subject document. The Commission on Water Resource Management (CWRM) is the agency responsible for administering the State Water Code (Code). Under the Code, all waters of the State are held in trust for the benefit of the citizens of the State, therefore, all water use is subject to legally protected water rights. CWRM strongly promotes the efficient use of Hawaii's water resources through conservation measures and appropriate resource management. For more information, please refer to the State Water Code, Chapter 174C, Hawaii Revised Statutes, and Hawaii Administrative Rules, Chapters 13-167 to 13-171. These documents are available via the Internet at <http://www.hawaii.gov/dlnr/cwrn>.

Our comments related to water resources are checked off below.

- 1. We recommend coordination with the county to incorporate this project into the county's Water Use and Development Plan. Please contact the respective Planning Department and/or Department of Water Supply for further information.
- 2. We recommend coordination with the Engineering Division of the State Department of Land and Natural Resources to incorporate this project into the State Water Projects Plan.
- 3. We recommend coordination with the Hawaii Department of Agriculture (HDOA) to incorporate the reclassification of agricultural zoned land and the redistribution of agricultural resources into the State's Agricultural Water Use and Development Plan (AWUDP). Please contact the HDOA for more information.
- 4. We recommend that water efficient fixtures be installed and water efficient practices implemented throughout the development to reduce the increased demand on the area's freshwater resources. Reducing the water usage of a home or building may earn credit towards Leadership in Energy and Environmental Design (LEED) certification. More information on LEED certification is available at <http://www.usgbc.org/leed>. A listing of fixtures certified by the EPA as having high water efficiency can be found at <http://www.epa.gov/watersense/>.
- 5. We recommend the use of best management practices (BMP) for stormwater management to minimize the impact of the project to the existing area's hydrology while maintaining on-site infiltration and preventing polluted runoff from storm events. Stormwater management BMPs may earn credit toward LEED certification. More information on stormwater BMPs can be found at <http://hawaii.gov/dbedt/czm/initiative/lid.php>.
- 6. We recommend the use of alternative water sources, wherever practicable.
- 7. We recommend participating in the Hawaii Green Business Program, that assists and recognizes businesses that strive to operate in an environmentally and socially responsible manner. The program description can be found online at <http://energy.hawaii.gov/green-business-program>

- 8. We recommend adopting landscape irrigation conservation best management practices endorsed by the Landscape Industry Council of Hawaii. These practices can be found online at http://www.hawaiiscape.com/wp-content/uploads/2013/04/LICH_Irrigation_Conservation_BMPs.pdf
- 9. There may be the potential for ground or surface water degradation/contamination and recommend that approvals for this project be conditioned upon a review by the State Department of Health and the developer's acceptance of any resulting requirements related to water quality.

Permits required by CWRM:

Additional information and forms are available at http://hawaii.gov/dlnr/cwrn/info_permits.htm.

- 10. The proposed water supply source for the project is located in a designated water management area, and a Water Use Permit is required prior to use of water. The Water Use Permit may be conditioned on the requirement to use dual line water supply systems for new industrial and commercial developments.
- 11. A Well Construction Permit(s) is (are) required before any well construction work begins.
- 12. A Pump Installation Permit(s) is (are) required before ground water is developed as a source of supply for the project.
- 13. There is (are) well(s) located on or adjacent to this project. If wells are not planned to be used and will be affected by any new construction, they must be properly abandoned and sealed. A permit for well abandonment must be obtained.
- 14. Ground water withdrawals from this project may affect streamflows, which may require an instream flow standard amendment.
- 15. A Stream Channel Alteration Permit(s) is (are) required before any alteration(s) can be made to the bed and/or banks of a stream channel.
- 16. A Stream Diversion Works Permit(s) is (are) required before any stream diversion works is (are) constructed or altered.
- 17. A Petition to Amend the Interim Instream Flow Standard is required for any new or expanded diversion(s) of surface water.
- 18. The planned source of water for this project has not been identified in this report. Therefore, we cannot determine what permits or petitions are required from our office, or whether there are potential impacts to water resources.
- OTHER:
SCAP may be required. The Commission on Water Resource Management requests that staff be consulted in the course of project development.

If there are any questions, please contact Dean Uyeno at 587-0234.

APPENDIX B
Cultural Impact Assessment

Mākaha Valley Lo'i Restoration Project

Cultural Impact Assessment

Mākaha Valley, O'ahu



Prepared for

Mohala I Ka Wai

Prepared by

 Townscape, Inc.

September 2014

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MANAGEMENT SUMMARY

Title	Cultural Impact Assessment for the proposed Mākaha Lo‘i Restoration Project, Mākaha Ahupua‘a, Wai‘anae District, Island of O‘ahu
Date	September 2014 (Draft)
Project Location	The project area is located within Tax Map Key 8-4-002:014 in the Mākaha Ahupua‘a, Wai‘anae District, Island of O‘ahu. It is situated in mid-valley just southwest of Kāne‘ākī Heiau; bordered by Mākaha Stream to the west, the Mauna ‘Olu Estates subdivision to the east, and the private Mākaha Valley Riding Stables to the south. The project parcel is approximately 1.5 miles mauka of the shoreline at Mākaha Beach Park.
Project Acreage	Approximately 13 acres
Land Jurisdiction	City and County of Honolulu (C&C), under the jurisdiction of the Board of Water Supply (BWS), leased to Mohala I Ka Wai (MIKW).
Agencies	C&C, BWS
Project Description	The non-profit organization MIKW has obtained conditional approval of a land license from the BWS to develop the Mākaha Valley Lo‘i Restoration (MVLRL) Project, which includes restoring ancient lo‘i kalo and traditional Native Hawaiian agriculture, protecting archaeological sites, and conducting watershed management and community education activities that will benefit the Mākaha watershed. The project will include the construction of three building structures.
Area of Potential Effect (APE)	The project’s APE is defined as the 13-acre parcel that will be licensed to MIKW for the MVLRL project. The restoring of the lo‘i and other proposed actions pose no additional auditory, visual, or other environmental impact to the project area vicinity or historical sites.
Cultural Tradition Focus	This project will promote the stewardship and preservation of Native Hawaiian cultural resources. This assessment focused on learning what types of activities and traditions were practiced in this area, including but not limited to: agriculture, architecture, religion and recreation.
Consultation Effort	Several knowledgeable individuals with cultural expertise and/or knowledge of the project area were contacted. Three interviews were conducted, while a total of eight people were contacted. Interviewees were Landis Ornellas, Eric Enos, and Cynthia Rezentes.
Identified Cultural Issues	No cultural activities are ongoing in the MVLRL parcel but the hunting of feral ungulates and the gathering of native plants takes place in the upper valley. The cultural impacts of the Mākaha Valley Lo‘i Restoration project are expected to be minimal to none.
Cultural Impact Recommendations	The proposed project does not appear to have the potential to affect ongoing traditional cultural practices. Instead, the proposed project will enhance and perpetuate Native Hawaiian traditional and cultural practices.

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1. INTRODUCTION

The community-based non-profit organization Mohala I Ka Wai (MIKW) has received conditional approval of a land license from the City and County of Honolulu Board of Water Supply (BWS) to develop the Mākaha Valley Lo'i Restoration (MVL R) Project. This Cultural Impact Assessment (CIA) provides applicable information to the assessment of the proposed MVL R project's cultural impacts required under Hawaii Revised Statutes Act 50, Chapter 343.

The MVL R project is located on a historically and culturally significant 13-acre parcel of land owned by the BWS. The project includes restoring ancient lo'i kalo and traditional Native Hawaiian agriculture, protecting archaeological sites, and conducting watershed management and community education activities that will benefit the Mākaha watershed. The project will include the construction of three building structures: a traditional Hawaiian community meeting hale, an equipment storage facility, and a garden compost facility. This area, located in mid-Mākaha Valley, is the location of four historic and pre-historic properties related to ranching and farming that tell the story of Mākaha's past. Mākaha and the Wai'anae District are unique compared to the rest of the island because they are deeply rooted in Hawaiian culture and many of the residents are also of Hawaiian ancestry, and still practice Hawaiian traditions today. The MVL R project will benefit the community by perpetuating the Hawaiian culture through lo'i restoration and a Hawaiian farm. The historic sites on the parcel range in age from 50 to over 500 years old and should be preserved and restored to the fullest extent possible.

2. METHODS

Literature review for this cultural assessment includes Place Names of Hawai'i (Pukui/Eldbert), Sites of O'ahu (Sterling and Summers), Mākaha Valley Historical Project (Green, Ladd, Yen), An Ancient History of Wai'anae (Cordy), and Historic Wai'anae (McGrath, Brewer, Krauss).

The community consultation process was conducted by interviewing kama'āina and kūpuna connected to the project area. Interviewees shared their 'ike on the cultural practices, landscape, and history of the area. Three personal interviews were conducted. The information gathered through the interviews is summarized in Section 6, Community Consultations.

3. CULTURAL BACKGROUND

3.1 Religious and Cultural Practices

Hawaiians have very strong religious beliefs. In ancient times, Hawaiians lived by a strict kapu (taboo) system which governed all ways of life, and breaking of a kapu was often punishable by death. The ancient Hawaiians worshiped hundreds of gods relating to war, prosperity, health, and agriculture. The four main gods were Kāne, Kanaloa, Kū, and Lono. Lono was a god frequently worshipped, for he was the god of agriculture. Kāne'ākī Heiau (near the MVLR site) was originally built as an agricultural temple to pray for healthy crops by calling upon Lono and offering gifts. Over the centuries, Hawaiian culture evolved and Kāne'ākī was expanded and transformed into a luakini or sacrificial heiau where prisoners or fallen chiefs were sacrificed to the gods. Many ancient cultural practices still thrive in Mākaha today. Hawaiian farming, hunting, dancing, lei-making, and weaving are practiced by the residents.



Figure 1. Kāne'ākī Heiau

3.2 Legends and Traditional Accounts

A legend documented by Edward Iopa Kealanahale titled “How Mākaha Got Its Name” tells about a love story between a goddess and a chief famous for his fishing skills. This legend takes place in an unnamed valley on the Wai‘anae coast which was later named Mākaha.

Long ago, there lived in this valley a handsome young chief named Mākaha. His skill as a fisherman gained island-wide attention, which eventually reached the ears of Ke Ānuehue, the goddess of rain, who lived in upper Mānoa Valley.

She was so intrigued that she sent her trusted winged friend, ‘Elepaio, to investigate Mākaha. ‘Elepaio returned with exciting stories of Mākaha’s daring and skills.

The next morning, Ke Ānuehue created an awe-inspiring double rainbow which arched from Mānoa Valley to this valley, from where she and her retinue could watch Mākaha perform his daring feats at the ocean.

The people of the Wai‘anae Valley were petrified by that magnificent rainbow that ended in this unnamed valley where Mākaha lived.

Knowing that Ke Ānuehue was watching, they prayed that she would bring them the much needed gentle rains and not the harsh storms she could create when displeased. Mākaha, aware of her presence, scaled Mauna Lahilahi and called loudly to his ‘aumakua Manō ‘ai Kanaka, the most vicious of man-eating sharks. As Manō ai Kanaka glided in from the ocean, Mākaha dived from the rocky pinnacle, emerged on Manō ‘ai Kanaka’s back and rode with regal grandeur.

As the two disappeared into the depths, the sea became calm. Suddenly Mākaha seemed to be everywhere along the rocky coast gracefully tempting death. Then, just as suddenly, Mākaha seemed to skim the ocean as Manō ‘ai Kanaka carried him to shore.

Mākaha then carried his entire catch to the rainbow’s end deep in the valley and offered it to Ke Ānuehue. Deeply touched, she sent gentle rains to the parched earth of the great Wai‘anae Valley. She was impressed by the selection of seafood that was offered her but was disappointed by the quality of the poi, mai‘a and ‘uala which were dry and stringy. She demanded to know why since she was so accustomed to good quality fruits. She was told that it was because of the lack of rainfall in the valley.

Ke Ānuehue became enamored with Mākaha and from then on her double rainbow would appear in Mākaha’s kuleana [land area] and gentle rains would fall on Wai‘anae so the people could enjoy lush bananas and an abundance of taro.

The people built a heiau in honor of Ke Ānuehue and Mākaha but Ke Ānuehue refused the honor and named the entire valley, Mākaha, by which it is now known.

(Kealanahale, 1975)

3.3 Land Use and Settlement Patterns

Mākaha was the site of one of the first settlement pattern studies done by Bishop Museum from 1968-1970. The Bishop Museum's settlement pattern studies were published and compiled into the Mākaha Valley Historical Project. Unlike the other ahupua'a, settlement in Mākaha was primarily in the mid-to-upper valley because of the abundant and easily accessible water sources in the valley (Green, Makaha Before 1880 A.D., 1980). Settlement for the majority of the other ahupua'a was near the ocean because of the soft, flat lands that made building shelters and farms easier. This settlement pattern resulted in almost all of Mākaha's historical resources being located in the middle or upper valley. Ancient land use consisted mainly of agriculture and has now transitioned to residential and preservation land.

3.4 Agriculture and Gathering

Agriculture was a huge part of ancient Hawaiian daily life, and it dominated the land cover in Mākaha Valley. The MVLRL parcel was prime agricultural land and was probably used for seasonal planting and wetland kalo. Dryland plants such as sweet potato and breadfruit were common in the lower areas of the valley where water was not as easily accessible.

4. HISTORICAL BACKGROUND

4.1 Early Settlement

Hawaiians were believed to have migrated to Hawai'i between A.D. 0-600, but did not settle in the dry leeward areas until about A.D. 1000-1200. According to oral history and modern archaeology, these areas (which include 'Ewa, Wai'anae, and Waialua) began major development and expansion around A.D. 1300. It was at this time that powerful districts and more administrative levels of chiefs had probably formed, with chiefs behaviorally isolating themselves from commoners (Cordy). As time went on, the complexity of the ruling system developed until the point of its documentation at European contact.

Oral histories indicate that O'ahu was first unified under one chief in the 1400s. As the society progressed, larger temples were built and agriculture expanded because of population growth, increased power of the ali'i, and greater access to laborers. Kāne'ākī Heiau was also built around this time (1400-1600 A.D.).

4.2 Early Post-Contact Period

In 1819, King Kamehameha II (Liholiho) abolished the kapu system after much pressure from his kuhina nui, Queen Ka'ahumanu. Heiau were destroyed, images of gods were burned, and the people were left with "no religious restraint or guidance" until March of

1820 when the first Protestant missionaries arrived (Kalakaua, 1887). Under the rule of Chief Boki and his wife Liliha, residents of the Wai'anae District had no desire to conform to Christianity and resisted the missionaries and continued their cultural practices even with the kapu system abolished (McGrath Jr., Brewer, & Krauss, 1973). Chief Boki and the isolation of Mākaha played great roles in the preservation of Mākaha's culture and Hawaiian sites, including the revered Kāne'ākī Heiau.

The influence of Westerners forever changed Hawai'i. Almost 50 to 75 percent of the Hawaiian population died after Western contact, and Hawaiian language and practices were looked down upon and sometimes forbidden (Cordy, 2002; McGrath Jr., et al., 1973). During this time much of the language, culture, and traditions of Hawaiians were lost with the kūpuna, which is why it is even more important to create Hawaiian cultural centers and perpetuate Hawaiian traditions.

4.3 The Great Māhele

In the 1840s, King Kamehameha III divided the Hawaiian islands and granted residents the right to own land. Almost the entire ahupua'a of Mākaha was awarded to High Chief Kuho'oheihēi Abner Pākī in 1848 during the division of the Crown and Konohiki Lands. In 1849, the division of the Konohiki and Kuleana lands allowed the chief's tenants to claim their land (Green, et al., 1970). The concept of land ownership was completely new to Hawaiians and many did not understand it. The few who understood the concept of land ownership were often intimidated by their chiefs and did not apply for land. As a result, only thirteen claims, totaling nine acres, were made in Mākaha with seven of them being granted Land Commission Awards (LCAs). According to the 39 taxpaying adult males in 1855, there was still a significant number of families living on Chief Pākī's land as opposed to owning their land. Six of the seven LCAs were located inland, which reinforces the prominence of inland settlement in Mākaha. In the same year, Chief Pākī died and the administrators of his estate sold the land to James Robinson & Co. (Green, et al., 1970). Hawaiians living on the Chief's land were evicted and became wanderers or contract laborers to the Europeans (McGrath, et al., 1973).

4.4 Ranching and Plantations

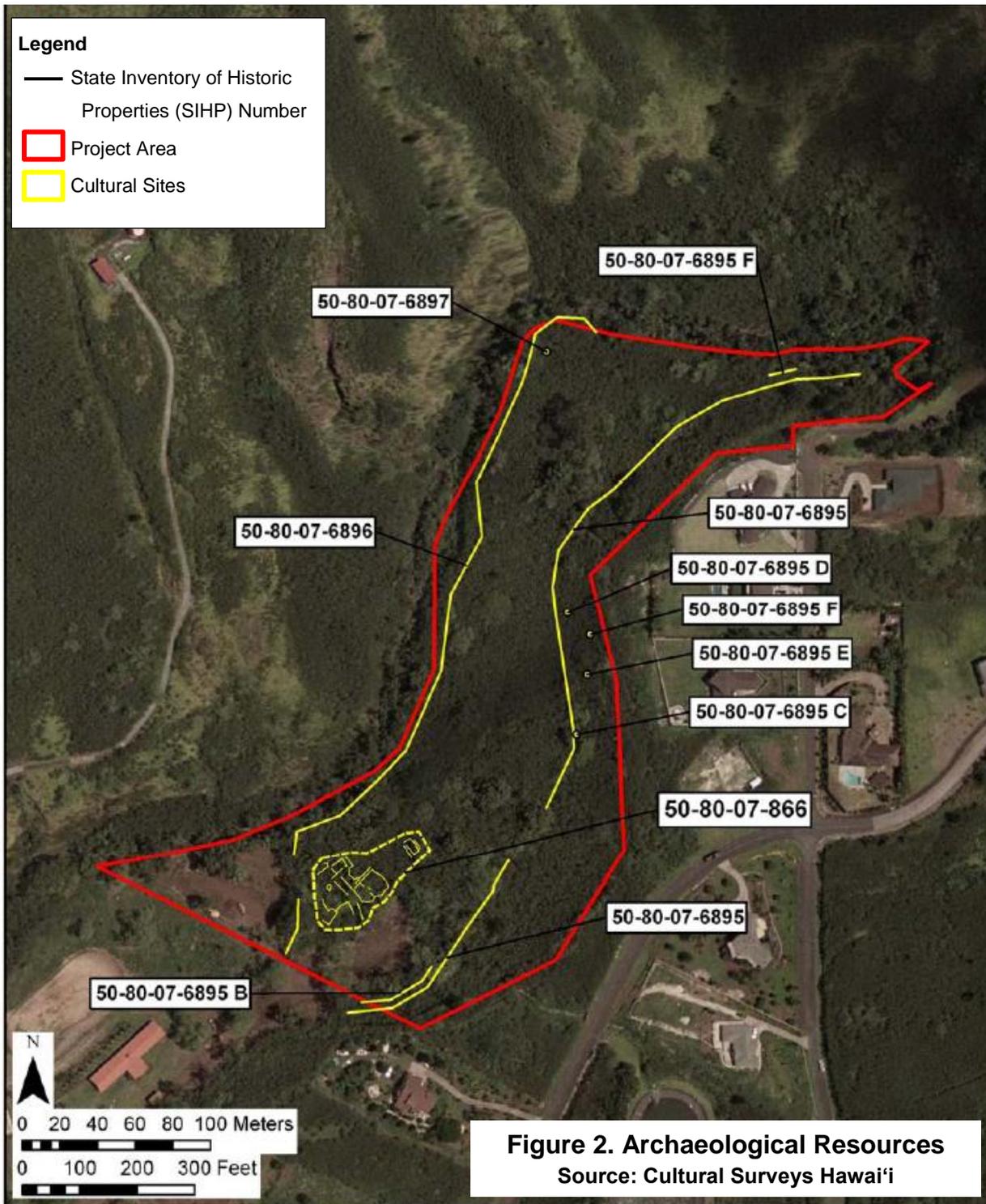
Robert W. Holt, a partner in James Robinson & Co. died in 1862 and the company's lands in Mākaha were put into a trust for Holt's daughter and three sons. Owen Jones Holt bought out the shares of his siblings and began a history of ranching in Mākaha. He and his family raised horses, cattle, sheep, turkeys and pigs; planted fruit trees, coffee and rice; and sold firewood. Holt began leasing lands to outsiders in 1880, which slowly diminished the presence of the Holt family in Mākaha. (Green, et al., 1970)

Over the years, there have been booming agriculture industries in Mākaha including coffee, rice, and sugarcane. Attempts at sugarcane production in Mākaha started as early as 1880, but the most successful efforts were those by the Wai'anae Company in

1908. The Wai'anae Company imported water from Wai'anae Valley because they didn't have full water rights in Mākaha. The coffee industry was also present in Mākaha. By 1890, there were 125 acres of coffee fields planted in Mākaha by James Robinson Holt II, who leased another 220 acres to the Mākaha Coffee Company in 1893. In 1922, the coffee land was sold to the Wai'anae Company for sugarcane expansion after low returns on coffee. Mākaha's rice industry began in 1899, but with almost all of the valley's water being used by sugar plantations, operations ended in 1909. Limited water resources from Mākaha Stream continued to restrict the expansion of the sugar plantation until 1945 when Glover Tunnel was built, giving Mākaha access to ground water for the first time.

4.5 Current Land Use

In October of 1946, one year after Glover Tunnel was built, the Wai'anae Company Sugar Plantation liquidated 9,150 acres of their property after years of drought, wage increases, and revenue loss. Most people envisioned Wai'anae becoming a ghost town, but Chinn Ho and the Capital Investment Co. saw the potential of this area and quickly bought the \$1.25 million section of land (McGrath, et. al., 1973). It was difficult to sell land in Wai'anae because of its reputation for inadequate water supply, but with Ho's enthusiasm and hard work his investment started to pay off from the early 1950s. By 1961, the company had made over \$8 million and still had at least \$20 million worth of land left to sell. Mākaha and the entire Wai'anae District experienced a huge population growth which led to growing infrastructure and development. There were public beaches, shopping centers, fire stations and banks. In 1969, the luxury Mākaha Resort and Golf Club was opened. During the late 20th century, Mākaha was transformed from a desiccated plantation into the lively residential community that it is today.



5. ARCHAEOLOGICAL BACKGROUND

Mākaha Valley is the location of one of the most intensive archaeological research project in the District of Wai'anae. Hundreds of historic and pre-historic sites have been found, dated, and researched including one of the sites in the MVLR parcel.

5.1 Archaeological Inventory Survey

An archaeological inventory survey (AIS; 2007) conducted for the project area identified four major historic sites within the 13-acre project parcel. The four historic sites are a historic plantation-era irrigation ditch, a stone cattle wall, a habitation complex related to ranching, and a pre-contact agricultural terrace. All historic features will be preserved by means of avoidance and protection.

The **irrigation ditch** site has seven historic features, including the irrigation ditch and its retaining walls. The irrigation ditch is associated with the sugar cane plantations from the early 20th century. It is made out of concrete and is currently filled with sediment, rocks, and overgrown vegetation. The ditch is located on the eastern edge of the parcel at the foot of the steep slope. There are a few remaining retaining walls on the upper and lower parts of the ditch, which were created to prevent erosion from above and to stabilize the foundation from below.

The **stone wall** is on the western side of the MVLR site and was most likely used for ranching to keep cattle from crossing the Mākaha Stream. The free-standing wall is approximately 420 meters long and stretches across almost the entire western side of the MVLR parcel along Mākaha Stream. There is slight damage to the wall due to bulldozing and the removal of rocks.

The **pre-contact terrace** was interpreted by the AIS to be a traditional Hawaiian agricultural terrace whose retained soil area was used for seasonal (winter) planting. The terrace would have been an ideal location to cultivate lo'i kalo with water from the stream. Radiocarbon dating of this site ranges from 1430-1650 A.D. with possible usage and reconstruction during the historic period. This historical site could be restored and expanded for use by the MVLR project.



Figure 3. Irrigation Ditch, Stone Wall, and Terrace (Source: Cultural Surveys Hawai'i)

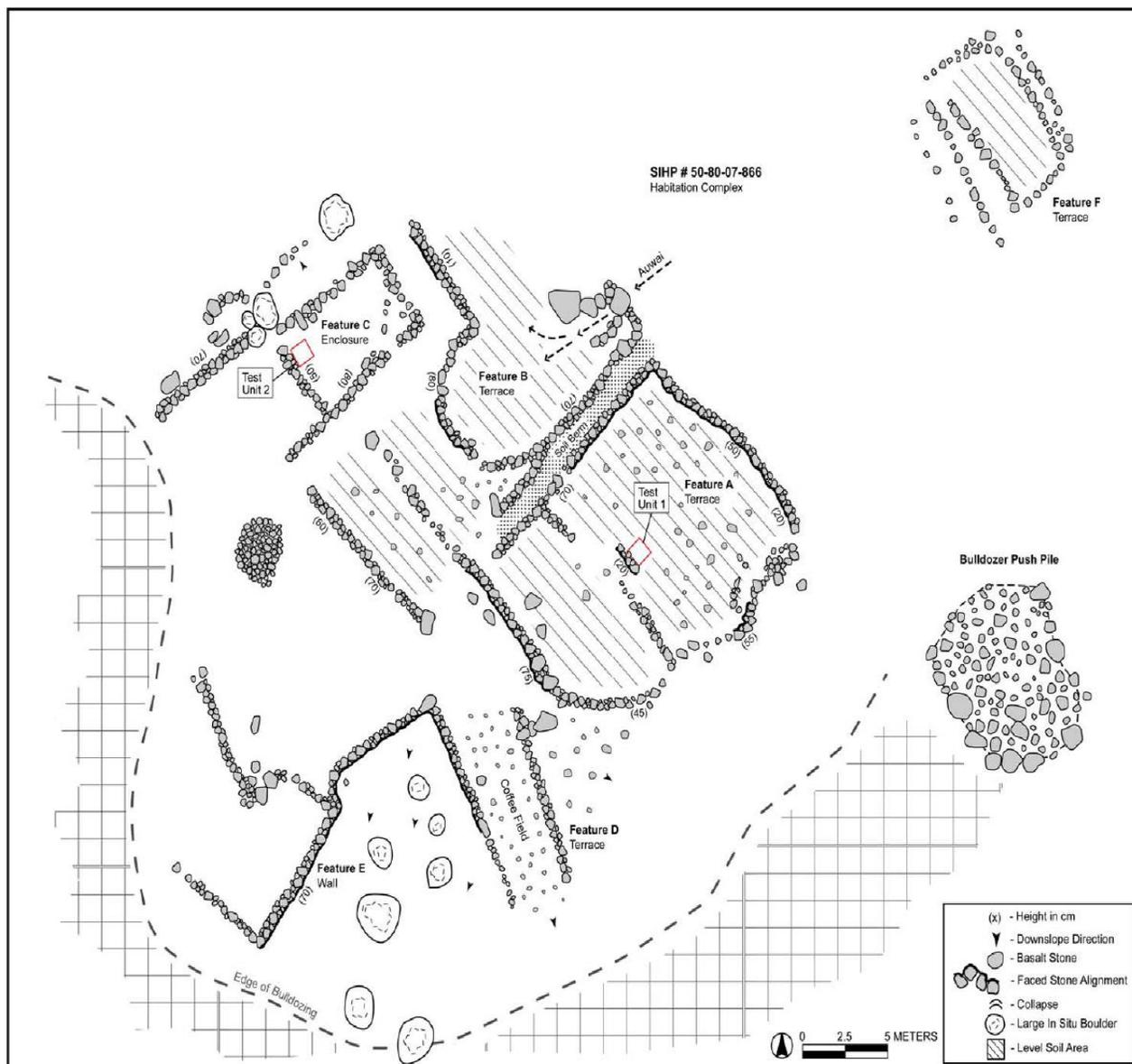


Figure 4. Habitation Site (Source: Cultural Surveys Hawai‘i)

The **habitation site** is composed of six historic terraces, low walls, and enclosures. It was described by Ladd and Yen (1972) as having three small rock mounds, a probable house platform, one sunken walled pit, and a series of terraces. Much of the resources that were found by Ladd and Yen in the 1970s have been disturbed by human influence, causing fewer historic remains to be seen today. This site dates back to Mākaha’s plantation and ranching period, but according to carbon analysis the habitation was built on a pre-contact site dating from 1430 to 1650 A.D. This habitation site was proven to be the residence of the prominent Holt family from 1910 to 1923 after the Wai‘anae Company took over the main Holt house for their plantation headquarters (Ladd & Yen, Makaha Valley Historical Project Interim Report No. 3, 1972).

5.2 Mākaha Valley Historical Project

The Mākaha Valley Historical Project (MVHP) was a privately funded project for the study of the lower valley. It took place from 1968 to 1970 and consisted of historical document research and archaeological excavation and interpretation. Over 600 archaeological features were recorded in the upper valley and 1,131 features in the lower valley. Thirty separate excavations including some radiocarbon samples dated Mākaha's settlement as early as the 13th century. The MVHP documented one of the sites in the MVLR parcel known as the habitation site. During the excavation of the habitation site, a stone pounder, 'ulu maika gaming stone, and an adze piece were found. James Holt, a former resident of this site, confirmed his family's use of the terraces for taro and vegetables in the late historic period. (Green 1969, 1970, 1980; Ladd & Yen 1972; and Ladd 1973.)

6. COMMUNITY CONSULTATIONS

The community consultation process was conducted by interviewing kama'āina and kūpuna connected to the project area. Townscape, Inc. spoke with three people via semiformal interviews. The interview method followed a "talk-story" form of information sharing. Townscape, Inc. also conducted a site visit with one of the interviewees, Landis Ornellas.

Interviewees were selected based on one or more of the following criteria: (1) had/has ties to the project area or vicinity; (2) is a known cultural practitioner; or (3) was referred by other cultural resource people.

Questions used for the interviews included:

- Ties/connection to the project area
- Knowledge of general history and present and past land use of the project area
- Knowledge of cultural sites that may be impacted by the project
- Knowledge of traditional gathering practices in the project area, both past and ongoing
- Recommendations for the project to address cultural concerns relating to the project area

Individuals were contacted via e-mail and/or telephone to schedule a talk-story session for this assessment. Community members contacted are shown in the table on the next page.

NAME	AFFILIATION	COMMENTS
Aila, Melva	Board Member of Mohala I Ka Wai	E-mail sent; left message; no response.
Aldeguer, Walterbea	Cultural practitioner	Unable to schedule meeting date/time.
Ayau, Tim	Golf course superintendent; Mākaha resident	E-mail sent; no response.
Cordy, Ross	Archaeologist	E-mail sent; no response.
Enos, Eric	Ka'ala Farm, Inc. and Mākaha resident	Interviewed on August 19, 2014.
Kila, Glen	Koa Mana; Mākaha resident	Unable to schedule meeting date/time.
Ornellas, Landis	Cultural Practitioner and caretaker of Kāne'ākī Heiau	Interviewed on July 3, 2014.
Rezentes, Cynthia	President of Mohala I Ka Wai	Interviewed on August 19, 2014.

6.1 Background of Interviewees

Cynthia Rezentes

Cynthia Rezentes has lived in Ma'ili her entire life and spent much of her time as a keiki in Mākaha, venturing into Mākaha's upper valley to gather fruits and plants with her family. Rezentes is the president of MIKW, the non-profit organization proposing the MVLR project.

Eric Enos

Eric Enos is a life-long Mākaha resident and is the director of Ka'ala Farm, Inc., a non-profit organization in Wai'anae Valley. Mr. Enos has first-hand knowledge in the restoration of ancient lo'i kalo at Ka'ala Farm and is also a board member of MIKW.

Landis Ornellas

Landis Ornellas has been a resident and caretaker of Mākaha Valley for over 40 years. He is also a Native Hawaiian cultural practitioner and the kahu of Kāne'ākī Heiau.

6.2 Traditional Cultural Practices

Through cultural research and interviews with community members, the cultural traditions still practiced today are summarized in this section.

Gathering

Mauka resources were used for many purposes including gathering for tools, canoe building, house construction, hula, food, cultural celebrations and medicine. Ms. Rezentes shared that as a keiki, she would go to the mauka areas with her father and uncle to gather plants. Some of the plants that were gathered include tī leaf, pepeiao fungus, palapalai, wauke, and mamake.

Fewer people go into the mauka areas now to gather plants because of the decrease in the presence of these native plants and the increase of invasive species. Generally, fewer people continue to practice traditional plant gathering. Ms. Rezentes remembered the upper Mākaha Valley having many canopy and sub-canopy levels with many native flora. She recalled seeing some coffee trees but not strawberry guava or Christmas berry trees that now make up most of the vegetation in the mauka areas.

During a site visit with Mr. Ornellas, no native plants were observed within the project area. The area was overgrown with nonnative trees and grass. Several large mango trees were observed throughout the site. Mr. Ornellas did point out several tamarind trees in the project area that could be used for medicinal purposes. No ongoing practices related to traditional plant gathering are present in the project area particularly because it is located on lands owned by City Board of Water Supply and due to the overgrowth of nonnative vegetation. The proposed project is unlikely to adversely impact those still practicing traditional plant gathering. In addition, the proposed project will restore native plants and remove invasive species.

Hunting

The most commonly hunted animal is the feral pig. During the site visit with Mr. Ornellas, markings left on trees by hunters were spotted. However, since the mauka lands are owned by the City Board of Water Supply, most of the hunters enter without permission. Access to hunting will not be affected as a result of the proposed project.

Research and community consultations suggest that hunting is not a traditional Hawaiian practice, but more of a modern tradition introduced by Europeans.

Aquatic Resources

The Mākaha coastline, as with the entire Wai'anae coast, was utilized for gathering and subsistence. Fish that were common in the Mākaha shoreline included 'ō'io and moi. In addition to bamboo pole fishing, it was common to use a large fishing net which is referred to as hukilau fishing.

Ms. Rezentes commented that even in the mid and upper reaches of Mākaha Stream, aquatic species such as 'o'opu and 'opae could be found. She recalled using small hand held nets to gather 'opae as a child. Ms. Rezentes remembered the upper reaches of Mākaha Stream flowing downstream of Kāne'ākī Heiau almost year round. Mr. Ornellas described the stream flowing continuously to the ocean in the past.

Most of the stream flow near the project area is from surplus water routed into Mākaha Stream from Glover Tunnel. The community members consulted do not believe that stream resources are used today since most of the fish and 'opae are no longer found in the project area.

Heiau

Although it is presently not open to the public, cultural practitioners are able to visit Kāne'ākī Heiau to give offerings and show respect to the gods. Examples of offerings given are leis, branch coral, pōhaku, and wai. Mr. Enos and Mr. Ornellas were part of the team of cultural caretakers in the restoration of the heiau. Mr. Ornellas currently serves as the kahu of the heiau. Access to the heiau would not be impacted by the proposed project.

Trails

Kumaipo Trail is a mauka trail that runs between Wai'anae and Mākaha. The trail went into the food patches and homes in Mākaha. A branch of that trail went to the mountain hat that looks down on Waialua and Mokuleia.

7. CULTURAL LANDSCAPE

The MVLR project is located on a historic and culturally significant land section. The project area shows Native Hawaiian settlement patterns and has a history of Hawaiian agriculture and farming. The settlement of the leeward area of O'ahu was estimated to be around 1200 A.D., though the earliest radiocarbon dating of historic sites on this parcel is about 1400 A.D. Just northeast of the MVLR parcel is the revered Kāne'ākī Heiau which also has a historical connection to agriculture. Historic sites such as terraces, stone walls, a habitation site, and an irrigation ditch show how the land use evolved from wetland and dryland plantings to ranching, and then use by the sugar plantations. Years of weathering and human presence have altered and destroyed parts of these sites and the post-contact introduction of invasive plants and animals has changed the landscape of this parcel.

8. SUMMARY AND RECOMMENDATIONS

The 13-acre MVLR parcel is home to four major historical sites including a habitation site, irrigation ditch, rock wall, and an ancient terrace. The habitation site, irrigation ditch, and cattle rock wall will be preserved by means of avoidance and educational signage to show visitors their significance. The ancient terrace will be preserved and restored to its traditional use as a retained soil area for wetland and dryland plantings. All sites will be cleared of invasive species before preservation and restoration activities take place. Workers and volunteer groups must take extra precaution while clearing, to not move any of the rocks from the historic sites.

The long range actions for this parcel include the replanting of native Hawaiian plants for edible, medicinal or cultural uses, and for the construction of a traditional style hale, composting toilets, equipment storage facility, and garden compost facility. The site of the proposed structures will be away from historic sites to eliminate negative impacts on these cultural or historic sites.

After several interviews with cultural practitioners and people tied to the MVLR area, no ongoing cultural practices were found in the MVLR vicinity. A few activities were noted in the upper valley where people may still practice hunting and gathering of plants, but no significant impact is expected on these practices. There are no known negative impacts or threats to the native culture. Rather, the MVLR project is expected to enhance the cultural knowledge and pride in this area.

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APPENDIX C

Archaeological Inventory Survey

**Archaeological Inventory Survey
of an Approximately 13-Acre Parcel for the Proposed
Mākaha Cultural Learning Center Project, Phase I,
Mākaha Ahupua‘a, Wai‘anae District, Island of O‘ahu
TMK: [1] 8-4-002:014 por.**

**Prepared for
Board of Water Supply**

**Prepared by
Hallett H. Hammatt, Ph.D.
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Management Summary

Reference	Archaeological Inventory Survey of an Approximately 13-Acre Parcel for the Proposed Mākaha Cultural Learning Center Project, Phase I, Mākaha Ahupua'a, Wai'anae District, Island of O'ahu (TMK: [1] 8-4-002:014 por.) (Hammatt et al. 2007)
Date	July 2007
Project Number (s)	Cultural Surveys Hawai'i, Inc. (CSH) Job Code: MAKAH 2
Investigation Permit Number	The fieldwork component of the archaeological inventory survey investigation was carried out under archaeological permit number 06-05, issued by the Hawai'i State Historic Preservation Division/Department of Land and Natural Resources (SHPD/DLNR), per Hawai'i Administrative Rules (HAR) Chapter 13-282.
Project Location	The project area is located in the northwestern portion of Mākaha Valley, situated along a natural stream terrace. The project area is bordered to the north and west by Mākaha Stream, to the east by a steep sloping bluff adjacent to Mauna 'Olu Street and private residences along Alahele Street, and to the south by a private horse ranch known as "Mākaha Ranch."
Project Funding and Land Jurisdiction	City and County of Honolulu (C&C), under the jurisdiction of the Board of Water Supply (BWS)
Agencies	C&C, BWS, SHPD
Project Description	The proposed project involves developing the subject property for the Mākaha Cultural Learning Center.
Project Acreage	Approximately 13 acres
Area of Potential Effect (APE) and Survey Acreage	The APE is defined as the entire approximately 13-acre project area. The proposed cultural learning center is evaluated as posing no additional auditory or visual impact to any surrounding potential historic properties. The survey area for the current inventory survey investigation included the entire approximately 13-acre project area.
Historic Preservation Regulatory Context	This document was prepared to support the proposed project's historic preservation review under Hawai'i Revised Statutes (HRS) Chapter 6E-42 and Hawai'i Administrative Rules (HAR) Chapter 13-284. In consultation with the Hawai'i State Historic Preservation Division (SHPD), the archaeological inventory survey investigation was designed to fulfill the State requirements for an archaeological inventory survey per HAR Chapter 13-13-276.

Fieldwork Effort	The fieldwork component of the archaeological inventory survey investigation was conducted on June 7 and 8, and July 3, 2006, by Hallett H. Hammatt, Ph.D., David Shideler, M.A., William H. Folk, B.A., Dominique Cordy, B.A., Darienne Dey, B.A., Jennifer Olson, B.A., Lleliena Loynas, B.A., and Jarib Porter. The fieldwork required 20 person-days to complete. In addition, Wai‘anae High School students assisted in the fieldwork effort on a volunteer basis.
Number of Historic Properties Identified	Four historic properties were identified within the project area. One site, SIHP # 50-80-07-866, was previously identified by the Mākaha Valley Historical Project (Green 1969). Three sites, SIHP #s 50-80-07-6895, 50-80-07-6896, and 50-80-07-6897, are newly identified.
Historic Properties Recommended Eligible to the Hawai‘i Register of Historic Places (Hawai‘i Register)	SIHP # 50-80-07-6895 historic, plantation-era irrigation ditch and associated retaining walls and terrace, recommended Hawai‘i Register eligible under Criterion D SIHP # 50-80-07-6896 historic, ranch-related stone wall, recommended Hawai‘i Register eligible under Criterion D SIHP # 50-80-07-6897 pre-contact, traditional Hawaiian agricultural terrace, recommended Hawai‘i Register eligible under Criterion D SIHP # 50-80-07-866 historic habitation complex, recommended Hawai‘i Register eligible under Criteria A, B, and D
Historic Properties Recommended Ineligible to the Hawai‘i Register	None
Effect Recommendation	The current archaeological inventory survey investigation identified four historic properties within the 13-acre project area. SIHP #s 50-80-07-6895, 50-80-07-6896, 50-80-07-6897, and 50-80-07-866 will potentially be affected by the proposed project. CSH’s project-specific effect recommendation is “effect, with proposed mitigation commitments.” The recommended mitigation measures will reduce the project’s potential adverse effect on these significant historic properties.

<p>Mitigation Recommendations</p>	<p>SIHP # 50-80-07-6895 historic, plantation-era irrigation ditch and associated retaining walls and terrace are remnants of Mākaha's historic land use and potential resources for educational exhibition and future archaeological research. Preservation, in the form of avoidance and protection, is recommended for the irrigation ditch and associated features.</p> <p>SIHP # 50-80-07-6896 historic, ranch-related stone wall is a remnant of Mākaha's historic land use and a potential resource for educational exhibition and future archaeological research. Preservation, in the form of avoidance and protection, is recommended for the stone wall.</p> <p>SIHP # 50-80-07-6897 pre-contact, traditional Hawaiian agricultural terrace is a remnant of Mākaha's pre-contact land use and a potential resource for educational exhibition and future archaeological research. Preservation, in the form of avoidance and protection, is recommended for the agricultural terrace. In keeping with the goals of the proposed Mākaha Cultural Learning Center, limited restoration of the terrace and possible construction of additional agricultural terraces would be deemed an appropriate cultural use of SIHP # 50-80-07-6897.</p> <p>SIHP # 50-80-07-866 habitation complex is a remnant of Mākaha's historic land use and a potential resource for educational exhibition and future archaeological research. Preservation, in the form of avoidance and protection, is recommended for the SIHP # 50-80-07-866 habitation complex.</p> <p>It is also recommended that a cultural resource preservation plan be prepared for the proposed Mākaha Cultural Learning Center project, in accordance with Hawai'i Administrative Rules (HAR) 13-277-3, to address buffer zones and protective measures for historic properties recommended for preservation. This preservation plan should detail the short and long term preservation measures that will safeguard the historic property during project construction and subsequent use of the project area.</p>
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Section 1 Introduction

1.1 Project Background

At the request of the City and County of Honolulu (C&C) Board of Water Supply (BWS), Cultural Surveys Hawai'i, Inc. (CSH) conducted an archaeological inventory survey of an approximately 13-acre parcel for the proposed Mākaha Cultural Learning Center Project, Phase I, Mākaha Ahupua'a, Wai'anāe District, Island of O'ahu (TMK [1] 8-4-002:014 por.). The project area is located on the floor of the northwestern portion of Mākaha Valley, situated along a natural stream terrace (Figures 1-3). The project area is bordered to the north and west by Mākaha Stream, to the east by a steep sloping bluff adjacent to the west side of Mauna 'Olu Street and private residences along Alahele Street, and to the south by a private horse ranch known as "Mākaha Ranch."

The land within the project area is owned by the City and County of Honolulu (C&C) and is under the jurisdiction of the Board of Water Supply (BWS). The project lands are currently undeveloped and is not being actively utilized. The project area is proposed to be developed into a cultural learning center. Proposed development within the Mākaha Cultural Learning Center project area may include: restoration of riparian biology and habitat within and along Mākaha Stream; restoration of traditional Hawaiian agricultural practices, including taro *lo'i* (irrigated pondfields); and construction of associated support infrastructure including a main building, field shelters, and a trail and roadway network (Figure 4). Minimally, land disturbing activities may include grubbing, grading, building construction, and excavations for the installation of subsurface utilities. The Area of Potential Effect (APE) is defined as the entire approximately 13-acre project area. The proposed cultural learning center is evaluated as posing no additional auditory or visual impact to any surrounding potential historic properties.

This document was prepared to support the proposed project's historic preservation review under Hawai'i Revised Statutes (HRS) Chapter 6E-42 and Hawai'i Administrative Rules (HAR) Chapter 13-284. In consultation with the Hawai'i State Historic Preservation Division (SHPD), the investigation was designed to fulfill the State requirements for an archaeological inventory survey per HAR Chapter 13-13-276. CSH completed the fieldwork component of the archaeological inventory survey under SHPD permit No. 0605, per Hawai'i Administrative Rules (HAR) Chapter 13-13-282.

1.2 Scope of Work

The archaeological inventory survey and its accompanying report documented all historic properties within the approximately 13-acre project area. The following scope of work satisfies State and County requirements for an archaeological inventory survey [per HAR 13-13-276]:

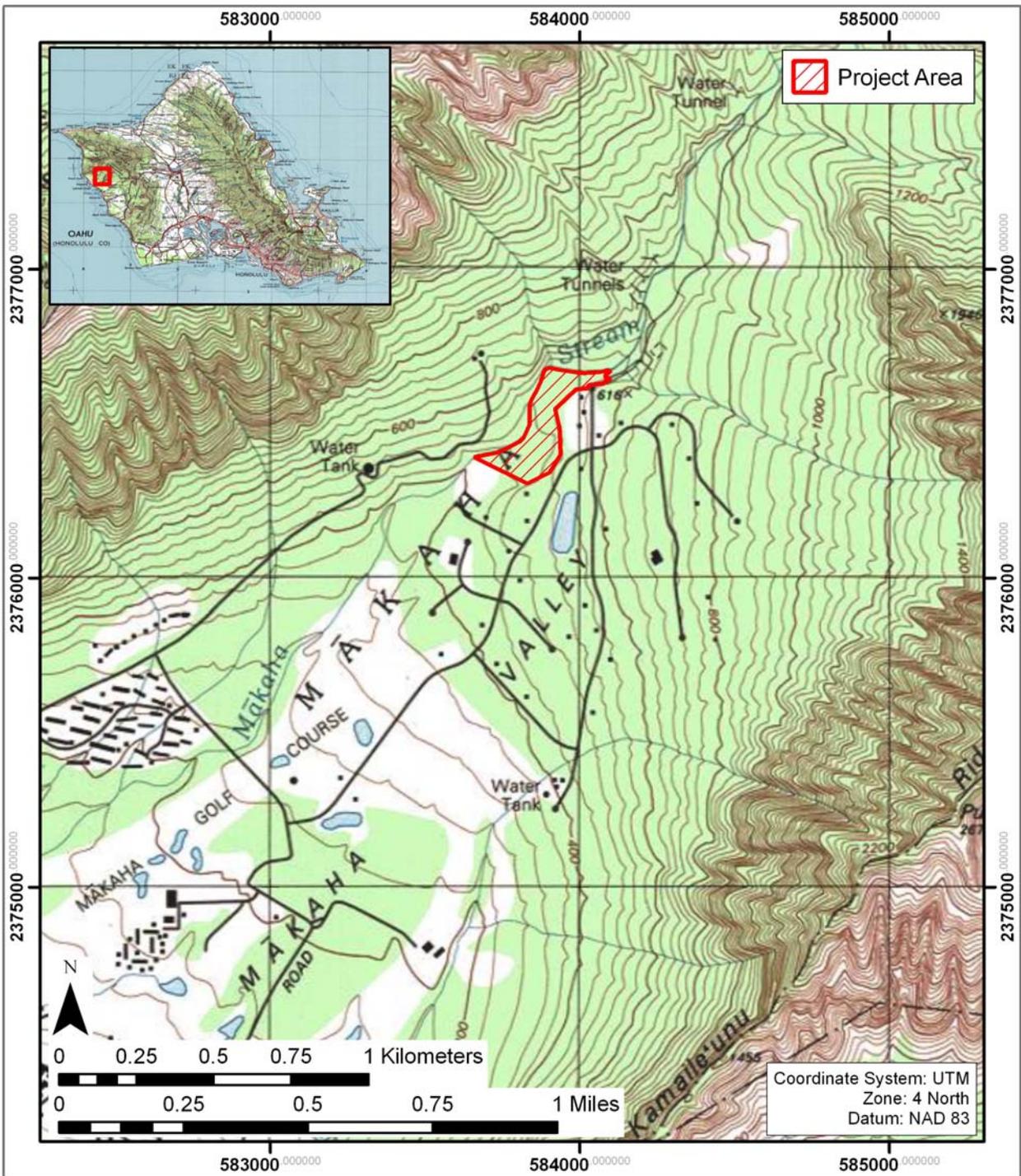


Figure 1. Portion of USGS 7.5-Minute Series Topographic Map, Waianae Quadrangle (1998), showing the location of the project area

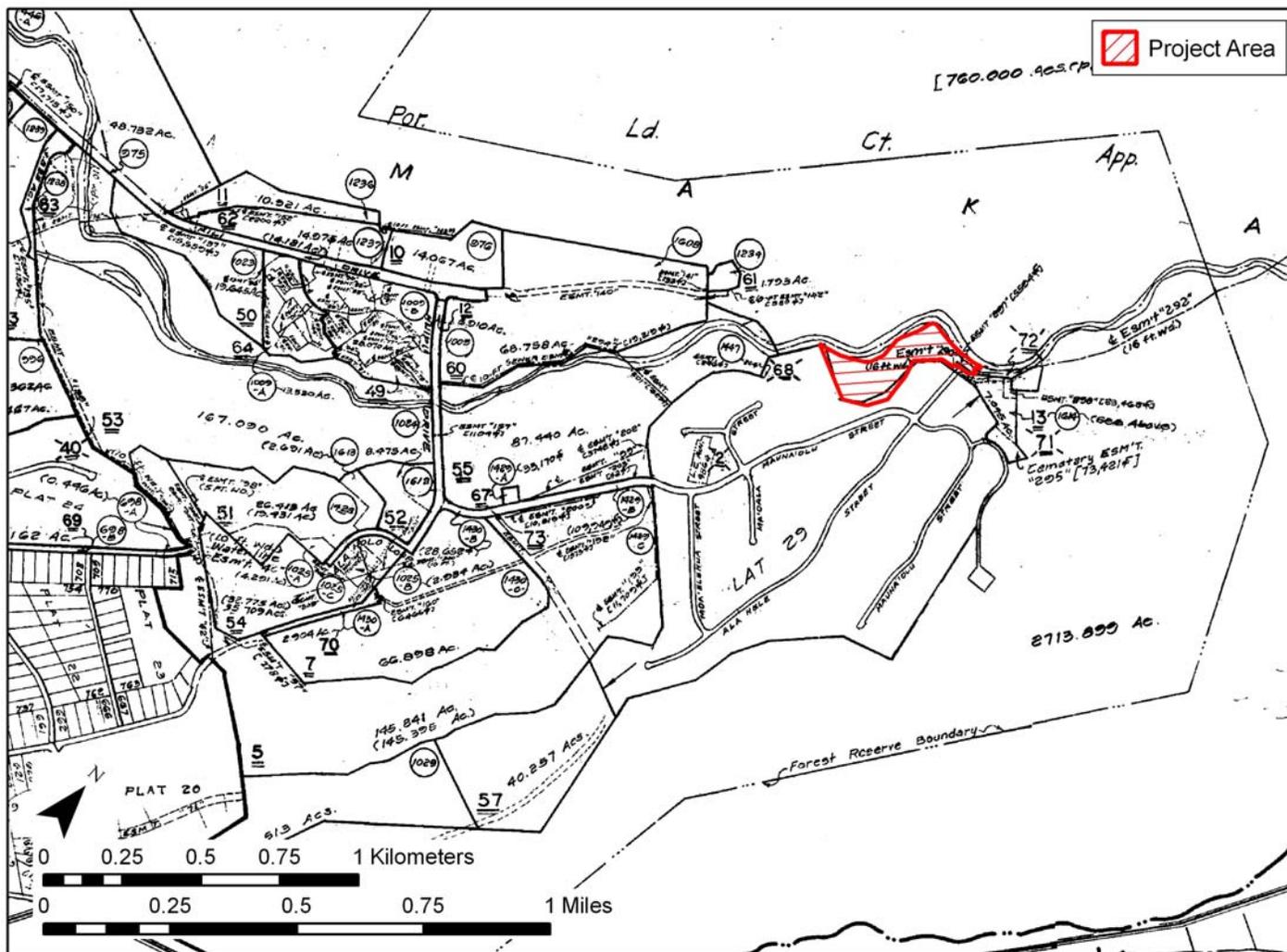


Figure 2. Portion of Tax Map Key 8-4-02, showing the location of the project area

Archaeological Inventory Survey, Mākaha Cultural Learning Center Project, Phase I

TMK: [1] 8-4-002:014 por.

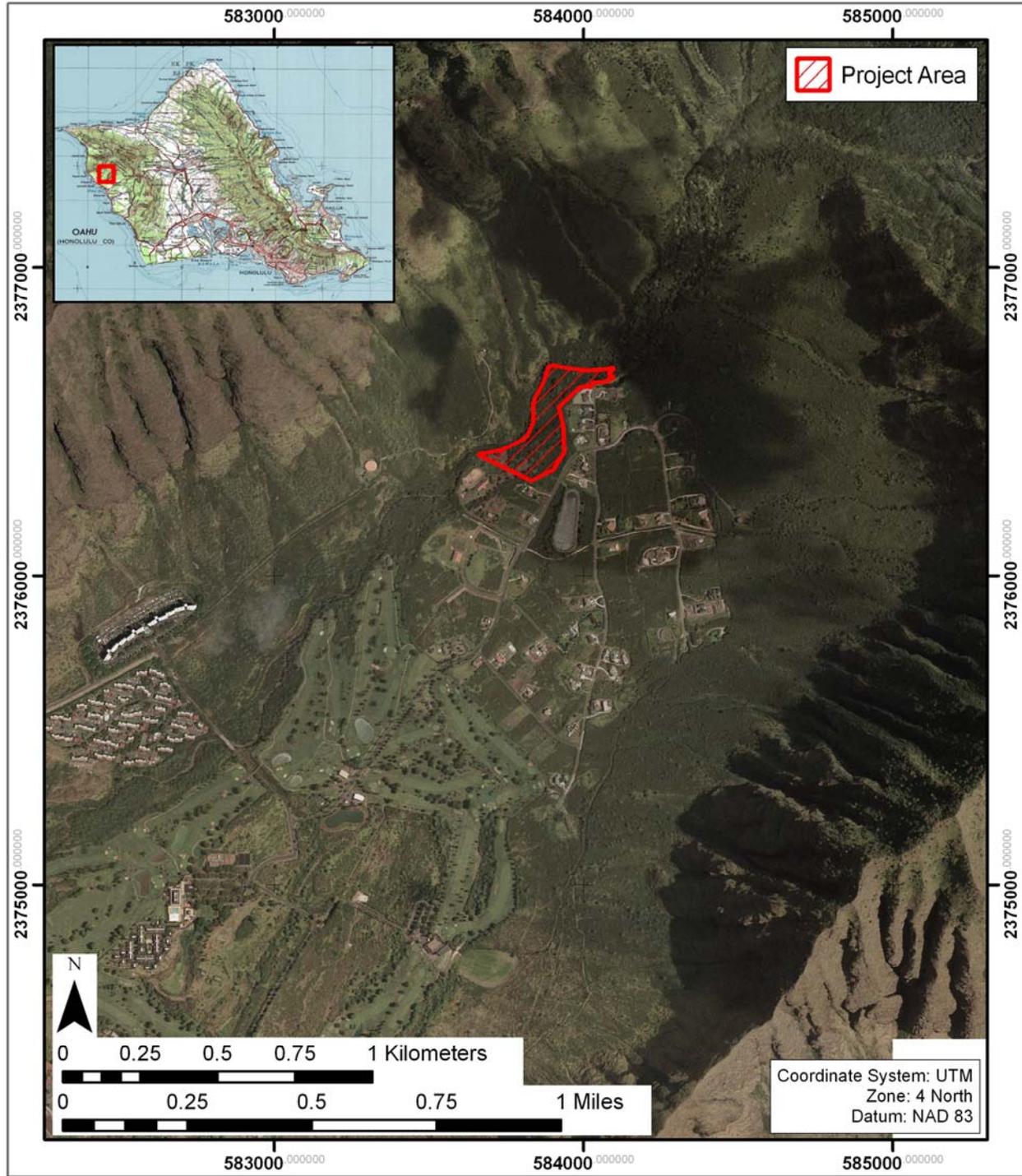


Figure 3. Aerial photograph showing the location of the project area (source: USGS Orthoimagery 2005)

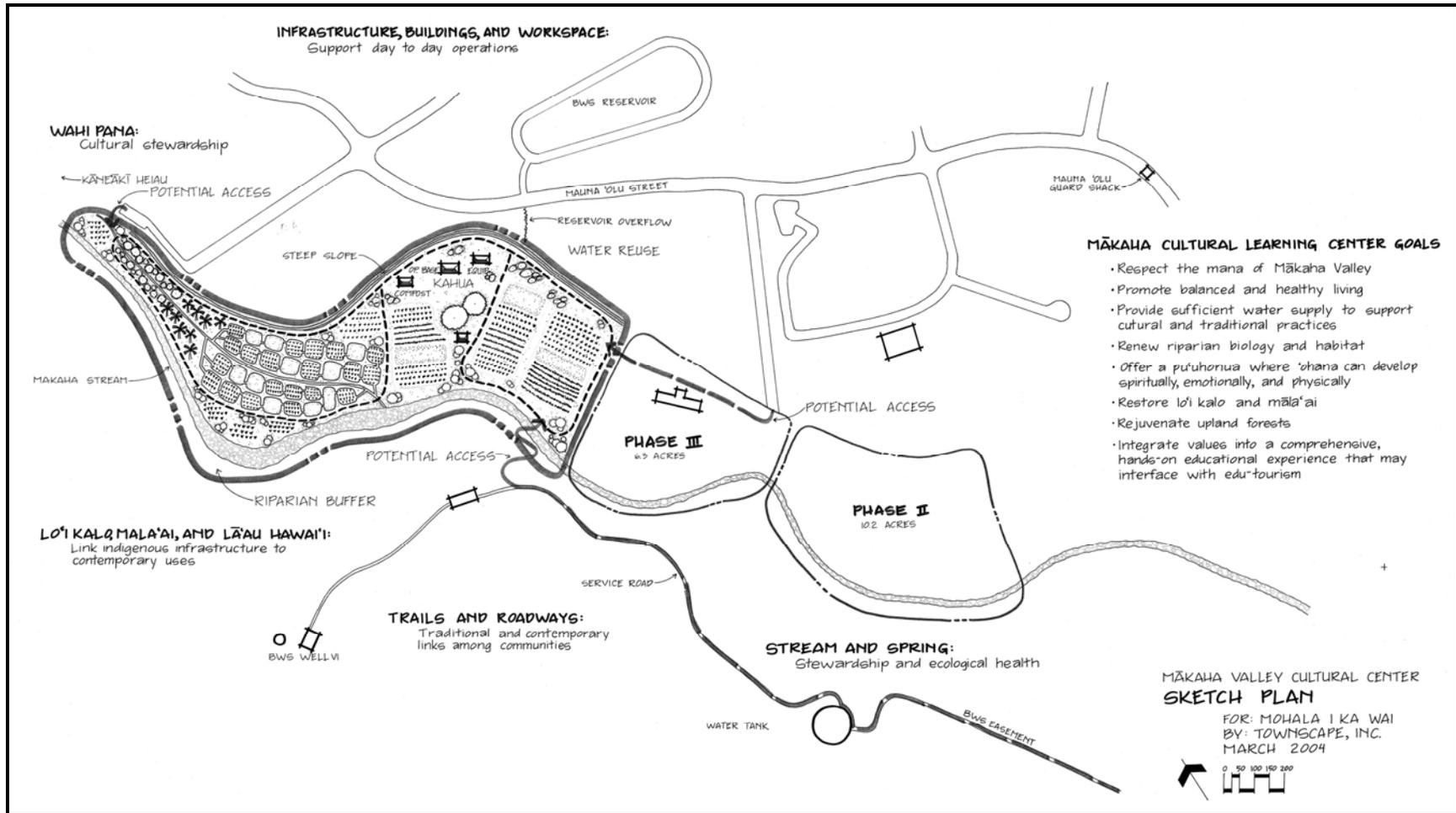


Figure 4. Mākaha Valley Cultural Center Sketch Plan, showing proposed development within the current Phase I project area

1. A complete ground survey of the entire approximately 13-acre project area for the purpose of historic property identification and documentation. All historic properties were located, described, and mapped with evaluation of function, interrelationships, and significance. Documentation included photographs and scale drawings of all historic properties. All historic properties were assigned State Inventory of Historic Properties (SIHP) numbers. All historic properties were also located with GPS survey equipment.
2. Limited subsurface testing to determine if subsurface deposits were located in archaeological sites within the project area, and, if so, evaluate their significance. Samples from these excavations were analyzed for chronological information.
3. Research on historic and archaeological background, including search of historic maps, written records, and Land Commission Award documents. This research focused on the project area with general background on the *ahupua'a* and district, and emphasizes settlement patterns.
4. Preparation of this inventory survey report including the following:
 - A project description
 - A topographic map of the survey area showing the locations of all historic properties;
 - Description of all historic properties with selected photographs, scale drawings, and discussions of function;
 - Historical and archaeological background sections summarizing prehistoric and historic land use as they relate to the project area's historic properties;
 - A summary of historic property categories and their significance in an archaeological and historic context;
 - Recommendations based on all information generated that will specify what steps should be taken to mitigate impact of development on the project area's significant historic properties - such as data recovery (excavation) and preservation of specific areas. These recommendations were developed in consultation with the client and the State agencies.

This scope of work also includes full coordination with the State Historic Preservation Division (SHPD), and the City and County of Honolulu relating to archaeological matters. This coordination takes place after consent of the landowner or representatives.

1.3 Environmental Setting

1.3.1 Natural Environment

Much of the land within the project area consists of relatively level or gently sloping terrain on a natural stream terrace/floodplain along the eastern bank of Mākaha Stream. Moderate to steep sloping terrain exists along the eastern portion of the project area, which can be described

as a rocky talus slope of alluvium and colluvium. Elevations within the project area range from approximately 125-170 m (410-560 ft) a.m.s.l.

Soils within the project area primarily consist of Pulehu Very Stony Clay Loam (PvC), with portions of Helemano Silty Clay (HLMG) and Lualualei Extremely Stony Clay (LPE) (Figure 5). Soils of the Pulehu Series are described as “well-drained soils on alluvial fans and stream terraces and in basins...developed in alluvium washed from basic igneous rock” (Foote et al. 1972). Soils of the Helemano Series are described as “well-drained soils on alluvial fans and colluvial slopes on the sides of gulches...developed in alluvium and colluvium derived from basic igneous rock” (Foote et al. 1972). Soils of the Lualualei Series are described as “well-drained soils on the coastal plains, alluvial fans, and on talus slopes...developed in alluvium and colluvium” (Foote et al. 1972).

The project area receives an average of approximately 800-1000 mm (31-39 in.) of annual rainfall (Giambelluca et al. 1986). Vegetation within the project area primarily consisted of exotic grasses, vines, and *koa haole* (*Leucaena leucocephala*), along with *kiawe* (*Prosopis pallida*), *klu* (*Acacia farnesiana*), lantana (*Lantana camara*), *kukui* (*Aleurites moluccana*), coffee (*Coffea sp.*), and mature mango trees (*Mangifera sp.*).

1.3.2 Built Environment

The subject parcel was undeveloped at the time of the inventory survey. No modern structures or infrastructure were located within the project area. The surrounding area is primarily rural. Private residences and paved roads border the project area to the east, and a private horse ranch borders the southern portion of the project area. To the north and west of the project area is the mountainous BWS Mākaha Watershed which is largely undeveloped, with the exception of water tanks, water tunnels, and associated infrastructure.

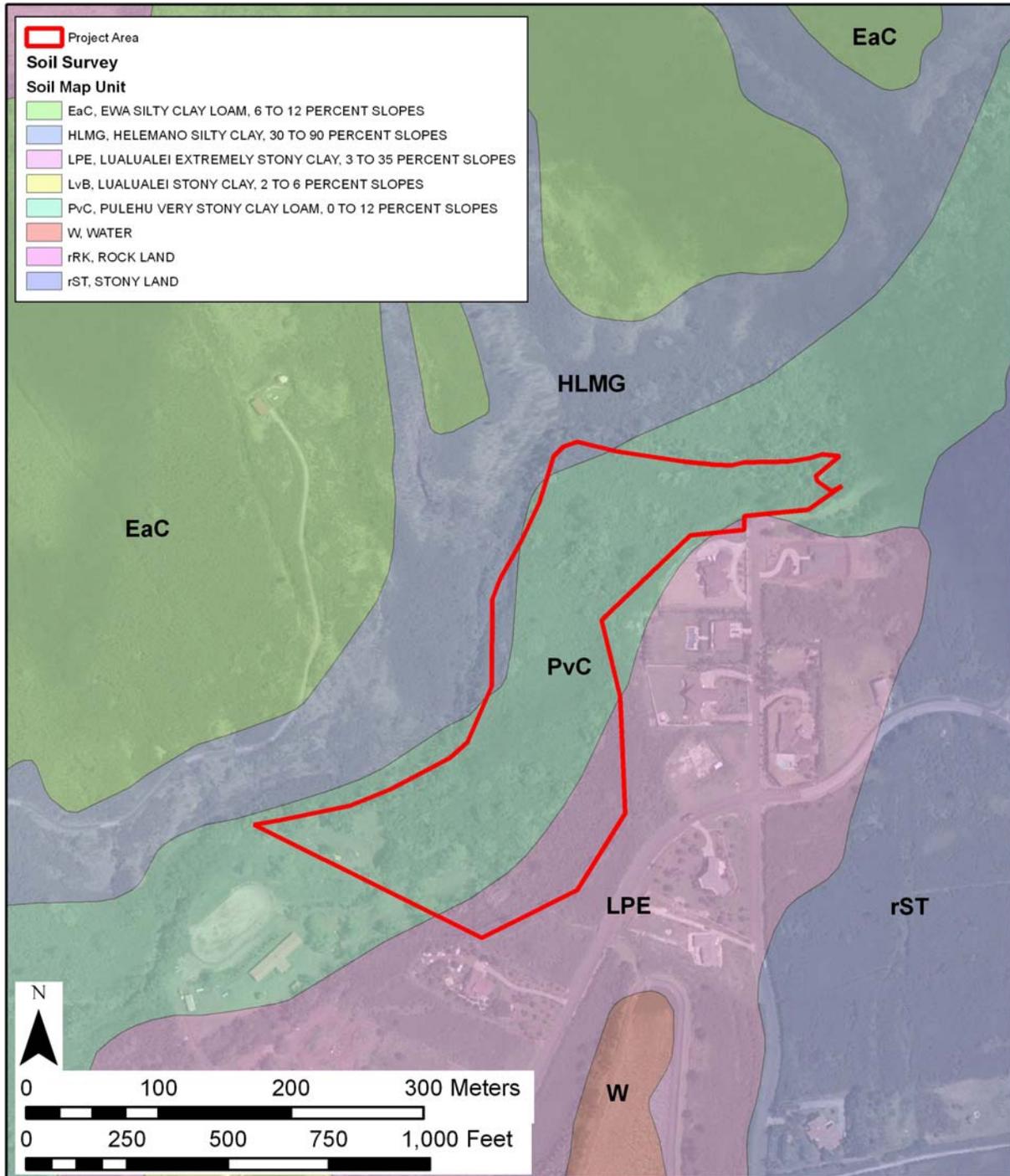


Figure 5. Overlay of Soil Survey of the State of Hawai'i (Foote et al. 1972), indicating soil types within the project area

Section 2 Methods

2.1 Field Methods

The fieldwork component of the archaeological inventory survey investigation was conducted on June 7 and 8, and July 3, 2006, by Hallett H. Hammatt, Ph.D., David Shideler, M.A., William H. Folk, B.A., Dominique Cordy, B.A., Darienne Dey, B.A., Jennifer Olson, B.A., Lleliena Loynas, B.A., and Jarib Porter. The fieldwork required 20 person-days to complete. In addition, Wai'anae High School students assisted in the fieldwork effort on a volunteer basis. Fieldwork consisted of a 100% coverage pedestrian inspection of the project area and limited subsurface testing at select archaeological sites. The pedestrian inspection of the project area was accomplished through systematic sweeps. The interval between the archaeologists was generally 5-10 m. All historic properties encountered were recorded and documented with a written field description, scale drawings, and photographs, and each site was located using Trimble Pro XR GPS survey technology (accuracy +/- 1 m).

Subsurface testing consisted of the partial excavation, by hand, of selected surface archaeological features located during the pedestrian survey. The purpose of the subsurface testing was to aid in determining the function of located surface sites, as well as to possibly obtain datable materials for later radiocarbon dating. All excavated material was sifted through a 1/8 in. wire mesh screen to separate out the soil matrix, then all cultural material was collected for analysis in the lab. Each test excavation was documented with a scale section profile, photographs, and sediment descriptions. Sediment descriptions included characterizations of Munsell color designations, compactness, texture, structure, inclusions, cultural material present, and boundary distinctness and topography.

2.2 Laboratory Methods

Laboratory analyses of material recovered from limited subsurface testing within the project area included:

1. Preparation and submittal of datable material, such as charcoal, to Beta Analytic for radiocarbon AMS dating.
2. Identification and cataloguing of traditional Hawaiian and historic artifacts. Any artifacts collected in situ at the project area or contained within sediment samples was measured, weighed and classified by material type and artifact type. The analysis then focused on distinguishing the possible function of the artifact.

2.3 Document Review

Historic and archival research included information obtained from the UH Hamilton Library, the State Historic Preservation Division Library, the Hawai'i State Archives, the State Land Survey Division, and the Archives of the Bishop Museum. Previous archaeological reports for the area were reviewed, as were historic maps and primary and secondary historical sources.

Information on Land Commission Awards was accessed through Waihona Aina Corporation's Māhele Data Base (<www.waihona.com>).

Section 3 Background Research

3.1 Traditional and Historical Background

3.1.1 Mythological and Traditional Accounts

The project area is located within the *ahupua'a* of Mākaha, which extends from the crest of the Wai'anae Mountain Range to the coast, between Wai'anae Ahupua'a to the southeast and Kea'au Ahupua'a to the northwest. Although there are many traditional accounts detailing the pre-contact period of other portions of the Wai'anae District, few exist for Mākaha. Nevertheless, the shores fronting the beautiful Mākaha Valley were known for their abundant marine resources. Edward Iopa Kealanahale's legend "How Makaha got its name" (Kealanahale 1975) highlights the great ocean resources:

Long ago, there lived in this valley a handsome young chief named Makaha. His skill as a fisherman gained island-wide attention, which eventually reached the ears of Ke Anuenue [the rainbow], the goddess of rain, who lived in upper Manoa Valley.

She was so intrigued that she sent her trusted winged friend, Elepaio, to investigate Makaha. Elepaio returned with exciting stories of Makaha's daring and skills.

The next morning, Ke Anuenue created an awe-inspiring double rainbow which arched from Manoa Valley to this valley, from where she and her retinue could watch Makaha perform his daring feats at the ocean.

The people of the Wai'anae Valley were petrified by that magnificent rainbow that ended in this unnamed valley where Makaha lived.

Knowing that Ke Anuenue was watching, they prayed that she would bring them the much needed gentle rains and not the harsh storms she could create when displeased.

Makaha, aware of her presence, scaled Mauna Lahilahi and called loudly to his aumakua [his ancestral spirit] Mano ai Kanaka, the most vicious of man-eating sharks. As Mano ai Kanaka glided in from the ocean, Makaha dived from the rocky pinnacle, emerged on Mano ai Kanaka's back and rode with regal grandeur.

As the two disappeared into the depths, the sea became calm. Suddenly Makaha seemed to be everywhere along the rocky coast gracefully tempting death. Then, just as suddenly, Makaha seemed to skim the ocean as Mano ai Kanaka carried him to shore.

Makaha then carried his entire catch to the rainbows end deep in the valley and offered it to Ke Anuenue. Deeply touched, she sent gentle rains to the parched earth of the great Wai'anae Valley. She was impressed by the selection of seafood that was offered her but was disappointed by the quality of the poi, mai'a [banana] and uala [sweet potato] which were dry and stringy. She demanded to know why since she was so accustomed to good quality fruits. She was told that it was because of the lack of rainfall in the valley.

Ke Anuenue became enamored with Makaha and from then on her double rainbow would appear in Makaha's kuleana [land area] and gentle rains would fall on Wai'anae so the people could enjoy lush bananas and an abundance of taro.

The people built a heiau in honor of Ke Anuenue and Makaha but Ke Anuenue refused the honor and named the entire valley, Makaha, by which it is now known.

Mākaha residents may have owed their successful exploitation of marine resources to more than just skill. Harry George Poe, born in Makua Valley in 1882, recounted in his diary that robbers threw their victims into a pit that went underground to the ocean (McGrath et al. 1973:11). He explains, "The reason is, they wants a man's legs without no hair on to make [an] aku [tuna] fishhook. They believed in those days that the human leg is best, lucky hook for aku" (McGrath et al. 1973:11). Such an account supports the definition given by Mary Kawena Pukui (1974) for "Mākaha" as "fierce" and especially the suggestion by Roger C. Green (1980) that the translation refers to the "fierce or savage people" who once inhabited the valley. Green (1980:5) mentions "...the 'Ōlohe people, skilled wrestlers and bone-breakers, by various accounts [who] lived in Mākaha, Mākua, and Kea'au, where they often engaged in robbery of passing travelers." One legend concerning the fierceness of Mākaha involves robbers and cannibals (McAllister 1933):

Long ago there lived here a group of people who are said to have been very fond of human flesh. At high altitude on each side of the ridge [separating Mākaha from Kea'au], guards were stationed to watch for people crossing this narrow stretch of land between the mountains and the sea. On the Mākaha side, they watched from a prominent stone known as Pohaku o Kane, on the Kea'au side, from a stone known as Pohaku o Kanaloa. The individual who passed here was in constant danger of death, for on each side of the trail men lay in wait for the signal of the watcher. If a group of persons approached, too many to be overcome by these cannibalistic peoples, the guards called out to the men hidden below, "Moanakai" (high tide); but if, as frequently happened, only two or three people were approaching the watchers called "Mololokai" (low tide). The individuals were then attacked and the bodies taken to two small caves on the seaside of the road. Here the flesh is said to have been removed and the bones, skin, and blood left in the holes, which at high tide, were washed clean by the sea.

For many years these people preyed upon the traveler until at one time men from Kauai, hairless men [Olohe] came to this beach. They were attacked by these cannibals but defeated them, killing the entire colony. Since then the region has been safe for traveling. (McAllister 1933:121-2)

Lua, often referred to as the “art of *lua*” or the Hawaiian martial art, literally means “hand-to-hand fighting” that includes bone-breaking (Pukui and Elbert 1986). The art of *lua* is said to have only been taught to the *ali'i* and their guards, as it was a long-standing familial secret and could only be passed down through relatives. In the early 1920s, the *kapu* was broken, and the Hawaiian martial art of *lua* was taught to other people outside of the bloodline. *Lua* had an array of weapons used in combat and made of different types of hardwood, such as *kauwila* and *kawa'u*, found throughout the Hawaiian Islands. Marine resources were also used to make weapons, such as the knifelike *leiomano*, which incorporates shark teeth, or the marlin (swordfish) bill.

A brief account (*Kuokoa*, July 12, 1923, in Sterling and Summers 1978:79) mentions the Hawaiian martial art and gives the location of a particular cave: “...Malolokai lies below [beyond] the hill of Maunalahilahi close to a cliff. Below, in the level land of Waihokaea are the bones of the travelers who were killed by skilled *lua* fighters.” There are also accounts of a talking stone on the hill of Malolokai, and two small pits on the *makai* side of the road at Kepuhi Point:

We rode to the plain of Kumanomano,... and it is said of the place, the teeth of the sun is sharp at Kumanomano. Mākaha rose above like a rain cloud. We passed in front of a famous hill Malolokai. We saw the talking stone standing there [*Kuokoa*, August 11, 1899 In Sterling and Summers 1978:79].

Other legends make reference to Mākaha, involving *menehune*, for example, and are mentioned in *Hawaiian Folk Tales* by Thos. G. Thrum (1998). In the story of Kekupua's Canoe, the *menehune* constructed a canoe for chief Kakaē, who lived in Wahiawā, for his wife to travel to Tahiti. Kekupua was the chief's main man who went to Mākaha to pull the canoe down to the ocean.

In Hi'iaka's “Address to Cape Kaena,” she mentioned Mākaha as she traveled along the sunny coast. As she stood at the top of the Pōhākea Pass, looking back she sang the following song (Emerson 1965:157):

Kaena's profile fleets through the calm,

With flanks ablaze in the sunlight-

A furnace-heat like Kilauea;

Ke-awa-ula swelters in heat;

Kohola'-lele revives in the breeze

That breath from the sea, Kai-a-ulu.

Kunihi Kaena, Holo i ka Malie;

Wela i ka La ke alo o ka pali;

Auamo mai i ka La o Kilauea;

Ikiiki i ka La na Ke-awa-ula

*Ola i ka makani Kai-a-ula Kohola'
lele-*

He makani ia no lalo.

Fierce glows the sun of Makua;
 How it quivers at Ohiki-lele-
 'Tis the Sun-god's dance o'er the plain,
 A roit of dance at Makaha.
 The sun-tooth is sharp at Kumano;
 Life comes again to Maile ridge,
 When the Sun-god ensheaths his fang.
 The Plain Walio' is sunburned and scorched;
 Kua-iwa revives with the nightfall;
 Waianae is consoled by the breeze
 Kai-a-ulu and waves its coco fronds;

 Kane-pu-niu's fearful of sunstroke'(e)
 A truce, now, to toil and fatigue:
 We plunge in the Lua-lei water
 And feel the kind breeze of Kona,
 The cooling breath of the goddess,

 As it stirs the leaves of ilima.

 The radiant heat scorches the breast
 While I sidle and slip and climb
 Up one steep hill then another;
 Thus gain I at last Moa-ula,
 The summit of Poha-kea.
 There stand I and gaze oversea
 To Hilo, where lie my dewy-cold
 Forest preserves of lehua
 That reach to the sea in Puna-
 My lehuas that enroof Kuki'i.

Haoa ka Loa i na Makua;
Lili ka La i Ohiki-lolo
Ha'a-hula le'a ke La i ke kula,
Ka Ha'a ana o ka La i Makaha;
Oi ka niho o ka La i Ku-manomano;
Ola Ka-maile i ka huna na niho
Mo'a wela ke kula o Walio;
Ola Kua-iwa i ka malama po
Ola Waianae i ka makani Kai-a-ulu
Ke hoa aku la i ka lau o ka niu
Uwe' o Kane-pu-niu i ka wela o ka
La;
Alaila ku'u ka luhi, ka malo'elo'e,
Auau aku i ka wai i Lua-lua-lei
Aheahe Kona, Aheahe Koolau wahine,
Ahe no i ka lau o ka ilima.
Wela, wela i ka La ka pili i ka
umauma,
I Pu'u-li'ili'i, i Kalawalawa, i Pahe-
lona,
A ka pi'i'na i Wai-ko-ne-ne'-ne;
Hoomaha aku i Ka-moa-ula;
A ka luna i Poha-kea
Ku au, nana i kai o Hilo:

3.1.2 Early Historic Period

Wai'anae District

The name of Wai'anae implies the richness of its *ahupua'a* coast, with *wai* meaning “water” and *'anae* meaning “large mullet” (Sterling and Summers 1978). Several accounts attest to the abundance of fish from Wai'anae waters (Wilkes 1845; Pukui et al. 1974). In 1840, Wilkes commented, “The natives are much occupied in catching and drying fish, which is made a profitable business, by taking them to Oahu, where they command a ready sale” (Wilkes 1845:81-82).

Wai'anae has been portrayed traditionally as a land of dual purpose: a refuge for the dispossessed and a hideout for the rebellious and outlawed. Certain landmarks in Wai'anae attest to this dichotomy. Kawiwi, a mountain between Wai'anae and Mākaha Ahupua'a, was dedicated as a refuge by priests during times of war (McAllister 1933; Kamakau 1992). Pōka'i Bay was used as a school administered by the exiled high-class priests and *kahuna* who took refuge in Wai'anae after Kamehameha I gained control of O'ahu (in Sterling and Summers 1978:68). It was also near Pōka'i Bay, at a place named Pu'u Kāhea, that the eighteenth-century prophet and *kahuna nui* of O'ahu, Ka'opulupulu, made his last famous prophecy before he was killed in Po'olua (in Sterling and Summers 1978:71).

Despite facing adversity among their fellow men, residents of Wai'anae had to unify in order to meet nature's challenges. Environmental conditions along the Wai'anae Coast certainly helped to shape the Wai'anae people. Captain George Vancouver, the first explorer to describe this coast in 1793, saw the Wai'anae Coast as “...composed of one barren rocky waste, nearly destitute of verdure, cultivation or inhabitants...” (Vancouver 1798:217). The *'ōku'u* epidemic of 1804 (thought to be cholera) also undoubtedly had a major effect on the native population, not only in Wai'anae but throughout O'ahu and the rest of the islands as well. John Papa 'Ī'ī relates that the *'ōku'u* “broke out, decimating the armies of Kamehameha I” [on O'ahu] (1959:16). Other diseases also took their toll. The combined census for the Wai'anae and 'Ewa Districts in 1831-1832 was 5,883 (Schmitt 1977:12). Twenty years later, the combined census for the two districts was 2,451.

Another foreign-introduced activity of the early historic period, which greatly impacted Hawaiian culture and the traditional lifestyle, was the sandalwood trade. In an effort to acquire western goods, ships, guns, and ammunition, the chiefs acquired massive debts to the American merchants ('Ī'ī 1959:155). These debts were paid off in shiploads of sandalwood. When Kamehameha found out how valuable the sandalwood trees were, he ordered the people not to let the felled trees crush the young saplings, to ensure their protection for future trade (Kamakau 1992:209-210).

Mākaha Ahupua'a

Earliest accounts specific to Mākaha describe a good sized inland settlement and a smaller coastal settlement (Green 1980). Green (1980:20-21) describes Mākaha's coastal settlement as “...restricted to a hamlet in a small grove of coconut trees on the Kea'au side of the valley, some other scattered houses, a few coconut trees along the beach, and a brackish water pool that served as a fish pond, at the mouth of the Mākaha Stream” (Figure 6).

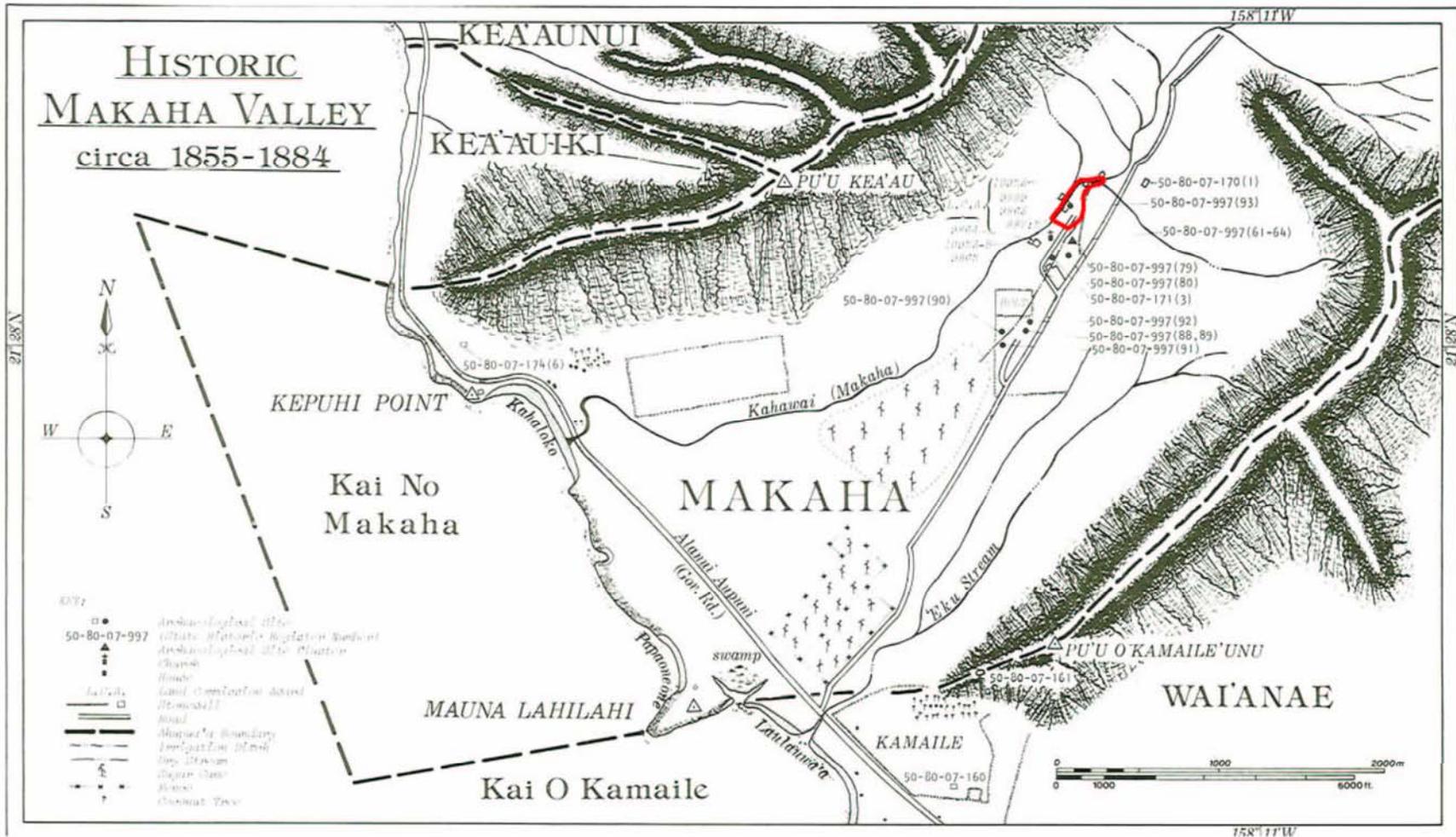


Figure 6. 1855-1884 Map (Green 1980) of Mākaha Valley showing location of project area (in red) and surrounding LCAs

This stream supported traditional wetland agriculture - taro in the pre-contact and early historic periods and sugarcane in the more recent past. Mākaha Stream, although it has probably changed course in its lower reaches, favors the northwest side of the valley leaving most of the flat or gently sloping alluvial plain on the southeast side of the valley. Rainfall is less than 20 inches annually along the coast and increases to approximately 60 inches along the 4000-foot high cliffs at the back and sides of the valley (Hammatt et al. 1985). Seasonal dryland cultivation in early times would have been possible, and dry land fields (*kula*) have been found in the valley in previous surveys (Green 1980).

The ancient, small (130-square meter) stepped stone *heiau* called Laukīnui, is so old that tradition claims it was built by the *menehune*. In areas watered by the stream there were *lo'i* lands, but along this arid coast there was plenty of land where there was not enough water for taro, and here sweet potatoes and other dryland crops may have flourished. The Bishop Museum study undertaken by Green (1980) found several field shelters with firepits associated with this dry land field system. Their settlement model indicates that during this early period the field shelters were used as rest and overnight habitations by people living permanently on the coast, who moved inland to plant, tend, and harvest their crops during the wet season (Green 1980: 74).

At the boundary between Mākaha and Wai‘anae Ahupua‘a lies Mauna Lahilahi, a striking pinnacle jutting out of the water. Vancouver describes Mauna Lahilahi as “a high rock, remarkable for its projecting from a sandy beach.” He also describes a village located south of Mauna Lahilahi situated in a grove of coconuts (Vancouver 1798:219). This village is Kamaile, which Green (1980:8) likens to a miniature *ahupua‘a* “with the beach and fishery in front and the well watered taro lands just behind.” A fresh water spring, Keko‘o, gave life to this land and allowed for the existence of one of the largest populations on the Wai‘anae Coast.

3.1.3 Māhele and LCA Documentation

The Organic Acts of 1845 and 1846 initiated the process of the Māhele - the division of Hawaiian lands, which introduced private property into Hawaiian society. In 1848, the crown and the *ali'i* (royalty) received their land titles. *Kuleana* awards for individual parcels within the *ahupua‘a* were subsequently granted in 1850. Mākaha Ahupua‘a had 13 claims of which 7 were awarded (Table 1). Six of the seven Mākaha LCAs were located inland, in the vicinity of the current project area, attesting to the importance of the inland settlement (see Figure 6). The seventh Mākaha LCA claims a *muliwai* as its western boundary. According to Pukui and Elbert (1986: 236) a *muliwai* refers to a “river, river mouth; pool near mouth of a stream, as behind a sand bar, enlarged by ocean water left there by high tide; estuary.” The reference to it as a boundary suggests this LCA was probably situated near the coast. Two unawarded claims also mention the *muliwai* as their boundary.

Land use information for the Mākaha LCAs is sparse. *Lo'i* lands and *kula* lands were an important part of sustenance. Aside from these general land specifications, there is mention of *noni*, ponds, and land for raising *ma‘o*. The *noni* and ponds are recorded in association with the *'ili* of Kamaile suggesting the claimant was claiming land in neighboring Wai‘anae Ahupua‘a in addition to the Mākaha claim. *Ma‘o* refers to an introduced species of “cotton” (*Gossypium barbadense* or *Gossypium hirsutum*), which was commercially grown in Hawai‘i beginning

Table 1. Land Commission Awards in Mākaha Ahupua‘a

Land Claim #	Claimant	'Ili	Land Use	Landscape Feature	Awarded
877	Kaana/Kuaana for Poomano, wife	Kapuaa	---	Surrounded by lands of Alapai	1 'āp.; 1.587 Acs (also Hotel St. & Waianae awards)
8228	Inaole (no name)	Laukini	house	stream on 2 sides	No
8763	Kanakaa	Hoaole	'ili		No
9689	Nahina	Kekio	16 lo'i, house lot	<i>kahawai</i> , <i>muliwai</i> on west	1 'āp. .957 Ac.
9859	Napoe	Aheakai/ Laukini Mooiki	17 lo'i (mo'o) & kula house	<i>pali</i> on N. Kalua ma on N., <i>kula</i> & stream on E, stream on S. <i>muliwai</i> on west.	No
9860	Kalua	Luulauwaa (Laulauwaa)	house	in <i>kahawai</i> (stream valley) of Mākaha, <i>hau</i> , <i>muliwai</i> on west	No
9861	Nahina, see above	Kekio	---	---	No
9862	Kanehaku	Kekio Mooiki	---	---	No
9863	Kala	Waikani Kahueiki Kapuaa	---	stream on S. <i>pali</i> (s) & stream land of Alapai	1 'āp.; (Kalihi) 1.346 Acs
9864	Kapea	Laukini	19 lo'i kula	<i>pali</i>	1 'āp.; 1.217 Acs
10613	Pākī, Abner	Ahupua'a	---	---	'Āpana 5: 4,933 Acres
10923	Uniu	Mākaha	---	stream on E. land of Kalua on S, <i>pali</i> on W.	1 'āp.; .522 Ac. 1 'āp.; .576 Ac.
10923B	Alapai	Kapuaa	2 lo'i & kula	<i>pali</i> on E. <i>kahawai</i> on W.	1 'āp.; .52 Ac.

in the early part of the nineteenth century, although it never became an important industry (Wagner et al. 1990: 876). *Ma'ō* generally does well in hot, arid environments and Mākaha would have been a suitable climate for such an industry.

Kuho'oheiehi (Abner) Pākī, father of Bernice Pauahi, was given the entire *ahupua'a* of Mākaha by Liliha after her husband, Boki, disappeared in 1829 (Green 1980). Although several individuals are recorded as having charge over Mākaha including Aua, Kanepaiki "chief of the Pearl River", and the present "King", A. Pākī felt entitled to the entire *ahupua'a* of Mākaha. It is uncertain how much of his claim he was granted. Whatever the case, it is suggested Pākī was able to wield a certain amount of control over the residents of Mākaha during the Māhele, resulting in the limited number of LCA applications. The number of taxpaying adult males in 1855 numbered 39, suggesting there were more families living and working the Mākaha lands (Barrere 1970: 7) than was reflected in Māhele awards.

Based on the Māhele documents, Mākaha's primary settlement was inland, where waters from Mākaha Stream could support *lo'i* and *kula* cultivars. Although there is evidence for settlement along the shore, for the most part, this was limited to scattered, isolated residents. The only "cluster" of habitation structures was concentrated near Mākaha Beach, near the Kea'au side of Mākaha, where there is also reference to a fishpond.

3.1.4 1850 to 1900

By ancient custom, the sea for a mile off the shores belonged to the *ahupua'a* as part of its resources. The ruling chief could prohibit the taking of a certain fish or he could prohibit all fishing at specific times. Pākī filed two such prohibitions, one in 1852 for the taking of *he'e* or octopus (*Polypus* sp.) and the other in 1854 for the taking of *'ōpelu* (*Decapterus pinnulatus*) (Barrere in Green 1980:7). In 1855, Chief Pākī died, and the administrators of his estate sold his Mākaha lands to James Robinson and Co. In 1862, one of the partners, Owen Jones Holt, bought out the shares of the others (Ladd and Yen 1972). The Holt family dominated the economic, land-use, and social scene in Mākaha from this time until the end of the nineteenth century. During the height of the Holt family dynasty, from about 1887 to 1899, the Holt Ranch raised horses, cattle, pigs, goats and peacocks (Ladd and Yen 1972:4). Mākaha Coffee Company also made its way into the Valley, buying up land for coffee cultivation, although they never became a prosperous industry. Upon Holt's death in 1862, the lands went into trust for his children.

3.1.5 1900 to Present

The Holt Ranch began selling off its land in the early 1900s (Ladd and Yen 1972). In 1907, the Wai'anae Sugar Company moved into Mākaha, and by 1923, virtually all of lower Mākaha Valley was under sugarcane cultivation. The plantation utilized large tracts of Lualualei, Wai'anae and Mākaha Valley. The manager's report for 1900 described the plantation as having some 400 acres of new land cleared, fenced and planted, two miles of railroad, and nearly three miles of flumes laid to said lands (Condé and Best 1973:357). For a half century, Mākaha was predominantly sugarcane fields, but by 1946, the manager's report announced the plans to liquidate the property because of the increase in wage rates, made the operation no longer profitable (Condé and Best 1973:358).

Historic maps illustrate the increased development of lower Mākaha Valley, in the vicinity of the current project area, through the first half of the 20th Century. A 1919 Fire Control Map (Figure 7) shows an inland settlement along Mākaha Stream, with a cluster of structures within the project area, and another cluster approximately 0.4 mi. (0.6 km) to the south. This is the same inland settlement illustrated in the Historic Mākaha Valley Map circa 1855-1884 (see Figure 6). A plantation irrigation ditch is also indicated passing through the eastern portion of project area, feeding the growing sugar plantations to the south. By 1928, the settlement structures are no longer indicated on the USGS map (Figure 8). This may indicate a shift in land use in the vicinity of the project area from a historic habitation settlement, to land use being dominated by growing commercial plantation and ranch interests. The 1928 USGS map does indicate the plantation ditch running through the project area, along with a stone wall immediately upslope of and parallel to the ditch, and an unpaved road down slope of and parallel to the ditch. The road is shown running up the middle of the project area. To the south of the project area, the map indicates increased construction of roads, fence lines, and stone walls, indicative of increased ranch and plantation development. The 1943 War Department map (Figure 9) is very similar to the previous 1928 USGS map, with no new major developments.

The lack of water resources played a role in Wai‘anae Sugar Company’s low profitability. In the 1930s, Wai‘anae Plantation sold out to American Factors Ltd. (Amfac, Inc.). American Factors Ltd. initiated a geologic study of the ground water in the mountain ridges in the back of Mākaha and Wai‘anae Valleys. The study indicated that tunneling for water would be successful, but before tunneling could commence, World War II came about and plans were put on hold (Green 1980). In 1945, American Factors Ltd. contracted the firm of James W. Glover, Ltd. to tunnel into a ridge in the back of Mākaha Valley. The completed tunnel (known as the “Glover Tunnel”) was 4200 feet long and upon completion had a daily water capacity of 700,000 gallons. The water made available was mainly used for the irrigation of sugar plantations. In 1946, Wai‘anae Plantation announced in the *Honolulu Advertiser* (Friday, Oct 18, 1946) that it planned to liquidate its nearly 10,000 acres of land. The day before, news of the impending sale was circulated among the investors at the Honolulu Stock Exchange. One of the investors was Chinn Ho.

The unorthodox Ho had started his Capital Investment Company only the year before with a bankroll of less than \$200,000, much of it the life savings of plantation workers. He was known as a friend of the little man, an eager disciple of economic growth, and an upstart. [McGrath et al. 1973:145]

Chinn Ho managed to broker the deal the following day, by 2 p.m, when the Wai‘anae Plantation sold the Mākaha lands to the Capital Investment Corporation, which stills maintains ownership of much of Mākaha Valley. There was an attempt to convert the sugar lands back to ranching, but the perennial problem of water continued. Parts of the property were sold off as beach lots, shopping centers and house lots. Many of the former plantation workers bought house

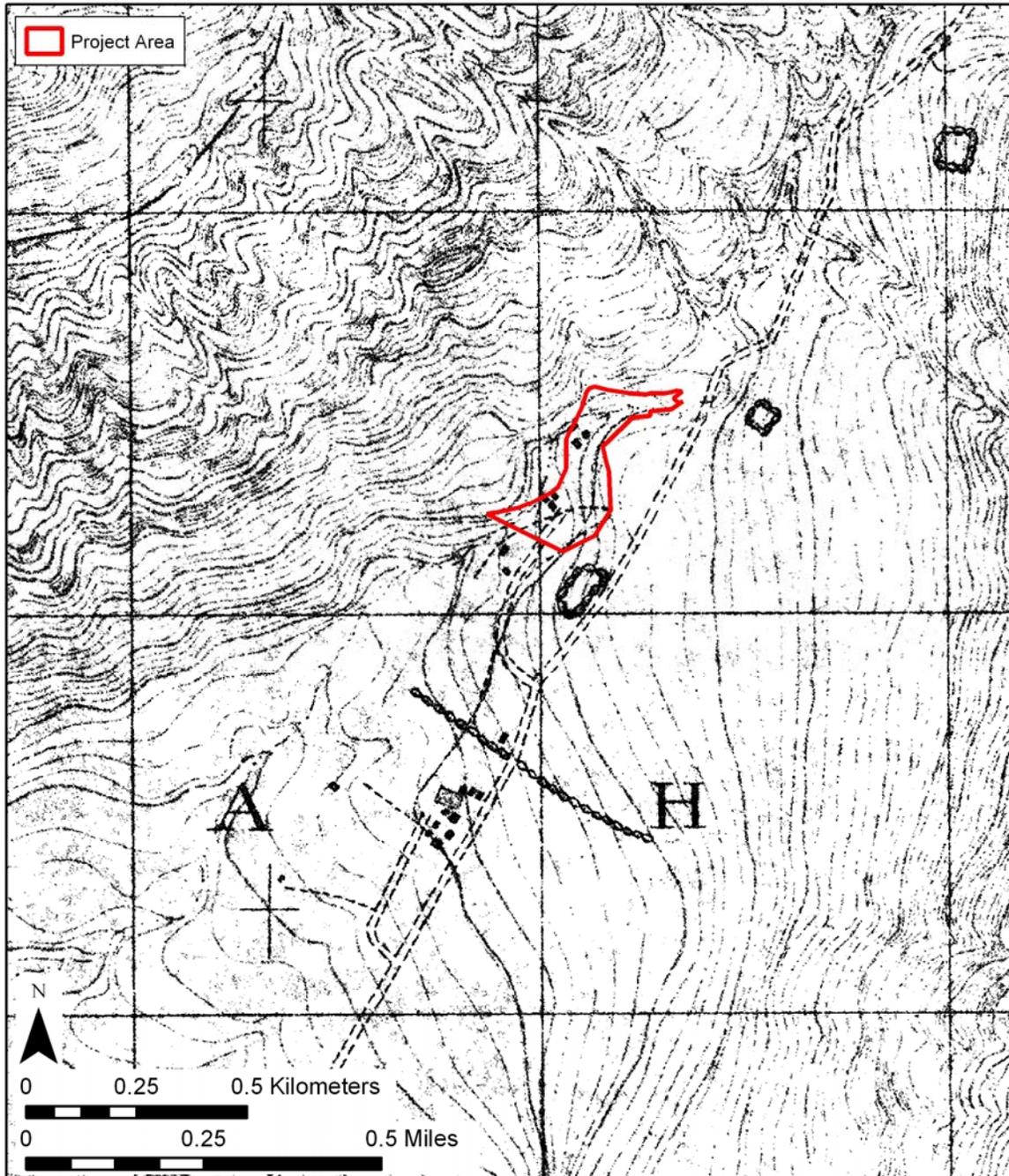


Figure 7. 1919 Fire Control Map, Wai'anae Quad., showing the location of the project area

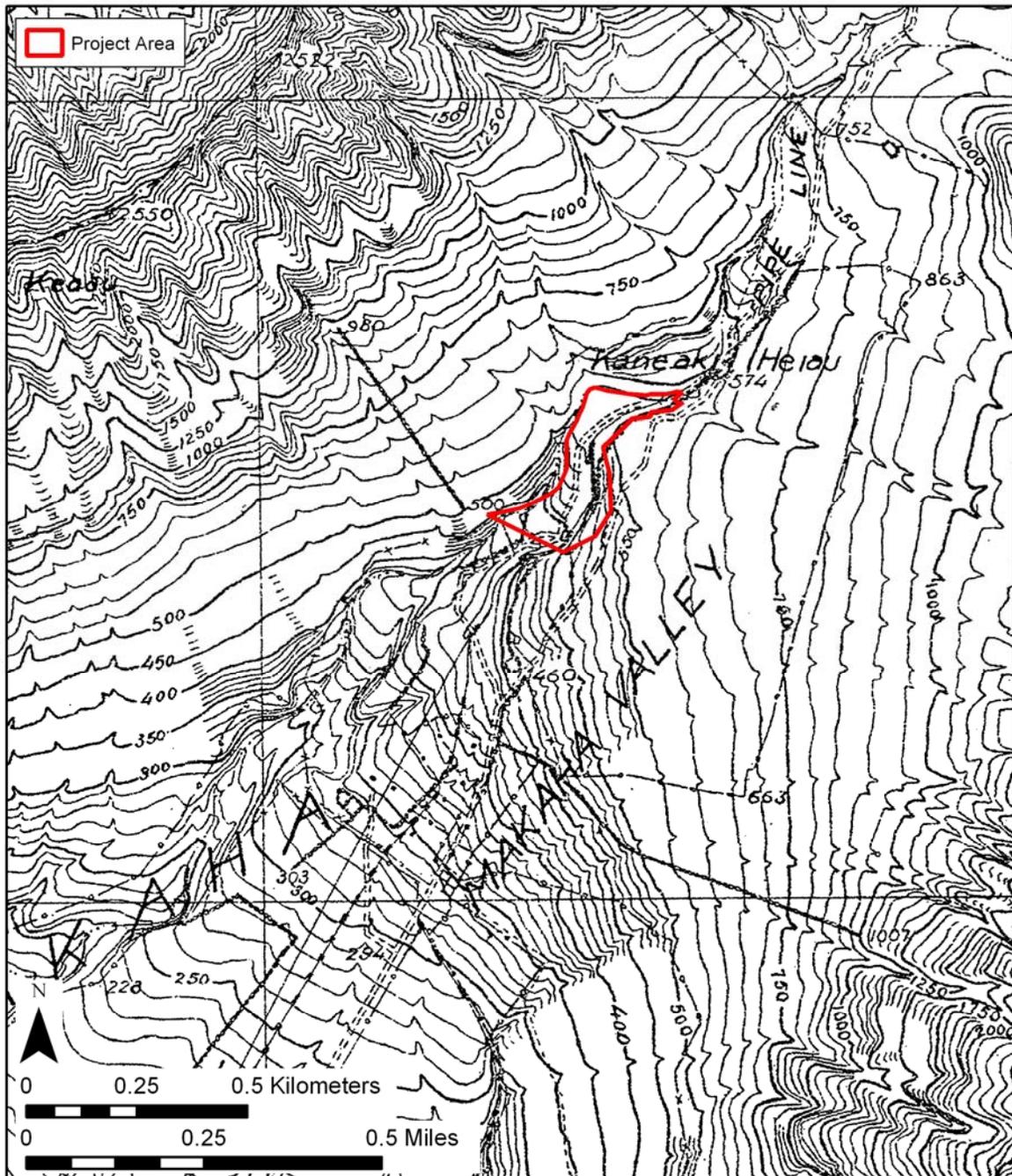
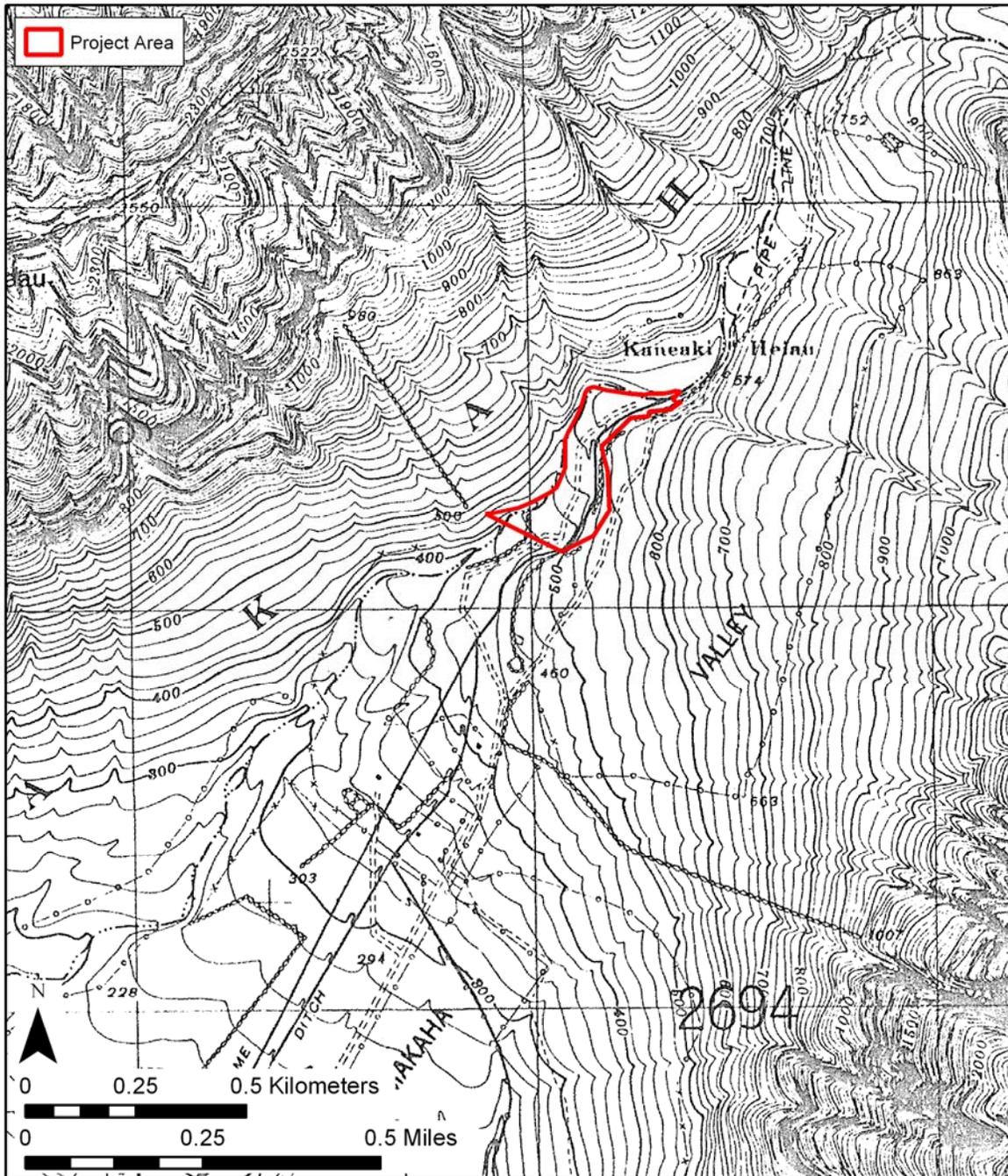


Figure 8. 1928-1929 USGS Topographic Map, Kaena Quad., showing the location of the project area



lots. Chinn Ho also put his personal investment into Mākaha and initiated resort development, including a luxury hotel. In 1969, the Mākaha Valley Golf Club, an 18-hole course with tennis courts, restaurant and other golf facilities was opened for local and tourist use (McGrath et al. 1973:146-163). Numerous other small-scale agricultural interests were pursued during this time period including coffee, rice and watermelons (Ladd and Yen 1972). Water from Glover Tunnel was now used to water Mākaha Valley farms, and the lush grounds of the Mākaha Inn and Country Club, and its associated golf course.

3.2 Previous Archaeological Research

A number of archaeological studies have been carried out in Mākaha Ahupua'a (Figure 10, Table 2), beginning with McAllister's (1933) island-wide survey in which he describes seven sites in Mākaha Ahupua'a. McAllister's Sites 173-175 are located in coastal Mākaha, with Sites 169-172 located in the mid and upper valley areas.

Site 173 was described as the "probable location" of a large rock reported in 1839 by E. O. Hall as "two or three miles distance" past the settlement at Pukahea (Pu'u Kahea) that was once an object of worship. This sacrificial stone was reported by Hall as "in no peculiar sense striking" and "as undignified as any other hump of inanimate matter along the road." It is unclear whether McAllister actually saw this stone, which Hall describes as "lying at the foot of a frightful precipice several hundred feet in height" but McAllister's map appears to locate it in the flats in the central seaward portion of the valley. Site 174, Laukinui Heiau, was described as "the important one [*heiau*] in Mākaha Valley", and said to be so old as to have been built by the *menehune*. McAllister places this site in the vicinity of Kepuhi Point and his description of the *heiau* incorporating a "coral outcrop" and "an amazing amount of coral" fits that locale. Site 175 known as Mololokai is located at the base of the ridge between Kea'au and Mākaha on the seaside of the road. This site was described as two pits where early cannibals had come to wash the de-fleshed bodies of their victims at high tide. Associated with this site were said to be two prominent stones, a Pōhaku O Kāne on the Mākaha side and a Pōhaku O Kanaloa on the Kea'au side (McAllister 1933 in Sterling and Summers 1978:79-80).

The following descriptions were provided for McAllister's Sites 169-172, which are located in the vicinity of the current project area:

Site 169. Terraces

Two-thirds of the way up the valley are to be found many rock-faced terraces, said to have been used for taro cultivation. They are about 3 feet high and usually long and narrow. Undoubtedly they were irrigated.

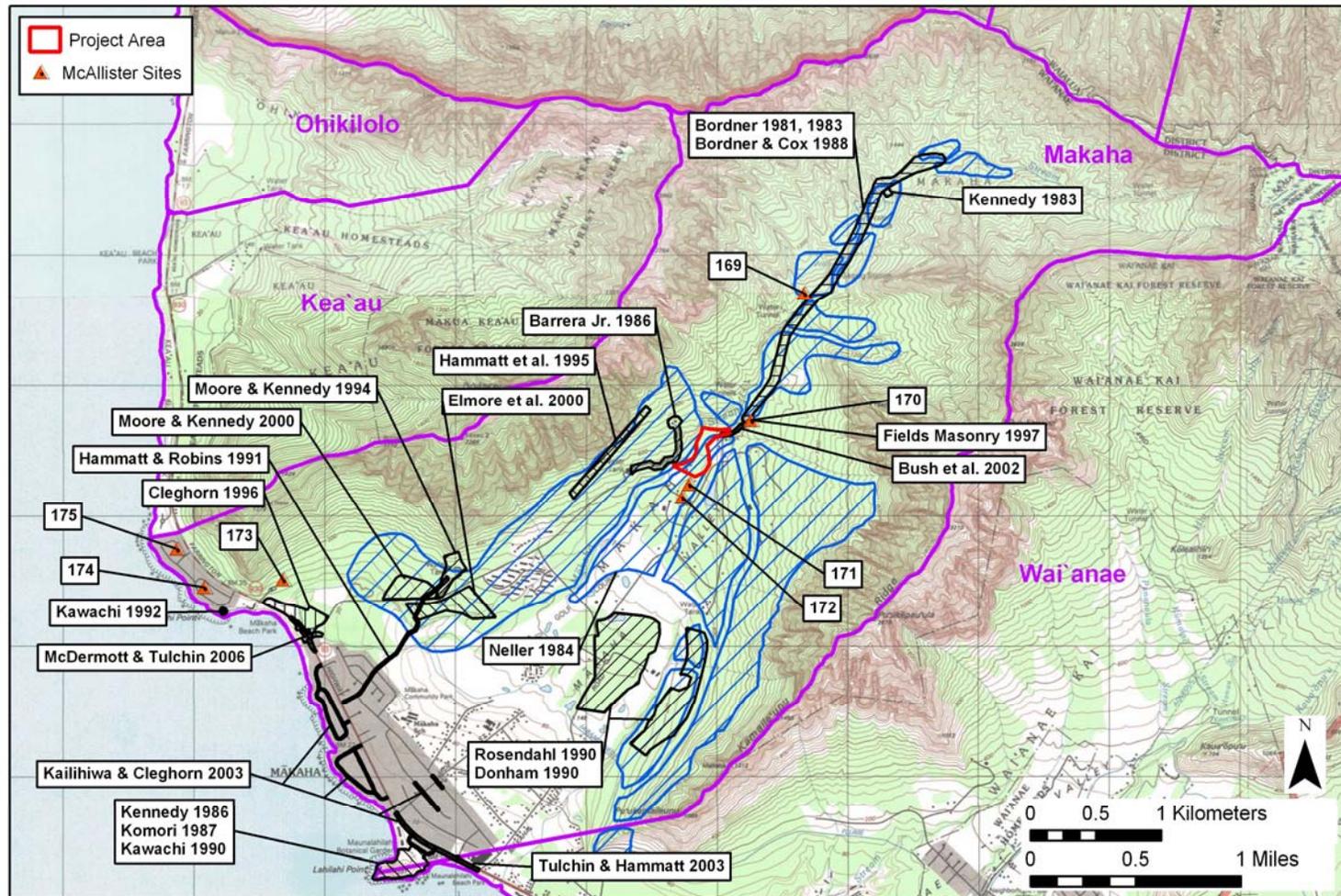


Figure 10. Portion of USGS 7.5-Minute Series Topographic Map, Waianae Quadrangle (1998), showing the locations of previous archaeological studies in Mākaha Ahupua‘a. Mākaha Valley Historical Project study areas are hatched in blue.

Table 2. Previous Archaeological Studies in Mākaha Ahupua'a

Study	Location	Type of Study	Findings
McAllister 1933	Island-wide	Island-wide Survey	Describes 7 sites within Mākaha Ahupua'a.
Green 1969	Large expanse of the central valley	Mākaha Valley Historical Project Report 1	Presents historical documentation and analysis of remains.
Green 1970	Large expanse of the central valley	Mākaha Valley Historical Project Report 2	Presents results of excavations including 16 carbon dates going back to circa AD 1200.
Ladd & Yen 1972	Large expanse of the central valley	Mākaha Valley Historical Project Report 3	Presents results of excavations.
Ladd 1973	Large expanse of the central valley	Mākaha Valley Historical Project Report 4	Presents results of excavations.
Green 1980	Large expanse of the central valley	Mākaha Valley Historical Project Report 5 - Summary	Summary of Archaeological Data and Cultural History.
Bordner 1981	Corridor in valley floor <i>mauka</i> of Kāne'ākī Heiau	Surface Survey	Notes numerous sites, mostly agricultural.
Bordner 1983	Corridor in valley floor <i>mauka</i> of Kāne'ākī Heiau	Surface Survey	Notes numerous sites, mostly agricultural.
Kennedy 1983	Elevation of 1072 feet in the valley floor, 2 km <i>mauka</i> of Kāne'ākī Heiau	Well Monitoring Report	Observed no buried features or artifacts.
Neller 1984	Central Valley (Site Area -997)	Archaeological Reconnaissance Survey	Identifies unreported sites, and re-analysis several sites.
Hammatt et al. 1985	West side of valley (Site Area 776)	Archaeological Reconnaissance Survey	Identifies numerous modified natural terraces assoc. with dryland agriculture.

Study	Location	Type of Study	Findings
Barrera Jr. 1986	West central side of the valley	Archaeological Survey	Identified four sites including four stone platforms, a U-shape habitation enclosure, a terrace and a wall. Some 17 test pits were excavated.
Kennedy 1986	Mauna Lahilahi	Archaeological Investigations	Identifies five archaeological sites.
Ahlo et al 1986	Mauna Lahilahi	Affidavits of brief oral histories	Accounts note the general sacredness of Mauna Lahilahi & the good fishing.
Komori 1987	Mauna Lahilahi	Archaeological Survey & Testing	Relocates Kennedy's five sites and describes eleven more. Reports eight carbon dates.
Bordner & Cox 1988	Upper valley valley floor	Mapping Project	Ties in previously identified sites, focus on sites -764 & -77, emphasis on dryland ag.
Donham 1990	Two areas on southeast side of the valley	Archaeological Inventory Survey	Identified a terrace assoc. with dry-land ag. and/or habitation.
Kawachi 1990	Mauna Lahilahi	Burial report	Describes remains of 2+ individuals, artifacts & sites.
Hammatt & Robins 1991	Water Street/ Kili Drive Area	Archaeological Inventory Survey	Identified a linear earthen berm understood as associated with commercial sugar cane cultivation.
Kawachi 1992	84-325 Makau St., Kepuhi Point	Burial Report	1 burial? "First in this particular area".
Moore & Kennedy 1994	Northwest side of the valley, 242-foot elevation	Archaeological Investigations	No historic features were located.

Study	Location	Type of Study	Findings
Cleghorn 1997	<i>Mauka</i> of Farrington Hwy, north of Kili Drive	Archaeological Inventory Survey	A cultural layer, a pond/wetland area remains of structures associated with the O. R. & L. Railroad, and a bridge foundation .
Pagliario 1999	Kāneʻākī Heiau	<i>Heiau</i> Restoration Report	Presents background, a restoration plan & an account of restoration work.
Magnuson 1997	Upper Mākaha Valley	Archaeological Review	Presents an overview & summary of previous studies.
Maly 1999	Central valley	Limited Consultation Study	Presents a historical overview and consultation with knowledgeable parties.
Elmore et al. 2000	South side of Kili Drive (Site area - 776)	Archaeological Inventory Survey	Identified three features poss. assoc. with dry-land ag. and/or habitation.
Moore & Kennedy 2000	North side of Kili Drive (Site area - 776)	Archaeological Inventory Survey	Identified two features poss. assoc. with dry-land ag.
Bush, Shideler and Hammatt 2002	Mauna Olu Non-Potable Reservoir Infrastructure Repair Project (TMK: 8-4-02:13, 8-4-29:43, 134, 135)	Archaeological Monitoring Report	Minimal finds
Kailihiwa& Cleghorn 2003	Lower Mākaha	Archaeological Monitoring Report	Identified three sites with five features.
Tulchin and Hammatt 2003	Kili Drive and Farrington Hwy.	Archaeological Inventory Survey	No cultural resources identified.
Tulchin and Hammatt 2004	Farrington highway, Jade Street to Kaulawaha Road, (TMK 8-4-01,03,04,11,13, 14; 8-5-02, 14-18	Archaeological Monitoring Report f	Minimal finds

Study	Location	Type of Study	Findings
Hammatt 2006	Mākaha Bridges 3 and 3A	Archaeological Monitoring Report for Geotechnical Testing	No significant finds
McDermott, and Tulchin 2006	Mākaha Bridges 3 and 3A, TMK: [1] 8-4-001:012, 8-4-002:045, 47, 8-4-018:014, 122, 123, 8-4-08:018, 019, 020	Archaeological Inventory Survey	Identifies 5 historic properties: 50-80-7-6822 Mākaha Bridge 3; 50-80-7-6823 Mākaha Bridge 3A; 50-80-7-6824 Farrington Highway; 50-80-7-6825 cultural layer with human remains; 50-80-12-6714 OR&L railroad

Site 170. Kaneaki Heiau

Kaneaki Heiau, about halfway up Makaha Valley, Wai‘anae. One of the best-preserved heiaus on Oahu. Consists of two main inclosed platforms and numerous terraces and adjoining spaces also inclosed. The upper platform has a raised terrace at one end upon which is an altar or possible oracle tower site. Massive walls inclose this platform on three sides; the fourth is open to the other platform, which is 6 feet lower. Three narrow steps connect these two platforms. The other inclosures are not so well delineated...

Site 171. Taro Terraces

Taro terraces, about halfway up Makaha Valley and on the Honolulu side of the stream. The terraces average from 20 to 50 feet in width and are of varying lengths, some times several hundred feet long. Rock facings from 1 or 2 feet to 6 feet in height separated the terraces. The stones of these facings are evenly piled at a slight slope with the upper side flush with the earth. Water was brought by irrigation ditches now destroyed. It is probable that the plantation flume which is just above the last terrace followed the old Hawaiian ditch. These terraces have been in use up to recent years.

Just up the stream from these terraces is a site pointed out to E. H. Bryan as a heiau. It is a two-terraced rectangle 25.5 feet by 58.5 feet in extent. The upper terrace is 24 feet by 25.5 feet, dirt-paved and 2 feet higher than the surrounding earth and lower terrace. The lower terrace is built out and is almost entirely stone-paved. The side toward the stream is 6 feet high. Immediately surrounding these two terraces the ground had formerly been planted. The site does not resemble that of a heiau and is much too elaborate for an old house site. It gives one the impression of a recent house site.

Site 172. Stone Platform

On the mountain side of Site 171 and near the stream is a rectangle of stones 7.5 by 14 feet in extent. There are large stones about the edge and smaller stones for a fill, but not evenly paved. It is 1.5 feet high. Almost in the center is a stone 2 feet high and 1 foot wide. Near by is a slight elevation which may have been a house site. This pile of stones does not look like a grave, nor does it appear to be recent. This may have been a small family shrine with the central stone used as an akua but this, however, can only be conjectured. Malo speaks of a heiau as one of the six houses "every self-respecting Hawaiian who desired to live up to the system of tabu was obliged to build for himself." But Malo also adds that the men's eating house (*mua*) probably served as the family chapel in most dwellings. [McAllister 1933 in Sterling and Summers 1978:77-78]

The Mākaha Valley Historical Project (Green 1969, 1970, 1980; Ladd and Yen 1972; and Ladd 1973) studied nearly all of Mākaha Valley and received funding from private enterprise, which uniquely lacked legal compulsion. The Mākaha Valley Historical Project drew upon fieldwork conducted between 1968 and 1970. Though Neller (1984:1) notes that sites were lumped into large geographical districts, most of which were surveyed at a mere reconnaissance level, the investigations nevertheless covered parts of the valley beyond those due for development and recorded more than 600 archaeological features in the upper valley and 1,131 features in the lower valley. Excluding the coastal strip and the central lower valley due to previous development, the historical project undertook excavations at 30 separate structural features including 10 field shelters, four stone mounds, three stepped-stone platforms, three house enclosures, two storage pits, a clearing, a site thought to be a shrine, a *heiau*, a pond field terrace system, a habitation feature, two historic house platforms, and a modern curbed foundation. Carbon dating indicated settlement as early as the 13th century, with settlement focused on the primary water source, Mākaha Stream. Subsequently, increased population expansion into *kula* lands occurred, and by the 16th century, the trend had spread to the "upper valley," largely replacing dry land farming with an irrigated taro system (i.e. *lo'i*) (Green 1980:75). Within the current project area, The Mākaha Valley Historical Project identified Site C4-93 (SIHP # 50-80-07-866), a historic habitation complex.

Richard Bordner (1981) carried out a survey of a linear project area up the middle of the valley floor inland of Kāneʻākī Heiau in support of road widening and well placement projects. This corridor ran through several site areas designated during the Mākaha Valley Historical Project. Descriptions of sites are by proximity to site mapping points. Bordner (1981:D-22) concludes "the entire Mākaha Valley was utilized for agricultural production in the most intensive way, such that all areas capable of it were undoubtedly utilized for crop production." This study accessioned two reviews by Roger C. Green and Matthew Spriggs resulting in Bordner's preparing "Mākaha Valley Well III - V Re-Survey" (1983) and writing "Appendix B: Response to M. Spriggs Review of Mākaha Wells" (n. d.).

Kennedy (1983) produced an archaeological monitoring report on work at a 100 m long strip near "Well IV" at an elevation of 1072 feet in the valley floor, two kilometers inland from Kāneʻākī Heiau. He saw no evidence of buried features or artifacts.

Earl Neller (1984) of the SHPD went back into the area designated as Site Area 997, which includes the current project area, “to clear up various deficiencies in the published reports and unpublished site data” and to re-examine various “puzzling inconsistencies.” He relocated sites previously reported as destroyed (McAllister Sites 171 & 172), identified unreported sites, and re-analyzed several sites studied during the Mākaha Valley Historical Project.

Hammatt, Shideler and Borthwick (1985) carried out an archaeological reconnaissance survey of a 3,000 foot long corridor on the west side of central Mākaha Valley in the 776 site area, documenting numerous modifications of natural terraces for dry land agriculture. Ten archeological sites (1 wall, 2 habitation sites, and 7 agricultural sites) were recorded.

Barrera, Jr. (1986) carried out an archaeological survey of a mid-valley well site on the west central side of the valley. The project area appears to have included a corridor approximately 600 m long and 30 m wide and a proposed reservoir site 90 m in diameter. He identified four sites including four stone platforms (Site -1465), a U-shape habitation enclosure (Site -1466), a terrace (Site -1467) and a wall (Site -1468). Some 17 test pits were excavated but virtually nothing was found.

Kennedy (1986) carried out archaeological investigations focused on the north (Mākaha) side of Mauna Lahilahi identifying five sites including a possible shrine, a *koa*, a linear pile and an enclosure.

Komori (1987) carried out an archaeological survey and testing at Mauna Lahilahi relocating Kennedy's (1986) five sites and an additional eleven sites including petroglyphs, enclosures, terraces, rock shelters & midden, and lithic scatters. He reports eight radiocarbon dates rather tightly in the AD 1300 to 1650 period.

Bordner and Cox (1988) carried out a mapping project on the upper valley floor inland of Kāne'ākī Heiau. While much of the focus of this study was more accurately locating sites previously identified during the Mākaha Valley Historical Project, their findings suggest that the relative importance of dry-land, non-irrigated agriculture had previously been underestimated.

Donham (1990) carried out an archaeological inventory survey of two discrete but adjacent parcels for a total of approximately 130 acres in the south central portion of the valley. Donham identified a terrace associated with dry-land agriculture and/or habitation.

Hammatt and Robins (1991) carried out an archaeological inventory survey of an approximately 4,600-foot long route of a proposed 20-inch water main extending northeast from Farrington Highway up Water Street and then continuing northeast to and across Kili Drive. They documented a single historic property SIHP # 50-80-07-4363. Site -4363 was described as “a linear earthen berm ... buttressed along its stream side with cobbles and boulders” (Hammatt and Robins 1991). The berm was interpreted as having been “associated with the historic sugarcane cultivation” (Hammatt and Robins 1991). Based on historic maps, the berm probably represents an old ditch alignment. The ditch alignment was probably altered during construction of the adjacent golf courses and presently functions as a flood control structure, protecting housing down slope. Subsurface testing within the corridor encountered nothing of archaeological significance.

Carol Kawachi (1992) of the SHPD wrote a memorandum on “Mākaha Burials Exposed by Hurricane ‘Iniki” documenting burial(s) eroding out of a lot at 84-325 Makau Street. This was a pit burial, approximately 50 cm below the surface extending 1.5 m long exposed from a sand bank by Hurricane ‘Iniki. The burial was reported to have included staghorn coral at major joints and a possible shell *nihopalaoa*.

Moore and Kennedy (1994) carried out archaeological investigations on the northwest side of the valley for a proposed reservoir at 242-foot elevation. The access corridor and reservoir site covered approximately eleven acres. No historic features were located.

Fields Masonry documented stabilization and restoration of Kāne‘ākī Heiau carried out in 1996 (1999 documentation by Emily Pagliaro). Prior restoration efforts had been carried out in 1970.

Magnuson (1997) carried out a preliminary archaeological review of upper Mākaha Valley for a proposed water line replacement project. This was primarily an archaeological literature review providing an overview of sites.

In 1997, test excavations associated with the inventory survey conducted for the “New Mākaha Beach Park Comfort Station and Parking Area” *mauka* of Farrington Highway by Paul Cleghorn identified a cultural layer present in an area approximately 80 m *mauka* of Farrington Highway near its intersection with Kili Drive. Radiocarbon analysis indicated an age range of A.D. 1440-1690. The deposit was suggested to be “evidence of a small encampment near the coast” (Cleghorn 1997:32). He also indicates the possible importance of a pond/wetland area just *mauka* of the Highway at Mākaha Beach Park: “This pond and wetland may have offered rich resources for the Hawaiians of the area, and the pond may have been used as an inland fishpond during the prehistoric and early historic eras” (Cleghorn 1997:33). This pond/wetland area is likely the area Green (1980) identified as “Kahaloko.” Also present in the area are remains of structures associated with the O. R. & L. Railroad (SIHP # 50-80-12-9714).

Maly (1999) carried out a “Limited Consultation Study with Members of the Hawaiian Community in Wai‘anae” in support of the Mauna ‘Olu Water System. Several interviewees deferred to Mr. Landis Ornellas (a co-founder of the organization *Hui Mālama o Kāne‘ākī Heiau*) as a cultural expert for mid-valley Mākaha. Concerns for continuing community consultation were expressed.

Elmore et al. (2000) carried out an archaeological inventory survey of an approximately 19.6-acre parcel located on the south side of Kili Drive and just west of the condominiums in a portion of the previously identified site area 50-80-07-776. A total of eight features were identified. Five of these were determined to be modern disturbances while the other three were thought to be possible traditional Hawaiian dry-land agricultural and/or habitation features.

Moore and Kennedy (2000) carried out an archaeological inventory survey of an approximately 20-acre parcel located on the north side of Kili Drive in a portion of the previously identified site area 50-80-07-776. A total of twelve features were identified. Ten of these were determined to be modern disturbances while the other two were thought to be possible traditional Hawaiian dry-land agricultural features.

Kailihiwa and Cleghorn (2003) monitored the Mākaha water system improvements phase II for ten streets in the *ahupua'a* of Mākaha and Wai'anae. A total of three sites were identified with five features: a pit, concrete flume, two fire features, and a charcoal deposit. No cultural material was found any of the deposits.

Tulchin and Hammatt (2003) found no surface or subsurface cultural resources during their archaeological inventory survey, located at the corner of Kili Drive and Farrington Highway, associated with a proposed fiber optic cable facility.

McDermott & Tulchin (2006) conducted an archaeological inventory survey associated with the replacement of Mākaha Bridges 3 and 3a. During that investigation five (5) historic properties were documented. These included two historic bridges, remnants of the O'ahu Rail and Land (O. R. & L.) Railroad, and a subsurface cultural layer containing previously disturbed human skeletal remains.

3.3 Settlement Pattern Summary and Predictive Model

Cordy (1998) provides a synthesis of the settlement patterns and prehistory of the Wai'anae District. This study places the settlement of Wai'anae into the wider context of O'ahu settlement as a whole. The proximity of expansive forest resources and well-watered agricultural lands to abundant marine resources made the windward side of O'ahu most appealing to the early O'ahu settlers and their descendants. Foraging trips to the dryer areas of the island would have occurred and were most likely associated with recurrent, temporary habitation during resource procurement. The rich marine resources of the Wai'anae District, particularly the fishing grounds offshore, would have been a strong draw for early O'ahu inhabitants. As population in the windward areas increased, permanent settlement began to spill over into the well-watered regions of O'ahu's leeward side. Eventually, with further population expansion, permanent settlement spread to the less watered regions of the leeward side, which included much of the Wai'anae District, including Mākaha (Cordy 1998:1-6). Settlement most likely began as temporary habitation along the coast in association with marine resource procurement. Later, permanent settlement would have developed in response to expanding populations in previously settled, better watered areas.

Available radiocarbon dates indicate that by A.D. 600-800, there was at least temporary coastal habitation on the Wai'anae coast. This dated sample comes from the area fronting Pōka'i Bay, one of the only areas along the Wai'anae Coast to have a perennial stream reach the coast, and undoubtedly one of the more attractive areas for early temporary and, later, permanent settlement (Cordy 1998:6).

Archaeological data suggest that a significant and rather substantial prehistoric population once occupied Mākaha Valley. Roger C. Green, in his summary Report No. 5 of the Mākaha Valley Historical Project (1980) proposed that the earliest Hawaiian settlement (before A.D. 1100) was probably focused along the coast at the mouth of Mākaha Stream. Following this initial settlement (and sometime after A.D. 1100) exploitation of the surrounding *kula* lands prompted an expansion into the surrounding lower valley.

Subsequently, as the population increased in Mākaha Valley, expansion into other *kula* regions occurred. Green argues that the *kula* expansion was a rational exploitation of “more than sufficient *kula* land in Mākaha for the coastal population” in an area with presumably little pressure on resources (Green 1980:74).

According to Green, various events during the 15th and early 16th centuries led to a population expansion into the upper valley regions. Green attributes this movement to “changes in the subsistence (irrigated wet taro system), emigration of a part of the population to an area of low population density, and development of a different means of social organization (in the form of social stratification and segmentation)” (Green 1980:75).

By the mid-1800s, the traditional Native Hawaiian lifestyle in Mākaha Valley was in decline. The sandalwood trade, which ended circa 1829, undoubtedly had a negative effect on the Native Hawaiian population. Beginning at this time, Mākaha Valley entered its cattle ranching period. The construction of the O.R. & L. Railroad more directly linked Honolulu to Wai‘anae in 1895. Based on the paucity of L.C.A.s claimed within the *ahupua‘a* and the early population figures, it appears that the Native Hawaiian population was quite low in the latter half of the 19th century.

In 1907, the Wai‘anae Plantation moved into Mākaha and placed large portions of the valley under sugarcane production. With plantation activity, Mākaha’s population numbers slowly increased in the early 1900s. With the construction of Farrington Highway in the 1930s, Mākaha became more closely tied with the rest of O‘ahu, including Honolulu. World War II greatly affected the landscape of the Mākaha coast by placing bunkers, gun emplacements and barbed wire along the waterfront.

Based on available settlement pattern investigations and the results of background research, it is expected that archaeological sites identified within the current project area may include the previously identified Site C4-93 (SIHP # 50-80-07-866) historic habitation complex, remnants of the historic plantation irrigation system, and possibly pre-contact agricultural features.

Section 4 Results of Fieldwork

4.1 Survey Findings

A 100% coverage pedestrian inspection was conducted over the entire approximately 13-acre project area. Lands within the project area generally consisted of a moderate to steep talus slope of alluvium and colluviums along the eastern portion of the project area, and a relatively wide and level floodplain bordered by Mākaha Stream in the western portion of the project area. At the time of the pedestrian inspection, the Mākaha Stream channel was dry, with no flowing or standing water. However, evidence of substantial flooding was observed, particularly in the southern portion of the project area.

Four historic properties comprised of 15 individual archaeological features were identified within the project area (Table 3; Figure 11 and Figure 12). Each of the identified historic properties was located with GPS survey equipment and assigned State Inventory of Historic Properties (SIHP) number designations. UTM coordinates of the approximate center point of each of the historic properties are provided in Appendix A.

- SIHP # 50-80-07-6895 consists of a historic irrigation ditch and associated retaining walls located in the eastern portion of the project area. The irrigation ditch is oriented roughly northeast to southwest and is situated along the base of the talus slope. Retaining walls provide support for the ditch along its downslope edge and prevent erosion and rockfall from upslope.
- SIHP # 50-80-07-6896 is a free-standing stone wall located in the western portion of the project area, running roughly parallel to the bank of Mākaha Stream.
- SIHP # 50-80-07-6897 is a terrace located in the northern portion of the project area. The terrace is situated within an overflow channel immediately south of the main Mākaha Stream channel, and is bordered to the north, east, and west by the SIHP 50-80-07-6896 wall.
- In addition to the three newly identified historic properties, the previously identified SHIP # 50-80-07-866 historic habitation complex (Green 1969) was identified within the southwestern portion of the project area.

Detailed descriptions of all historic properties identified in the project area follow.

Table 3. Historic Properties Identified within the Project Area

SIHP # (50-80-07)	Site Type	Features	Age	Function	Significance Criteria	Mitigation Recommendations
6895	Irrigation Ditch and Associated Retaining Walls and Terrace	7	Historic	Plantation Irrigation	D	Preservation (Avoidance and Protection)
6896	Stone Wall	1	Historic	Ranch-Related Cattle Barrier	D	Preservation (Avoidance and Protection)
6897	Terrace	1	Pre-Contact	Agricultural	D	Preservation (Avoidance and Protection), Possible Restoration
866	Walls, Terraces, Mound, Enclosure	6	Historic	Habitation Complex	A, B, D	Preservation (Avoidance and Protection)

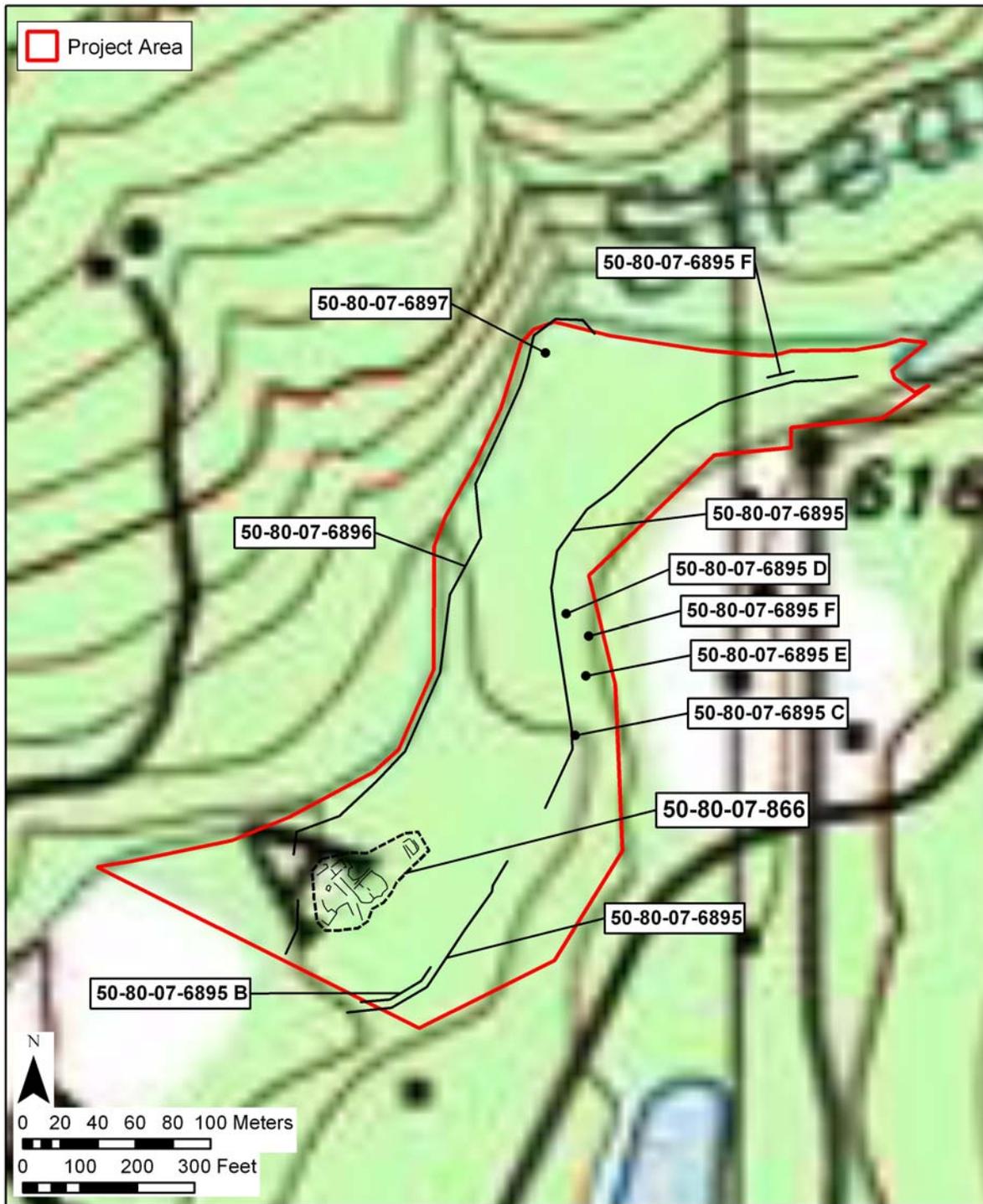


Figure 11. Portion of USGS 7.5-Minute Series Topographic Map, Waianae Quadrangle (1998), showing the locations of historic properties identified in the project area

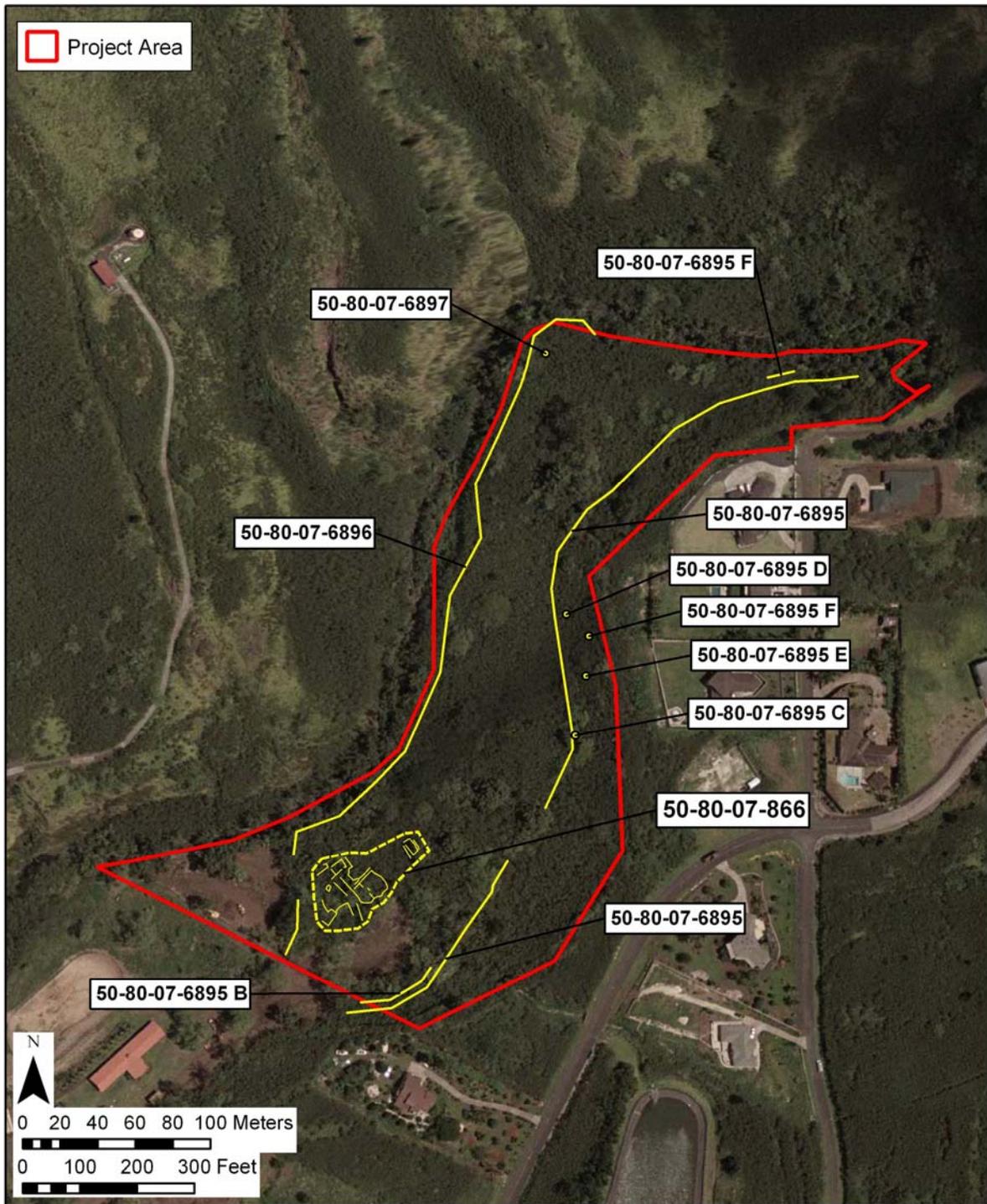


Figure 12. Aerial photograph showing the locations of historic properties identified in the project area (source: USGS Orthoimagery 2005)

4.2 Site Descriptions

4.2.1 SIHP # 50-80-07-6895

SITE TYPE:	Improved Ditch, Retaining Walls and Terraces
FUNCTION:	Plantation Irrigation
FEATURES:	6
DIMENSIONS:	Approx. 475 linear m within the project area
CONDITION:	Poor
PROBABLE AGE:	Historic
TAX MAP KEY:	[1] 8-4-002:014

DESCRIPTION:

SIHP # 50-80-07-6895 consists of a historic irrigation ditch and associated retaining walls located in the eastern portion of the project area (see Figure 11 and Figure 12 above). The Feature A irrigation ditch is oriented roughly northeast to southwest and is situated along the base of a talus slope up to 100 feet high (Figure 13). The ditch begins near the northeastern boundary of the project area, near a natural confluence of the main Mākaha Stream channel and tributaries descending the valley walls from the east and west. The ditch extends approximately 475 linear m through the project area and continues to the southwest. The ditch is constructed of stacked basalt boulders and cobbles, with a cement finish on the inside of the ditch walls and along the base of the ditch (Figure 14). The interior of the ditch measures 1.5 m wide and 0.9 m deep. Much of the interior of the ditch has suffered infilling from erosion of sediment upslope. A portion of the ditch has been disturbed by bulldozing in the southern portion of the project area.

Feature B is a stacked stone retaining wall located along the down slope side of the Feature A irrigation ditch (Figure 13). The retaining wall extends intermittently along the southern portion of the Feature A ditch in excess of 40 m, and continues to the south outside of the project area. The Feature B retaining wall is constructed of stacked basalt boulders and cobbles, 6-8 courses high, with a maximum height of 1.4 m (Figure 15). The retaining wall has a sloping face and supports an approximately 3.5 m wide, level terrace area along the base of the talus slope. The Feature A irrigation ditch is constructed on the level terrace supported by the Feature B retaining wall.

Feature C is a small, stacked stone retaining wall located upslope of the Feature A irrigation ditch. The retaining wall extends approximately 12 m along the contour of the steep sloping hillside. The retaining wall is constructed of stacked basalt boulders and cobbles, 3-5 courses high, with a maximum height of 1.5 m (Figure 16). The stones comprising the wall average 30-40 cm diameter, with some larger boulders also incorporated into the construction. The Feature C retaining wall functions in preventing erosion of stones and sediment from the talus slope into the Feature A irrigation ditch below.

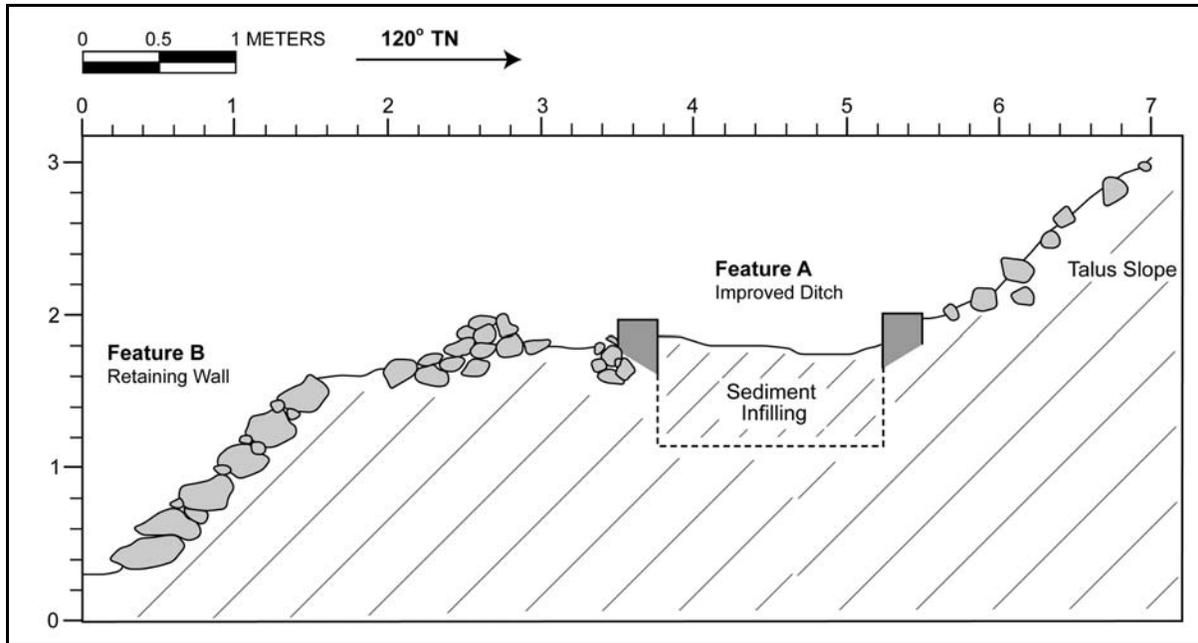


Figure 13. Cross-section diagram of SIHP # 50-80-07-6895 Features A and B



Figure 14. Photograph of SIHP # 50-80-07-6895 Feature A improved ditch, view to southeast

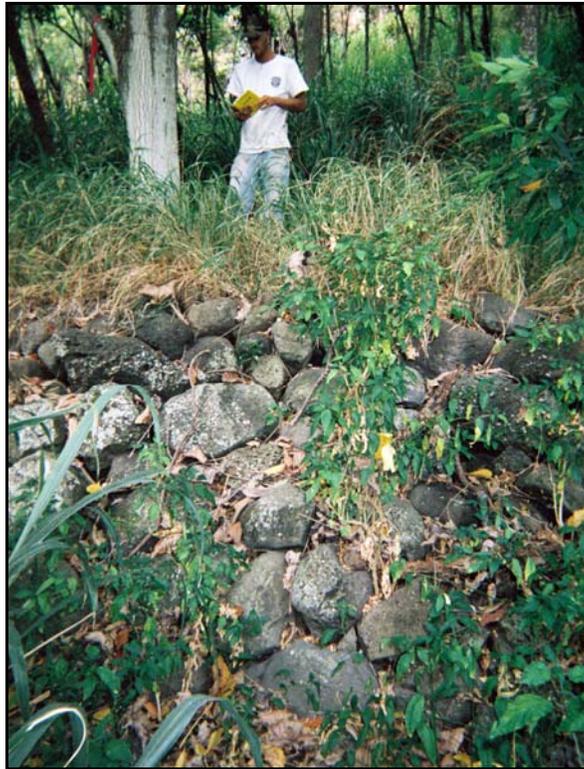


Figure 15. Photograph of SIHP # 50-80-07-6895 Feature B retaining wall, view to southeast



Figure 16. Photograph of SIHP # 50-80-07-6895 Feature C retaining wall, view to southeast

Feature D is a small, stacked stone retaining wall located upslope of the Feature A irrigation ditch. The retaining wall measures approximately 2.5 m in length, is oriented along the contour of the steep sloping hillside, and is constructed between large, *in situ* basalt boulders. The retaining wall is constructed of stacked basalt boulders and cobbles, 4-6 courses high, with a maximum height of 2.0 m (Figure 17). The Feature D retaining wall functions in preventing erosion of stones and sediment from the talus slope into the Feature A irrigation ditch below.

Feature E is a small, stacked stone retaining wall located upslope of the Feature A irrigation ditch. The retaining wall measures approximately 8.0 m in length and is oriented along the contour of the steep sloping hillside. The retaining wall is constructed of stacked basalt boulders and cobbles, 4-6 courses high, with a maximum height of 1.5 m (Figure 18). The Feature E retaining wall functions in preventing erosion of stones and sediment from the talus slope into the Feature A irrigation ditch below.

Feature F is a stacked stone terrace located upslope of the Feature A irrigation ditch. The terrace is constructed between a large, *in situ* basalt boulder and a moderately sloping hillside (Figure 19). The large boulder measures 2.2 m wide by 1.7 m tall and serves as the western, down slope retaining wall of the terrace. The terrace is constructed of stacked basalt boulders and cobbles, 2-7 courses high (Figure 20). The terrace measures 3.5 m by 2.0 m wide, with a maximum height of 1.6 m. The terrace is faced along the southern edge and nearly flush with the slope along the north and east edges. The interior of the terrace is stone-filled with a relatively level boulder and cobble surface. The Feature F functions as a stone-clearing terrace and in preventing erosion of stones and sediment from the talus slope into the Feature A irrigation ditch below.

Feature G is a stacked stone retaining wall located along the down slope side of the Feature A irrigation ditch, similar to Feature B (Figure 21). The retaining wall extends approximately 11 m along the northern portion of the Feature A ditch, near the beginning of the ditch at its intersection with Mākaha Stream. The Feature G retaining wall is constructed of stacked basalt boulders and cobbles, 6-8 courses high, with a maximum height of 1.5 m (Figure 22). The retaining wall has a sloping face and supports an approximately 3.5 m wide, level terrace area along the base of the talus slope. The Feature A irrigation ditch is constructed on the level terrace supported by the Feature G retaining wall. Remnant barbed-wire fencing and metal water pipes were observed along the Feature G retaining wall.

SIHP # 50-80-07-6895 Features A-G are interpreted to represent historic, plantation-related irrigation infrastructure. The Feature A ditch, and later metal pipes, provided water from Mākaha Stream to the sugar plantations in lower Mākaha Valley. The structures are in fair to poor condition, with heavy sedimentation and disturbance to the Feature A ditch and significant collapse of stacked stone retaining walls and terraces (i.e. Features B-G). Despite degradation of the structures, intact portions of the features are adequate to convey the site's integrity of location, design, materials, and workmanship. Due to the demise of plantation agriculture in the area and significant modern development in the vicinity, the site does not have integrity of setting, feeling, or association. SIHP # 50-80-07-6895 is assessed as significant under Criterion D (have yielded, or may be likely to yield information important in prehistory or history) of the Hawai'i Register of Historic Places evaluation criteria.

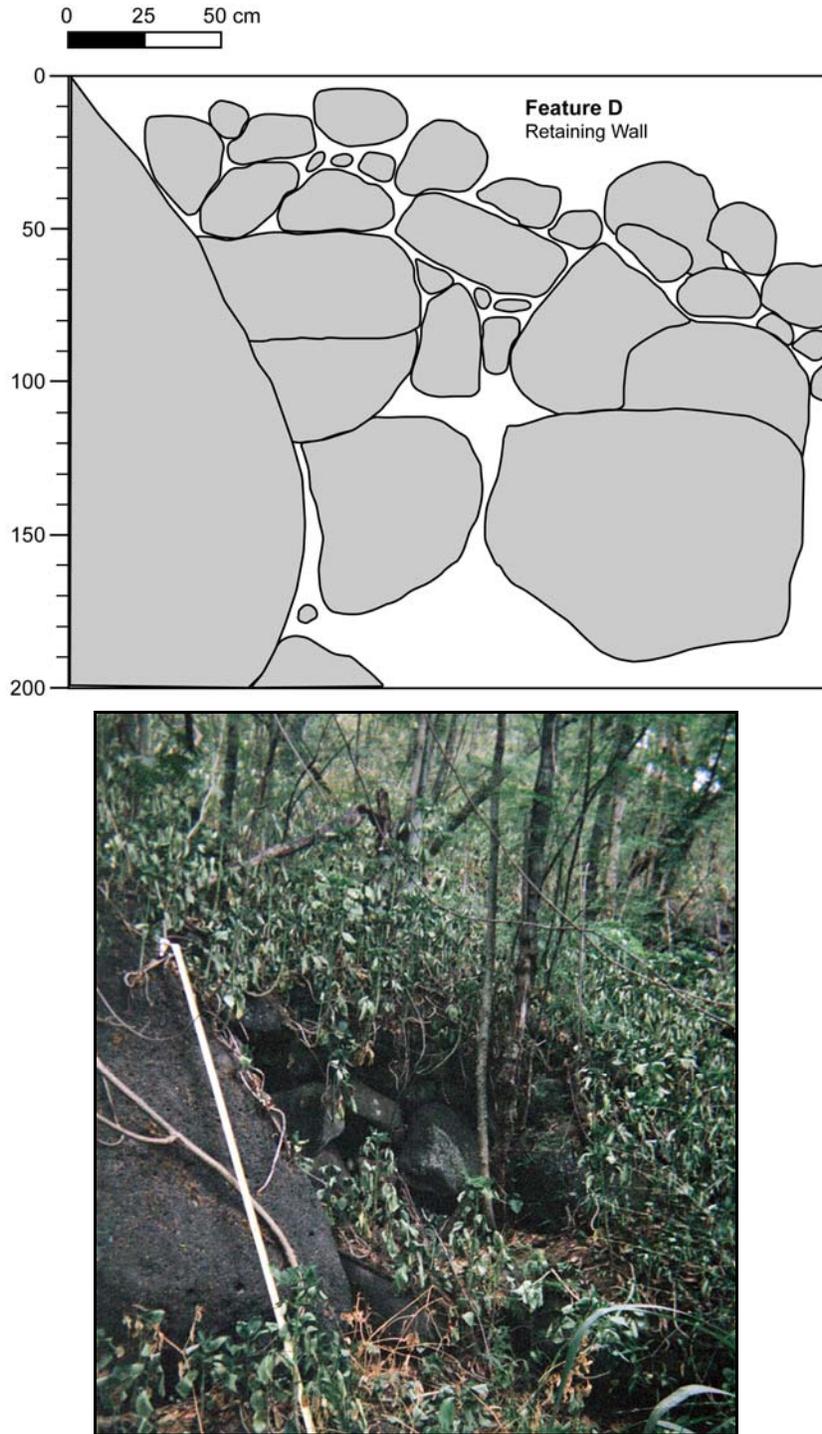


Figure 17. Profile diagram (above) and Photograph (below, view to southeast) of SIHP # 50-80-07-6895 Feature D retaining wall



Figure 18. Plan view diagram (above) and photograph (below, view to east) of SIHP # 50-80-07-6895 Feature E retaining wall

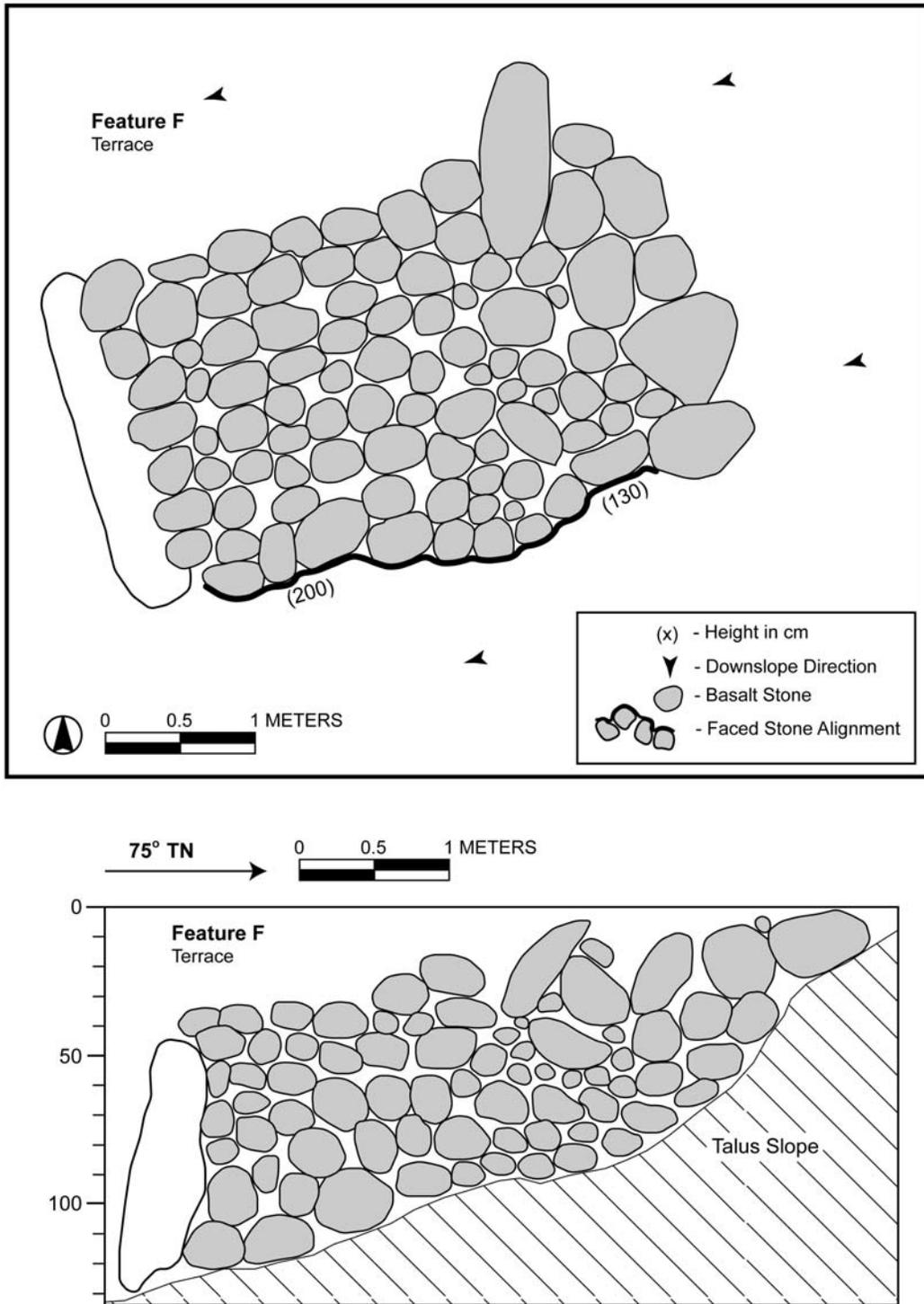


Figure 19. Plan view diagram (above) and cross-section diagram (below) of SIHP # 50-80-07-6895 Feature F terrace



Figure 20. Photograph of SIHP # 50-80-07-6895 Feature F terrace, view to north



Figure 21. Photograph of SIHP # 50-80-07-6895 Feature G retaining wall, view to southeast

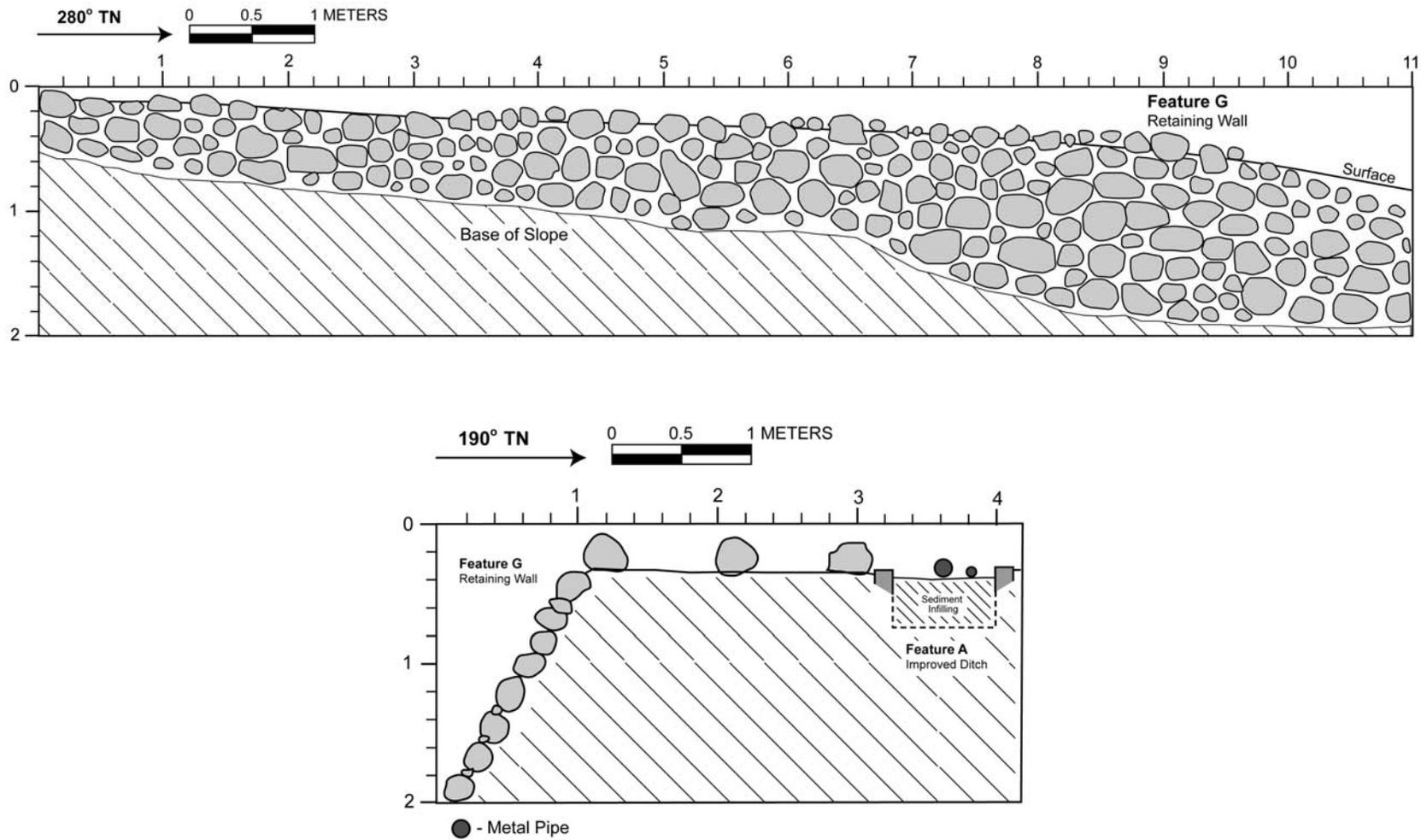


Figure 22. Profile (above) and cross-section (below) diagrams of SIHP # 50-80-07-6895 Feature G retaining wall

4.2.2 SIHP # 50-80-07-6896

SITE TYPE:	Stone Wall
FUNCTION:	Cattle Barrier
FEATURES:	1
DIMENSIONS:	Approx. 420 linear m within the project area
CONDITION:	Fair
PROBABLE AGE:	Historic
TAX MAP KEY:	[1] 8-4-002:014

DESCRIPTION:

SIHP # 50-80-07-6896 is a free-standing stone wall located in the western portion of the project area, running roughly parallel to the bank of Mākaha Stream (see Figure 11 and Figure 12). The stone wall is generally oriented northeast to southwest, extends approximately 420 linear m within the project area, and continues to the southwest. The wall is generally situated immediately upslope of the eastern bank of Mākaha Stream (Figure 23).

The SIHP # 50-80-07-6896 stone wall is constructed of stacked, water-rounded basalt boulders and cobbles, 4-6 courses high, with larger stones at the base and progressively smaller stones in the upper courses of the wall construction. The wall is faced along both edges and trapezoidal shaped, with a wide base and narrow top surface (Figure 24). The wall measures an average of 1.5 m in width, with a maximum height of 1.7 m. The northern portion of the wall is constructed along a gravel bar, within the Mākaha Stream channel. The wall separates an overflow channel from the main stream channel. The wall construction in this area is generally lower in height than other portions, and also incorporates large, *in situ* basalt boulders and bedrock outcrops into the wall construction. The southern portion of the SIHP # 50-80-07-6896 wall has been disturbed by land clearing activities within the project area and in the adjacent property to the southwest. In addition, portions of the wall are less than 1 m in height, apparently due to rock removal.

SIHP # 50-80-07-6896 is interpreted to represent a historic, ranch-related cattle wall. The wall functions in restricting the movement of cattle across Mākaha Stream. SIHP # 50-80-07-6896 is in fair condition as much of the wall is generally intact, with some collapse and disturbance observed. Despite the limited disturbance and collapse of portions of SIHP # 50-80-07-6896, intact portions of the wall are adequate to convey the site's integrity of location, design, materials, and workmanship. Due to the demise of large-scale ranching operations in the area and significant modern development in the vicinity, the site does not have integrity of setting, feeling, or association. SIHP # 50-80-07-6896 is assessed as significant under Criterion D (have yielded, or may be likely to yield information important in prehistory or history) of the Hawai'i Register of Historic Places evaluation criteria.

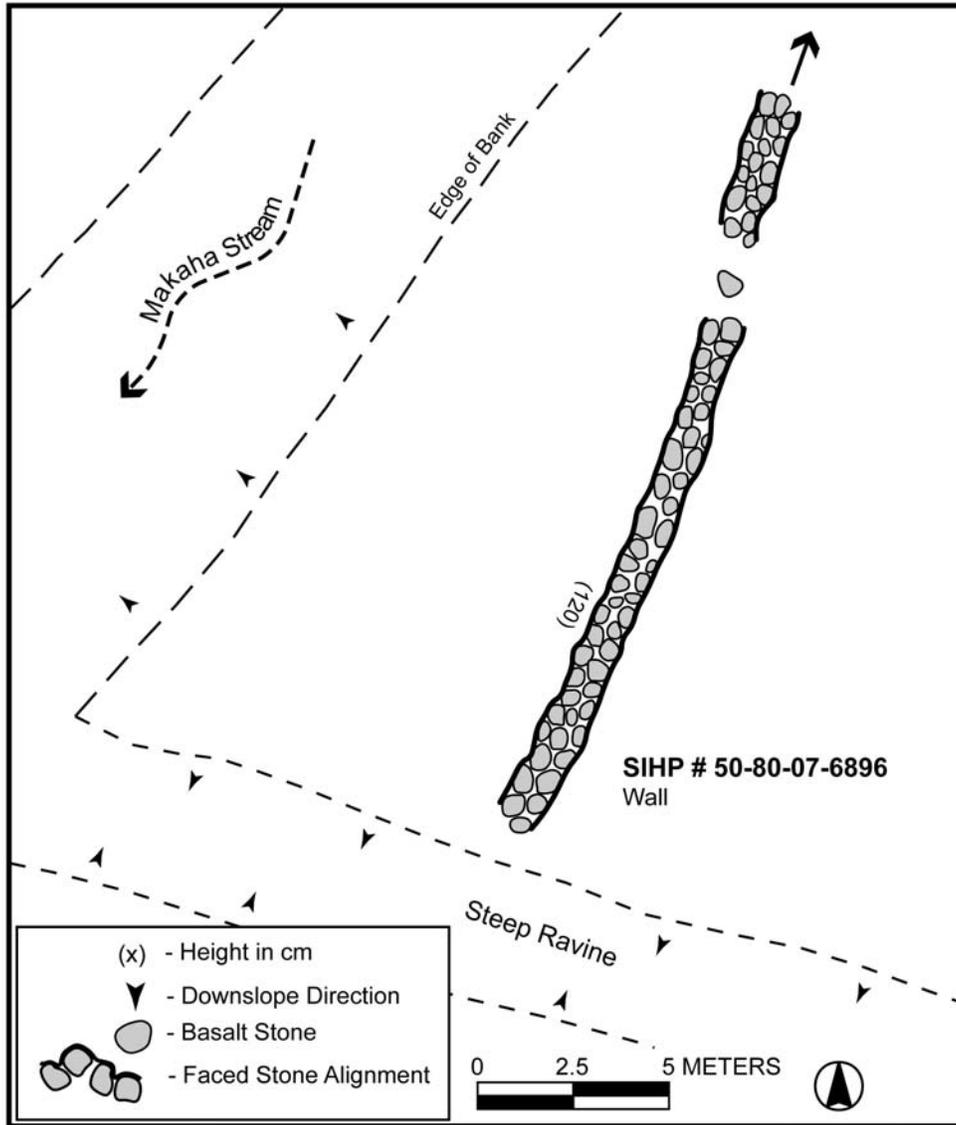


Figure 23. Plan view diagram of a portion of the SIHP # 50-80-07-6896 stone wall



Figure 24. Photographs of portions of the SIHP # 50-80-07-6896 stone wall (above, view to west) (below, view to southwest)

4.2.3 SIHP # 50-80-07-6897

SITE TYPE:	Terrace
FUNCTION:	Agricultural
FEATURES:	1
DIMENSIONS:	25 m E/W by 12 m N/S
CONDITION:	Good
PROBABLE AGE:	Pre-contact
TAX MAP KEY:	[1] 8-4-002:014

DESCRIPTION:

SIHP # 50-80-07-6897 is a terrace located in the northern portion of the project area (see Figure 11 and Figure 12 above). The terrace is situated within an overflow channel immediately south of the main Mākaha Stream channel, and is bordered to the north, east, and west by the SIHP 50-80-07-6896 wall (Figure 25). The overflow channel is approximately 7-10 m wide.

The terrace is constructed with a stacked basalt boulder and cobble retaining wall. The retaining wall is oriented perpendicular to the direction of water flow and stretches across the northern portion of the overflow channel (Figure 26). The retaining wall measures approximately 7.5 m long, with an average width of 0.5 m and maximum height of 0.6 m. The retaining wall is faced along the downslope edge and nearly flush with the ground level on the upslope side (Figure 27). The wall retains a nearly level soil terrace upslope, measuring approximately 25 m by 12 m wide. At the center of the overflow channel, there is an extension to the retaining wall that runs perpendicular to the main retaining wall. This approximately 2.5 m long wall segment also retains a small soil terrace. In addition, approximately 7 m east of the main terrace retaining wall is another small stacked stone retaining wall. This wall segment measures 1 m in length and is constructed between bedrock outcrops within the same overflow channel.

SIHP # 50-80-07-6897 is interpreted to be a pre-contact, traditional Hawaiian agricultural terrace, whose retained soil area was used for seasonal (winter) planting. The terrace within the overflow channel is fairly level and would have retained moisture from seasonal rains and overflow from Mākaha Stream. SIHP # 50-80-07-6897 is in good condition with little collapse observed. The site maintains integrity of location, design, materials, and workmanship. Due to the extensive modification of the landscape by historic and modern development in the vicinity, the site does not have integrity of setting, feeling, or association. SIHP # 50-80-07-6897 is assessed as significant under Criterion D (have yielded, or may be likely to yield information important in prehistory or history) of the Hawai'i Register of Historic Places evaluation criteria.

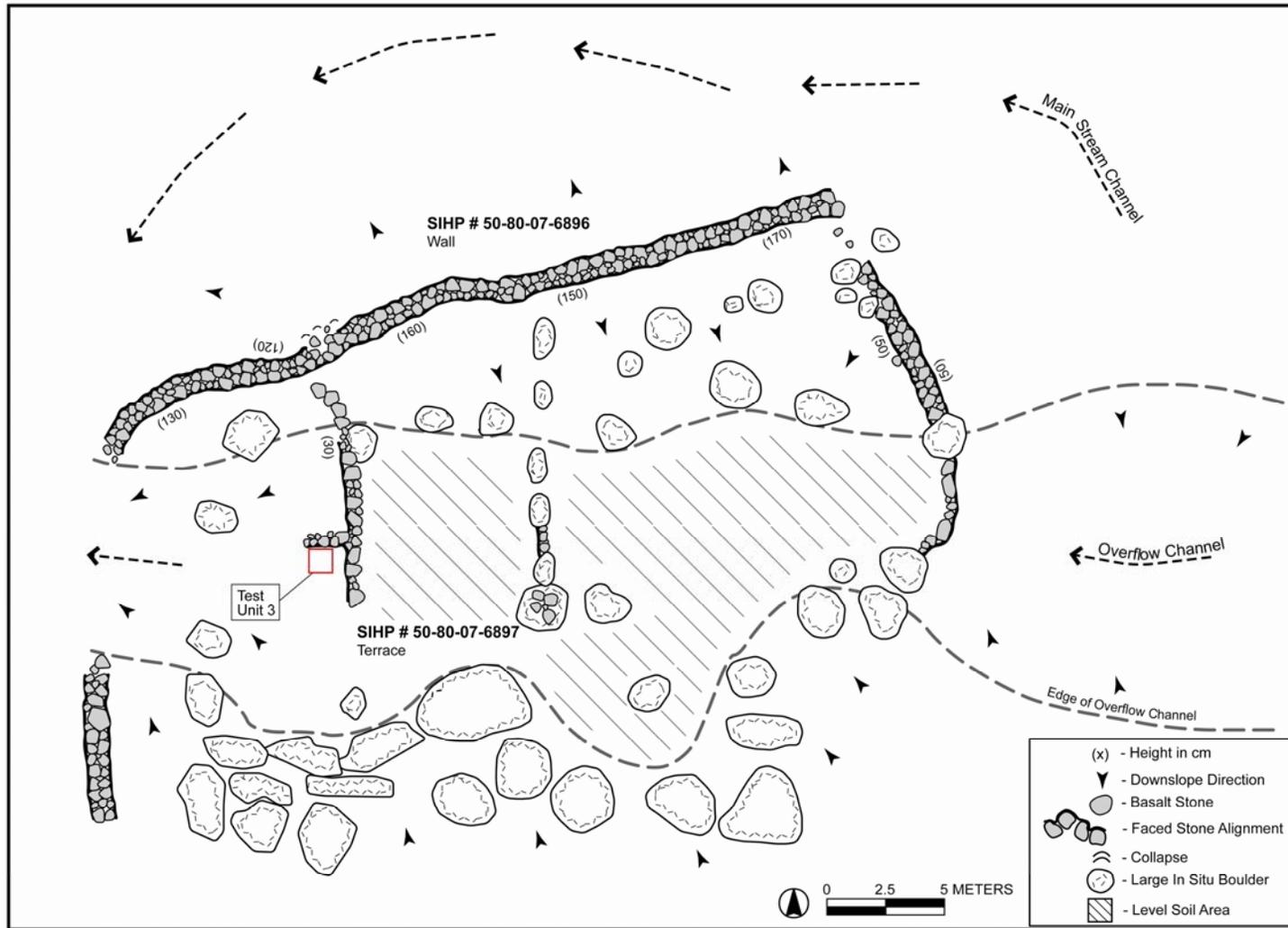


Figure 25. Plan view diagram of the northern portion of SIHP # 50-80-07-6896 wall and SIHP # 50-80-07-6897 terrace

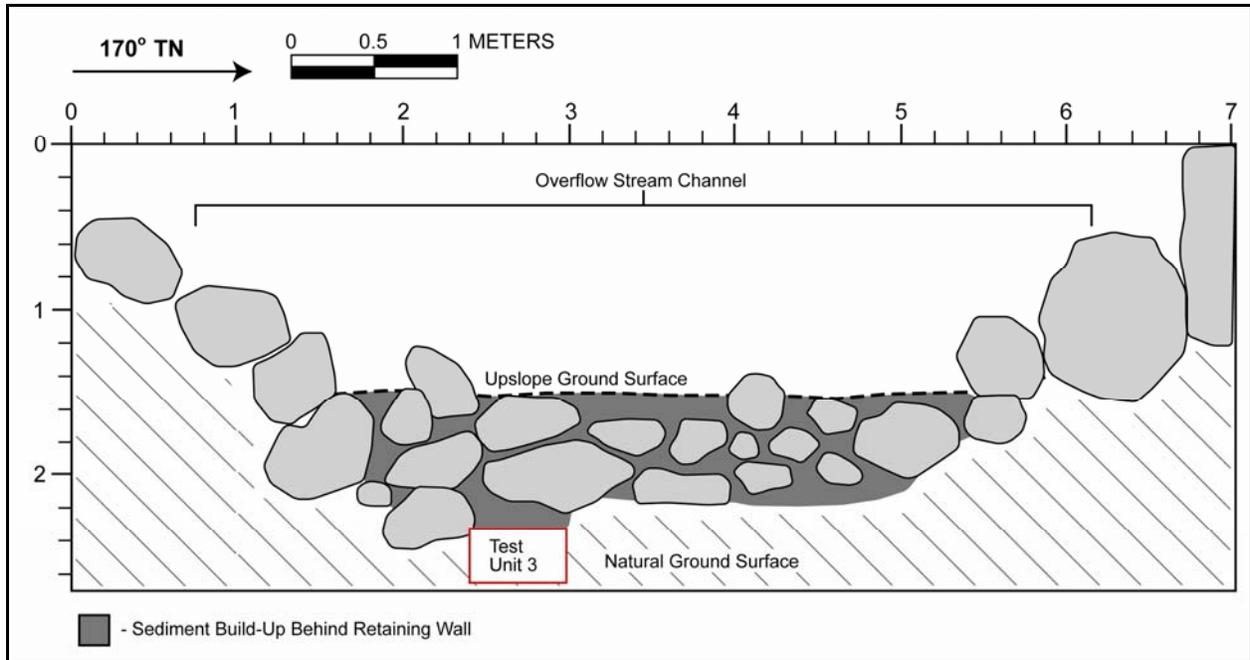


Figure 26. Profile diagram of SIHP # 50-80-07-6897 terrace



Figure 27. Photograph of SIHP # 50-80-07-6897 terrace, view to east

4.2.4 SIHP # 50-80-07-866

SITE TYPE:	Terraces, walls, enclosure
FUNCTION:	Habitation Complex
FEATURES:	6
DIMENSIONS:	70 m NE/SW x 40 m NW/SE
CONDITION:	Fair
PROBABLE AGE:	Historic
TAX MAP KEY:	[1] 8-4-002:014

DESCRIPTION:

SIHP # 50-80-07-866 consists of a historic habitation complex located in the southwestern portion of the project area (see Figure 11 and Figure 12 above). The complex was previously identified during the Mākaha Valley Historical Project (Green 1969) and designated Site 50-OA-C4-93 under the Bishop Museum site numbering system. The site complex was mapped in detail (Figure 28) and the following brief description was provided:

Site C4-93, the first site tested, is composed of a series of what appear to be terraces, low walls, and enclosures. The area contains three small rock mounds, a probable house platform, one sunken walled pit, and a series of terraces. [Ladd and Yen 1972:6]

SIHP # 50-80-07-866 was relocated during the current inventory survey investigation. Due to modern land disturbance (bulldozing) in the immediate vicinity of the site complex, and for educational/demonstration purposes, SIHP # 50-80-07-866 was re-mapped to assess the current condition and extent of the site (Figure 29). Additional feature designations and detailed descriptions of the constructions were also generated by the current study. The SIHP # 50-80-07-866 site complex is situated on a gently sloping alluvial terrace, approximately 40 m southeast of the main Mākaha Stream channel. An overflow stream channel is located along the northwestern portion of the site complex. The SIHP # 50-80-07-866 site complex consists of six individual features covering an area measuring approximately 70 m NE/SW by 40 m NW/SE.

Feature A consists of two adjoining terrace areas in the eastern portion of the site complex. The Feature A terraces measure approximately 16 m NE/SW by 11 m NW/SE, and are divided by a 1 to 2 course alignment of basalt boulders and cobbles. The terraces are bordered along four sides by loosely stacked basalt boulder and cobble retaining walls. The retaining walls are constructed of stacked stones, 1-3 courses high, with heights ranging from 20-70 cm (Figure 30). The *mauka* portion of the Feature A terraces is level and paved with basalt cobbles and pebbles. The *makai* portion has a gently sloping soil surface. Feature A appears to function as a habitation area.

A raised soil berm is located along the northwestern edge of the Feature A terraces, separating the Feature A terraces from the Feature B terraces (Figure 31). The berm measures approximately 1.8 m wide, 12 m long, with a maximum height of 70 cm. The berm is constructed with stacked basalt boulder and cobble retaining walls along each edge, with infilling

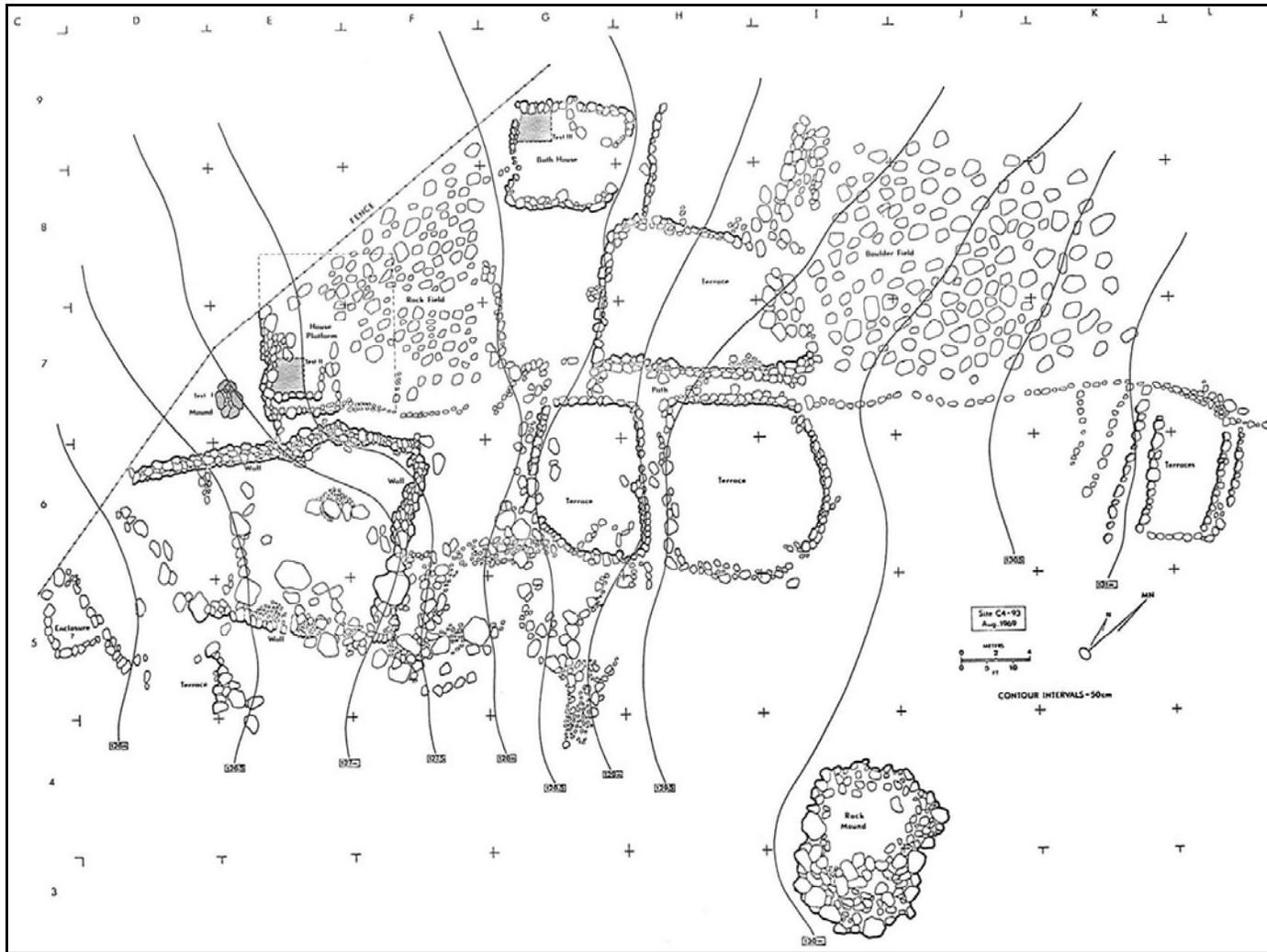


Figure 28. "Plan View of Site C4-93" (adapted from Ladd and Yen 1972:8)

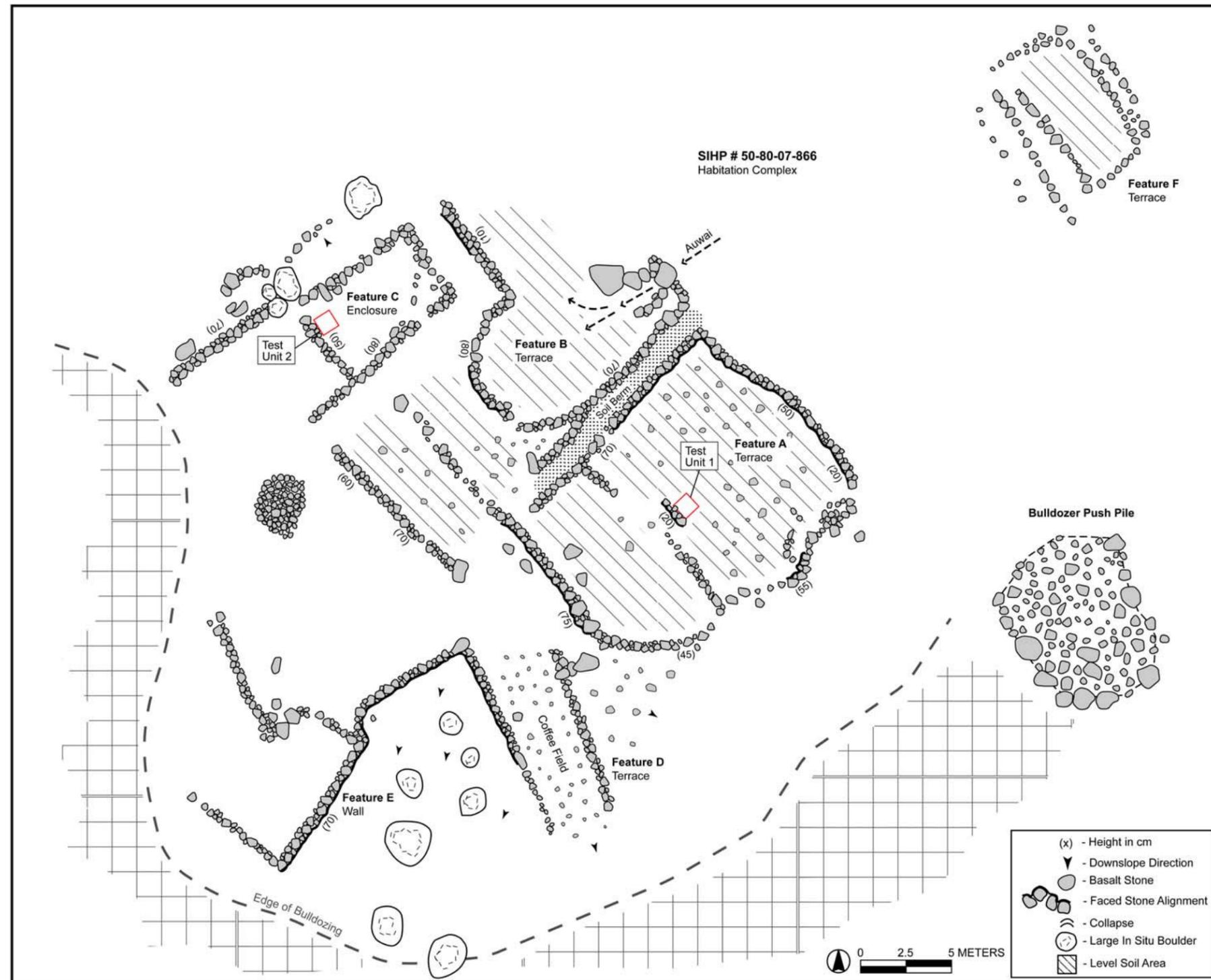


Figure 29. Plan view diagram of SIHP # 50-80-07-866 habitation complex



Figure 30. Photograph of SIHP # 50-80-07-866 Feature A terrace, view to north



Figure 31. Photograph of SIHP # 50-80-07-866, soil berm separating Feature A terrace and Feature B terrace, view to south

of basalt stones and soil. The berm appears to function as both a partition between the Feature A and Feature B terraces, and as a walking path through the *mauka* portion of the site complex.

Feature B consists of three adjoining terrace areas in the northern portion of the site complex. The Feature B terraces measure approximately 20 m NE/SW by 9 m NW/SE. The *mauka*-most terrace is the best constructed and defined of the three terraces. The terrace is bordered on the southeast by the soil berm and on the southwest by a loosely stacked basalt boulder and cobble retaining wall. The retaining wall is constructed of stacked stones, 1-3 courses high, with a maximum height of 80 cm. A constructed '*auwai* (irrigation channel) exists at the northeastern corner of the terrace. The '*auwai* is a stone lined channel measuring 1.3 m wide and 3.4 m long, with a basalt boulder capstone where the '*auwai* enters the Feature B terrace (Figure 32). The path of the '*auwai mauka* of the Feature B terrace could not be located, likely due to erosional infilling. The interior of the *mauka* terrace is relatively level soil with few surface stones. The two *makai* Feature B terraces are poorly defined. The terraces are bordered only along the downslope edges by 1 or 2 course alignments of basalt boulders and cobbles (Figure 33). The crude retaining walls support relatively level soil areas. Large mango trees are presently growing within the *makai* terraces. The Feature B terraces appear to function as agricultural planting areas.

Feature C is a rectangular enclosure located in the northwestern portion of the site complex. The enclosure measures 7.5 m by 4.6 m wide and is situated at the edge of an overflow channel of Mākaha Stream. The enclosure is bordered by stacked basalt boulder and cobble walls, 2 or 3 courses high, with a maximum height of 80 cm (Figure 34). The interior of the enclosure has a relatively level soil surface that is lower in elevation than the exterior land surface. The northern wall of the enclosure extends to the east and retains a small soil terrace immediately upslope. The Feature C enclosure was previously described as the location of a bathhouse (Ladd and Yen 1972).

Feature D is a terrace area located in the southern portion of the site complex, *makai* of the Feature A terraces. The terrace measures 10 m by 4 m wide and is bordered on the upslope and downslope edges by 1 or 2 course alignments of basalt boulders and cobbles. The surface of the terrace is relatively level with abundant surface stones. At present, coffee trees are growing in the terrace. Feature D appears to function as an agricultural planting area.

Feature E is a stacked stone wall located in the southwestern portion of the site complex. The wall extends approximately 17 m northeast to southwest along the edge of a low bluff. At its northern end, the wall intersects with the southern retaining wall of the Feature D terrace. The Feature E wall is constructed of stacked basalt boulders and cobbles, 2-4 courses high, with a maximum height of 90 cm. The wall is faced along the downslope edge and nearly flush with the ground surface along the upslope edge (Figure 35). Crude alignments of basalt boulders and cobbles extend to the northwest from the middle and southern portions of the wall, perpendicular to the main wall construction. These alignments retain relatively level soil terraces. The Feature E area was previously described as functioning as a habitation area (Ladd and Yen 1972).



Figure 32. Photograph of SIHP # 50-80-07-866 Feature B terrace, showing the 'auwai and capstone, view to north.



Figure 33. Photograph of SIHP # 50-80-07-866 Feature B terrace, showing the lower terrace walls, view to north



Figure 34. Photograph of SIHP # 50-80-07-866 Feature C enclosure, view to southeast



Figure 35. Photograph of SIHP # 50-80-07-866 Feature E wall, view to north

Feature F consists of an area of remnant terracing, located approximately 22 m northeast of the Feature A terrace. The terrace area measures 8.6 m by 6.1 m wide and is bordered on four sides by rough alignments of basalt boulders and cobbles (Figure 36). The interior of the terrace is level soil with few surface stones. A large mango tree is presently growing in the Feature F terrace. Feature F appears to function as an agricultural planting area associated with the SIHP # 50-80-07-866 site complex.

SIHP # 50-80-07-866 was interpreted by Ladd and Yen (1972) to be a historic habitation complex, which was confirmed through interviews with members of the Holt family related in the following account:

As a form of corroboration to this assumption of the habitation of this site, Mr. James Robinson Holt (mentioned earlier as a long-time resident of Makaha Valley), was asked to visit the site and tell what he knew about it. He could remember the site very well as it had been his home from 1910 to 1923. He said that he and his immediate family moved there in 1910 when the Waianae Company took over the main Holt house for their plantation headquarters. (Attempts to locate the main Holt house were unsuccessful). Mr. Holt said that the house was a wood-frame one on an elevated rock foundation, and that the house had been built by Hawaiians before his family moved in. He also indicated that he had put an addition onto the house (perhaps explaining the mixture of square-cut and round-wire nails).

Mr. Holt walked around the rest of the site and pointed out other features and explained what the land and buildings were used for. According to him, the house was located in the vicinity of test 2; we had excavated the corner nearest to the front lanai. He could remember nothing about the three rock mounds. Our hypothesis that there had been a building over the sunken pit was correct--it was the bath house. He also pointed out another refuse area and said that there should be a lot of bottles in it; there were not, but he had an explanation for the lack--during prohibition, all discarded bottles were picked up and used for home brew. He also pointed out the old road leading to the house area, and pointed out the locations of the old servants' quarters and horse stable. (This area is now a horse pasture and there are no visible remains of either the stable or the living quarters.)

Mr. Holt's account generally supports the findings based on the test excavations. He filled in many of the details that could not have otherwise been supplied, but his account in no way contradicts what we found through archaeological techniques.

Mrs. Holt added the final piece of proof about the site. When she was shown a few pieces of china that were found in test 2, she immediately recognized them as the Lokelani pattern and said that she had a set of dishes with that pattern, given to her by her mother-in-law. She said that "Lokelani" was a very popular pattern in the late 1890s and the early part of the 20th century. [Ladd and Yen 1972:6-10]



Figure 36. Photograph of SIHP # 50-80-07-866 Feature F terrace, view to north

SIHP # 50-80-07-866 is interpreted to be a historic habitation complex with associated garden-type agricultural features, and a former residence of members of the prominent Holt family. SIHP # 50-80-07-866 is in fair condition with collapse and sedimentation observed throughout the site complex. Despite the degradation of portions of the component features, the site complex is intact and maintains integrity of location, design, materials, and workmanship. Due to the extensive modification of the landscape by historic and modern development in the vicinity, the site does not have integrity of setting or feeling. SIHP # 50-80-07-866 is assessed as significant under Criterion D (have yielded, or may be likely to yield information important in prehistory or history) of the Hawai'i Register of Historic Places evaluation criteria. In addition, because of the association of SIHP # 50-80-07-866 with the Holt family and their impact on the history and landscape of Mākaha, the site is also assessed as significant under Criteria A (associated with events that have made an important contribution to the broad patterns of our history) and B (associated with the lives of persons important in our past) of the Hawai'i Register of Historic Places evaluation criteria.

4.3 Test Excavations Findings

4.3.1 Previous Test Excavations at SIHP # 50-80-07-866

The following summary of the results of subsurface testing at SIHP # 50-80-07-866 was provided by Ladd and Yen (1972:6-10):

Three areas were chosen for test excavation—the first test was dug in one of the small rock mounds; the second, a 2-meter square, was put in the SE corner of the platform; and the third, another 2-meter square, was put in the SW corner of the sunken walled pit.

The results of test 1 indicated that the rock mound had been a refuse heap--coral, *kukui*-nut shell, faunal material, and charcoal were all found in abundance. Some historical material was also recovered--nails, ceramic pieces, and broken glass.

Before test 2 was begun, we assumed that this area was a house platform because of its shape, size, and some stone alignments on the surface suggestive of a pavement and house outline. The materials found in this test strongly backed up this assumption--an abundance of nails (both square-cut and round-wire), bottle glass, ceramic pieces, bones, buttons, a cartridge case, and an 1883 Kalakaua dime. Sample materials and artifacts were heaviest in the top layer, above what appeared to be an uneven stone pavement. Below this possible pavement (from approximately 12 cm on down) the quantity of portable artifacts dwindled, and below 30-cm depth, no sample materials and artifacts were found.

We originally thought that the sunken walled pit had been some kind of an animal pen or possibly an agricultural enclosure. The materials found in test 3, however indicated that there had been some type of structure over the pit. The nails, assorted pieces of metal, large pieces of plate glass, and pieces of leather found indicated the presence of a rather modern structure.

Site C4-93 produced a variety of historical artifacts as well as a stone pounder, an *'ulu maika* game stone, and an adz piece. The surface of the site was strewn with historical material--bottles, metal pieces, and china.

Several different types of china were found at this site--the two most abundant were an undecorated, coarse, yellow type, and a smooth, hand-painted, floral-design type with a reddish line around the rim. The first, was called "plain yellow" by Spargo, who stated that this type was of poor quality, coarse, and very plentiful in the late 19th century [1926]. There are no manufacturers' marks on any of the fragments found; thus, it is not possible to tell where or by whom they were made.

The other type--the hand-painted floral design with the reddish line around the rim--is more traceable although, at this point, not completely. The pattern has been identified as "Lokelani," and there are still sets of this china in Honolulu homes. A study of some of them revealed that at least some of it was made in Staffordshire, England, by Crescent and Sons, and that it was imported to Hawaii by W. W. Dimond Co., Ltd. Dimond Co. is known to have been in business as early as 1895, but it is possible that some "Lokelani" could have been imported earlier.

Several other, very small, fragments of white china were found in C4-93, but they are too small and too undistinguished to be identified.

The various types of ceramic fragments found would indicate that the site was occupied around the turn of the century and perhaps later.

Glass was found in great abundance both on the surface and in the excavations. The surface collection is made up entirely of bottle glass--some fragments and a few complete bottles. They are definitely 20th century bottles, having flat bottoms and uniform shapes.

The excavations also yielded many other pieces of glass; most are very small and are varied in color and texture. Two fragments of an interesting bottle were found below the surface--they are deep blue and quite small. One of the fragments is the narrow neck and rim of the bottle and the other is a piece of the base. Their sizes indicate a small-volume bottle with a long neck, perhaps a medicine bottle. Because there are no identifying marks on the remaining pieces, little more can be said about them.

Several large pieces of plate glass were found in test 3; their presence there, while not immediately datable, at least points to the possibility of a structure in this area.

Metal was the most abundant artifact found at C4-93. Badly corroded pieces of machinery were found on the surface, and more than 100 nails were found in the excavations. There are slightly more of the square type than the more modern, round-wire type, and long and short of both kinds, varying in size from long spikes to very short finishing nails. Most of the nails were found in the outer edge of test 2, with some in test 3 and a few in test 1. The square nails are the type commonly used up to the turn of the century. Wire nails did not really become heavily used until the late 1890s and square-cut nails were preferred well into the 20th century.

It would seem, then, that the structures at C4-93 were built either when both types of nails were common, or when square nails were used almost exclusively and repaired or added onto when wire nails were common.

Besides nails, many other pieces of metal were found. All the most interesting pieces were found in test 3--two drawer handles, one ornamental piece, and a curious piece that could have been a toilet-flush handle. They have no identifying marks.

Of the miscellaneous items, the buttons are modern and do not help to date the site. The leather is badly rotted, but it seems to be the sole of a shoe. The clay-pipe piece is much too large to have been part of a smoking pipe, and it has no identifying marks; at the present time it has not been dated.

The artifact evidence seems to indicate occupation of C4-93 toward the end of the 19th and into the 20th century. Most of the artifacts are from the late 19th century. The china, nails, and glass do not allow for an earlier historical habitation, although it is possible that this site may have been occupied in precontact times because it would have been a good location for growing taro. [Ladd and Yen 1972:9-10]

4.3.2 SIHP # 50-80-07-866 Test Unit 1

A 1 m by 1 m test excavation was made within the central portion of the SIHP# 50-80-07-866 Feature A terrace to better determine the age and function of the feature (see Figure 29 above). The test excavation was located adjacent to a well-constructed and minimally disturbed portion of the terrace retaining wall. The excavation was made in this location in an attempt to recover datable material from beneath the base of the constructed wall to date the initial construction of the feature.

The surface of the test excavation consisted of level soil, clear of surface stones, covered with a layer of leaf litter and humus. A broken poi pounder was recovered from the surface of the terrace, in the immediate vicinity of Test Unit 1. Two sediment strata were observed through the excavation of Test Unit 1 (Figure 37). Stratum I consisted of a very dark grayish brown clay loam, representing developing top soil. Stratum II consisted of a similar dark brown clay loam that continued to a depth underlying the terrace wall. A charcoal sample was recovered from beneath the base of the wall structure and submitted for radiocarbon dating analysis. Stratum II also contained historic artifacts including glass shards and a rubber shoe heel. The test excavation was terminated at clearly sterile sediments.

Following the test excavation, the excavated area was partially backfilled. Detailed sediment descriptions are as follows:

<u>Strata</u>	<u>Depth (cmbs)</u>	<u>Description</u>
Stratum I	0-5	10YR 3/2 very dark grayish brown clay loam; weak, medium blocky structure; dry, weakly coherent consistency; slightly plastic; no cementation; terrestrial origin; Lower Boundary (LB) is clear, wavy.
Stratum II	5-BOE	10YR 3/3 dark brown clay loam; weak, fine blocky structure; dry, weakly coherent consistency; slightly plastic; no cementation; terrestrial origin; LB is below BOE.

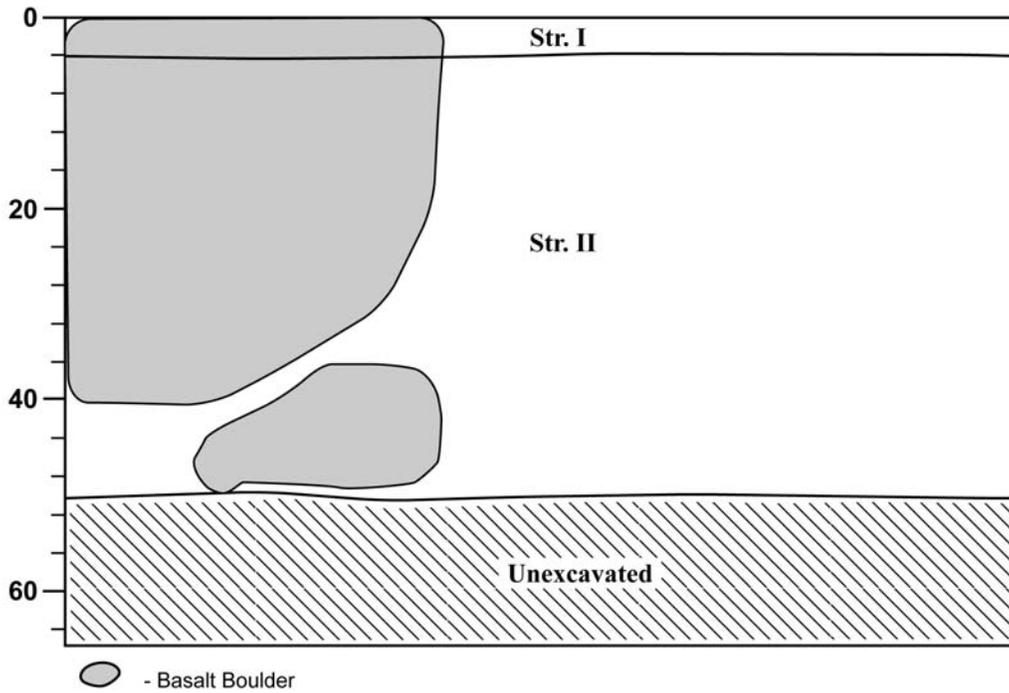
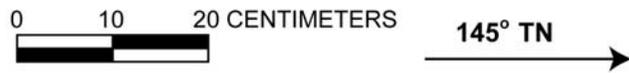


Figure 37. Post-excitation photograph (above, view to northeast) and stratigraphic profile (below) of SIHP # 50-80-07-866 Test Unit 1

4.3.3 SIHP # 50-80-07-866 Test Unit 2

A 1 m by 1 m test excavation was made within the northwestern portion of the SIHP# 50-80-07-866 Feature C enclosure to better determine the age and function of the feature (see Figure 29 above). The test excavation was located adjacent to a well-constructed and minimally disturbed portion of the enclosure wall. The excavation was made in this location in an attempt to recover datable material from beneath the base of the constructed wall to date the initial construction of the feature.

The surface of the test excavation consisted of level soil, clear of surface stones, covered with a layer of leaf litter and humus. Two sediment strata were observed through the excavation of Test Unit 2 (Figure 38). Stratum I consisted of a very dark grayish brown clay loam, representing developing top soil. Stratum II consisted of a similar very dark grayish brown clay loam that continued to a depth underlying the enclosure wall. A bulk sediment sample was recovered from beneath the base of the wall structure and submitted for radiocarbon dating analysis. Stratum II also contained various historic artifacts including glass shards, metal nails, bullet shell casings, and a threaded metal pipe. The test excavation was terminated at clearly sterile sediments.

Following the test excavation, the excavated area was left open for possible demonstration purposes associated with the proposed cultural learning center. Detailed sediment descriptions are as follows:

<u>Strata</u>	<u>Depth (cmbs)</u>	<u>Description</u>
Stratum I	0-5	10YR 3/2 very dark grayish brown clay loam; weak, medium blocky structure; dry, weakly coherent consistency; slightly plastic; no cementation; terrestrial origin; Lower Boundary (LB) is clear, wavy.
Stratum II	5-BOE	10YR 3/2 very dark grayish brown clay loam; weak, fine blocky structure; dry, weakly coherent consistency; slightly plastic; no cementation; terrestrial origin; contains historic refuse; LB is below BOE.

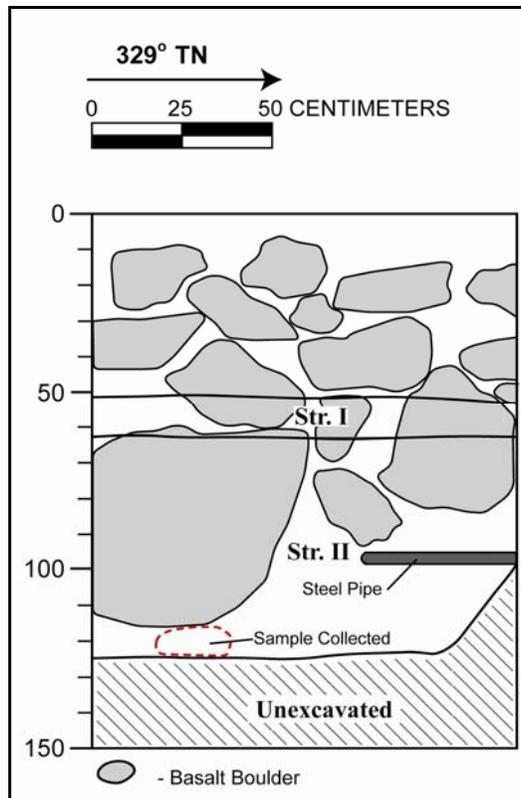


Figure 38. Photograph (above) and stratigraphic profile (below) of the west face of SIHP # 50-80-07-866 Test Unit 2

4.3.4 SIHP # 50-80-07-6897 Test Unit 3

A 1 m by 1 m test excavation was made adjacent to the downslope edge of the SIHP# 50-80-07-6897 terrace to better determine the age and function of the feature (see Figure 25 above). The test excavation was located adjacent to a well-constructed and minimally disturbed portion of the terrace retaining wall. The excavation was made in this location in an attempt to recover datable material from beneath the base of the constructed wall to date the initial construction of the terrace.

The surface of the test excavation consisted of level soil, clear of surface stones, covered with a layer of leaf litter and humus. Three sediment strata were observed through the excavation of Test Unit 3 (Figure 39 and Figure 40). Stratum I consisted of a very dark grayish brown clay loam, representing developing top soil. Stratum Ia consisted of a brown sandy loam. This stratum likely originated from a flooding event of Mākaha Stream. Stratum II consisted of a very dark grayish brown clay loam that continued to a depth underlying the terrace wall. A bulk sediment sample was recovered from beneath the base of the wall structure and submitted for radiocarbon dating analysis. The test excavation was terminated at clearly sterile sediments.

Following the test excavation, the excavated area was reconstructed as closely as possible to its original state. Detailed sediment descriptions are as follows:

<u>Strata</u>	<u>Depth (cmbs)</u>	<u>Description</u>
Stratum I	0-5	10YR 3/2 very dark grayish brown clay loam; weak, medium blocky structure; dry, weakly coherent consistency; slightly plastic; no cementation; terrestrial origin; Lower Boundary (LB) is clear, wavy.
Stratum Ia	0-15	10YR 4/3 brown sandy loam; structureless; dry, loose consistency; non-plastic; no cementation; terrestrial origin; LB is abrupt, smooth.
Stratum II	5-BOE	10YR 3/2 very dark grayish brown clay loam; weak, fine blocky structure; dry, weakly coherent consistency; slightly plastic; no cementation; terrestrial origin; LB is below BOE.

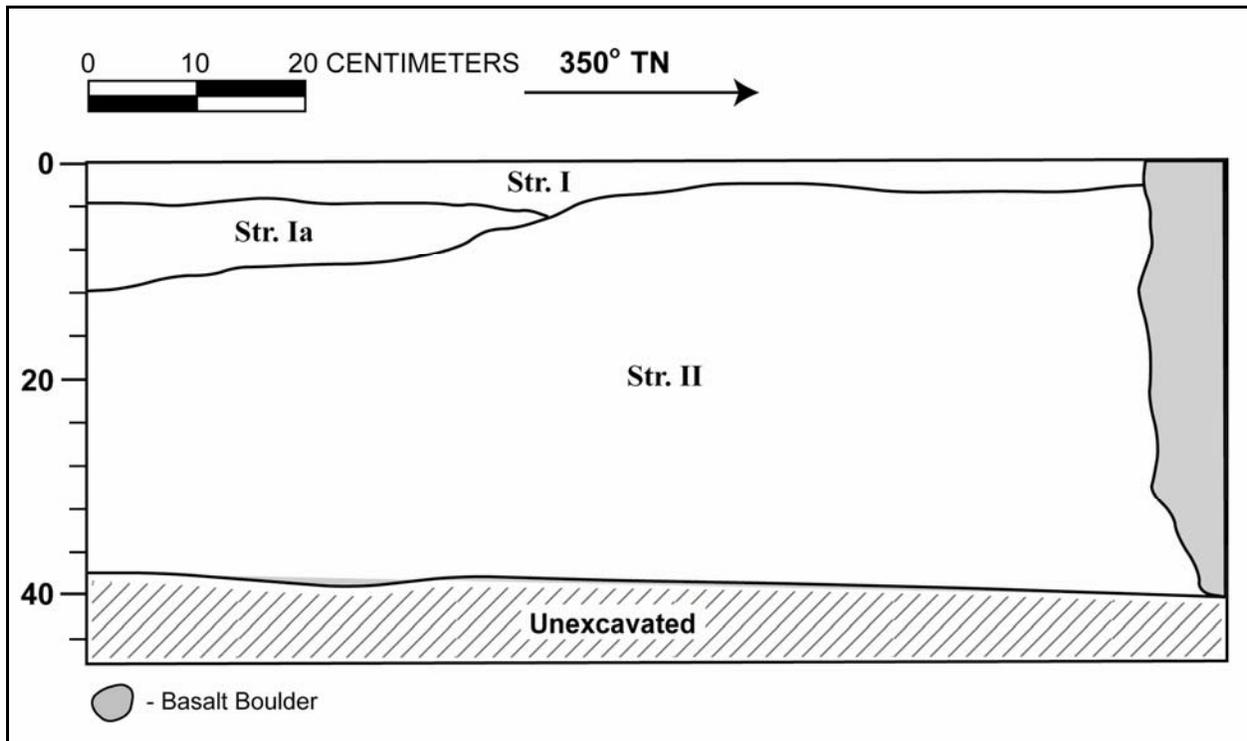


Figure 39. Photograph (above) and stratigraphic profile (below) of the west face of SIHP # 50-80-07-6897 Test Unit 3

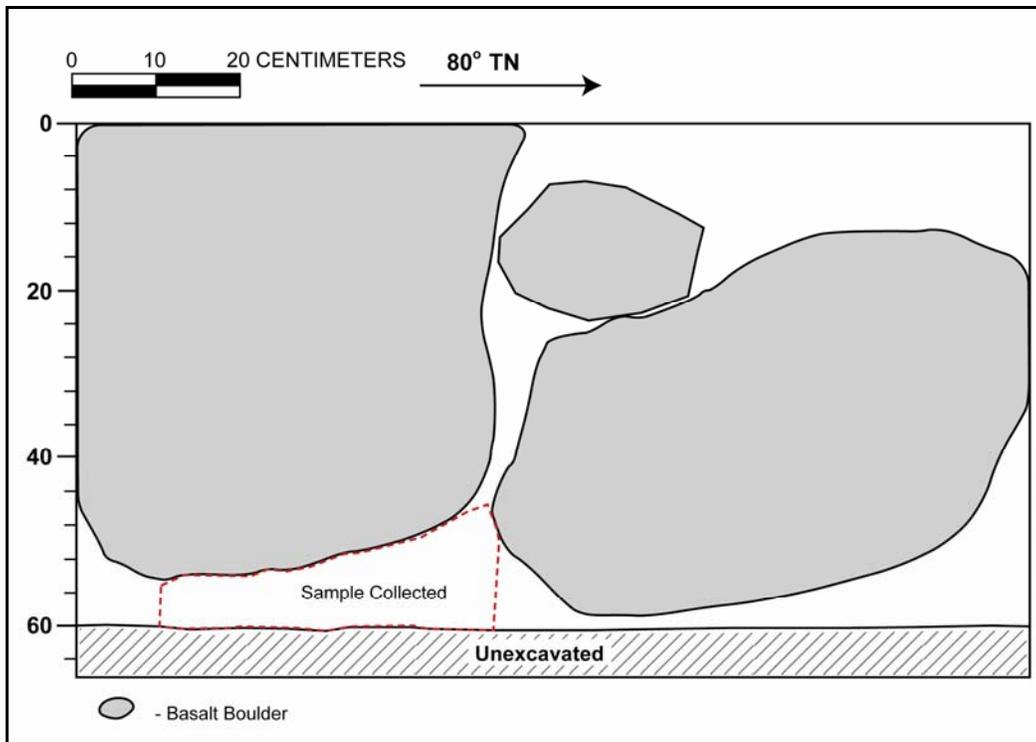


Figure 40. Photograph (above) and stratigraphic profile (below) of the north face of SIHP # 50-80-07-6897 Test Unit 3

Section 5 Results of Laboratory Analysis

Test Unit 1 at SIHP # 50-80-07-866 Feature A contained a total of 58.1 g of charcoal (Table 4) and 71 artifacts (Table 5). A broken poi pounder (Figure 41) was recovered from the surface of SIHP# 50-80-07-866 Feature A in the vicinity of Test Unit 1. Stratum I contained basalt flakes, volcanic glass flakes, glass shards, and a rubber shoe heel. Stratum II contained only basalt flakes. The artifact collection is indicative of historic occupation. A charcoal sample was recovered from beneath the base of the Feature A wall structure and submitted for radiocarbon dating analysis (Beta -218980) (see Appendix B: Radiocarbon Dating Analysis below). Radiocarbon dating analysis yielded a calibrated 2-sigma date range of A.D. 1430 to 1650 (95.4%) with a single calibration curve intercept of A.D. 1490. This date range is completely within the pre-contact period and indicates occupation of the SIHP # 50-80-07-866 site area prior to the historic occupation by the Holt family.

Test Unit 2 at SIHP # 50-80-07-866 Feature C contained a total of 9 artifacts (Table 5). All artifacts were recovered from Stratum II, and consisted of basalt flakes, glass shards, bullet shell casings (Figure 42), and various metal hardware, including a metal pipe. The artifacts are indicative of historic occupation, and the metal pipe supports the previous description of Feature C as a bath house. A bulk sediment sample containing light charcoal flecking was recovered from beneath the base of the Feature C wall structure and submitted for radiocarbon dating analysis (Beta -218981) (see Appendix B: Radiocarbon Dating Analysis below). Radiocarbon dating analysis yielded two possible date ranges, with a calibrated 2-sigma date range of 1948 to present (88.6%) being the most probable. This modern date does not provide conclusive evidence for dating the initial occupation of SIHP# 50-80-07-866.

Test Unit 3 at SIHP # 50-80-07-6897 did not contain any artifacts. A bulk sediment sample containing light charcoal flecking was recovered from beneath the base of the SIHP # 50-80-07-6897 wall structure and submitted for radiocarbon dating analysis (Beta -218982) (see Appendix B: Radiocarbon Dating Analysis below). Radiocarbon dating analysis yielded a calibrated 2-sigma date range of 1950 to present (95.4%). This modern date does not provide conclusive evidence for dating the initial construction of SIHP# 50-80-07-6897.

Table 4. Catalog of Charcoal Recovered from Test Excavations 1-3 within SIHP # 50-80-07-866 and SIHP # 50-80-07-6897

Acc. #	SIHP # (50-80-07)	Test Unit	Stratum	Depth (cmbd)	Weight (g)	Comments
C-1	866	1	II	20-30	6.7	--
C-2	866	1	II	30-40	29.9	--
C-3	866	1	II	40-50	18.8	Sample for analysis (Beta - 218980)
C-4	866	2	II	68-75	4.3 kg	Bulk sediment sample for analysis (Beta -218981)
C-5	6897	3	II	20-40	5.6 kg	Bulk sediment sample for analysis (Beta -218982)
C-6	6897	3	II	20-40	5.5 kg	--
C-7	6897	3	II	20-40	0.4	--
C-8	866	1	I	0-5	2.7	--

Table 5. Catalog of Artifacts Recovered from Test Excavations 1 and 2 within SIHP # 50-80-07-866

Test Unit	Stratum	Depth (cm)	# of Pieces	Max. Length (cm)	Max. Width (cm)	Max. Thickness	Total Weight (g)	Material Type	Function	Comments
1	II	10-20	20	3.8	2.3	1	36.5	basalt	flakes	--
1	II	20-30	9	3.8	2.6	1	14.2	basalt	flakes	--
1	II	30-40	13	4.1	2.6	7.5	28.7	basalt	flakes	--
1	II	40-50	6	3.8	3.4	1.1	35.7	basalt	flakes	--
1	I	0-5	1	8.3	7.6	1.2	81.4	rubber	shoe heel	--
1	I	0-5	4	1.3	1	0.4	0.9	basalt	flakes	--
1	I	0-5	3	1	0.6	0.5	0.9	glass	shard	2 clear, 1 amber
1	I	0-5	2	1	0.7	0.4	0.4	volcanic glass	flakes	--
1	I	surface	1	7.1	8.6	8.6	567	basalt	poi pounder	top half broken off
2	II	45	1	7.4	1.3	0.2	4.8	glass	shard	clear
2	II	45	1	1.1	5.5	0.2	52.5	metal	undetermined	rusted metal piece with diamond shaped protuberances
2	II	45	1	1.1	0.7	0.7	17	metal	nail	bent in 90 degree angle
2	II	45	1	0.9	2.2	2.2	6.1	metal	bullet	shell casing

2	II	45	1	4.9	0.4	0.4	2.1	metal	undetermined	rusted metal piece
2	II	45	1	5.9	0.5	0.3	3.8	metal	handle	metal piece, both ends bent at 90 degree angle
2	II	45	1	1.9	1.3	1.3	4.2	metal	bullet	shell casing, 44 caliber
2	II	45	1	1.9	1.7	0.2	35.7	metal	undetermined	metal strip with thin, sharp protuberances
2	II	45	1	5.2	4.3	6	3231.8	metal	undetermined	threaded metal pipe bent at 90 degree angle
1	I	0-5	2	1	0.7	0.3	0.3	volcanic glass	flakes	--
1	I	0-5	8	2.8	2.5	0.8	24.9	basalt	flakes	--
1	I	0-5	2	0.6	0.3	0.2	0.1	glass	shard	clear



Figure 41. Photograph of artifact Acc. # 9, broken poi pounder



Figure 42. Photograph of artifacts Acc. # 13 (left) and Acc. # 16 (right), bullet shell casings

Section 6 Summary and Interpretation

The archaeological inventory survey of the approximately 13-acre project area identified four historic properties, representing two periods of land-use within the Mākaha Valley property. Surface archaeological features within the project area consisted predominantly of historic-era structures. The SIHP # 50-80-07-6895 irrigation ditch and associated plantation infrastructure and SIHP # 50-80-07-6896 cattle wall are remnants of the large-scale commercial plantation and ranching period, which has a long history in Mākaha. While the SIHP # 50-80-07-866 historic habitation complex also originates from this period carbon dating from Test Unit 1 at this site indicates the historic habitation was built on a pre-contact site (dating to A.D. 1430 to 1650). The historic house site was identified as a former residence of Holt Family members, prominent figures in the history of Mākaha.

In addition to these historic-era sites, one pre-contact archaeological feature was identified within the project area. SIHP # 50-80-07-6897 consisted of a traditional Hawaiian agricultural terrace located adjacent to Mākaha Stream. Despite the lack of additional pre-contact archaeological features, lands within the project area were likely fully cultivated and occupied prior to the construction of the historic sites identified in the inventory survey. The topography and availability of water from Mākaha Stream would make the project area an ideal location for *lo'i* development and wetland taro cultivation. Radiocarbon dating of a charcoal sample recovered from within the SIHP # 50-80-07-866 Feature A terrace yielded a date range of A.D. 1430 to 1650. This dates the initial construction of the terrace to the pre-contact period, with subsequent usage and possible reconstruction in the historic period.

Section 7 Significance Assessments

Each historic property identified within the project area was evaluated for significance according to the broad criteria established for the Hawai'i Register of Historic Places. The five criteria are:

- A Associated with events that have made an important contribution to the broad patterns of our history;
- B Associated with the lives of persons important in our past;
- C Embodies the distinctive characteristics of a type, period, or method of construction, represents the work of a master, or possesses high artistic value;
- D Have yielded, or is likely to yield information important for research on prehistory or history;
- E Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property, or due to associations with traditional beliefs, events or oral history accounts – these associations being important to the group's history and cultural identity.

SIHP # 50-80-07-6895 consists of a historic irrigation ditch and associated retaining walls located in the eastern portion of the project area. SIHP # 50-80-07-6895 Features A-G are interpreted to represent plantation-related irrigation infrastructure, functioning in providing water from Mākaha Stream to the sugar plantations in lower Mākaha Valley. SIHP # 50-80-07-6895 is assessed as significant under Criterion D of the Hawai'i Register of Historic Places evaluation criteria.

SIHP # 50-80-07-6896 is a free-standing stone wall located in the western portion of the project area, running roughly parallel to the bank of Mākaha Stream. SIHP # 50-80-07-6896 is interpreted to represent a historic, ranch-related cattle wall, functioning in restricting the movement of cattle across Mākaha Stream. SIHP # 50-80-07-6896 is assessed as significant under Criterion D of the Hawai'i Register of Historic Places evaluation criteria.

SIHP # 50-80-07-6897 is a terrace located in the northern portion of the project area, situated within an overflow channel immediately south of the main Mākaha Stream channel. SIHP # 50-80-07-6897 is interpreted to be a pre-contact, traditional Hawaiian agricultural terrace, whose retained soil area was used for seasonal (winter) planting. SIHP # 50-80-07-6897 is assessed as significant under Criterion D of the Hawai'i Register of Historic Places evaluation criteria.

SIHP # 50-80-07-866 consists of a habitation complex located in the southwestern portion of the project area. SIHP # 50-80-07-866 is interpreted to be a historic residence of the prominent Holt family. SIHP # 50-80-07-866 is assessed as significant under Criteria A, B, and D of the Hawai'i Register of Historic Places evaluation criteria.

Section 8 Project Effect and Mitigation Recommendations

The following project effect discussion and cultural resource management recommendations are intended to facilitate project planning and support the project's required historic preservation consultation. This discussion is based on the results of this archaeological inventory survey investigation and CSH's communication with the project proponents regarding the project's potential impacts to the historic properties described in the Results of Fieldwork section, above.

8.1 Project Effect

Proposed development within the Mākaha Cultural Learning Center project area may include: restoration of riparian biology and habitat within and along Mākaha Stream; restoration of traditional Hawaiian agricultural practices, including taro *lo'i* (irrigated pondfields); and construction of associated support infrastructure including a main building, field shelters, and a trail and roadway network. Minimally, land disturbing activities may include grubbing, grading, building construction, and excavations for the installation of subsurface utilities. The Area of Potential Effect (APE) is defined as the entire approximately 13-acre project area.

The current archaeological inventory survey investigation identified the following historic properties within the project area. These features will potentially be affected by the proposed project:

1. SIHP # 50-80-07-6895: historic, plantation-era irrigation ditch and associated retaining walls and terrace. Assessed as significant under Criterion D of the Hawai'i Register of Historic Places evaluation criteria.
2. SIHP # 50-80-07-6896: historic, ranch-related stone wall. Assessed as significant under Criterion D of the Hawai'i Register of Historic Places evaluation criteria.
3. SIHP # 50-80-07-6897: pre-contact, traditional Hawaiian agricultural terrace. Assessed as significant under Criterion D of the Hawai'i Register of Historic Places evaluation criteria.
4. SIHP # 50-80-07-866: historic habitation complex. Assessed as significant under Criteria A, B, and D of the Hawai'i Register of Historic Places evaluation criteria.

In keeping with the proposed use of the property as a cultural learning center, the project proponents have indicated they are agreeable to preserving all of the identified historic properties within the project area, with appropriate buffer zones. These remnants of Mākaha's past are valuable resources that can be used to support the educational goals of the proposed cultural learning center. CSH's project-specific effect recommendation is "effect, with proposed mitigation commitments." The recommended mitigation measures will reduce the project's potential adverse effect upon these significant historic properties.

8.2 Mitigation Recommendations

To reduce the proposed project's potential adverse effect on significant historic properties, the following mitigation measures are recommended. The mitigation measures should be completed prior to any land disturbing activities within the 13-acre Mākaha Cultural Learning Center project area.

SIHP # 50-80-07-6895 historic, plantation-era irrigation ditch and associated retaining walls and terrace was documented with written descriptions, photographs, scale drawings, and accurately located with GPS survey equipment. SIHP # 50-80-07-6895 features are remnants of Mākaha's historic land use and potential resources for educational exhibition and future archaeological research. Preservation, in the form of avoidance and protection, is recommended for the SIHP # 50-80-07-6895 irrigation ditch and associated features.

SIHP # 50-80-07-6896 historic, ranch-related stone wall was documented with written descriptions, photographs, scale drawings, and accurately located with GPS survey equipment. SIHP # 50-80-07-6896 is a remnant of Mākaha's historic land use and potential resource for educational exhibition and future archaeological research. Preservation, in the form of avoidance and protection, is recommended for the SIHP # 50-80-07-6896 stone wall.

SIHP # 50-80-07-6897 pre-contact, traditional Hawaiian agricultural terrace was documented with written descriptions, photographs, scale drawings, and accurately located with GPS survey equipment. Limited subsurface testing was also conducted within the terrace. The SIHP # 50-80-07-6897 terrace is a remnant of Mākaha's pre-contact land use and potential resource for educational exhibition and future archaeological research. Preservation, in the form of avoidance and protection, is recommended for the SIHP # 50-80-07-6897 agricultural terrace. In keeping with the goals of the proposed Mākaha Cultural Learning Center, limited restoration of the terrace and possible construction of additional associated agricultural terraces would be deemed an appropriate cultural use of SIHP # 50-80-07-6897.

SIHP # 50-80-07-866 habitation complex was documented with written descriptions, photographs, scale drawings, and accurately located with GPS survey equipment. Limited subsurface testing was also conducted within the Feature A terrace and Feature C enclosure. The SIHP # 50-80-07-866 features are remnants of Mākaha's historic land use and potential resources for educational exhibition and future archaeological research. Preservation, in the form of avoidance and protection, is recommended for the SIHP # 50-80-07-866 habitation complex.

It is also recommended that a cultural resource preservation plan be prepared for the proposed Mākaha Cultural Learning Center project, in accordance with Hawai'i Administrative Rules (HAR) 13-277-3, to address buffer zones and protective measures for historic properties recommended for preservation. This preservation plan should detail the short and long-term preservation measures that will safeguard the historic property during project construction and subsequent use of the project area.

8.3 Compatibility of Proposed Mākaha Cultural Learning Center Plans with Preservation of Cultural Resources

Although the proposed development plans are understood to be rather preliminary at this time, they do indeed appear to be quite compatible with preservation of the identified cultural resources. A comparison of the initially proposed development plans (see Figure 4) with the location of identified cultural resources (see Figure 11) indicates that the “Kahua” operations base could potentially be situated either to the east or west of the SIHP # 50-80-07-6895 irrigation ditch. It appears that the Holt family home site (SIHP # 50-80-07-866) could easily be preserved within the proposed development plans. Again, it is the perception of Cultural Surveys Hawai'i that, in keeping with the goals of the proposed Mākaha Cultural Learning Center, restoration and revitalization of the SIHP # 50-80-07-6897 pre-contact, traditional Hawaiian agricultural terrace and possible construction of additional associated agricultural terraces in the vicinity would be an appropriate cultural use of the site.

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Appendix A UTM Coordinates of Identified Historic Properties

Coordinate System: UTM

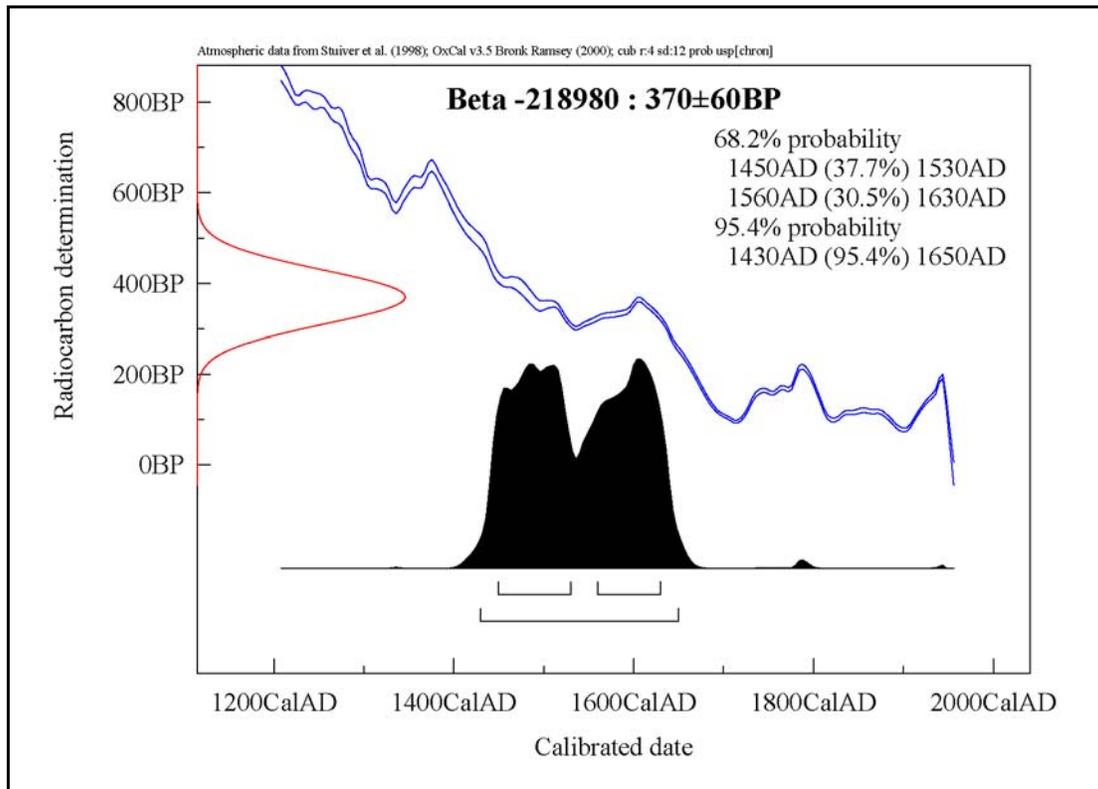
Zone: 4 North

Datum: NAD 83

SIHP #	Easting	Northing
50-80-07-6895	583910	2376463
50-80-07-6896	583847	2376537
50-80-07-6897	583897	2376665
50-80-07-866	583792	2376380

Appendix B Radiocarbon Dating Analysis

	BETA ANALYTIC INC. DR. M.A. TAMERS and MR. D.G. HOOD	UNIVERSITY BRANCH 4985 S.W. 74 COURT MIAMI, FLORIDA, USA 33155 PH: 305/667-5167 FAX: 305/663-0964 E-MAIL: beta@radiocarbon.com	
REPORT OF RADIOCARBON DATING ANALYSES			
Dr. Hallett H. Hammatt Cultural Surveys Hawaii	Report Date: 8/28/2006 Material Received: 7/24/2006		
Sample Data	Measured Radiocarbon Age	¹³ C/ ¹² C Ratio	Conventional Radiocarbon Age(*)
Beta - 218980 SAMPLE : MAKAH2CH3 ANALYSIS : Radiometric-Standard delivery MATERIAL/PRETREATMENT : (charred material); acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1430 to 1650 (Cal BP 520 to 300)	280 +/- 60 BP	-19.8 o/oo	370 +/- 60 BP




BETA ANALYTIC INC.

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REPORT OF RADIOCARBON DATING ANALYSES

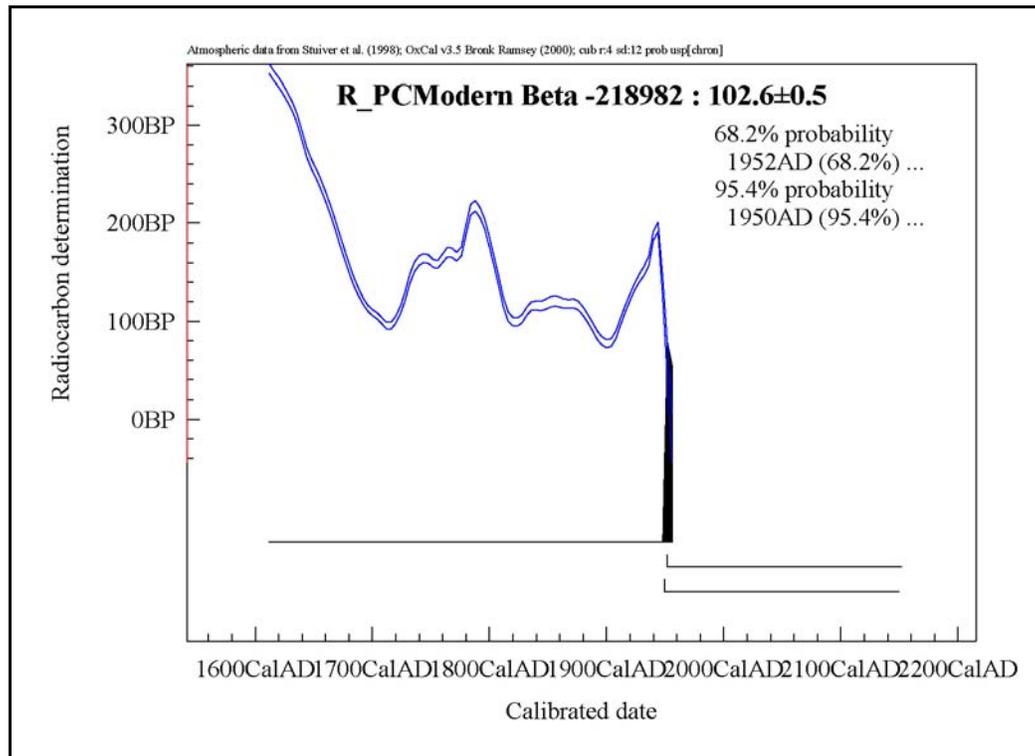
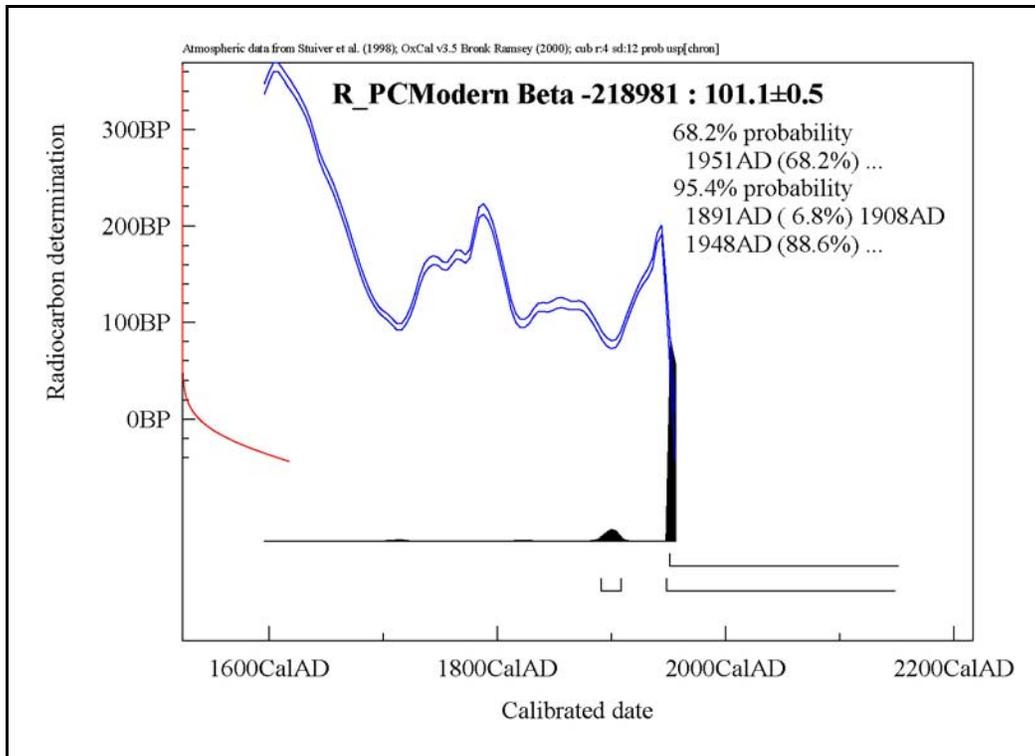
Dr. Hallett H. Hammatt

Report Date: 9/7/2006

Cultural Surveys Hawaii

Material Received: 7/24/2006

Sample Data	Measured Radiocarbon Age	¹³ C/ ¹² C Ratio	Conventional Radiocarbon Age(*)
Beta - 218981 SAMPLE : MAKAH2CH4 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (organic sediment): acid washes COMMENT: reported result indicates an age of post 0 BP and has been reported as a % of the modern reference standard, indicating the material was living within the last 50 years.	101.6 +/- 0.5 pMC	-22.3 o/oo	101.1 +/- 0.5 pMC
Beta - 218982 SAMPLE : MAKAH2CH5 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (organic sediment): acid washes COMMENT: reported result indicates an age of post 0 BP and has been reported as a % of the modern reference standard, indicating the material was living within the last 50 years.	102.8 +/- 0.5 pMC	-24.2 o/oo	102.6 +/- 0.5 pMC



APPENDIX D

Fauna and Flora Survey

Biological surveys for TMK: 8-4-002:014 por. in Mākaha Valley, O‘ahu

October 23, 2014

DRAFT

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Introduction

AECOS Inc.¹ conducted biological a resources survey of an approximately 14.5-ac area (TMK: 8-4-002:014 por.) located in Mākaha Valley on leeward O‘ahu (Figure 1). The area surveyed is located a short distance downstream of Kāne‘āki Heiau and will be developed in traditional agriculture by the Board of Water Supply (Mākaha Valley Lo‘i Project or “Project”). The purpose of our survey was to establish the presence or absence of sensitive biological resources—such as listed species or rare native species—on the Project site.

Site Description

The project site lies on a shelf on the floor of Mākaha Valley at around 500 ft above sea level. The shelf itself has a gentle slope downward to the west, but the valley margins are steep here—vertical in places—limiting access to the site from either the upstream (through Kāne‘āki Heiau access road; TMK: 8-4-002:013) or downstream (through private property; TMK: 8-4-029:142) ends of the shelf. Mākaha Stream is further incised 1 to 5 meters below the shelf and flows mostly in a channel deflected to the far right side² (west here) of the shelf. At the upper end, there is a low head dam on Mākaha Stream with a (now non-functional) diversion to an old ‘auwai that can be traced along the side of the shelf opposite from the stream channel (Figure 2) and terminating about half way down the site.

¹ Report prepared for Townscapes, Inc. and intended to become part of the public record for the environmental assessment process.

² Right and left sides or banks of a stream are always determined by facing in the direction of flow.



Figure 1. Location of the Project on the Island of O‘ahu.

Mākaha Stream

The following description of Mākaha Stream is modified from *AECOS* (2011; 2013). Mākaha Stream arises on the west slope of Mt. Ka‘ala, flowing first westward then south through Mākaha Valley. The stream (State ID number 3-5-007) is perennial,³ although flow in the project vicinity is probably intermittent.

³ A perennial stream has year-round, continuous flow in at least part of its bed; flow need not be continuous from upper reaches to the sea. Mākaha Stream is an interrupted perennial stream.



Figure 2. Satellite view of middle of Mākaha Valley with approximate survey outlined. Green symbols mark locations of features of interest encountered.

Considerable water supply development is present in upper Mākaha Valley, so historical flow characteristics of the stream in the Project area are uncertain; however, the characterization in the Hawai‘i Stream Assessment (Hawaii Cooperative Park Service Unit, 1990) of Mākaha Stream being an interrupted stream defined as having “stream flows year-round in the upper portions, and intermittently at lower elevations” is appropriate. As related in a previous survey conducted by AECOS (AECOS, 1997), flow appears to be perennial from near the upper most reach of Mākaha Stream to approximately 250 m (800 ft) above sea level (ASL). Here, the stream becomes influent (flow disappearing into the bed). Just downstream from Kāne‘āki Heiau (around 180 m or 580 ft), Glover Tunnel supplies water to the stream. Stream flow was present in the upper part of the project area during our 2014 survey.

Methods

Botanical Survey

The survey area was limited to area between the left stream bank and the top of the steep slope along the eastern side of the site. The survey was conducted on August 27, 2014. For the survey, a boundary map was loaded into a GPS unit (Trimble 6000 Series, GeoXH) to serve as a guide and the unit recorded the progress track of the botanist. Using the recorded track in real time served as feedback on the adequacy of coverage of the pedestrian survey. Plant species were identified as they were encountered and notations used to develop a qualitative sense of abundance. Plants not immediately recognized during the survey were photographed and/or a representative feature (flower, fruit) collected for later identification at the laboratory. Plants were identified with nomenclature mostly following *Manual for the Flowering Plants of Hawai‘i: Volumes I and II* (Wagner et al., 1990; 1999) with updated name changes published in various sources as summarized by Imada (2012). Also utilized were Palmer (2003) for ferns and fern allies and Staples and Herbst (2005) for ornamental plants.

Terrestrial Vertebrates

Six avian count stations were stationed roughly equidistant from each other within the study site. Two stations were located along the eastern property border, one near the entrance to Kāne‘āki Heiau and another located at the southern end of the property where a small ditch originating from nearby Mauna‘olu Reservoir enters the property from the east. Two stations were located along Mākaha Stream on the western side of the site, and two stations

were located in the middle of the shelf. A single six-minute stationary point count was made at each of the count stations. Field observations were made with the aid of Tasco 12 X 25 binoculars and by listening for vocalizations. All avian counts were conducted in the morning hours of August 27, 2014. Time not spent counting at point count stations was used to search the area for species not represented in the stationary point counts. Weather conditions were ideal, with no rain, unlimited visibility, and winds of between 5 and 10 miles per hour. The avian nomenclature used in this report follows the *AOU Check-List of North American Birds* (2014).

Our 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 project area. Mammal scientific names follow *Mammals in Hawai‘i* (Tomich, 1986).

Survey Results

Flora and Vegetation

A mixed mesic forest (Figure 3) occurs at the very upper end of the site, and includes a number of larger trees such as: Java plum (*Syzygium cuminii*), monkey pod (*Albizia saman*), kukui (*Aleurites moluccana*), African tulip tree (*Spathodea campanulata*), Chinese banyan (*Ficus microcarpa*), silk oak (*Grevillea robusta*), and Chinaberry (*Melia azedarach*). These larger trees, and especially Java plum, are also associated with the riparian environment along the banks of Mākaha Stream.

The Project site lies along a segment of Mākaha Stream which flows along the western side of the property, minimally incised at the upper end of the site (Fig. 3), but increasingly incised downstream (that is, confined in a channel below the level of the shelf). Much of the site is covered by a short-stature forest of *koa haole* (*Leucaena leucocephala*) trees with an undergrowth of scattered clumps of shrubs, vines, and Guinea grass (a mixture of *Panicum maximum* and *Panicum maximum* var. *trichoglume*; Figure 4). Within the site, the larger trees tend to be mostly mango (*Mangifera indica*), tamarind (*Tamarindus indica*), and lemon gum (Eucalyptus). Larger trees in the lower half of the site are mostly *kiawe* (*Prosopis pallida*).

The list of plant species encountered in our survey is provided as Table 1. A total of 43 flowering plants and two species of ferns were observed during the plant survey. Two species of flowering plants remain unidentified; neither had



Figure 3. Mākaha Stream just above where it enters the Project area.



Figure 4. Short-stature forest of *koa haole* that typifies most of the Project site.

Table 1. Flora for Mākaha Valley Lo'i Project, O'ahu.

Family Species	Common name	Status	Abundance	Notes
<i>FERNS AND FERN ALLIES</i>				
POLYPODIACEAE				
<i>Phymatosorus grossus</i> (Langd. & Fisch.) Brownlie	<i>lauae</i>	Nat	U	
THELYPTERIDAE				
<i>Christella</i> sp.	wood fern	Nat	U	
<i>FLOWERING PLANTS</i>				
DICOTYLEDONS				
ACANTHACEAE				
<i>Asystasia gangetica</i> (L.) T. Anderson	Chinese violet	Nat	O2	
ANACARDIACEAE				
<i>Mangifera indica</i> L.	mango	Nat	C	
<i>Schinus terebinthifolius</i> Raddi	Christmas berry	Nat	U	
APOCYNACEAE				
<i>Thevetia peruviana</i> (Pers.) K. Schum.	be-still	Nat	R	
ASTERACEAE (COMPOSITAE)				
<i>Calyptocarpus vialis</i> Less.	---	Nat	R1	
<i>Synedrella nodiflora</i> (L.) Gaertn.	nodeweed	Nat	U	
BIGNONIACEAE				
<i>Macfadyena unguis-cati</i> (L.) A. Gentry	cat's-claw climber	Nat	U3	
CARACACEAE				
<i>Carica papaya</i> L.	papaya	Nat	R	
CLUSIACEAE				
<i>Clusia rosea</i> Jacq.	autograph tree	Nat	R	
CUCURBITACEAE				
<i>Coccinia grandis</i> (L.) Voigt	scarlet-fruited gourd	Nat	R	
EUPHORBIACEAE				
<i>Aleurites moluccana</i> (L.) Willd.	<i>kukui</i>	Pol	C	
FABACEAE				
<i>Albizia saman</i> F. Muell.	monkeypod	Nat	R	
<i>Leucaena leucocephala</i> (Lam.) deWit	<i>koa haole</i>	Nat	AA	<1>
<i>Neonotonia wightii</i> (Wight & Arnott) Lackey	glycine vine	Nat	AA	
<i>Pithecellobium dulce</i> (Roxb.) Benth.	<i>'opiuma</i>	Nat	R	
<i>Prosopis pallida</i> (Humb. & Bonpl. ex Willd.) Kunth	<i>kiawe</i>	Nat	O	
<i>Senna surattensis</i> (N.L. Burm.) H. Irwin & Barneby	<i>kolomona</i>	Nat	R	
<i>Tamarindus indica</i> L.	tamarind	Nat	U	

Table 1 (continued).

Family Species	Common name	Status	Abundance	Notes
MALVACEAE				
<i>Abutilon grandifolium</i> (Willd.) Sweet	hairy abutilon	Nat	R	
<i>Malvastrum coromandelianum</i> (L.) Garcke	false mallow	Nat	O	
MELIACEAE				
<i>Melia azedarach</i> L.	Chinaberry	Nat	C	
<i>Toona ciliata</i> M. Roem.	Australian red cedar	Nat	O	
MORACEAE				
<i>Ficus microcarpa</i> L. fil.	Chinese banyan	Nat	U	
MYRTACEAE				
<i>Eucalyptus citriodora</i> Hook.	lemon-scented gum	Nat	R	
<i>Syzygium cuminii</i> (L.) Skeels	Java plum	Nat	A	
NTCTAGINACEAE				
<i>Bougainvillea cf. spectabilis</i> Wild.	bougainvillea	Orn	R	
PASSIFLORACEAE				
<i>Passiflora edulis</i> Sims	passion fruit	Nat	U	<2>
PHYTOLACCACEAE				
<i>Rivina humilis</i> L.	coral berry	Nat	O3	
RUBIACEAE				
<i>Coffea arabica</i> L.	Arabian coffee	Nat	O	
SAPINDACEAE				
<i>Filicium decipiens</i> (Wight & Arnott) Thwaites ex J.D. Hook.	fern tree (juv.)	Nat	R	
SAPOTACEAE				
<i>Chrysophyllum oliviforme</i> L.	satinleaf	Nat	R	
<i>Sideroxylon persimile</i> (W. Hemsley) T. D. Pennington	bumelia	Nat	C	
SOLANACEAE				
<i>Brugmansia x candida</i> Pers.	angel's trumpet	Orn	R	
TILIACEAE				
<i>Triumfetta</i> sp.	bur bush	Nat	R	<2>
VERBENACEAE				
<i>Lantana camara</i> L.	lantana	Nat	R	
MONOCOTYLEDONS				
ARACEAE				
<i>Epipremnum pinnatum</i> (L.) Engler	pothos vine	Nat	R	
ARECACEAE				
<i>Cocos nucifera</i> L.	<i>niu</i> , coconut	Pol	R	
MUSACEAE				
<i>Musa</i> hybrid	<i>mai'a</i>	Pol	R	
POACEAE (GRAMINEAE)				
<i>Oplesmenus hirtellus</i> (L.) P. Beauv.	basket grass	Nat	C	
<i>Urochloa maxima</i> (Jacq.) Webster	Guinea grass	Nat	AA	
<i>Panicum maximum</i> var. <i>trichoglume</i> (K. Schum.) C.E. Hibberd	small Guinea grass, green panic	Nat	A	

Table 1 (continued).

Legend to Table 1:

Status = distributional status

End = endemic; native to Hawai‘i and found naturally nowhere else.**Ind** = indigenous; native to Hawai‘i, but not unique to the Hawaiian Islands.**Ind?** = likely an indigenous species.

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

Nat? = possibly an early Polynesian introduction.

Pol = an early Polynesian introduction.

Abundance = occurrence ratings for plants on property in March 2008

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.

AA - Abundant - very abundant and dominant; defining vegetation type.

Notes:

<1> See Figure 3.

<2> Plant lacking flowers or fruit at time of survey; identification uncertain.

fruits or flowers at the time of the survey, although several individuals occur on the site. Neither is a native species. None of the species recorded is truly native to the Hawaiian Islands, although three (6.9%) are early Polynesian introductions (so-called “canoe plants”). Thus, the flora of the site can be characterized as disturbed secondary growth. The presence of the *auwai* (with modern, concrete, features) suggests this land was previously cleared of all but the larger trees and probably once supported some form of agriculture in modern times.

Avian Survey Results

Results of the bird survey are summarized in Table 2. Six stationary point counts throughout the site resulted in the identification of only 33 individual birds of nine species representing eight separate families. The most abundant species sighted, the Common Myna (*Acridotheres tristis*), was observed at all six stations, albeit in relatively low numbers. Red-vented Bulbul (*Pycnonotus cafer*) and Japanese Bush-Warbler (*Cettia diphone*) were sighted at half of the six stations. Common Waxbill (*Estrilda astrild*), Northern Mockingbird (*Mimus polyglottos*), White-rumped Shama (*Copsychus malabaricus*), House Sparrow (*Passer domesticus*), and Spotted Dove (*Streptopelia chinensis*) were observed infrequently at some point count stations.

Nine additional species were observed in transit between point count stations and while conducting a pedestrian transect of the property. A mixed flock of

Table 2. List of bird species encountered and stationary point count data, Mākaha Valley Lo'i Project.

PHYLUM, CLASS, ORDER, FAMILY <i>Genus species</i>	Common name	Status	Counts						Abundance (total/# stas.)
			Sta. 1	Sta. 2	Sta. 3	Sta.4	Sta. 5	Sta. 6	
CHORDATA, AVES	BIRDS								
COLOMBIFORMES									
COLUMBIDAE									
<i>Geopelia striata</i> Linnaeus	Zebra Dove	Nat	--	--	--	--	--	--	--
<i>Streptopelia chinensis</i> Scopoli	Spotted Dove	Nat	2	--	--	--	--	--	0.33
AVES, GALLIFORMES									
PHASIANIDAE									
<i>Pternistis erckelii</i> Rüppell	Erckel's Francolin	Nat	--	--	--	--	--	--	--
<i>Pavo cristatus</i> Linnaeus	Common Peafowl	Nat	--	--	--	--	--	--	--†
AVES, PASSERIFORMES									
CETTIIDAE									
<i>Cettia diphone</i> Kittlitz	Japanese Bush-warbler	Nat	--	--	--	2	2	1	0.83
EMBERIZIDAE									
<i>Tiaris olivaceus</i> Linnaeus	Yellow-faced Grassquit	Nat	--	--	--	--	--	--	--
ESTRILDIDAE									
<i>Estrilda astrild</i> Linnaeus	Common Waxbill	Nat			2			1	0.50
<i>Lonchura atricapilla</i> Vieillot	Chestnut Munia	Nat	--	--	--	--	--	--	--
<i>Lonchura cantans</i> Gmelin	African Silverbill	Nat	--	--	--	--	--	--	--

Table 2 (continued).

PHYLUM, CLASS, ORDER, FAMILY <i>Genus species</i>	Common name	Status	Counts						Abundance (total/# stas.)	
			Sta. 1	Sta. 2	Sta. 3	Sta.4	Sta. 5	Sta. 6		
MIMIDAE										
<i>Mimus polyglottos</i> Linnaeus	Northern Mockingbird	Nat	--	--	1	--	--	--	--	0.17
MUSCICAPIDAE										
<i>Copsychus malabaricus</i> Scopoli	White-rumped Shama	Nat	--	--	1	--	--	--	--	0.17
PASSERIDAE										
<i>Passer domesticus</i> Linnaeus	House Sparrow	Nat	--	--	1	--	--	--	--	0.17
PYCNONOTIDAE										
<i>Pycnonotus cafer</i> Linnaeus	Red-vented Bulbul	Nat	--	2	2	--	--	--	1	0.83
<i>Pycnonotus jocosus</i> Linnaeus	Red-whiskered Bulbul	Nat	--		2	--	--	--	1	0.50
STURNIDAE										
<i>Acridotheres tristis</i> Linnaeus	Common Myna	Nat	2	1	4	2	1	2	2	2.00
THRAUPIDAE										
<i>Cardinalis cardinalis</i> Linnaeus	Northern Cardinal	Nat	--	--	--	--	--	--	--	--
<i>Paroaria coronata</i> J.F. Miller	Red-crested Cardinal	Nat	--	--	--	--	--	--	--	--
TIMALIIDAE										
<i>Leiothrix lutea</i> Scopoli	Red-billed Leiothrix	Nat	--	--	--	--	--	--	--	--

Status = distributional status

End = endemic; native to Hawai'i and found naturally nowhere else.

Ind = indigenous; native to Hawai'i, but not unique to the Hawaiian Islands.

Nat = naturalized, exotic, bird introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778

† Species presence inferred from identification of non-living material;

Chesnut Munia (*Lonchura atricapilla*) and African Silverbill (*Lonchura cantans*) congregating on the low head dam and nearby foliage comprised the single largest assemblage of birds observed during the survey. Numerous species including Erkel's Francolin (*Pternistis erckelii*) make use of the steep ground across Mākaha Stream from the site. Northern Cardinal (*Cardinalis cardinalis*) and Red-crested Cardinal (*Paroaria coronata*) seem to prefer the short-stature forest on the property as both species were conspicuous in the branches of young *koa haole* trees.

Mammalian Survey Results

Several small Indian mongoose (*Herpestes auropunctatus*), were observed on the maintained lawn alongside the entrance to the *heiau*. Scat from domestic cow (*Bos taurus*) and domestic horse (*Equus caballus*) were present on the trails bisecting the property. The barking of a dog (*Canis familiaris*) was audible near the lower end of the survey area.

Assessment

Flora

The subject parcel supports no botanical resources of particular concern with the exception of a lemon gum on the site at the location shown in Fig. 2. This single tree is particularly interesting as it may be the largest lemon gum specimen (measured not as height, but girth of the main trunk) in the Hawaiian Islands (see Figure 5). The Wikipedia site on superlative trees (Wikipedia, 2014) has four of the world's 9 tallest trees represented by species of *Eucalyptus*. The listing of the stoutest trees includes two *Eucalyptus* in the top 9, these coming in at 21.8 and 22.0 ft in girth. The *E. citriodora* at the Project site is likely to be over 15 ft in girth and possibly approaches 20 ft. No *Eucalyptus citriodora* is listed in the City and County of Honolulu, Exceptional Tree program (C&C, 2014). This tree could qualify for listing.

Avian Resources

The findings of the avian survey are consistent with the location of the site and alien dominated vegetation on the site. All 18 species of birds recorded during the time we spent on the site are alien to the Hawaiian Islands. Thus, no concerns are raised with respect to the resident avifauna. However, once the land is cleared and developed into pond fields, several protected species of birds can be anticipated to at least visit the fields regularly. Included would be



Figure 5. Trunk of an exceptional lemon gum growing in the middle of the site.

endangered Black-necked Stilt (*Himantopus mexicanus knudseni*), Black-crowned Night-Heron (*Nycticorax nycticorax hoactli*) and Pacific Golden-Plover (*Pluvialis fulva*). These three species are known from the golf courses lower in the valley (AECOS, 1997), attracted to the water features and open areas within the golf facility grounds. Black-crowned Night-Heron and Pacific Golden-Plover Pacific are both common indigenous species. The heron is a water obligate

resident nesting species, commonly encountered close to just about any water feature in the state. The plover is a migratory shorebird species that nests in the high Arctic during the late spring and summer months, returning to Hawai'i to spend the fall and winter months each year. They usually leave Hawai'i for the Arctic in late April or the very early part of May, and return to the central Pacific in August. All three species are protected by state statutes (DLNR, 1998); however, Hawaiian stilt is a federally listed species and may require further considerations once the pond fields (*lo'i*) are operational.

Mammalian Resources

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*; 'ōpe'ape'a), all terrestrial mammals currently found on the Island of O'ahu are alien species. Most are ubiquitous. Although no rodents were detected during the course of this survey, it is likely that the four established alien Muridae found on O'ahu—roof rat (*Rattus r. rattus*), Norway rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mouse (*Mus musculus domesticus*) use various resources within the Project area on a seasonal basis. No Hawaiian hoary bats were detected during the course of this survey. Given the paucity of documented records of this species on O'ahu this is not surprising.

Conclusions

Potential Impacts to Protected Species and Habitats

Because no plants or animals currently protected under federal or state endangered species statutes were detected during the course of these surveys, and there is minimal likelihood that listed species would be present in this area, the proposed Project will not result in deleterious impacts to any protected species or protected species habitats.

No federally designated Critical Habitat occurs in the vicinity of the Project. However, a state designated Conservation District (G or general subzone) is located immediately upslope of Mākaha Stream where the stream course runs east-west across the north Project boundary. This conservation district boundary dips into the Project area in the vicinity of the low head dam, so that a portion of the left stream bank downstream of the dam is included in the conservation district.

The National Wetlands Inventory (NWI; USFWS, 1984) designates Mākaha Stream as PF03C: a seasonally flooded stream in a broad-leaved evergreen forest. This characterization is correct. The stream is jurisdictional under the Clean Water Act (regarded as “Waters of the U.S.”) and therefore any construction activities within the ordinary high water mark (OHWM) of the stream would be subject to permit requirements as administered by the U.S. Army Corps of Engineers.

Although no seabirds were detected during the course of this survey, several seabird species potentially overfly the site on occasion. The primary causes of mortality in resident seabirds are predation by alien mammalian species at the nesting colonies (USFWS, 1983; Simons and Hodges, 1998; Ainley et al., 2001) and collisions with man-made structures (Hadley, 1961; Telfer, 1979; Sincock, 1981; Reed et al., 1985; Telfer et al., 1987; Cooper and Day, 1998; Podolsky et al., 1998; Ainley et al., 2001; Hue et al., 2001; Day et al., 2003). There are no known nesting colonies of any of the resident seabird species present on O‘ahu on, or within close proximity of the Project site.

Recommendations

The *Eucalyptus citriodora* (lemon gum) located on the site appears to be exceptional for its size. Despite the considerable distance of this tree from Mākaha Stream (see Fig. 2), its large roots can be seen snaking across the ground in the direction of the stream and likely the stream is serving as a source of water for this specimen. It is recommended that this tree not be removed and that particular care be exercised during ground clearing (grubbing) to not disturb the tree or its roots. Lemon gum trees are popular landscape trees and this particular one appears unique for its size.

Although Hawaiian hoary bat was not detected in our survey, the possibility exists that this bat is present in the area. The removal of vegetation within the Project area may temporarily displace individual roosting bats. As bats use multiple roosts within their home territories, the potential disturbance resulting from the removal of the vegetation would be minimal. During the pupping season, females carrying their pups may be less able to rapidly vacate a roost site as the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they 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) during the pupping season from June 1 to September 15.

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