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MAR 23 2016

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GOVERNOR OF HAWAII

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

MAR - 7 2016

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OFC. OF ENVIRONMENTAL QUALITY CONTROL

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

Dear Mr. Glenn:

**Draft Environmental Assessment for**
**Decommissioning of DLNR Poohohoo Reservoir No. 2**
**TMK (3rd.) 7-1-001:006 (por.)**
**North Kona District, Island of Hawaii**

With this letter, the Department of Land and Natural Resources hereby transmits the Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFONSI) for the Decommissioning of DLNR Poohohoo Reservoir No. 2, situated in TMK (3rd.) 7-1-001:006 (por.), in the North Kona District on the island of Hawaii for publication in the next available edition of the Environmental Notice.

We have enclosed the following:

- One paper copy of the Draft EA;
- A CD containing the PDF file for the EA and a WORD file with the OEQC Environmental Notice Publication Form; and
- A hardcopy of the OEQC publication form

If there are any questions, please contact Mr. Carty Chang, Chief Engineer of our Engineering Division, at 587-0230.

Sincerely,

SUZANNE D. CASE
Chairperson

Enclosures
c: Geometrician Associates LLC

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MAR 23 2016

# AGENCY PUBLICATION FORM

| | |
|---|---|
| Project Name: | Decommissioning of DLNR Poohohoo Reservoir No. 2 |
| Project Short Name: | (Poohohoo Resevoir No. 2 Decommissioning) |
| HRS §343-5 Trigger(s): | Use of State Land and State Funds |
| Island(s): | Hawai'i |
| Judicial District(s): | North Kona |
| TMK(s): | (3rd) 7-1-001:006 (por.) |
| Permit(s)/Approval(s): | Chapter 6e, HRS, determination (Historic Properties) |
| Proposing/Determining Agency: | Department of Land and Natural Resources<br>Engineering Division |
| *Contact Name, Email, Telephone, Address* | Gayson Ching<br>Gayson.Y.Ching@Hawaii.gov<br>(808) 587-0232<br>1151 Punchbowl St., Room 221<br>Honolulu, HI 96813 |
| Accepting Authority: | (for EIS submittals only) |
| *Contact Name, Email, Telephone, Address* | |
| Consultant: | Geometrician Associates |
| *Contact Name, Email, Telephone, Address* | Ron Terry<br>rterry@hawaii.rr.com<br>(808) 969-7090<br>PO Box 396<br>Hilo HI 96721 |

| **Status (select one)** | **Submittal Requirements** |
|---|---|
| __X__ DEA-AFNSI | Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice. |
| ____ FEA-FONSI | Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice. |
| ____ FEA-EISPN | Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice. |
| ____ Act 172-12 EISPN ("Direct to EIS") | Submit 1) the proposing agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice. |
| ____ DEIS | Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice. |
| ____ FEIS | Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice. |
| ____ FEIS Acceptance Determination | The accepting authority simultaneously transmits to both the OEQC and the proposing agency a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice. |

| | |
|---|---|
| FEIS Statutory Acceptance | Timely statutory acceptance of the FEIS under Section 343-5(c), HRS, is not applicable to agency actions. |
| ____ Supplemental EIS Determination | The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice. |
| ____ Withdrawal | Identify the specific document(s) to withdraw and explain in the project summary section. |
| ____ Other | Contact the OEQC if your action is not one of the above items. |

**Project Summary**

Provide a description of the proposed action and purpose and need in 200 words or less. DLNR plans to decommission Poohohoo Reservoir No. 2, an abandoned earthen structure located on the makai flanks of a cinder cone at 3,800 feet in elevation in the Pu'uwa'awa'a Forest Reserve. The reservoir was built in 1968 as part of a system of catchments, tanks and pipelines supplying ranch water, but it was damaged shortly after construction and has not held water since. As it is currently unused and not needed or suitable for future use, it will be decommissioned by removing the liner remnants and excavating and breaching the embankments. No threatened or endangered species or historic sites or cultural practices would be affected by the action. Project plans include precautions to minimize erosion and sedimentation and ensure that the area is geologically stable and can be eventually restored to a native forest condition. Temporary visual impacts from removing the artificial topography will be minor, and after regrowth of koa trees, the scenic character will improve.

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OFC. OF ENVIRONMENTAL
QUALITY CONTROL

# DRAFT ENVIRONMENTAL ASSESSMENT

# Decommissioning of DLNR Poohohoo Reservoir No. 2

TMK (3rd.) 7-1-001:006
North Kona District, Hawai‘i Island, State of Hawai‘i

March 2016

State of Hawai‘i
Department of Land and Natural Resources
Engineering Division

# DRAFT ENVIRONMENTAL ASSESSMENT

## Decommissioning of DLNR Poohohoo Reservoir No. 2

TMK (3rd.) 7-1-001:006
North Kona District, Hawai‘i Island, State of Hawai‘i

PROPOSING/
APPROVING AGENCY:

State of Hawai‘i
Department of Land and Natural Resources
PO Box 621
Honolulu, HI 96809

CONSULTANT:

Geometrician Associates LLC
PO Box 396
Hilo, HI 96721

CLASS OF ACTION:

Use of State Land
Use of State Funds

This document is prepared pursuant to:

The Hawai‘i Environmental Protection Act,
Chapter 343, Hawai‘i Revised Statutes (HRS), and
Title 11, Chapter 200, Hawai‘i Department of Health Administrative Rules (HAR).

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## SUMMARY OF THE PROPOSED ACTION, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

DLNR has identified the need to decommission Poohohoo Reservoir No. 2, an abandoned earthen reservoir located on the *makai* flanks of a cinder cone named Poohohoo. The site is an isolated area at 3,800 feet in elevation in the Pu‘uwa‘awa‘a Forest Reserve of the Big Island. The reservoir was planned to be part of the system of catchment areas, storage tanks and pipelines that supplied water to Pu‘uwa‘awa‘a Ranch when it had leases over the State lands in the area. It was built around 1968 to add to the storage capacity of Poohohoo Reservoir No. 1, which is located directly adjacent and to the west. Shortly after construction, the liner was damaged by winds and the reservoir has not held water since. As the reservoir is currently unused and not suitable for future use, it will be decommissioned by removing the remnants of the liner and excavating and breaching the embankments that were built when the reservoir was originally constructed. The earthmoving is expected to require one or more bulldozers and excavators. The excavated embankment material will be used to fill the reservoir and any excess material will be disposed of onsite, near the reservoir, in an existing open area. This open area will also house a temporary staging area for storage for minimal amounts of equipment, tools and materials. If necessary, additional staging can occur at the former airstrip in Pu‘uwa‘awa‘a. All equipment and materials brought to the project site will utilize existing unpaved roads, which will be marked by DLNR, in order to minimize ground and vegetation disturbance.

As part of planning for the decommissioning, DLNR undertook studies of the flora and fauna and historic properties in the area to ensure that no threatened or endangered species or historic sites or cultural practices would be affected by the action. Project plans include extensive precautions to minimize erosion and sedimentation and ensure that the area is geologically stable and can be eventually restored to a native forest condition. Temporary visual impacts from removing the artificial topography of the reservoir walls will be minor, and after regrowth of natural koa trees, which occurs rapidly in this area, the scenic character of the area will improve.

# PART 1: PROJECT DESCRIPTION, PURPOSE AND NEED AND ENVIRONMENTAL ASSESSMENT PROCESS

## 1.1 Project Location and Description

The Hawai‘i State Department of Land and Natural Resources (DLNR) has identified the need to decommission an abandoned earthen reservoir at 3,800 feet in elevation at Pu‘uwa‘awa‘a on the Island of Hawai‘i (Figures 1-4). The reservoir is located in the Pu‘uwa‘awa‘a Forest Reserve on the *makai* flanks of a cinder cone named Poohohoo, a prominent topographic feature located about a quarter mile downhill from the *makai* boundary of the Forest Bird Sanctuary, a conservation subunit within Pu‘uwa‘awa‘a.[1]

The reservoir was part of the system of catchments, storage tanks and pipelines that supplied water to Pu‘uwa‘awa‘a Ranch when it had leases over the State lands in the area. It was built around 1968 to add to the storage capacity of Poohohoo Reservoir No. 1, which is located directly adjacent to the west. After construction, the liner was damaged by winds and the reservoir has not held water since.

As the reservoir is currently unused and not suitable for future use, it will be decommissioned by removing the remnants of the damaged butyl liner and excavating and breaching the constructed embankments. This will stop the accumulation of water at the bottom of the reservoir, where there is now a small pond. About 19,000 square feet of surface will be excavated and embanked, involving about 9,600 cubic yards of material. The earthmoving is expected to require one or more bulldozers and excavators. The excess soil and rock will be transferred to an existing open area near the reservoir.

A staging area for storage of equipment, minimal amounts of materials and tools, and fueling, will be located downhill from the reservoir in an already disturbed area. Although not currently anticipated to be necessary, a temporary baseyard may be established at the former Pu‘uwa‘awa‘a airstrip if warranted. This location is already fully disturbed, with no archaeological or biological concerns, is easily accessed from the highway, has access roads to all areas in Pu‘uwa‘awa‘a, has space for large trucks to park, and can accommodate helicopter landings if necessary. All equipment and materials brought to the project site will utilize existing unpaved roads, which will be marked by DLNR, in order to minimize ground and vegetation disturbance.

As part of planning for the decommissioning, DLNR undertook studies of the flora and fauna and historic properties in the area to ensure that no threatened or endangered species or historic sites would be affected by the action. The plans for the project include extensive precautions to minimize erosion and sedimentation and ensure that the area is geologically stable and can be restored to a native forest condition.

The work would cost approximately $300,000, with funding from the State of Hawai‘i. It would begin in mid-2016 and would require approximately 2 to 3 months to complete.

[1] Note on spelling: With a few exceptions, the name of the *ahupua‘a* and most place names derived from it are spelled Pu‘uwa‘awa‘a throughout this EA, despite at least five common variants. Exceptions are made for document titles and legal or official names. Poohohoo is spelled without an ‘okina in keeping with its long historical usage.

**Figure 1. Location Map**

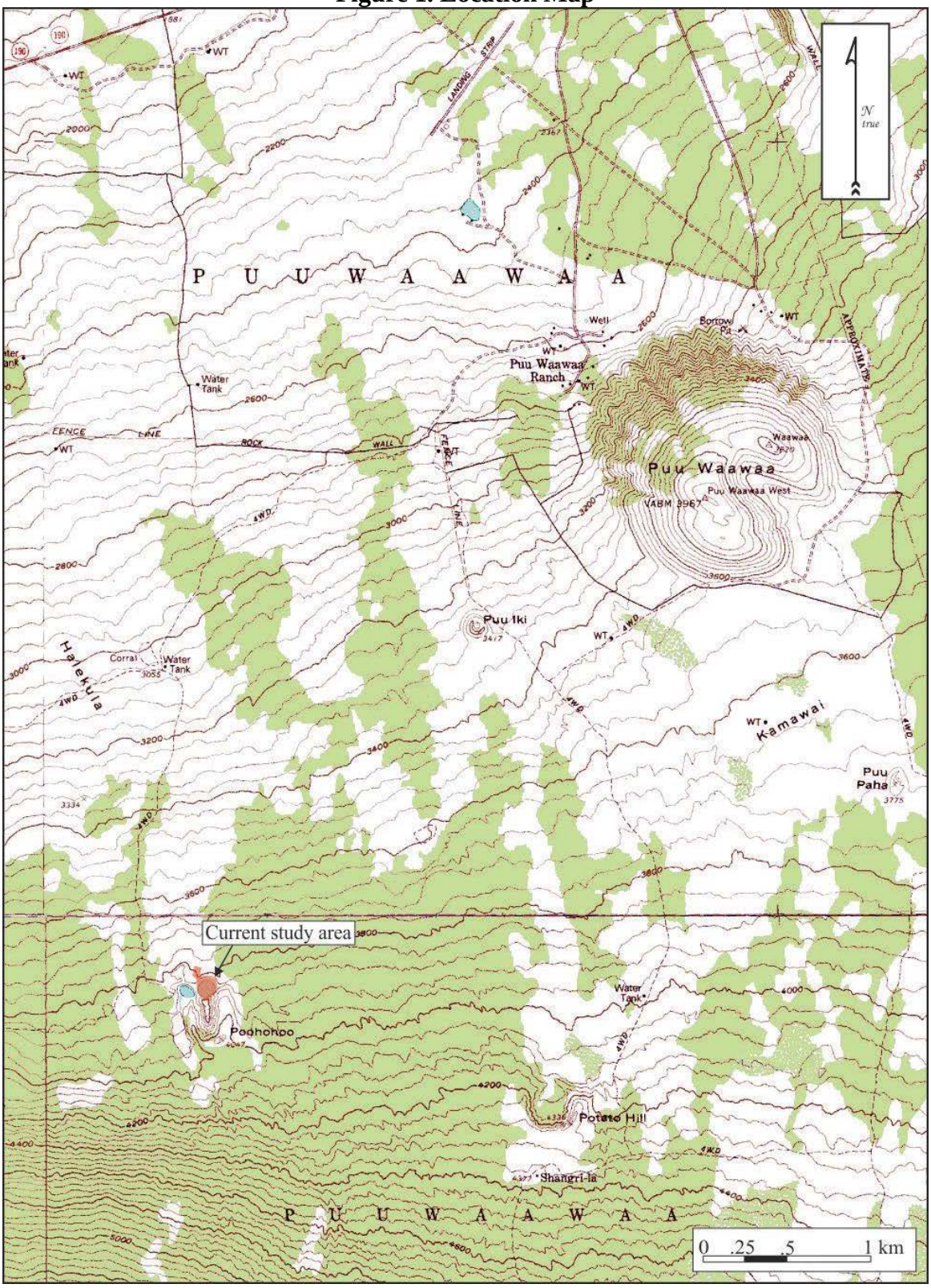


**Figure 2. TMK Map**

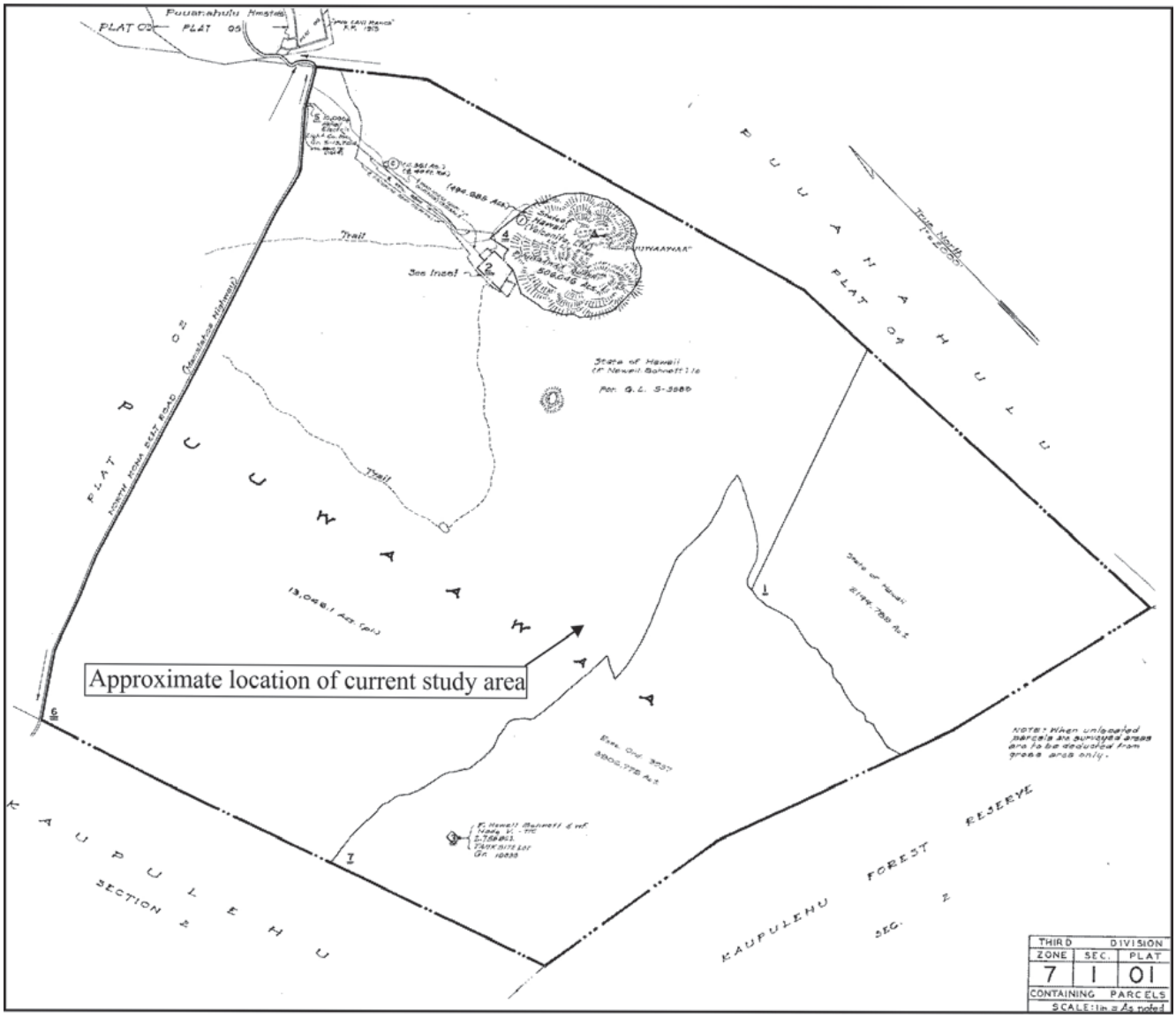


**Figure 3. Project Site Photos**

▲ 3a. Airphoto © Google Earth

**Figure 3. Project Site Photos**

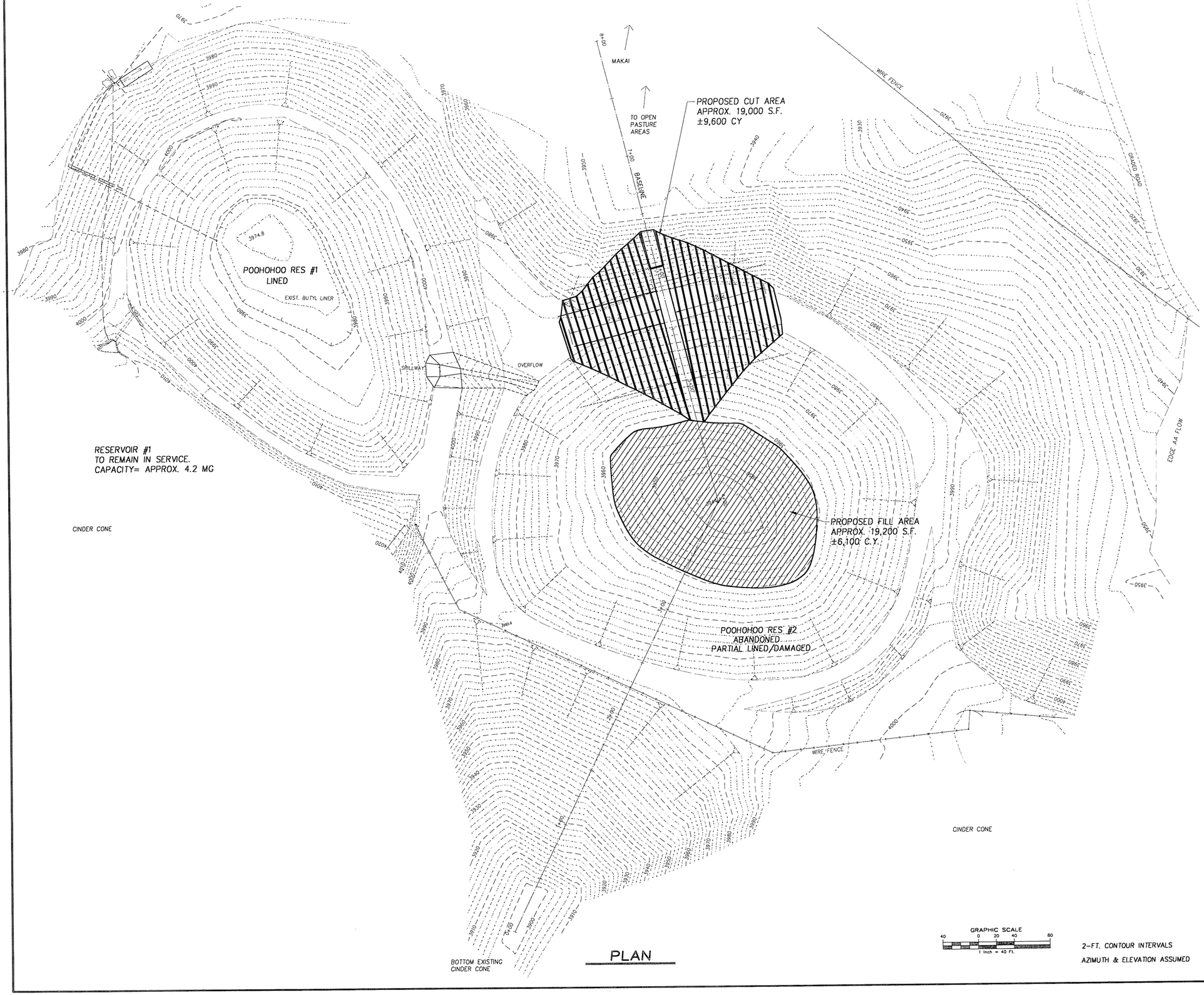
3b. North berm of reservoir, view to the southeast ▲

▼ 3c. Proposed construction staging and disposal area, view to SE

**Figure 3. Project Site Photos**

3d. View from Poohohoo summit over reservoir to Pu‘uanahulu ▲

▼ 3e. Interior of reservoir and artificial pond




PLAN

GRAPHIC SCALE
40 0 20 40 80
1 inch = 40 Ft.

2-FT. CONTOUR INTERVALS
AZIMUTH & ELEVATION ASSUMED

NOTES:

1. RESERVOIR #2 – APPROX. 10 M.G. CAPACITY
2. GENERAL SCOPE OF WORK IS TO DECOMMISSION RESERVOIR #2
3. REMOVE AND PROPERLY DISPOSE OF DAMAGED BUTYL LINER.
4. EXCAVATE BREAK IN EMBANKMENT WALL TO STOP ACCUMULATION OF WATER.
5. APPROX. 3/4 OF RESERVOIR SURFACE IS VEGETATED.

| REVISION NO. | SYM. | DESCRIPTION | SHT/OF | DATE | APPROVED |
|---|---|---|---|---|---|
| | | | | | |

JASON K. INABA
LICENSED PROFESSIONAL ENGINEER
6188-C
HAWAII, U.S.A.
PRELIMINARY

THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION.

INABA ENGINEERING, INC.
ID # 15015 FB #

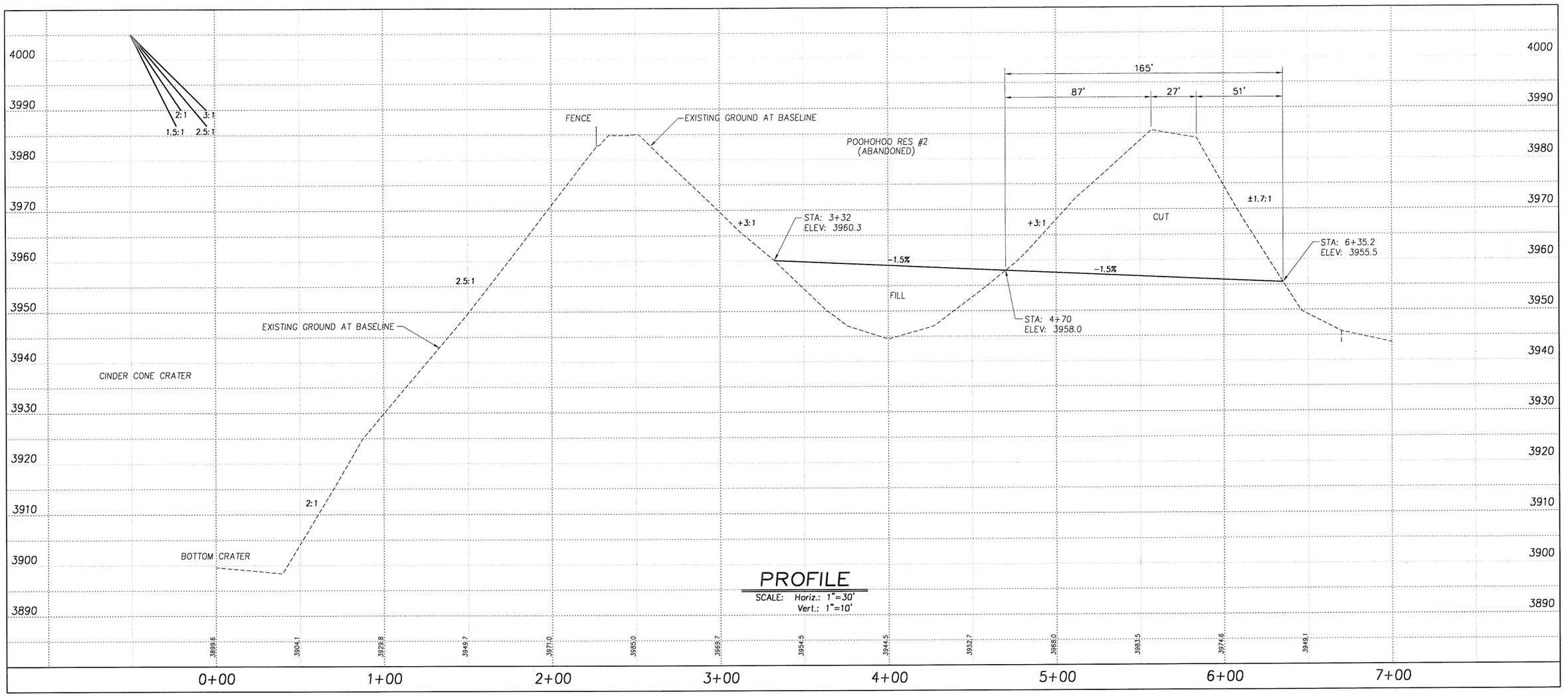
STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

PUU WAAWAA
WATER SYSTEM IMPROVEMENT, HAWAII

POOHOHOO RESERVOIR SITE
RESERVOIR #1 AND #2

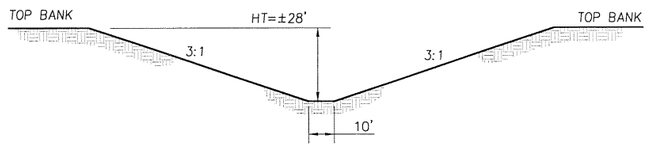
| | |
|---|---|
| DESIGNED: | SUBMITTED: |
| DRAWN: | DATE: |
| CHECKED: | SCALE: |
| APPROVED: | DRAWING NO. |
| CHIEF ENGINEER DATE | |

JOB NO. 500CH15A SHEET NO. ___ OF ___ SHEETS




## PROFILE

SCALE: Horiz.: 1"=30'
Vert.: 1"=10'




## A TYPICAL CUT SECTION

SCALE: 1"=30'

GRAPHIC SCALE

30 0 15 30 60 120

( IN FEET )
1 inch = 30 ft.

AZIMUTH & ELEVATION ASSUMED

| REVISION NO. | SYM. | DESCRIPTION | SHT/OF | DATE | APPROVED |
|---|---|---|---|---|---|
| | | | | | |

JASON K. INABA LICENSED PROFESSIONAL ENGINEER 6188-C HAWAII, U.S.A. PRELIMINARY

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INABA ENGINEERING, INC.

ID #15015 FB #

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

PUU WAAWAA
WATER SYSTEM IMPROVEMENT, HAWAII

POOHOHOO RESERVOIR SITE
RESERVOIR #2 – PROFILE

| DESIGNED: | SUBMITTED: |
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| DRAWN: | DATE: |
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| APPROVED: | DRAWING NO. |
| CHIEF ENGINEER DATE | |

JOB NO. 500CH15A SHEET NO. ___ OF ___ SHEETS

## 1.2 Purpose and Need

The Dam Safety Program of DLNR has the goal of making dams as safe as practical. Dams and reservoirs are a critical part of State infrastructure, providing benefits upon which our communities and industries depend. In Hawai‘i, most dams were constructed before 1940 to support the sugarcane plantations or other agriculture or grazing. Because of the age of these facilities, the State Dam Safety Program plays a vital role in regulating and promoting the safety of these structures. Funding for the State Dam Safety Program comes from a mixture of State and federal sources. The vital funding given to this program helps significantly to reduce the risks to life and property due to dam failures. The Poohohoo Reservoir no longer serves a useful function, and although it holds only minimal amounts of water even after heavy rains, the stagnant water supports mosquitos and performs no useful functions. In order to eliminate the potential for catastrophic reservoir failure and resulting mass wasting, DLNR believes that it is in the best interest of public safety to breach the artificial embankment.

## 1.3 Environmental Assessment Process

This Environmental Assessment (EA) process is being conducted in accordance with Chapter 343 of the Hawai‘i Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200, of the Hawai‘i Administrative Rules (HAR), is the basis for the environmental impact process in the State of Hawai‘i. According to Chapter 343, an EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria. Part 4 of this document states the finding (anticipated finding, in the Draft EA) that no significant impacts are expected to occur; Part 5 lists each criterion and presents the findings (preliminary, for the Draft EA) for each made by the Hawai‘i State Department of Land and Natural Resources (DLNR). If, after considering comments to the Draft EA, and the Board of Land and Natural Resources (BLNR), the official approving agency, concludes that, as anticipated, no significant impacts would be expected to occur, then the agency issues a Finding of No Significant Impact (FONSI), and the action will be permitted to occur. If the approving agency concludes that significant impacts are expected to occur as a result of the proposed action, then an Environmental Impact Statement (EIS) must be prepared.

## 1.4 Public Involvement and Agency Coordination

The following agencies, organizations and individuals were consulted in development of the environmental assessment:

Federal:

U.S. Forest Service, Experimental Tropical Forest

State:

Department of Health
Office of Hawaiian Affairs

County:
Fire Department
Planning Department
Police Department

Private:
Ku‘ulei Keakealani
Na Pu‘u Water Inc.
Pu‘uanahulu Community Association
Sierra Club

Copies of communications received during early consultation are contained in Appendix 1a.

## PART 2: ALTERNATIVES

### 2.1 No Action

Under the No Action Alternative, Poohohoo Reservoir No. 2 would not be formally decommissioned by removing the remnants of the liner and excavating and breaching the embankments. The improvements to public safety for this nonworking reservoir planned by the Dam Safety Program of DLNR would not be implemented. Conversely, there would be no impact to the ground surface or vegetation. Although the No Action Alternative does not accomplish the purpose and need of the project, it serves as a useful baseline for measuring the impacts of the project. If the reservoir is not decommissioned, it would still have to be registered as a dam and be monitored per State regulations.

### 2.2. Restore and Utilize the Reservoir

The Pu‘uwa‘awa‘a water system consists of several reservoirs, catchment areas, storage tanks, pipelines and pumps for use for firefighting and cattle and game watering. Various studies, plans and proposals in the past (e.g, Juvik and Tango 2003; Hawai‘i State DOFAW 2003) have included refurbishment of Poohohoo Reservoir No. 2 as a component of an upgraded system. DLNR has been engaged in the process of renovating many aspects of the system. The agency has relined the Lake House reservoir and has started major repairs to the Hale Piula water catchment in the Forest Bird Sanctuary, fixing the two 500,000-gallon steel tanks, reclaiming catchment surfaces, and reinstalling or repairing water lines. There are plans to expand restoration of catchment surfaces at Hale Piula so that water can be piped through new lines to the Poohohoo Reservoir No. 1, which will be relined and restored. From there, water will gravity flow to the Lake House reservoir.

DLNR has determined that it is not advisable to attempt to restore and integrate Poohohoo Reservoir No. 2 into this system for several reasons. First, there is insufficient water collected in the catchments to fill all three reservoirs and keep them full. Although the catchment located above Poohohoo could be repaired to catch some additional water, the small amount does not justify the cost of repairs and maintenance. Instead, DLNR has concluded that the optimum storage system to fulfill management goals consists of the two large steel tanks at Hale Piula plus the upper Poohohoo reservoir, as well as

some smaller tanks in *mauka* areas that would replace some of the old dismantled wooden tanks taken down in the past. This will provide water *mauka* as well as an area for helicopters to dip in for firefighting. If Poohohoo Reservoir No. 2 was somehow restored, it would likely remain empty most of the time, which would mean the liner would degrade in the sun over time and maintenance would take time and continued financial support. The Lake House reservoir is the priority for keeping filled, as it was re-lined recently and is much closer to the highway where most fires actually start.

In addition, DLNR lacks the capacity at Puʻuwaʻawaʻa to manage a large-scale water infrastructure project that includes officially designated dams. It would need trained staff to constantly monitor and maintain the infrastructure. This would include not only the reservoir water but also the new water lines, pressure-breaker tanks and storage tanks that it would entail. During very wet times when water would start to fill that larger reservoir, DLNR would lack the infrastructure and personnel to make use of it - at least without very large capital expenditures. During dry times, the reservoir would be empty and degrading, because there would be a priority of filling the Lake House Reservoir for firefighting in the lowland dry forest and using it for cattle grazing *mauka* and *makai*.

For all these reasons, restoring and reutilizing Poohohoo Reservoir No. 2 is not a reasonable alternative.

## 2.3 Alternative Strategies

As the proposed project appears to be an appropriate response to the purpose and need of the project, and there are no alternative strategies that could accomplish this with less cost, fewer environmental impacts, or related side benefits, no alternative strategies have been advanced in this Environmental Assessment.

## PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

The area of liner and embankment removal, the area in which this material will be emplaced, and the staging area for the construction activity are jointly referred to in this EA as the *project site*. The term *project area* is more flexibly used to describe the general environs of this part of Kona and particularly the Puʻuwaʻawaʻa.

### 3.1 Physical Environment

#### 3.1.1 Climate, Geology, Soils and Geologic Hazards

*Environmental Setting*

At 3,800 feet in elevation, the project site has a cool and seasonally moist climate, with daytime temperatures in the low 70s (Fahrenheit) and nighttime temperatures that often dip into the 50s or lower. Annual rainfall averages about 27 inches (Giambelluca et al 2013). Geologically, the project site is located on the *makai* flank of Poohohoo cinder cone on Hualālai Volcano, which has been dated at between 3,000-5,000 years before the present (Wolfe and Morris 1996). Soil on the project site is classified by the U.S. Natural Resources Conservation Service (formerly Soil Conservation Service) as Nawahine gravelly medial silt loam (U.S. Soil Conservation Service 1973). This deep, cindery soil is moderately permeable and has medium runoff and low flooding potential.

The entire Big Island is subject to geologic hazards, especially lava flows and earthquakes. Volcanic hazard in the project area is assessed by the U.S. Geological Survey as 4 on a scale of ascending risk 9 to 1 (Heliker 1990:23). The hazard risk is based on the fact that Hualālai has steep slopes and is the third most historically active volcano on the island. Volcanic hazard zone 4 areas have had about 5 percent of the area covered with lava since 1800 and less than 15 percent of the area covered in the past 750 years.

The Island of Hawaiʻi experiences high seismic activity and is at risk from major earthquake damage (USGS 2000), especially to structures that are poorly designed or built, as the 6.7-magnitude quake of October 15, 2006 demonstrated.

Although there is no evidence of mass wasting such as landslides or rockfalls on the project site itself, areas closer to the steep parts of Poohohoo cinder cone, where cut faces that were quarried in creating the two reservoirs, exhibit rockfall debris.

*Impacts and Mitigation Measures*

The project is meant to address the geologic integrity of the abandoned reservoir. In general, geologic conditions impose no constraints and the project is not imprudent to undertake. All work will conform to current County of Hawaiʻi grading rules, regulations, and codes, which help ensure the stability of working and finished slopes. Contractors performing the work will be aware of the rockfall areas and

take precautions to ensure a safe work environment. The final landform is being engineered to result in a landform that is not prone to mass wasting. Moreover, undertaking the decommissioning project, will eliminate the potential for catastrophic reservoir failure and resulting mass wasting.

### 3.1.2 Drainage, Water Features and Water Quality

*Existing Environment*

The project site is not mapped within a 100-year floodplain on the Federal Emergency Management Agency's Flood Insurance Rate Maps (FIRM), and therefore the area is considered Flood Zone X, outside the 100-year floodplain.

A shallow "pond" that varies in size (with a maximum area of several hundred square feet) depending on rainfall remains impounded with a section of the reservoir where the liner still has some integrity (Figure 3e). This is not a natural feature, and it offers a breeding site for mosquitos that can be harmful to native birds as well as humans. It does not connect with any other water bodies, including streams, ponds, lakes or the Pacific Ocean. As part of the EA process, the U.S. Army Corps of Engineers (USACE) is being consulted to verify that this artificial feature would not be considered a water of the U.S. subject to USACE jurisdiction under the Clean Water Act.

*Impacts and Mitigation Measure*

Because the project will disturb more than one acre of soil, a National Pollutant Discharge Elimination System (NPDES) permit must be obtained from the Hawai‘i Department of Health and a Grading Permit must be obtained from the Hawai‘i County Department of Public Works by the contractor before the project commences. A Storm Water Pollution Prevention Plan (SWPP) utilizing Best Management Practices (BMPs) to minimize erosion and sedimentation will be required for these permits and will be developed during final design. Typical BMPs expected to be utilized include silt fences, permeable silt rolls, slope surface protection such as revegetating, and designated fueling areas.

### 3.1.3 Flora, Fauna and Ecosystems

*Background Biological Information for the Upper Pu‘uwa‘awa‘a Area*

The natural vegetation of this elevational band in Pu‘uwa‘awa‘a is montane mesic forest (Gagne and Cuddihy 1990), which in the early 1900s comprised various trees including koa, māmane (*Sophora chrysophylla*), naio (*Myoporum sandwicense*) and ‘akoko (*Euphorbia olowaluana*), with some ‘ōhi‘a (*Metrosideros polymorpha*) and sandalwood (*Santalum paniculatum*). The montane mesic forest changes from a predominately koa-‘ōhi‘a forest at about the 4,200-foot elevation to an open-canopied ‘ōhi‘a-māmane woodland, which extends down to about 3,000 feet in elevation.

Pu‘uwa‘awa‘a once had one of the most interesting botanical assemblages in the Hawaiian Islands. Following extensive surveys of vegetation in 1909, botanist Joseph Rock in 1913 declared Pu‘uwa‘awa‘a "... the richest floral section of any in the whole territory" (Rock 1913). But even then,

the effects of ranching were beginning to be felt. A report for the Commissioner of Agriculture and Forestry at the turn of the last century cited concerns over the effects of grazing on large sandalwood and koa trees, predicting that dense forests would within two decades give way entirely to open, drier pasture land (Koebele 1900).

Although degradation ensued more slowly than Koebele envisioned, the forests of Puʻuwaʻawaʻa have been greatly altered over the past century by ranching, wildfires, illegal koa harvesting and the introduction of invasive species. Giffin (2003) wrote that as late as 1959 the māmane canopy in Waihou Forest, which is found between the 3,000- and 3,500-foot elevation in Puʻuwaʻawaʻa in the vicinity of Poohohoo, remained essentially intact; it is now an open pasture with the few remaining trees dead or dying. Non-native grasses and weeds have largely replaced native understory plants. More than 60 non-native plant species have been identified in the area, many of which disrupt native forest ecosystems. The non-native species posing the greatest threat include kikuyu grass (*Cenchrus clandestinus*), fountain grass (*Cenchrus setaceus*), banana poka (*Passiflora mollissima*), silk oak (*Grevillea robusta*), and German ivy (*Delairea odorata*).

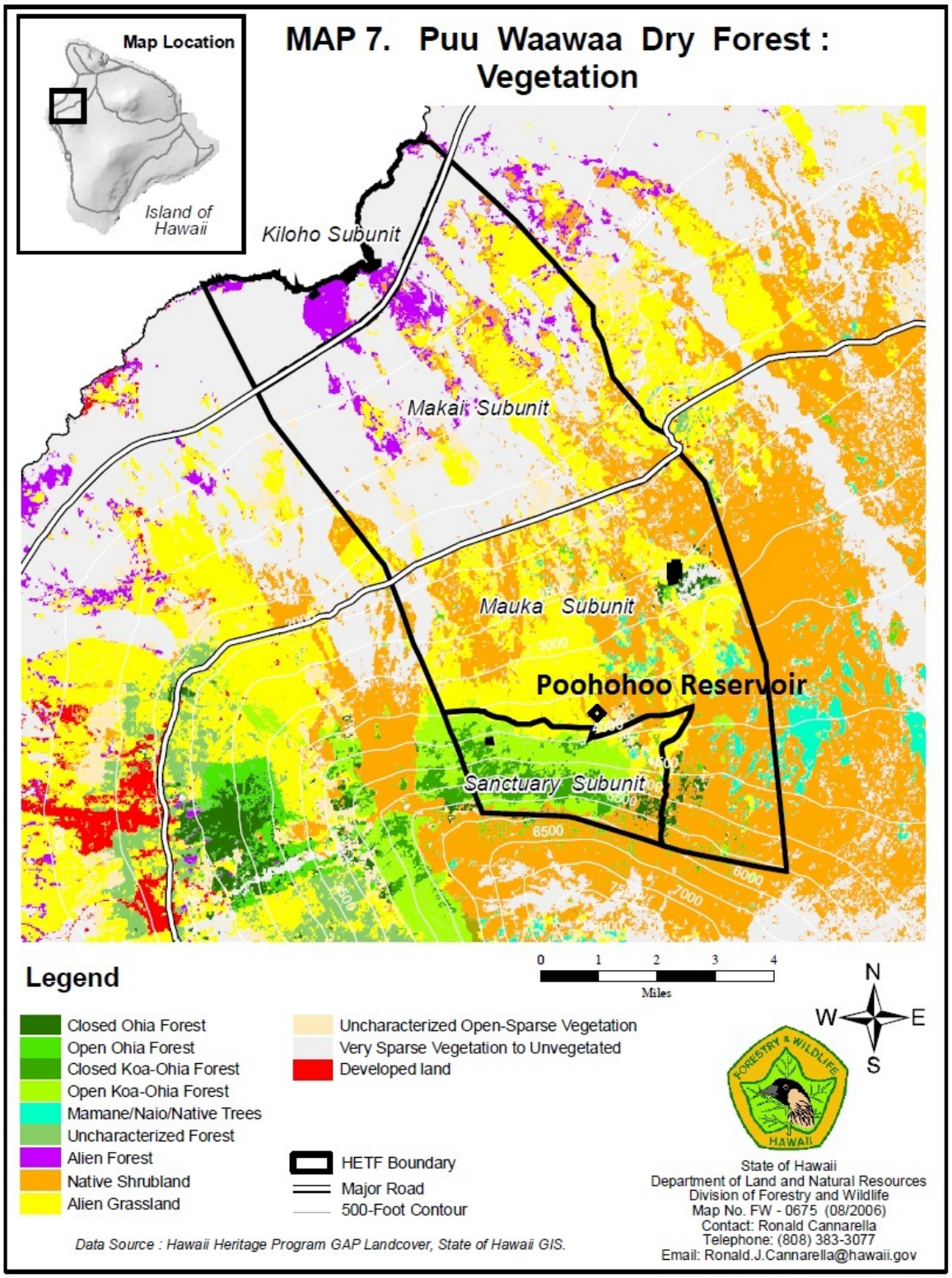
Nonetheless, significant remnants of the biological history of Puʻuwaʻawaʻa remain. The current vegetation reflects both its rich origins and the history of disturbance (Figure 5). Floristically, there are at least 182 native vascular plant species, several of which occur nowhere else in the Hawaiian Islands. Of the roughly 40 rare plant species found in Puʻuwaʻawaʻa, 22 have been officially listed or proposed for listing on the endangered species list. A dozen of those are no longer found at Puʻuwaʻawaʻa, although some still exist on the adjacent lands of Puʻuanahulu or Kaʻūpūlehu (Giffin 2003).

In order to effectively conserve and manage the unique resources of these *ahupuaʻa*, the DLNR Division of Forestry Wildlife (DOFAW) has implemented traditional Hawaiian land planning and management in a contemporary context to promote sustainable resource management and community access to natural resources. The *Management Plan for the Ahupuaʻa of Puʻu Waʻawaʻa and the Makai Lands of Puʻu Anahulu* (Hawaiʻi State DOFAW 2003 – discussed in more detail in Section 3.6.6) prioritizes preservation of threatened and endangered species as well as native ecosystems. As part of this, the Puʻuwaʻawaʻa Forest Bird Sanctuary was specifically created by the BLNR in 1984 to preserve habitat for endangered forest birds. It extends in elevation from 4,000 to 6,500 feet, encompassing 3,806 acres of forest bird habitat. Poohohoo Reservoir No. 2 lies just *makai* of the Forest Bird Sanctuary.

The Management Plan proposed a number of fenced conservation units *makai* of the Forest Bird Sanctuary that provide another layer of protection in the Forest Reserve (Figure 6). They are slowly being implemented, including three near – but not directly on – Poohohoo Cinder Cone. Henahena and ʻAiea have been fully approved and will be fenced in the next year. DOFAW has planted 10,000 native trees from a variety of species within the 204-acre Waihou 1 exclosure over the last 6 years.

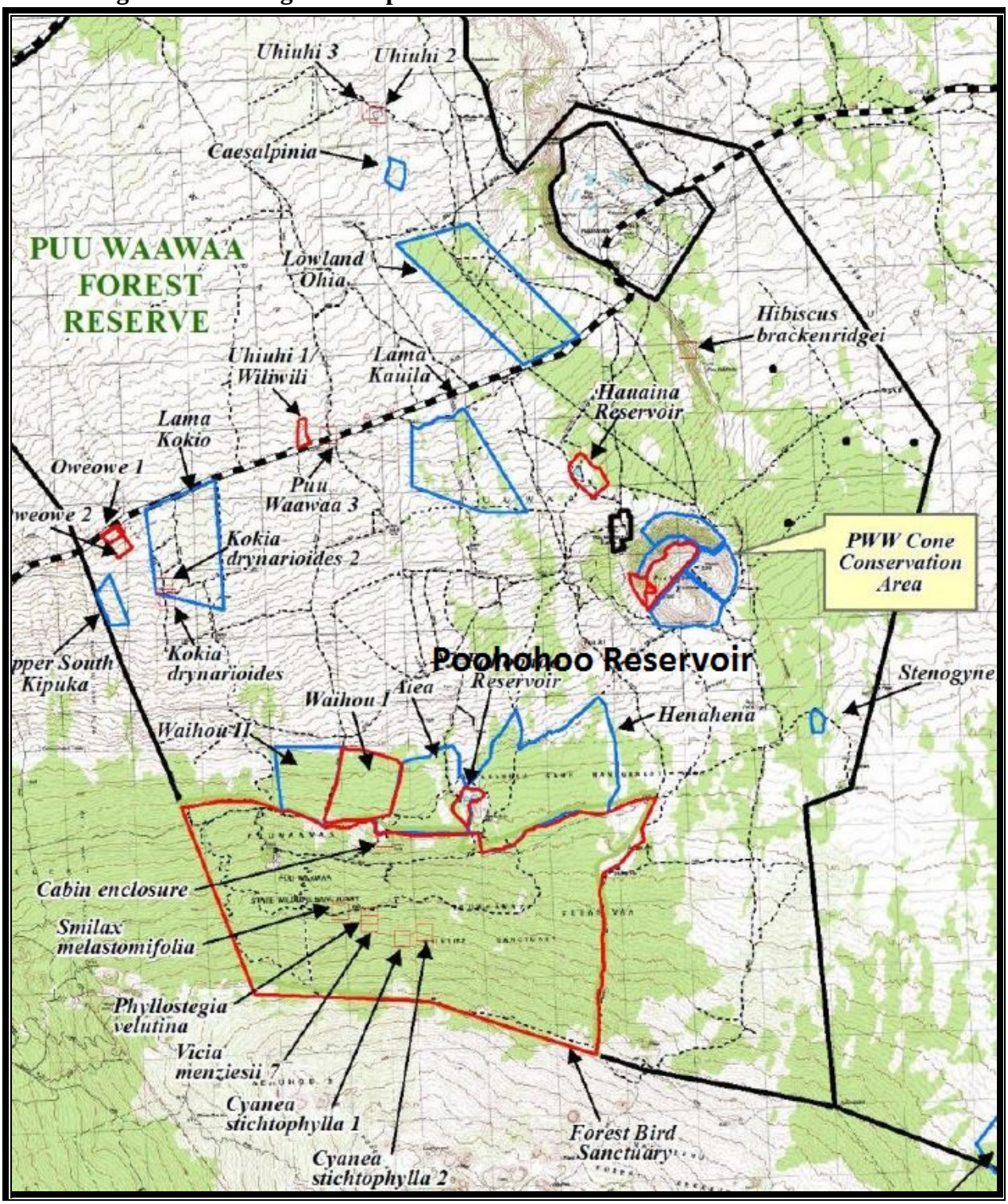
With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), or *ʻopeʻapeʻa*, all terrestrial mammals currently found on the island of Hawaiʻi are alien species. Most of these alien mammals are ubiquitous, and none are of conservation concern. Cattle are grazed in various portions

**Figure 5. Vegetation Map, Pu‘uwa‘awa‘a**




Source: DOFAW Map for Hawaii Experimental Tropical Forest

**Figure 6. Existing and Proposed Conservation Exclosures at Pu‘uwa‘awa‘a**




Source: DOFAW map from Draft North Kona Game Management Habitat Conservation Plan.
Notes: Portion of source map. Boundaries: Black: HCP area. Red: existing larger exclosures. Lavender: existing small exclosure. Blue: proposed exclosure

of Pu‘uwa‘awa‘a, and the function of the reservoirs when they were built was to supply water for cattle. According to Giffin (2003), three species of exotic game mammals inhabit the Pu‘uwa‘awa‘a region: feral sheep (*Ovis aries*), feral goats (*Capra hircus*) and feral pigs (*Sus scrofa*). Feral sheep are most abundant in upland forests, while feral goats occur throughout Pu‘uwa‘awa‘a, but are most abundant at lower elevations. Feral pigs are widely distributed, but most abundant in wetter, dense forests. Feral mouflon (*Ovis gmelini musimon*) and mouflon hybrids have also been reported at higher elevations. Alien non-game animals present at Pu‘uwa‘awa‘a are the small Indian mongoose (*Herpestes auropunctatus*), Polynesian rat (*Rattus exulans*), roof rat (*Rattus rattus*), house mouse (*Mus domesticus*), feral cats, and wild dogs. All of these are also considered detrimental to native ecosystems. Feral cats, rats and mongooses are subject to active trapping efforts to decrease their adverse effects on native plants and animals.

Hawaiian hoary bats are solitary and found widely dispersed throughout the Island of Hawai‘i. Local bats appear to prefer coastal areas for feeding and roosting, but they are not uncommon in upland forests. Trees are generally chosen as roost sites, but a few bats have been found in caves. Sightings by State biologists include several at the Sanctuary Cabin (4,000 ft. elevation) and above Poohohoo (4,250 ft. elevation) (DOFAW 2003).

A very large variety of native and non-native invertebrates are present at Pu‘uwa‘awa‘a. A few taxa of native land snails still exist, restricted to upper elevations, primarily in the Forest Bird Sanctuary. The introduced European garlic snail (*Oxychilus alliarius*), a ground-dwelling, omnivorous mollusk that threatens native snails, is abundant. Native forest arthropods are numerous and include striking species such as giant dragonflies (*Anax strenuus*), Kamehameha butterflies (*Vanessa tameamea*), hawk moths (*Hyles* and *Manduca* spp.), iridescent green koa bugs (*Coleotichus blackburniae*), cricket-like long-horned beetles (*Plagithmysus* spp.), delicate lacewings (*Anomalochrysa* spp.), predatory Ichneumon wasps and happy-face spiders (*Theridion grallator*). The endangered *Drosophila heteroneura* (a type of pomace fly) is present in upper forested areas. This species is known to breed in the bark and stems of *Clermontia, Cheirodendron,* and *Delissea undulata*. The endangered Blackburn’s sphinx moth (*Manduca blackburni)* is widely abundant on the ubiquitous weed tree tobacco (*Nicotiana glauca*) mostly below 3,000 feet in elevation. It is noteworthy that this moth was considered to be extirpated on the Big Island until it was spotted by two professional photographers at Pu‘uwa‘awa‘a in December 1998. As discussed above, the historic native host for Blackburn’s sphinx moth, the ‘aiea tree, is present in low numbers near Poohohoo and is known to host the moth. At least six of the 15 yellow-faced bees (*Hylaeus* sp.) found in some part of Pu‘uwa‘awa‘a are considered rare, although none were part of the Proposed Rule to list 49 endangered species in Hawai‘i, including seven *Hylaeus* species (*Federal Register,* September 30, 2015, Vol, 80, No. 189, 58820-58909). The most serious threat to these native bees, other than habitat loss, is the introduced honey bee (*Apis mellifera*), which aggressively displace native bees and compete with them for nectar and pollen resources (Giffin 2003), as well as subsidize invasive wasp populations, which then prey on native bees.

Pu‘uwa‘awa‘a is probably best known for its native birds, both extant and extinct. There are five endemic honeycreeper species, one monarchine flycatcher, two raptors and a goose. The honeycreepers are ‘Amakihi (*Hemignathus virens*) as well as ‘Apapane, I‘iwi, Hawaii ‘Akepa (*Loxops coccineus*), and Hawaii Creeper (*Oreomystis mana*). Other native birds are the ‘Elepaio (*Chasiempis sandwichensis*), Nēnē (*Branta sandvicensis*), ‘Io or Hawaiian hawk (*Buteo solitarius*), and Pueo or Hawaiian Short-eared Owl (*Asio flammeus sandwichensis*). The ‘Alala or Hawaiian Crow (*Corvus hawaiiensis*) was formerly present but is now extinct in the wild, with reintroduction efforts taking place in Ka‘ū. Five of these native birds are classified as endangered: the Hawaii ‘Akepa, Hawaii Creeper, Nēnē, Hawaiian Hawk and ‘Alala.

The endangered Hawaiian Petrel (*Pterodroma sandwichensis*), the threatened Newell’s Shearwater (*Puffinus auricularis newelli*), and the Band-rumped Storm Petrel (*Oceanodroma castro* – which was proposed for listing on September 30, 2015), may occasionally overfly the site at altitudes of about 100 feet as they pass between nesting areas on high mountains and in the saddle between Mauna Kea and Mauna Loa to foraging grounds in the ocean. No suitable nesting habitat is known to be present in the area.

Game birds were introduced many times at Pu‘uwa‘awa‘a, beginning in the late 1800s. Many species are now present, including various Francolins (*Francolinus* sp.), California Quails (*Callipepla californica*), Wild Turkeys (*Meleagris gallopavo*), Peacocks (*Pavo cristatus*) and Ring-necked Pheasants (*Phasianus colchicus*) (Lewin 1971). Many kinds of songbirds were imported and propagated by the owners of Pu‘uwa‘awa‘a Ranch. Aviaries for these birds were maintained near ranch headquarters by Mr. L.S. Dillingham. Various parrots and parakeets have also become established in or near the area. The most abundant non-native birds in the upper areas of Pu‘uwa‘awa‘a are Japanese White-eye (*Zosterops japonicus)*, House Finch (*Carpodacus mexicanus*), Northern Cardinal (*Cardinalis cardinalis*) and Red-billed Leiothrix (*Leiothrix lute*a) (DOFAW 2003).

Given this biologically rich setting, a thorough biological inspection survey of the area to be affected was conducted by DOFAW. The biological survey is contained in full in Appendix 3 and is summarized below.

*Existing Flora, Fauna and Vegetation*

As shown in Figures 3 and 4 and discussed extensively in Section 1.1, the project site itself is centered on the *makai* flank of a cinder cone on terrain that has been heavily modified by earthmoving to create a reservoir. The affected area of the reservoir and surrounding area is a small portion of a 28-acre exclosure fenced with ungulate-proof hog wire to protect the area from cattle, sheep, goats and pigs. Through a process of natural succession aided by the fencing, there has been significant re-growth of ‘ōhi‘a and koa around the outside edges of the reservoirs. Non-native pines and occasional silver oak and jacaranda are also thriving. The koa and ‘ōhi‘a are found mostly in small, dense stands 10 to 25 feet in height that appear to have emerged after the reservoir area was fenced in the 1960s/1970s.

Larger koa can be found growing out of holes in the Poohohoo No. 2 reservoir liner. A small artificial pond lies at the center of the reservoir where the liner is somewhat intact.

The airphoto in Figure 3a shows that the former reservoir is surrounded by higher portions of the Poohohoo cinder cone as well as grazing land. This surrounding area contains patches of koa-ʻōhiʻa forest, as well as a number of non-native trees, shrubs, grasses and ferns. Less common but critical are several individuals of the endangered species ʻaiea (*Nothocestrum breviflorum*) found outside the project site to the west. These were identified by DOFAW surveys and they continue to be managed with perimeter fencing and monitored by DOFAW personnel. The project site is within a 291-acre unit that along with almost 9,000 acres in Puʻuwaʻawaʻa is designated as critical habitat for *ʻaiea*. It is expected to be fenced from ungulates as part of the pending North Kona Game Management HCP.

Intensive biological surveys were conducted between 1:00 and 4:00 PM on January 22, 2016 in the affected area and within a 20-meter buffer around it, as well as approximately 50 meters to the north. Surveyed sites included the area proposed to be removed from the reservoir embankment as well as surrounding areas that will likely be disturbed during project implementation. Work consisted of a combination of targeted surveys of areas with missing liner and multiple plants, and 6-foot belt transects throughout the proposed cut area.

Of the 34 plant species found (Table 1 of Appendix 3), 10 were native, either endemic or indigenous species. These were koa (*Acacia koa*), loulu fern (*Coniogramme pilosa*), aʻaliʻi (*Dodonaea viscosa*), ʻōhiʻa (*Metrosideros polymorpha*), sword fern (*Nephrolepis cordifolia*), pāpala kēpau (*Pisonia brunoniana*), golden fern (*Pityrogramma austroamericana*), whisk fern (*Psilotum nudum*), pōpolo (*Solanum americanum*), and māmane (*Sophora chrysophylla*). None of these species is listed as threatened or endangered, or considered a species of concern (USFWS 2016); however, pāpala kēpau is of local interest, as mature trees have been found in only three locations at Puʻuwaʻawaʻa. It is important to note that the two individuals of this species detected were found to the east of the lower Poohohoo reservoir, well away from the proposed impact area.

As discussed above, six individuals of the endangered ʻaiea (*Nothocestrum breviflorum*) have been found previously to the west, southwest of the upper Poohohoo reservoir. There is almost no chance these trees will be impacted by the excavation activities because they are on the opposite side of the impact area, but the ungulate-proof fence must be maintained to prevent ungulate ingress into the unit.

Ten bird species were detected in and around the project area (see Table 2 of Appendix 3). Only two were native: the Hawaiian Hawk or ʻIo (*Buteo solitarius*) and the Hawaii ʻAmakihi (*Chlorodrepanis virens*). The ʻIo was seen perched on a dead branch on a tall pine tree about a quarter mile to the southwest of the lower reservoir. After about 10 minutes it joined a second ʻIo, and they spent about 20 minutes soaring above Poohohoo cinder cone (to the south of the lower reservoir) before disappearing. At no point did they land on any trees in the project area and no nests were observed. Hawaii ʻAmakihi were seen multiple times throughout the survey, looking for insects on koa and ʻōhiʻa.

A feral pig was disturbed in a bed halfway up the proposed cut area after which pig trails and scat were observed in the area, indicating a potential breach in the hog wire fence surrounding the area. There

were multiple pig wallowing areas in the mud in the artificial pond at the bottom of the lower reservoir. These wallows were filled with water, and many non-native birds were seen bathing in these pools, including Saffron Finch and Nutmeg Mannikin. The pond appears to serve as a place for the non-native birds to drink and bathe (the Hawaii ʻAmakihi was never seen in the pond drinking or bathing), though it also likely serves as a mosquito breeding pond, as there were many mosquitos in the area. For native birds in the Forest Bird Sanctuary that lies just *mauka* (especially Iʻiwi, *Drepanis coccinea*, which are extremely susceptible to mosquito-borne diseases such as avian malaria and pox), the fact that the project will remove this pond is biologically beneficial, as it will reduce mosquito breeding.

No detection efforts were focused on the bat, but it may be presumed to be present, based on prior sightings (Giffin 2003). The Hawaiian hoary bat clearly forages in the area, and it might roost within large shrubs or trees. The relatively short time that trees have been regrowing on the site means that the trees are fairly short in stature and thus may not support bat roosts.

No native insects of concern were observed in the project area (Table 3 of Appendix 3). Mosquitos were numerous, and honey bees (*Apis meliffera*) and wasps (*Vespula pensylvanica*) were present. While one potential plant host of the endangered Blackburn sphinx moth was found (pōpolo, *Solanum americanum*), this plant is used rarely (E Parsons, *pers. obs.*) compared with ʻaiea (*Nothocestrum breviflorum*) and tree tobacco (*Nicotiana glauca*). No eggs or larvae of Blackburn's sphinx moth (*Manduca blackburnii*) were observed on this plant. However, as with a very large area of Puʻuwaʻawaʻa, the project site is within designated critical habitat for the Blackburn's sphinx moth.

*Impacts and Mitigation Measures*

The proposed project involves the following elements with a potential to affect vegetation and animals:

- Removing a section of Poohohoo reservoir fence to gain access/entry
- Excavating a break in the embankment wall to stop the accumulation of water
- Removing approximately 19,000 square feet (+/- 9,600 cubic yards) of material from the north side of the lower Poohohoo reservoir embankment
- Moving the material (above) and depositing it at a location near the reservoir area
- Removing damaged butyl liner on, in, and around the lower reservoir
- Accessing the reservoir embankment and reservoir from the main access roads with vehicles and heavy equipment in order to conduct the work

These activities will impact both native and non-native species in the area, but with the exception of koa and ʻōhiʻa (which are numerous in the area), this project will mainly affect weeds which are not of conservation concern. Though koa and ʻōhiʻa will be removed on the embankment, the removal of the old, degraded butyl liner will provide more space for forest restoration and recovery. The 19,000 square feet of material removed from the embankment will need to be relocated somewhere nearby, but the vast majority of the area is pastureland with herbaceous weeds including fireweed and bull thistle, and there are ample areas for disposal. There are no areas directly to the north of the proposed cut area that had important native species that would be negatively impacted by this project.

The following mitigation measures will be implemented before, during and after project implementation in order to reduce impacts on the native species in the area so that there are no adverse effects:

- Though not directly in the proposed cut area, the two pāpala kēpau trees inside the 28-acre Poohohoo fence must be protected from disturbance. They are well away from any area of impact, but the project engineer has been made aware of their location and asked to ensure that they are not affected. If project design changes and there is a chance of disturbance near these individuals, DLNR Engineering Division will coordinate with DOFAW to ensure that these trees will have 4-foot high protective fencing, orange, plastic mesh or equivalent accepted by the Engineer, installed around each tree. Each tree will be surrounded with protective fence at a minimum of 10 feet from the trunk, with steel T-posts spaced at a minimum of 5 feet on center.
- The material excavated from the reservoir embankment will not be placed on top of any native ʻōhiʻa or koa if it can be avoided. Instead, it will be placed to the north of the reservoir in area of pasture grasses and weeds. After the topography has been adjusted to final grade and stabilization measures are in place, the DOFAW Puʻuwaʻawaʻa crew will be contacted so that the area can be replanted with native vegetation as soon and as completely as possible. In order to prevent erosion, kikuyu grass clippings will be cut from nearby grasses and these stems will be buried in the soil and watered. Ultimately, this entire area will be reforested as part of DOFAW's ongoing conservation efforts.
- The six endangered ʻaiea (*Nothocestrum breviflorum*) trees inside the ungulate proof fence are well away from the lower Poohohoo reservoir. While project activities have been specifically designed for complete avoidance of these trees, any ungulates (hooved mammals, such as cows, horses, and feral goats, sheep, and pigs) that get inside the fence could impact them through browsing, root trampling, and bark stripping. Therefore, the existing hog-wire Poohohoo fence will be maintained in a way as to prevent access by these ungulates for the entire duration of the project.
- There will be no clearing of woody vegetation taller than 15 feet during the Hawaiian hoary bat pupping season, which runs from June 1 through September 15 each year.
- There will be no earthmoving or tree cutting during the breeding season for Hawaiian Hawks (March through September), if feasible. If this time period cannot be avoided, DLNR will arrange for a hawk nest search to be conducted by a qualified biologist, and if hawk nests are present in or near the project site, all land clearing activity will cease until the expiration of the breeding season.
- The area will be monitored for invasive species, which will be removed if necessary, for a two-year period after construction is complete, after which the need for continued monitoring will be assessed. All tools, equipment, clothing, vehicles, and supplies will be checked for seeds of invasive plants as well as mud and debris, and will be thoroughly cleaned each and every time before entering Puʻuwaʻawaʻa. Areas of bare soil and other similar disturbances created from the project will be monitored for invasion by non-native plants including bull thistle, fireweed, and other exotics, and these will be suppressed for the duration of the project through chemical or mechanical means, or by covering the affected areas with shade cloth or equivalent.
- Special attention will be given to prevent the spread of Rapid ʻŌhiʻa Death into Puʻuwaʻawaʻa.

No vehicles from areas affected by ROD will be allowed to enter into Pu‘uwa‘awa‘a unless they have been completely and thoroughly cleaned according to protocols established by UH and USFS (http://www2.ctahr.hawaii.edu/forestry/disease/ohia_wilt.html

With these mitigation measures in place, no impacts to threatened or endangered species are expected to occur. The proposed project will require reshaping of artificial topography that now supports ‘ōhi‘a and koa seedlings, saplings and small trees, along with a number of other native herbs and ferns, as well as non-native species. The area will be revegetated and is expected to ultimately regrow with superior native vegetation. Adverse effects to the biota will therefore be negligible and temporary, and with successful emergence of a native forest, there will be a net benefit.

### 3.1.4 Air Quality, Noise and Scenic Resources

The State Department of Health, Clean Air Branch, monitors ambient air in the State of Hawai‘i via 14 air monitoring stations on three islands. In general, ambient air quality in the State of Hawai‘i continues to be among the best in the nation. The Environmental Protection Agency has set standards for six pollutants: 1) carbon monoxide; 2) nitrogen dioxide; 3) sulfur dioxide; 4) lead; 5) ozone; and 6) particulate matter ($PM_{2.5}$ and $PM_{10}$). Particulate matter is measured in microns. The subscripts $_{2.5}$ and $_{10}$ represent microns in aerodynamic diameter. Owing to high gas output from Kilauea Volcano, the State has also set standards for hydrogen sulfide, which is monitored on the Big Island. Because of the generally excellent air quality in the rural islands, the State’s measures most of the criteria pollutants associated with urban air quality problems only on O‘ahu.

The Island of Hawai‘i has seven stations, all of which are considered Special Purpose Monitoring Stations established primarily to analyze volcanic emissions of sulfur dioxide, which convert into particulate sulfate and produce a volcanic haze (vog). In the Puna station, hydrogen sulfide is also monitored. The stations on the Big Island measure only $PM_{2.5}$ via a continuous monitor, and sulfur dioxide and hydrogen sulfide with a continuous pulsed fluorescence ambient air analyzer. Two stations have been utilized in West Hawai‘i, one of which is still in operation at Konawaena High School. Another station was located near Waikoloa Village in South Kohala, but it was shut down on April 1, 2014. According to the 2014 annual summary none of the measured pollutants exceeded State or federal standards in 2014 at these two stations (Hawai‘i State DOH-CAB). Even when values were on the higher end of the range, the values are still mostly attributed to volcanic emissions. Volcanic eruptions are considered natural events and therefore EPA may exclude the exceedances of the 1-hour NAAQS from attainment determinations. As would be expected by the above data and the regional context, air quality in the project area, which is far removed from industrial land uses or major highways, is generally good. When air pollution does occur in West Hawai‘i, is mainly derived from vog.

Noise at Poohohoo is generated mainly from wildlife and wind and is very low.

The Pu‘uwa‘awa‘a area is highly scenic, but the project area does not contain any specific sites that are considered significant for their natural beauty or scenic character in the Hawai‘i County General Plan. Photographs in Figure 3 illustrate the scenic value of Poohohoo, the top of which protrudes from the

surrounding landscape and offers both a scenic resource and a scenic vantage point, although the public is not generally present to enjoy these. As can be seen in the photos, however, the reservoir itself contains torn and unsightly fragments of liner.

*Impacts and Mitigation Measures*

Air quality, noise and visual impacts would occur during the two to three months that earthmoving equipment would be removing the liner, breaching the reservoir walls and reshaping the terrain to a stable configuration that would prevent accumulation of standing water and promote forest regeneration. DLNR will develop implement dust control measures compliant with provisions of Hawai‘i Administrative Rules, Chapter 11-60.1, “Air Pollution Control,” Section 11-60.1-33, “Fugitive Dust.” After the work is finished, the site will be restored to natural vegetation and air quality will return to existing levels.

Noise may temporarily disturb wildlife in the form of native birds, but they can easily remove themselves from the area and return once the disturbance is over. Although there are no sensitive human noise receptors nearby, State Department of Health noise regulations still apply. Noise pollution is regulated by the State Department of Health which has set specific decibel levels into three classes based on land use. Hawai‘i Administrative Rules Title 11, Chapter 46, Community Noise Control contain the specific sound levels in A-weighted decibels (dBA), a measurement based on human hearing. The maximum permissible day and night levels vary by zoning district and time of day. Areas zoned for agriculture are classified as Class C lands, in which sound levels during construction may not exceed 70 dBA at the property boundary at any time of the day for more than 10 percent of the time within any twenty minute period, except by permit or variance. Impulsive noise – derived from activities such as hammering, pile driving, and explosion – shall be 10 dBA above the maximum permissible sound levels. Construction equipment with a motor and/or exhaust system shall operate with a muffler, except for pile hammers or pneumatic hand tools weighing less than 15 pounds. Earthmoving equipment will generate high levels of noise during construction, which will occur in the daytime. Based on the lack of sensitive noise receptors and distances of over a quarter mile to the nearest property boundary, no violation of State noise regulations is expected to occur, and no noise mitigation should be required. After the work is finished, noise will return to existing low levels.

Although there will be visual changes during construction, none will be noticeable to any viewers. The scenic values of the site over the long term will be improved by a more natural, forested appearance rather than a dilapidated reservoir.

### 3.1.5 Hazardous Substances and Wildfire

*Hazardous Substances: Environmental Setting, Impacts and Mitigation Measures*

No professional evaluation such as a Phase I Environmental Site Assessment (ESA) was performed for the project site. To DLNR officials’ knowledge, there have been no spills or other incidents involving hazardous or toxic substances, and no such materials are stored on the sites of the proposed

construction. The modification of the terrain necessary to decommission the reservoir does not pose any unreasonable risk in terms of worker or public exposure to such materials.

*Wildfire: Environmental Setting, Impacts and Mitigation Measures*

In the last century, wildfires have become very common in Northwest Hawai‘i (HWMO 2007; Hawai‘i State DOFAW 2003). Fires in Hawai‘i are usually caused by human activity, most commonly as a result of arson or catalytic converters touching dry grass. Wildfires can lead to injuries and death to people and wildlife, property losses and soil erosion, with consequent impacts to water and air quality. A less obvious but more devastating impact is the threat they pose to Hawaiian ecosystems by converting native habitats into grasslands or shrublands dominated by nonnative species (Cuddihy and Stone 1990). Unlike many other areas in the world, the majority of dryland native Hawaiian plants are not adapted to wildfires, and they generally perish when exposed to fire. Native shrubs and trees may recover from fire to some degree, but native plant communities are often overwhelmed by more aggressive alien species after fires. Many nonnative species are pyrophytic (adapted to fire) and thrive in the aftermath of wildfires. Unlike native shrubs and trees, many alien grasses recover quickly, increasing in ground cover and biomass after a fire. Fires encourage non-native grass by stimulating growth from the base of clumps and encouraging seed production. The establishment of pyrophytic grasses increases the threat of additional fires. Two-thirds of the dry forests of the Big Island have been lost, primarily due to wildfire carried by invasive grasses (HWMO 2007). Extensive areas of Pu‘uwa‘awa‘a and especially Pu‘uanahulu have burned in historical times (Hawai‘i State DOFAW 2016 [in prep.]). In the last two years, a fire of over 5,000 acres occurred in Pu‘uanahulu, and as recently as February 2016 over 1,000 acres burned there. However, the project site at Poohohoo has not experienced a recorded fire.

Any project involving heavy equipment operation in dry grasslands with heavy fuel loads has a risk of fire ignition and consequent wildfire. Hot catalytic converters, sparks from metal scraping rock during equipment transport or operation, and other ignition sources can be sources. In order to minimize the chance of fire ignition, the following procedures will be undertaken.

- No smoking will be allowed in the project area, including during equipment transport from Pu‘uwa‘awa‘a Access Road to the project site.
- Proper ignition prevention procedures will be followed by all workers for equipment, and construction equipment will be equipped with necessary mufflers and spark arresters to prevent fires.
- Vehicles will not be parked in vegetation of any kind whenever possible, and a designated parking area will be developed. In any locations where parking of vehicles must occur as part of the work, vehicles will not park in vegetation greater than 4 inches in height.
- Certified fire extinguishers will be present in all vehicles and onsite at all times and all personnel will be trained in their use.
- If any welding and metal cutting is necessary, it must be conducted in an area free of vegetation with 100 gallons of water and a pump and hose available.

## 3.2 Socioeconomic and Cultural

### 3.2.1 Socioeconomic Characteristics

*Environmental Setting*

The project affects and benefits Pu‘uwa‘awa‘a as well as the community of hunters, birders, hikers and others from the Big Island and elsewhere who benefit from this resource. The 2010 U.S. Census of Population counted 185,079 residents on the Big Island, with a very diverse ethnic mix of 33.7% White, 22.2% Asian, 12.1% Native Hawaiian or Pacific Islanders, and 29.5% with two or more races. With 14.5% over 65 years old (compared to about 14% for the State as a whole), and a median age of 41.5 years (compared to 38.6 for the State), the population is skewed towards the older adults and the elderly. Many younger working-age residents who grow up in Hawai‘i County relocate to other islands or states to find work. Nevertheless, since 1980, Hawai‘i County has consistently been among the 100 fastest-growing counties in the U.S., mainly because it attracts working age adults or retirees, particularly in the Puna, Kohala and Kona districts.

DOFAW manages hunting lands in the Pu‘uwa‘awa‘a Forest Reserve and the Pu‘uanahulu Game Management Area (GMA). Current land management in the Pu‘uanahulu GMA is primarily for maintenance of non-native game mammal populations for hunting, in addition to conservation of native habitat. Pu‘uwa‘awa‘a Forest Reserve is a multi-use area where management includes game population maintenance for hunting, natural resource conservation and restoration, and other activities such as cattle grazing and trail use. Hunting is conducted by residents from all over Hawai‘i as well as non-residents for food, sport, recreation, and social interaction. Formal public hunting programs at Pu‘uwa‘awa‘a Ranch date back to 1978, although this activity has a much longer history in the area, likely dating to pre-contact times. Hunting in the State of Hawai‘i is regulated by DOFAW and requires a hunting license whether hunting on public or private land. Species subject to hunting include feral sheep, mouflon hybrid sheep, goat, pig, and game birds. All public hunting in the area is currently administered via either manned or unmanned hunter check stations and requires hunting licenses and additional harvest tags for selected game. Game bird hunting in both Pu‘uwa‘awa‘a Forest Reserve and Pu‘uanahulu Game Management Area is usually open during weekends and State holidays from November through January, and between March 1 and April 15 for turkey. Game mammal hunting in Pu‘uanahulu Game Management Area usually is open during weekends and State holidays from March to June. In Pu‘uwa‘awa‘a Forest Reserve, including the project site, feral sheep and goats are harvested through the issuance of nuisance control permits and regular hunting processes. Game mammal hunting there is also open from August to mid-September in the Makai and Youth/Disabled sections.

Many parts of Pu‘uwa‘awa‘a are also utilized for other forms of outdoor recreation, including hiking and wildlife viewing. Hawai‘i has 34 endangered bird species that are among the objects of “life lists” for birders from around the world. The 2006 recreational survey estimated that 155,000 Hawai‘i residents and 107,000 visitors engaged in wildlife viewing (USFWS and USCB 2006). A much larger number engage in hiking. Because of the remoteness of the Poohohoo area and the lack of signed trails or access routes, almost no hiking occurs in this area. Although most of the land in the upper parts of

Pu‘uwa‘awa‘a south of the cone area is slated for primarily conservation rather than recreational uses, some hiking trails and wildlife viewing areas may be developed in the future.

*Impacts and Mitigation Measures*

On a long term basis, the reservoir decommissioning project will not affect hunting, hiking or birding, nor will it have any other adverse socioeconomic impacts. It undertakes a necessary safety improvement to benefit the general public and will serve to restore the natural environment. During the decommissioning activities, which will involve heavy equipment, the public will be asked to stay outside the construction limits for safety. As the area experiences almost no public use and there are no critical recreational resources in the affected area, no adverse effect should occur.

### 3.2.2 Cultural Resources

The information in this section relies on historical research provided in the Archaeological Assessment Survey (AAS) by ASM Affiliates, Inc., contained in full in Appendix 2, various other published and unpublished sources, and consultation with DOFAW officials and others who reside in Pu‘uwa‘awa‘a conducted for the EA and/or as part of the AAS.

*Cultural Background for Era Prior to Western Contact*

The settlement of Hawai‘i resulted from voyages taken across the open ocean. For many years, researchers have proposed that early Polynesian settlement voyages between Kahiki (the ancestral homelands of the Hawaiian gods and people) and Hawai‘i were underway by A.D. 300, with long distance voyages occurring fairly regularly through at least the thirteenth century. It has been generally reported that the sources of the early Hawaiian population – the Hawaiian Kahiki – were the Marquesas and Society Islands. Recent work summarized by Kirch (2012) indicates a later settlement date of about 1000 A.D.

For generations following initial settlement, communities were clustered along the watered, windward (*ko‘olau*) shores of the Hawaiian Islands. Along the *ko‘olau* shores, streams flowed and rainfall was abundant, and agricultural production became established. The *ko‘olau* region also offered sheltered bays from which deep sea fisheries could be easily accessed, and near shore fisheries, enriched by nutrients carried in the fresh water, could be maintained in fishponds and coastal waters. It was around these bays that clusters of houses where families lived could be found. In these early times, Hawai‘i’s inhabitants were primarily engaged in subsistence level agriculture and fishing.

Over a period of several centuries, areas with the richest natural resources became populated and perhaps crowded, the population began expanding to the *kona* (leeward side) and upland areas such as Waimea (Kirch 2012). Over the generations, the ancient Hawaiians developed a sophisticated system of land and resources management. By the time ‘Umi-a-Līloa rose to rule the island of Hawai‘i in ca. 1525, the island (*mokupuni*) was divided into six districts or *moku-o-loko*. On Hawai‘i, the district of Kohala is one of six major *moku-o-loko* within the island. Kohala like other large districts on Hawai‘i, was subdivided into ‘*okana* or *kalana* (regions of land smaller than the *moku-o-loko*, yet comprising a

number of smaller units of land). The *moku-o-loko* and *ʻokana* or *kalana* were further divided into manageable units of land, and were tended to by the *makaʻāinana* (people of the land). Of all the land divisions, perhaps the most significant management unit was the *ahupuaʻa*. *Ahupuaʻa* are generally wedge-shaped pieces of land that radiate out from the center of the island, extending to the ocean fisheries fronting the land unit. They were usually marked by an altar with an image or representation of a pig placed upon it (thus the name *ahu-puaʻa* or pig altar).

The *ahupuaʻa* were also divided into smaller individual parcels of land (such as the *ʻili*, *kōʻele*, *māla*, and *kīhāpai,* etc.), generally oriented in a *mauka-makai* direction, and often marked by stone alignments (*kuahiwi*). In these smaller land parcels the native tenants tended fields and cultivated crops necessary to sustain their families, and the chiefly communities with which they were associated. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the common people who lived in a given *ahupuaʻa* had access to most of the resources from mountain slopes to the ocean. These access rights were almost uniformly tied to residency on a particular land, and earned as a result of taking responsibility for stewardship of the natural environment, and supplying the needs of the *aliʻi*.

Entire *ahupuaʻa*, or portions of the land were generally under the jurisdiction of appointed konohiki or lesser chief-landlords, who answered to an *aliʻi-ʻai-ahupuaʻa* (chief who controlled the *ahupuaʻa* resources). The *aliʻi-ʻai-ahupuaʻa* in turn answered to an *aliʻi ʻai moku* (chief who claimed the abundance of the entire district). Thus, *ahupuaʻa* resources supported not only the *makaʻāinana* and *ʻohana* who lived on the land, but also contributed to the support of the royal community of regional and/or island kingdoms. This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resources management planning. In this system, the land provided fruits and vegetables and some meat in the diet, and the ocean provided a wealth of protein resources.

The project site is located on the Island of Hawaiʻi within the District of North Kona in the *ahupuaʻa* of Puʻuwaʻawaʻa. Kona is one of six major *moku-o-loko* (districts), and extends from the shore across the entire volcanic mountain of Hualālai, and continues to the summit of Mauna Loa. Like other large districts on Hawaiʻi, Kona was further divided into *ʻokana* or *kalana* (regions of land smaller than the *moku-o-loko*, yet comprising a number of smaller units of land). In the region now known as Kona *ʻakau* (North Kona), there are several ancient regions (*kalana*) as well. The southern portion of North Kona was known as "Kona *kai ʻōpua*" (interpretively translated as: Kona of the distant horizon clouds above the ocean), and included the area extending from Lanihau (the present-day vicinity of Kailua Town) to Puʻuohau (often called Red Hill). The northern-most portion of North Kona was called "Kekaha" (descriptive of an arid coastal place). Native residents of the region affectionately referred to their home as *Kekaha-wai-ʻole o nā Kona* (Waterless Kekaha of the Kona District), or simply as the *āina kaha*. Puʻuwaʻawaʻa Ahupuaʻa is located within a smaller district of Kekaha known as Nāpuʻu, literally translated as "the hills" (Pukui et al. 1974).

Clark (1987) offered a regional settlement pattern model for the Pre-Western Contact use of nearby Waikoloa that included four elevationally delimited environmental zones: Coastal Zone, Intermediate Zone, Kula Zone, and Wilderness Zone. The Coastal Zone extends up to about 150 feet elevation, and was used for permanent and temporary habitation, coastal resource exploitation, and limited

agriculture. The Intermediate Zone extends from the Coastal Zone to about 1,900 feet elevation. This zone was used primarily for seasonal agriculture with associated short-term occupation, typically situated near intermittent drainages. The Kula Zone extends from the Intermediate Zone to about 2,700 feet elevation (and to 3,200 feet in certain areas). This was the primary agricultural and residential area, with extensive formal fields and clustered residential complexes. The Wilderness Zone extends above the Kula Zone to the mountaintops, and was a locus for the collection of wild floral and faunal resources. Puʻuwaʻawaʻa crosses several environmental zones that are generally referred to as *wao* in the Hawaiian language. These environmental zones include the near-shore fisheries and shoreline strand (*kahakai*) and the *kula kai*/*kula uka* (shoreward/inland plains). These regional zones were greatly desired as places of residence by the natives of the land.

Continuing into the *kula uka* (inland slopes), the environment changes as elevation increases. The zones called the *wao kanaka* (region of man) and *wao nahele* (forest region) in Puʻuwaʻawaʻa are generally situated between the 1,800 to 2,400 foot elevations, and are crossed by the present-day Māmalahoa Highway. The highway is situated not far below the ancient *ala loa*, or foot trail, also known as Ke-alaʻehu, and was part of a regional trail system passing through Kona from Kaʻū to Kohala. Within the forest region, rainfall increases to 30 or 40 inches annually, and taller forest growth occurred. This region provided native residents with shelter for residential and agricultural uses, and a wide range of natural resources that were of importance for religious, domestic, and economic purposes.

Hawaiians see all things within their environment as being interrelated. That which was in the uplands shared relationships with that which was in the lowlands, coastal region, and even in the sea, and the *ahupuaʻa* as a land unit was the thread that bound all things together in Hawaiian life. In an early account written by Kihe (in *Ka Hōkū o Hawaiʻi*, 1914-1917), with contributions by John Wise and Steven Desha Sr., the significance of the dry season in Kekaha and the custom of the people departing from the uplands for the coastal region is further described:

> *…ʻOia ka wā e neʻe ana ka lā iā Kona, hele a maloʻo ka ʻāina i ka ʻai kupakupa ʻia e ka lā, a o nā kānaka, nā liʻi o Kona, pūheʻe aku la a noho i kahakai kāhi o ka wai e ola ai nā kānaka* – It was during the season, when the sun moved over Kona, drying and devouring the land, that the chiefs and people fled from the uplands to dwell along the shore where water could be found to give life to the people. (*Ka Hōkū o Hawaiʻi*, April 5, 1917)
>
> "Ola aku la ka ʻāina kaha, ua pua ka lehua i ke kai — The natives of the Kaha lands have life, the lehua blossoms are upon the sea!" (*Ka Hoku o Hawaii*, February 21, 1928)

The *lehua* blossoms are likened to canoes returning to the sea. Puʻuwaʻawaʻa was a favorable place to live in North Kona because of the freshwater springs and brackish pools along the coast and the more favorable agricultural land in the uplands. The coastal area of Puʻuwaʻawaʻa contains the protected bay at Kīholo and was the location of a significant fishpond, as well as numerous springs and water caves. The land provided sheltered canoe landings, deep sea and nearshore fisheries, and important salt making resources. The inland agricultural field systems and diverse forest and mountain resources also

attracted native residents to the area. Through these diverse resources, the native families were sustained on the land.

There are numerous native and historical accounts that mention Puʻuwaʻawaʻa specifically, and even more that encompass the greater Kekaha region. Perhaps one of the earliest datable traditions that reference the Nāpuʻu-Kekaha region was collected by Abraham Fornander (1916-1917) titled "*The Legend of Kaulanapokii*". The legend speaks of traveling through the uplands, viewing Kīholo and Kapalaoa from Huʻehuʻe, and describes the practice of salt making at Puakō (also important in the coastal lands of Puʻuwaʻawaʻa). By association with Hīkapōloa, chief of Kohala at the time of the events described in this story, the *moʻolelo* dates to around the thirteenth century. Native historian Samuel Kamakau (1961) recorded that during the reign of Lono-i-ka-makahiki, Kamalālāwalu (the king of Maui) made plans to invade the island of Hawaiʻi. Kamalālāwalu (Kama) sent spies to determine how many people lived on the island. The spies "landed at Kawaihae," and one of them, Ka-uhi-o-ka-lani, traveled the trail between Kawaihae to Kanikū (Kamakau 1961:56). Returning to his companions, Ka-uhi-o-ka-lani reported "I went visiting from here to the lava bed and pond that lies along the length of the land." He was told, "Kaniku is the lava bed and Kiholo, the pond" (Kamakau 1961:56).

In another historical account, Kamakau described eighteenth century events in the Kekaha region, with particular emphasis on the lands of Puʻuwaʻawaʻa and Kaʻūpūlehu. When Alapaʻi-nui—ruler of Hawaiʻi—died in 1754, and his son Keaweʻōpala was chosen as his successor (Kamakau 1961:78). In the years preceding that time, the young chief Kalaniʻōpuʻu, had been challenging Alapaʻi's rule. The challenge continued after Alapaʻi's death, and following a short reign, Kalaniʻōpuʻu killed Keaweʻōpala and secured his rule over Hawaiʻi.

One of the most prolific native writers of the late nineteenth and early twentieth centuries, lived on the island of Hawaiʻi at Puʻuanahulu. His name was John Whalley Hermosa Isaac Kihe, who also wrote under the penname KaʻohuhaʻaheoināKuahiwiʻekolu (The proud mist on the three mountains). Born in 1853, Kihe's parents came from Honokōhau and Kaloko. During his life, Kihe taught at various schools in the Kekaha region, served as legal counsel to native residents applying for homestead lands, and worked as a translator on the Hawaiian Antiquities collections of A. Fornander. In the later years of his life, Kihe lived at Puʻuanahulu with his wife, Kaimu (Puʻuanahulu Homestead Grant No. 7540), and served as the postman of Nāpuʻu. Kihe, who died in 1929, was also one of the primary informants to Eliza Maguire, who translated some of Kihe's writings, publishing them in abbreviated form in her book "*Kona Legends*" (Maguire 1926).

In the series of articles entitled "*Na Hoonanea o ka Manawa, Kekahi mau Wahi Pana o Kekaha ma Kona*" (Pleasant Passing of Time [Stories] About Some of the Famous Places of Kekaha at Kona), Kihe presented detailed narratives of native traditions of Nāpuʻu and Kekaha (*Ka Hoku o Hawaii*; Dec. 6th 1923 to Feb. 21st 1924). Kihe described some of the famous places (*wahi pana*), and how they came to be named. He also identified some of the early residents of the region, and practices associated with water catchment and agriculture. The account of the priest Moemoe, and the shark-man, ʻĪwahaʻouʻou, from *Ka Hoku o Hawaii*; January 3, 1924 includes several important place names in the lowlands of Puʻuwaʻawaʻa. Significantly, there are named caves and sites, and descriptions of

cultivating practices in the uplands of Nāpuʻu. The former residence of sharkman, ʻĪwahaʻouʻou, is situated near the Puʻuwaʻawaʻa-Puʻuanahulu boundary several miles from the project site, and overlooks the *kula* (plains). This site is still pointed out by elder *kamaʻāina* of the land.

*Post-Western Contact Cultural and Historical Background*

Captain James Cook and his crew first arrived in the Hawaiian Islands on January 18, 1778, on board the *H.M.S. Resolution* and *Discovery*, prior to sailing north and searching fruitlessly for the Northwest Passage. Returning a year later, he spent a month in Kealakekua Bay, where he was killed in February 1779 over a dispute involving one of the ship's skiffs. With the arrival of foreigners in the islands, Hawaiʻi's culture and economy underwent drastic changes. Demographic trends during the early part of the nineteenth century indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. At first there was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history (Kent 1983). Later, as the Historic Period progressed, Kamehameha I died, the *kapu* system was abolished, Christianity established a firm foothold in the islands, and introduced diseases and global economic forces began to have a devastating impact on traditional life-ways. Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early Western visitors. Introduced foods often grown for trade with Westerners included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845). The arrival of foreigners in Hawaiʻi signified the end of the Precontact Period, and the beginning of the Historic Period, and the end of an era of uniquely Hawaiian culture.

Of singular importance for the upland areas of Kekaha as well as Kohala was the proliferation of cattle. Brought by Captain Vancouver in 1793 and 1794, and protected by a *kapu* placed on them by Kamehameha, they multiplied rapidly. By the time the *kapu* was lifted a few years later, wild cattle had become rampant throughout the island, disturbing native gardens and damaging streams, grasslands and forests. Foreign bullock hunters were then employed to keep the herds under control. Although the meat was eaten, the main economic products were the hides. Foraging cattle wreaked havoc on the agricultural fields and were responsible for a flurry of wall building as people tried to keep the feral cattle out of their fields and homes. John Parker worked for Governor Kuakini as a bullock hunter in 1831, and before long had founded the famous ranch that still bears his name.

There are few if any early 19$^{th}$ century accounts of the uplands of Puʻuwaʻawaʻa by Westerners, although the British missionary William Ellis did travel the coast in 1823 and provided accounts of the fishponds there (Ellis 1963). Later missionaries and other visitors also confined their descriptions (and probably most activities) to the coast.

In 1848, the Hawaiian system of land tenure was radically altered by the *Māhele ʻĀina*. The *Māhele* (division) defined the land interests of Kamehameha III (the King), the high-ranking chiefs, and the *konohiki*. As a result of the *Māhele*, all land in the Kingdom of Hawaiʻi came to be placed in one of three categories: (a) Crown Lands (for the occupant of the throne); (b) Government Lands; and (c) Konohiki Lands. Laws in the period of the *Māhele* record that ownership rights to all lands in the

kingdom were “subject to the rights of the native tenants;” those individuals who lived on the land and worked it for their subsistence and the welfare of the chiefs.

The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two year period that expired on February 14, 1848 to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more time than was prescribed by the two year term, and the deadline was extended several times, not for new claims, but for the Land Commission to finish its work (Maly and Maly 2002). As the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The “*Kuleana* Act,” passed by the King and Privy Council on December 21, 1849, clarified the native tenant’s rights to the land and its resources, and also the process by which they could apply for, and be granted fee-simple interest in their *kuleana*. The volumes of native registry and testimony collected for the *kuleana* claims provide a snap-shot of life in Hawai‘i during the middle part of the nineteenth century. Information recorded in the these volumes contains the names of smaller land divisions (*‘ili*, *mo‘o*, etc.) within the *ahupua‘a*, ties individual claimants and their families to specific locations within those land divisions, provides background information about when, and from whom, the claimants received their lands, and gives accounts of the land use at that certain time and place.

Mikahela Kekauonohi (a granddaughter of Kamehameha I) claimed Pu‘uwa‘awa‘a Ahupua‘a during the *Māhele*; however, the *ahupua‘a* was relinquished to the government perhaps in lieu of commutations for other lands awarded. Five *kuleana* claims, all in the coastal portion of the *ahupua‘a* near Kiholo Bay, were made, but none were granted (Maly and Maly 2006). As Pu‘uwa‘awa‘a was retained as crown land during the *Māhele*, it was not until 1873 that its boundaries were surveyed. The boundary testimonies and survey records provide a good summary of traditional knowledge of places, and identify localities ranging from the shore to the upper most boundaries of the *ahupua‘a*. The narratives described trails and forest resources of Pu‘uwa‘awa‘a; the occurrence of historical features, including residences and agricultural fields; the practice of salt making; and many place names. Maly and Maly 2006 contain several translated testimonies that provide interesting information on the area; none relate directly to the project site.

The first formal leases in the area were issued in 1863 and involved the *ahupua‘a* of Pu‘uanahulu. The lessees, three O‘ahu residents, sold their interests two years later to Francis Spencer for incorporation into the holdings of the Waimea Grazing and Agricultural Company. During the next several decades, ranching operations spread to more than 120,000 acres of Pu‘uanahulu and Pu‘uwa‘awa‘a. In 1893, a new lease for 40,000 acres of Pu‘uwa‘awa‘a was granted to an apparent partnership involving Robert Hind and Eben Low, who happened to be the son-in-law of Governor Sanford Dole. The terms of the 25-year lease included the preservation of the forest there and the restriction of further expansion of the lantana plant. Over the next year or so, Hind and Low reported to the commissioners of Crown Lands on the status of their lease enterprise, noting that dry times and a lack of springs were taking a toll on

their effort to grow trees and raise cattle. They said it was taking a prodigious effort to control lantana and other invasive species.

When the Hawaiian Kingdom started issuing homesteads in the late 1800s, those seeking lands were competing with Pu‘uwa‘awa‘a Ranch for desirable crop and grazing land. By 1914, Robert Hind began acquiring title to lots in Pu‘uanahulu from homesteaders who, according to terms of the homesteading application process, needed to prove they had jobs, and the only ones available in the area were those offered by the ranch. Hind’s growing sociopolitical influence led to his appointment in 1916 as Hawai‘i Territorial Senator, a position he held for several years. By this time the ranch’s primary residence had been built. The home became known as Pihanakalani, which translated as “gathering place [of] high supernatural beings,” and was visited by dignitaries from around the world. Over the next two decades the corporation “Robert Hind, Limited” was created to consolidate his interests, which by then consisted of 120,000 acres ranging up to 6,000 feet in elevation, with all but 300 acres involving leased government lands. They included 100,000 acres covered with lava flows, with only about 1,500 acres of the remainder considered good grazing land – mostly around the 5,000-foot elevation. Another 100 acres were planted in crops. In 1929 the ranch contained 30 miles of fences, half stone and half wire, and 2,000 head of cattle. It was at this time that efforts were undertaken to reduce the number of goats that were competing with the cattle for forage. In the mid-1930s, changes were made to the leases to exclude private parcels, including many along the coast. The leases for Pu‘uanahulu and Pu‘uwa‘awa‘a were again put up for auction in 1937 with Hind retaining them, but at a much higher cost. Robert Hind died in 1938 and his operations continued under a trust overseen by Trustee John K. Clarke until Clarke’s death in 1951. In 1948, the ranch contracted surveyor Charles Murray to prepare a map of the ranch paddocks and fencing projects that were underway. The map (Figure 16 of Appendix 2) also identifies the names of the paddocks, as they were remembered by the *kama‘āina* cowboys. The Poohohoo project site falls within the “Waiho 1 Paddock.”

In 1955, the Commissioner of Public Lands removed 500 acres at Pu‘uwa‘awa‘a from the lease and granted them to Volcanite, Limited, also known as Hawaiian Ornamental Concrete Products, Ltd., for use as a quarry for a period of 21 years. Volcanite, Ltd. voluntarily surrendered the lease in 1967 following complaints of violations but then obtained a series of revocable permits to continue operations until 1988.

In 1958 the officers of Robert Hind Ltd. decided the ranch could not maintain operations without prohibitively expensive investments in water systems and other range improvements and sold the fee simple holdings to Dillingham Ranch. Two years later, Dillingham was the high bidder on a 40-year lease for the government properties, which it transferred to F. Newell Bohnett in 1972. In 1984, the State Board of Land and Natural Resources removed 84,397 acres from the Pu‘uwa‘awa‘a Ranch lease.

Poohohoo Reservoir No. 2 was constructed in the early 1960s in response to a need for a large reservoir after Dillingham Ranch, Inc. had taken over the Pu‘uwa‘awa‘a Ranch holdings in 1958. The initial plan was to construct the reservoir immediately downslope from the Hale Piula catchment area. However, insufficient fill material and adverse slope conditions near the catchment area resulted in the relocation of the reservoir installation at Poohohoo. The cinder cone offered ample fill material for the

construction of embankments in addition to the inherent shape of the landform lending itself to the development of a reservoir. The Poohohoo Reservoir and catchment facility is located about two miles east of the Hale Piula catchment area, and just outside the northern boundary of the Forest Bird Sanctuary within the Pu‘uwa‘awa‘a Ranch lands and consists of five distinct elements (Juvik and Tango 2003).

As previously mentioned, the focus of the current project, Poohohoo Reservoir No. 2, was the larger of two butyl-rubber lined reservoirs constructed in the early 1960s. It had a potential storage capacity of 10 to 12 million gallons a mean diameter of roughly 350 feet and a maximum depth of 40 feet. According to Juvik and Tango (2003), the subject reservoir was built at an elevation slightly below the No. 1 reservoir and was connected by an overflow drain. In 2003, Reservoir No. 1 was recorded as “a still functioning, butyl-rubber lined reservoir, approximately 250 ft in perimeter diameter, with a storage capacity of 3-4 million gallons” (Ibid.:43). A 20,000-sq. ft. butyl-rubber sloping catchment surface was designed to collect and channel rainwater into Reservoir No. 1, and a 190,000-sq. ft. bituminous paved rainwater catchment surface, which has since fallen into disrepair, was intended to feed water into both the reservoirs. The latter catchment surface was built after it was discovered that the water line connecting Poohohoo Reservoir with the Hale Piula catchment could not transport enough water. The fifth and final element of the reservoir and catchment facility at Poohohoo was the outer slope on the western face of the cinder cone. Although it was hoped that runoff from here would drain into the catchment surfaces, the porous substrate never produced significant runoff (Ibid.).

Longtime cowboy and local resident Mikio “Miki” Kato, recalls that the liner of Poohohoo Reservoir No. 2 suffered irreparable damage from exposure to high winds and was abandoned shortly after its construction. As a result, it was never actually utilized as a reservoir (Juvik and Tango 2003).

In 2003, Juvik and Tango observed that the subject reservoir was partially lined but not currently in use. They also made the following comment regarding the potential inherent in the Po‘ohoho‘o facilities:

> It should be noted that, although largely degraded and currently non-functioning, the existing water collection and storage facilities at Poohohoo represent a substantial past capital investment that it would be difficult or impossible to replicate with new construction (due to costs, and current permitting and environmental restrictions). Thus, the marginal cost of repairing this system to full operational status presents an extremely favorable economic opportunity for providing increased water availability at Pu‘u Wa‘awa‘a. (Juvik and Tango 2003:44)

Since that time, the DLNR has determined that repairing the Poohohoo Reservoir No. 2 to meet existing safety standards is not justified based on any potential contribution it could make to the area’s non-potable water supply.

Bohnett’s lease on the remaining property expired in 2000. In 2002 the BLNR transferred all State-managed lands in the *ahupua‘a* of Pu‘uwa‘awa‘a from the DLNR Land Division to DOFAW and the Division of State Parks (Giffin 2003). The agencies were directed to develop a management plan to

provide for the restoration of native ecosystems and preservation of cultural resources, as discussed elsewhere in this document.

In 1993 the fee-simple parcel containing the ranch homes and HQ was sold by Bohnett to Pu‘uwa‘awa‘a Ranch. In 2000 the ranch sold the property to Jerry R. King, who sold all but four acres with a home on it in April 2006 to Henk and Akemi Rogers, who still hold the property and reside there part-time.

*Consultation*

To gain further possible insights about the project area and the specific site of the proposed project, the AIS and EA included consultation with a variety of individuals, as detailed in Appendix 2. On May 27, 2015 Robert B. Rechtman, Matt Clark and Ron Terry met with Miki Kato. Mr. Kato has lived in the *ahupua‘a* since about 1962 and worked at the Pu‘uwa‘awa‘a Ranch since 1956; he currently lives about a half mile *makai* of the project area. Mr. Kato is very knowledgeable about the general area, and he indicated that he was unaware of the presence of any archaeological or cultural sites at the project site, and also of any cultural practices that may have occurred there. As part of the EA early consultation process, the Office of Hawaiian Affairs, the Pu‘uanahulu Community Association, and the Pu‘uwa‘awa‘a Advisory Council were also contacted about the action (see Appendix 1a for responses). No specific cultural practices, resources or sites were identified.

*Existing Cultural Resources or Practices*

Inspections were conducted of the reservoir interior, the *makai* slopes of the artificial embankment created to hold the reservoir, and the areas just *makai* where the material removed from the reservoir would be deposited by DLNR staff highly familiar with the area, as well as professional archaeologists and biologists (see Section 3.1.3 and 3.2.3). These revealed no evidence of cultural activities or structures, unique natural features, biological resources or other features that would be valuable for gathering, ceremonial, or access purposes. No agency or group identified any natural, cultural or historical resources or expressed concern about potential cultural impacts.

*Impacts and Mitigation Measures*

It is reasonable to conclude that, based upon the lack of resources in the area, which was altered in the 1960s in the attempt to create a reservoir and has been essentially neglected and abandoned since then, the exercise of native Hawaiian rights related to gathering, access or other customary activities will not be affected, and there will be no adverse effect upon cultural practices or beliefs. The Draft EA was distributed to OHA, SHPD, the Pu‘uanahulu Community Association, and the Pu‘uwa‘awa‘a Advisory Council in order to solicit comment on this initial finding.

### 3.2.3 Historic Properties and Archaeological Sites

Archaeological fieldwork was conducted on May 27, 2015 by Robert B. Rechtman, Ph.D. and Matthew R. Clark B.A. The survey area was approximately 6 acres, approximately twice as large as

the proposed area of disturbance, and included all of Poohohoo Reservoir and the immediately surrounding land, along with a construction staging area in the pasture to the north (see Figure 3 of Appendix 2). The archaeological surface survey involved a 100 percent surface inspection of this area. Ground surface visibility was fair to excellent. The interior of the reservoir still retains its butyl-rubber lining across much of the surface. The field survey determined that no archaeological features were present on the surface. Given the nature of the substrate, which was built up to construct the reservoir, there is virtually no likelihood of encountering subsurface remains.

*Impacts and Mitigation Measures*

Given the absence of findings of historic properties, the archaeologists concluded that the proposed reservoir decommissioning would not affect any known historic properties. The archaeological survey was submitted to the State Historic Preservation Division (SHPD) for review and concurrence on December 8, 2015. As of February 29, 2016, SHPD had not responded concerning the adequacy of the survey or provided a review of the report. The Final EA will provide an update of coordination with SHPD.

As an added precaution, DLNR will ensure that in the unlikely event that any unanticipated archaeological resources are unearthed during project activities, in compliance with HAR 13§13-280, work in the immediate vicinity of the finds will be halted and DLNR-SHPD contacted.

## 3.3 Utility and Road Infrastructure

*Existing Facilities Services, Impacts and Mitigation Measures*

No utilities of any type are available or needed at the remote project site. Onsite electrical needs would be provided by a portable generator stored in the bed of a pickup truck.

The proposed decommissioning of the reservoir and associated reshaping of the terrain to prevent the accumulation of standing water and the promotion of vegetation regrowth will involve hauling of equipment, supplies and materials over the course of several weeks. The heaviest loads will be associated with hauling earthmoving machines. The route involves Highway 190, Puʻuwaʻawaʻa Access Road, and a sequence of DLNR roads that service Poohohoo Reservoir No. 1 and adjacent conservation areas. Work may cause very temporary delays on the Puʻuwaʻawaʻa Access Road, which is used by several residents, the Puʻuwaʻawaʻa Energy Lab, the Na Puʻu Water Inc. water well operators, hunters, and others. DLNR will work to inform these parties of activities with the potential to cause more than negligible delays and will schedule hauling operations to minimize inconvenience.

## 3.4 Secondary and Cumulative Impacts

### 3.4.1 Secondary Impacts

The proposed project would not involve major secondary impacts, such as population changes or effects on public facilities. As the reservoir is not in use and not feasible to use, it will have no effect

on cattle or wildlife water supply and associated secondary impacts to ranching, hunting, or endangered species recovery actions.

### 3.4.2 Cumulative Impacts

*Planned and Reasonably Foreseeable Projects*

Several projects involving active land uses are known to be occurring within a ten-mile radius of the project site. The Hawai‘i Department of Transportation is planning drainage improvements on the “big bend” on Mamalahoa Highway between Pu‘uanahulu and Pu‘uwa‘awa‘a over the course of the next year (Ramon Acob, HDOT, pers. comm., July 2015). In addition, Na Pu‘u Water Inc. (NWI), a small, non-profit, community based, and member-owned water system serving the local residents of Pu‘uanahulu-Pu‘uwa‘awa‘a area, is constructing a ground-mounted solar photovoltaic array consisting of approximately 800 monocrystalline solar panels and a flywheel energy storage system capable of storing 400 kWhrs of energy. NWI owns, maintains, and operates two 2,500-foot deep groundwater wells that are sufficient for local community needs. The cost for electricity to pump water from these deep wells burdens the local residents and ranchers. The project’s goal is to provide renewable energy facilities that would reduce reliance on fossil fuel energy and stabilize and reduce pumping costs on the Pu‘uwa‘awa‘a Well (*OEQC Environmental Notice,* February 23, 2015).

A more diffuse and wide-ranging project that comprises past, present and future actions is being conducted by DOFAW, which manages 103,988 acres of land in the Pu‘uwa‘awa‘a Forest Reserve, the Forest Bird Sanctuary and the Pu‘uanahulu Game Management Area (GMA). These lands are being managed for maintenance of non-native game mammal populations for hunting, conservation of native habitat, natural resource restoration, and other activities such as cattle grazing and trail use. DLNR-DOFAW is undertaking a Habitat Conservation Plan (HCP) to consider and mitigate for the potential impacts from DOFAW game mammal management activities on endangered species within this area. Potential negative impacts on the plant species that are covered in the HCP include direct take from grazing, browsing, and soil disturbance associated with the active management of food and water resources for game mammals and cattle. This HCP provides for avoidance and minimization measures as well as mitigation which will provide net benefit to the species and environment, above and beyond any incidental take of covered species which may occur due to Plan actions. The HCP will also use cattle and game mammal grazing to reduce fuel loads outside of planned and existing exclosures to reduce the likelihood of wildland fire, which is a primary threat to dryland forests. All plant species located outside of fenced units in this area are considered subject to take. Blackburn’s sphinx moth (*Manduca blackburni*) is the only insect species identified as potentially impacted, primarily from removal of non-native tree tobacco (*Nicotiana glauca*) from fuel breaks to allow access for management and hunting activities.

*Cumulative Impacts and Mitigation Measures*

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. Most of the adverse effects of the project to decommission Poohohoo Reservoir No. 2 – including noise, air

quality, archaeological, cultural, and biological impacts – are very limited in severity, nature and geographic scale. They are not of a magnitude or severity such that they would combine with impacts from other projects. However, the project will involve transportation of heavy equipment, the types and numbers of which will only be known after a contractor proposes specific methods as part of a bid for the project. There is potential for interaction of traffic impacts as State workers or contractors building fuel breaks, fences, solar panels, as well as the contractors for the proposed reservoir decommissioning project, share the narrow access roads within Puʻuwaʻawaʻa. As a mitigation measure, DLNR proposes the following:

- Prior to construction, the contractor will contact DLNR officials and determine if construction or marshalling schedules for other projects pose a potential conflict for road uses, and will negotiate scheduling to ensure that all parties are able to have appropriate road access.

## 3.5 Required Permits and Approvals

Aside from the Chapter 343, HRS, Finding of No Significant Impact and a finding of no effect to significant historic properties pursuant to Chapter 6e, HRS, no permits or approvals are expected to be required.

## 3.6 Consistency With Government Plans and Policies

### 3.6.1 Hawaiʻi State Plan and State Functional Plans

Adopted in 1978 and last revised in 1991 (Hawaiʻi Revised Statutes, Chapter 226, as amended), the Plan establishes a set of themes, goals, objectives and policies that are meant to guide the State's long-run growth and development activities. The three themes that express the basic purpose of the *Hawaiʻi State Plan* are individual and family self-sufficiency, social and economic mobility and community or social well-being. The proposed project would promote these goals by decommissioning a reservoir in conformance with safety requirements, thereby enhancing quality-of-life and community and social well-being through increasing public safety.

Twelve Functional Plans were also developed to further define the goals and objectives of the Hawaiʻi State Plan. The twelve functional plans include: 1) Agriculture; 2) Conservation Lands; 3) Employment; 4) Energy; 5) Health; 6) Higher Education; 7) Historic Preservation; 8) Housing; 9) Recreation; 10) Tourism; 11) Transportation; and 12) Water Resources Development. Functional plans that have a positive or adverse impact from the proposed reservoir decommissioning are Agriculture, Water Resource Development, Employment and Historic Preservation.

The issues of concern in the **Agriculture Functional Plan** are:

- Growth and development of diversified agriculture throughout the State that continues to constitute a dynamic and essential component of Hawai'i's strategic, economic, and social well-being.

- Support research and development activities that strengthen economic productivity in agriculture, stimulate greater efficiency, and enhance the development of new products and agricultural byproducts.

Decommissioning of the reservoir will have no adverse impact on agriculture because the reservoir has never been functional and does not contribute to the agricultural productivity of the area.

The issues of concern in the **Water Resources Development Functional Plan** are:

- Coordinate development of land use activities with existing and potential water supply.
- Support research and development of alternative methods to meet future water requirements.
- Reclaim and encourage the productive use of runoff water and wastewater discharges.
- Assist in improving the quality, efficiency, service, and storage capabilities of water systems for domestic and agricultural use.
- Support water supply services to areas experiencing critical water problems.
- Promote water conservation programs.

The Water Resource Development Plan encourages the use of alternative water supplies and the reuse of storm water. Aside from the fact that the reservoir is not now nor ever been functional, its small size, relative isolation and functional redundancy make it unsuitable for storage of storm water or alternative water sources.

Decommissioning of the reservoir will have no impact on water resource development.

The issues of concern in the **Historic Preservation Function Plan** are:

- Preservation of historic properties.
- Collection and preservation of historic records, artifacts and oral histories and perpetuation of traditional skills.
- Public information and education on the ethnic and cultural heritages and history of Hawai‘i.

The potential for historic properties and the cultural background of the Poohohoo area were systematically investigated as part of an Archaeological Assessment Survey submitted to the State Historic Preservation Office (SHPD) for review and approval. No historic properties are present and there will be no effect to significant historic properties.

### 3.6.2 Hawai‘i State Land Use Law and Hawai‘i County Zoning

All land in the State of Hawai‘i is classified into one of four land use categories – Urban, Rural, Agricultural, or Conservation – by the State Land Use Commission, pursuant to Chapter 205, HRS. The project site is classified within the State Land Use Agricultural District. County zoning for the

area is A-20a (Agricultural, 20-acre minimum lot size). Management and maintenance of a reservoir, including decommissioning, is a permitted activity in these land use designations.

### 3.6.3 Hawai‘i County General Plan

The *General Plan* for the County of Hawai‘i is the document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i. The latest plan was adopted by ordinance in 2005. The *General Plan* is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai‘i. Below are pertinent Goals, Objectives, Policies and Standards followed by a discussion of conformance.

**ECONOMIC GOALS**

(d) Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County’s cultural, natural and social environment.

**ENVIRONMENTAL QUALITY POLICIES**

(a) Take positive action to further maintain the quality of the environment for residents both in the present and in the future.

**ENVIRONMENTAL QUALITY STANDARDS**

(a) Pollution shall be prevented, abated, and controlled at levels that will protect and preserve the public health and well being, through the enforcement of appropriate Federal, State and County standards.
(b) Incorporate environmental quality controls either as standards in appropriate ordinances or as conditions of approval.

**HISTORIC SITES GOALS**

(a) Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawaii.

**HISTORIC SITES POLICIES**

(c) Require both public and private developers of land to provide historical and archaeological surveys and cultural assessments, where appropriate, prior to the clearing or development of land when there are indications that the land under consideration has historical significance.

**FLOODING AND OTHER NATURAL HAZARDS GOALS**

(a) Protect human life.

(b) Prevent damage to man-made improvements.
(c) Control pollution.
(d) Prevent damage from inundation.
(e) Reduce surface water and sediment runoff

**FLOODING AND OTHER NATURAL HAZARDS POLICIES**

(q) Consider natural hazards in all land use planning and permitting.

**FLOOD CONTROL AND OTHER NATURAL HAZARDS STANDARDS**

(a) Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawaii County Code.
(b) Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).
(c) Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control," of the Hawaii County Code.

**NATURAL BEAUTY**

(a) Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.
(b) Protect scenic vistas and view planes from becoming obstructed.
(c) Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

**NATURAL RESOURCES AND SHORELINES GOALS**

(a) Protect and conserve the natural resources of the County of Hawaii from undue exploitation, encroachment and damage.
(f) Ensure that alterations to existing land forms and vegetation, except crops, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.

Discussion: The proposed project is consistent with all relevant goals, policies, and standards of the General Plan. Historic sites, natural resources and natural beauty have all been inventoried or analyzed and no adverse effects are foreseen. The project will prevent and not promote flooding. The safety for the general public will be improved and the land will be restored to a more natural condition, in keeping with the conservation uses of the area.

The County designates the site Conservation in the General Plan Land Use Pattern Allocation Guide Map (LUPAG), and the action would be considered consistent with the LUPAG.

### 3.6.4 Kona Community Development Plan

The Kona Community Development Plan (CDP) encompasses the judicial district of North and South Kona, and was developed under the framework of the February 2005 County of Hawai‘i General Plan. Community Development Plans are intended to translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County. CDPs are also intended to serve as a forum for community input into land-use, delivery of government services and any other matters relating to the planning area.

The General Plan now requires that a Community Development Plan shall be adopted by the County Council as an "ordinance," giving the CDP the force of law. This is in contrast to plans created over past years, adopted by "resolution" that served only as guidelines or reference documents to decision-makers. The Kona CDP was adopted in September 2008 by the County Council. The version referenced in this Environmental Assessment is at: http://www.hawaiicountycdp.info/north-and-south-kona-cdp. The purposes of the Kona CDP are to:

- Articulate Kona's residents' vision for the planning area.
- Guide regional development in accordance with that vision, accommodating future growth while preserving valued assets.
- Provide a feasible infrastructure financing plan to improve existing deficiencies and proactively support the needs of future growth.
- Direct growth in appropriate areas.
- Create a plan of action where government and the people work in partnership to improve the quality of life in Kona to live, work, and visit.
- Provide a framework to monitor the progress and effectiveness of the plan and to make changes and update, if necessary.

The draft CDP states that:

> "Outside of the Urban Area, the character of the rural areas should prevail. This means that limited future growth should be directed to the existing rural towns and villages in a way that revitalizes and enhances the existing rural lifestyle and culture of those communities. Outside of these towns and villages, the protection of important agricultural land is a priority objective. Protecting these lands requires regulations and incentives that will keep these lands available for agricultural use. Any development outside of the rural towns and villages should be directed to suitable areas that are not important for agriculture, in clustered patterns that will optimize the preservation of rural open space."

The proposed project does not affect the rural character of the area and conducts a necessary safety operation for the benefit of the general public. It would not affect viewplanes, agricultural uses, or open space, and would not affect the rural ambience of this part of Kona.

The proposed project is consistent with all aspects of the Kona CDP. It is in keeping with the plan's guiding principles in Chapter 3, including particularly item No. 1:

*Protect Kona's natural resources and culture.*

It also conforms with item No. 7:

*Encourage a diverse and vibrant economy emphasizing agriculture and sustainable economies.*

The project is also consistent with aspects of the economic development strategy expressed in Section 4.8, particularly in its support of initiatives such as:

*Ecosystem Services. The concept of ecosystem services attempts to make conservation a viable business option. The policies encourage the further exploration and development of this concept.*

The Kona CDP also notes that critical habitat designated by the U.S. Fish and Wildlife Service (see Section 3.1.3, which discusses the presence of critical habitat over large areas of Pu‘uwa‘awa‘a) is a sensitive resource, per Policy ENV-1.5. Critical habitat is a tool for recovery of endangered species on projects or land with a federal nexus. The project would benefit rather than adversely affect endangered species, and no aspect of the project is in conflict with the recovery of endangered species at Pu‘uwa‘awa‘a.

### 3.6.5 Local Pu‘uwa‘awa‘a Plans: Pu‘u Wa‘awa‘a Management Plan and U.S. Forest Service Experimental Tropical Forest

*"Management Plan for the Ahupua‘a of Pu‘u Wa‘awa‘a and the Makai Lands of Pu‘u Anahulu"*

On January 25, 2002 the Board of Land and Natural Resources transferred responsibility for State managed lands within the *ahupua‘a* of Pu‘uwa‘awa‘a and Pu‘uanahulu from the Land Division to the Divisions of Forestry and Wildlife (DOFAW) and State Parks. Subsequently, DOFAW and State Parks worked with the Pu‘uwa‘awa‘a Advisory Council to develop a management plan for Pu‘uwa‘awa‘a and the lands of Pu‘uanahulu *makai* of Queen Ka‘ahumanu Highway – an area comprising approximately 40,711 acres. The plans states that these lands represent a remarkable diversity of historical, natural, cultural and recreational resources: archaeological and cultural sites, a rich history of ancient and contemporary human use, historic coastal trails, an undeveloped coastline environment (approximately 8.5 miles long), good swimming beaches, anchialine ponds, uncommon ecosystems that are highly unique in their species composition, livestock grazing and hunting.

DOFAW initiatives led to the establishment and official designation of the Pu‘uwa‘awa‘a Forest Bird Sanctuary. The plan also aspired to emulate the traditional concept of *ahupua‘a* management in a contemporary context. This plan presented 62 unique objectives that were intended to support the complex array of resource management needs and community interests that applied. These set the framework for management of this area for a 10-year period beginning in July 2003. According to recent evaluations by DOFAW, 26 of the objectives, which had a budget of over $26 million, were achieved within the 10-year period, and some of the remaining 34 objectives are no longer relevant due

to various changes. The plan recognized the need to actively seek additional resources through grants, cooperative agreements and partnerships. DLNR and Pu‘u wa‘awa‘a Advisory Council continue to seek to implement the plan.

The following discussion of the consistency of the proposed project with the objectives of the *Management Plan for the Ahupua‘a of Pu‘uwa‘awa‘a and the Makai Lands of Pu‘uanahulu* is restricted to those applicable in some way to the proposed project.

**Objective 6. Reduce fire hazard at Pu‘u Wa‘awa‘a using prevention measures.**

The project will include best management practices to reduce fire hazard during construction. The project does not reduce the amount of water available for fire-fighting through helicopter dips, as the abandoned reservoir is not capable of holding water.

**Objective 12. Protect isolated occurrences of rare and endangered species**
**Objective 16: Preserve and protect unique native invertebrate populations at Pu‘u Wa‘awa‘a and the makai lands of Pu‘u Anahulu.**
**Objective 17: Protect and enhance native bird populations and their habitat**

The proposed project is within a general area of valuable native species and habitat, but the project site does not contain rare, threatened or endangered species. Ultimately, the project would allow the area to regenerate with native forest and have a beneficial effect on habitat. No adverse impact on native species will occur.

**Objective 42. Survey and develop historic trails within and adjacent to the ahupua‘a for public use**

The proposed project does not make use of a historic trail or any other historic property and does not affect public access in any way.

**Objective 48. Conduct a comprehensive cultural and archaeological survey of Pu‘u Wa‘awa‘a and the makai portion of Pu‘u Anahulu**
**Objective 49. Protect and Restore Cultural Sites**

The EA included an archeological survey of the affected area, which determined that archaeological resources were not present. Consultation as part of the archaeological survey and EA consultation process indicated that the area does not have cultural resources or support cultural practices that could be adversely affected by the proposed project.

*"Puu Waawaa Dry Forest Unit of the U.S. Forest Service Hawaii Experimental Tropical Forest"*[2]

The Hawaii Experimental Tropical Forest (HETF) was established in 2007 and includes two Units: the Laupahoehoe Wet Forest, totaling 12,343 acres, and the Puu Waawaa Dry Forest, totaling 38,885 acres. The HETF is part of a network of USFS Experimental Forest and Range units across the United States (http://www.hetf.us/page/puu_waa_waa/).

The HETF overlays existing State of Hawai'i, Department of Land and Natural Resources (DLNR) managed lands at Pu'uwa'awa'a. The USDA Forest Service (USFS), Pacific Southwest Research Station in Hilo, Institute of Pacific Islands Forestry (IPIF), works with DLNR-DOFAW and State Parks to cooperatively manage research and education activities within the HETF. The mission is to provide landscapes, facilities, and data/information to support research and education activities contributing to a better understanding of how to conserve and manage the biological diversity and functioning of tropical forest and stream ecosystems as well as to understand the human dimensions of natural resources conservation and management. The Puu Waawaa Unit is significant because it represents a tropical dry forest, one of the most endangered forest types in the world. In Hawai'i, the few remnants are severely threatened by wildfire, invasive species, and land cover changes. This unit is also unique in that it is the only tropical dry forest experiment station in the U.S., and one of few across the world, even though they are the most widespread of tropical ecosystems.

The unit contains both highly degraded as well as intact forests in an elevational gradient that supports all the major dry and mesic forest types in Hawai'i. Biological research in this forest found a great diversity of plants, land snails, arthropods, and birds, both native and non-native. Seventeen species of endangered plants are present, along with eleven endangered bird species and one insect. Botanical surveys reveal that a great number of plants have been extirpated at Pu'uwa'awa'a in recent years. Since the establishment of the HETF in 2007, plans have been underway to construct education and science facilities at both the Laupahoehoe and Puu Waawaa Units of the HETF.

The proposed project is within a general area of valuable native species and habitat, but the project site does not contain rare, threatened or endangered species. Ultimately, the project would allow the area to regenerate with native forest and have a beneficial effect on habitat. No adverse impact on native species or the Puu Waawaa Unit of the HETF should occur.

## PART 4: DETERMINATION

The Hawai'i State Department of Land and Natural Resources expects to determine that the proposed project will not significantly alter the environment, as impacts will be minimal, and intends to issue a Finding of No Significant Impact (FONSI). This determination will be reviewed based on comments to the Draft EA, and the Final EA will present the final determination.

[2] [Note: *'okina* are excluded in the spelling of names in this discussion of the U.S. Forest Service actions, in keeping with the official USDA names].

## PART 5: FINDINGS AND REASONS

Chapter 11-200-12, Hawai‘i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

1. *The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.* No valuable natural or cultural resources would be committed or lost, and the project would ultimately help restore native habitat.
2. *The proposed project will not curtail the range of beneficial uses of the environment.* The proposed project expands and in no way curtails beneficial uses of the environment.
3. *The proposed project will not conflict with the State's long-term environmental policies*. The State’s long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The project has a goal of partially restoring a geological feature that was altered and allowing a native forest to be restored to the site. It has been designed to avoid environmental impacts and fulfills aspects of these policies calling for protecting the natural environment. It is thus consistent with all elements of the State’s long-term environmental policies.
4. *The proposed project will not substantially affect the economic or social welfare of the community or State.* The project will benefit the economic and social welfare of the community by enhancing public safety.
5. *The proposed project does not substantially affect public health in any detrimental way.* The proposed project will benefit public health by improving public safety of a government facility.
6. *The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities*. No adverse secondary effects are expected to result from the proposed project. The project will not enable development or cause in-migration, or lead to any other secondary impacts.
7. *The proposed project will not involve a substantial degradation of environmental quality*. The project will not degrade the environment in any substantial way.
8. *The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.* The area has been inspected by biologists from DOFAW and no endangered species of flora is present in the actual area to be affected. Mitigation measures related to timing of vegetation removal and precautionary surveys prior to construction, if warranted by the season of construction, will prevent adverse impacts to wide-ranging endangered vertebrates, nearby endangered plant species, and the general ecosystem.
9. *The proposed project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions.* With simple mitigation involving schedule coordination, the project would not produce adverse cumulative effects. The project does not involve a commitment for larger actions.
10. *The proposed project will not detrimentally affect air or water quality or ambient noise levels.* No adverse effects on these resources would occur. No water quality or significant air quality impacts would occur. There are no sensitive human receptors to noise in the area, and wildlife will be able to relocate from the area if affected and return once the disturbance is over.
11. *The project does not affect nor would it likely to be damaged as a result of being located in environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area,*

*geologically hazardous land, estuary, fresh water, or coastal area.* Although the project is located in an area with seismic risk, the entire Island of Hawai‘i shares this risk, and the project would not be imprudent to implement and would employ design and construction standards appropriate to the seismic zone. All work will conform to current County of Hawai‘i grading rules, regulations, and codes, which help ensure the stability of working and finished slopes. Contractors performing the work will be made aware of the rockfall areas and take precautions to ensure a safe work environment. The final landform is being engineered to result in a landform that is not prone to mass wasting. Moreover, undertaking the decommissioning project will eliminate the potential for catastrophic dam failure and resulting mass wasting.

12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* No scenic vistas or viewplanes identified in the Hawai‘i County General Plan will be adversely affected by the project. Long-term, the scenic character of the area will improve with restoration of a more natural topography and vegetation.
13. *The project will not require substantial energy consumption*. The project involves only minor energy use and no adverse effects are expected.

For the reasons above, the proposed project is not expected to have any significant effect in the context of Chapter 343, Hawai‘i Revised Statues and section 11-200-12 of the State Administrative Rules.

**REFERENCES**


Clark, J. 1987. *Waimea-Kawaihae, a Leeward Hawaii Settlement Pattern*. Unpublished Ph.D. dissertation, Department of Anthropology, University of Illinois at Urbana-Champaign.

Cuddihy L.W. and C.P. Stone. 1990. *Alteration of Native Hawaiian Vegetation*. Cooperative National Park Resources Studies Unit, University of Hawai‘i, Honolulu.

Ellis, W. 1963. *Journal of William Ellis, a Narrative of an 1823 Tour Through Hawai‘i*. Honolulu: Mutual Publishing.

Fornander, W. 1916-1919. *Fornander Collection of Hawaiian Antiquities and Folklore*. (9 vols.) Honolulu: Bishop Museum Press.

Gagne, W. and L. Cuddihy. 1990. “Vegetation,” pp. 45-114 in W.L. Wagner, D.R. Herbst, and S.H. Sohmer, eds., *Manual of the Flowering Plants of Hawai‘i.* 2 vols. Honolulu: University of Hawai‘i Press.

Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte, 2013. Online Rainfall Atlas of Hawai‘i. *Bull. Amer. Meteor. Soc.*, doi: 10.1175/BAMS-D-11-00228.1.

Hawai‘i County Planning Department. 2005. The General Plan, County of Hawai‘i. Hilo. http://www.hawaii-county.com/la/gp/toc.html.

Hawai‘i State Department of Health, Clean Air Branch (DOH-CWB). 2015. *State of Hawaii, Annual Summary 2014 Air Quality Data.* http://health.hawaii.gov/cab/files/2015/09/aqbook_2014.pdf accessed November 2015.

Hawaii Wildfire Management Organization (HWMO). 2007. *Community Wildfire Protection Plan for Northwest Hawaii Island.* With support from the Fire Management Program of Hawaii State Department of Land and Natural Resources, Division of Forestry and Wildlife.

Heliker, C. 1990. *Volcanic and Seismic Hazards on the Island of Hawai‘i.* Washington: U.S. GPO.

Giffin, J. 2003. *Pu‘u Wa‘awa‘a Biological Assessment*. State of Hawai‘i, Department of Land and Natural Resources, Division of Forestry and Wildlife.

Hawai‘i County Planning Department. 2005. *The General Plan, County of Hawai‘i*. Hilo.

Hawai‘i State Division of Forestry and Wildlife (DOFAW). 2003. *Management Plan for the Ahupua‘a of Pu‘u Wa‘awa‘a and the Makai Lands of Pu‘u Anahulu*. Honolulu: DOFAW.

_____. 2016 (in prep.). *Nāpu‘u Conservation Project: Draft habitat conservation plan for game management at Pu‘u Wa‘awa‘a and Pu‘u Anahulu.* Honolulu.

Juvik, J.O. and L.K. Tango. 2003. *Climate and Water Resources, Pu‘u Wa‘awa‘a*. Rept. prep. for Hawai‘i DLNR and U.S. Fish and Wildlife Service.

Kamakau, S. 1961. *Ruling Chiefs of Hawai‘i*. Honolulu: The Kamehameha Schools Press.

Kirch, P.V. 2012. *A Shark Going Inland Is My Chief: The Island Civilization of Ancient Hawai‘i*. Berkeley, CA.: University of California Press.

Klavitter, J.L. 2000. *Survey methodology, abundance, and demography of the endangered Hawaiian Hawk: Is de-listing Warranted?* Unpublished Master of Science Thesis. University of Washington.

Koebele, A. 1900. “Report of Prof. Koebele on Destruction of Forest Trees, Hawaii.” pp. 50-60 in Report of Commissioner of Agriculture and Forestry, Territory of Hawai‘i. Honolulu.

Lepson, J.K. and L.A. Freed. 1997. “ ‘Ākepa (Loxops coccineus)”. *in*: Scott, J. M, S. Conant, and C. Van Riper III (editors) *Evolution, Ecology, Conservation, and Management of Hawaiian Birds: A Vanishing Avifauna.* Studies in Avian Biology No. 22: Cooper’s Ornithological Society, Allen Press, Lawrence, Kansas.

Lewin. V. 1971. “Exotic Game Birds of the Puu Waawaa Ranch, Hawaii.” J*ournal of Wildlife Management* 35(1);141-155.

Maly, K. and O. Maly. 2006. *He Mahi Moʻolelo No Puʻuwaʻawaʻa Me Nāpuʻu O Na Kona-A Collection of Cultural and Historical Accounts of Puʻuwaʻawaʻa and the Napuʻu Region-District of Kona on the Island of Hawaiʻi*. Kumu Pono Associates LLC. HIHTEF116-Puʻuwaʻawaʻa (123006a). Prep. for the Institute of Pacific Islands Forestry USDA Forest Service, Hilo, Hawaiʻi.

Montgomery, S. 1975. "Comparative Breeding Site Ecology and the Adaptive Radiation of Picture-Winged Drosophila in Hawaii." *Proceedings, Hawaiian Entomological Society* 22(1):65-103.

Munro, G.C. 1944. *Birds of Hawaii.* Tong Publishing Co., Honolulu.

Perkins, R.C.L. 1903. "Vertebrata." pp: 365-466 *In:* D. Sharp (ed.). *Fauna Hawaiiensis.* Vol. 1, Part IV. Cambridge, England: The University Press.

Pukui, M., S. Elbert and E. Moʻokini. 1974. *Place Names of Hawaii*. *Revised and Expanded Edition*. Honolulu: University of Hawaiʻi Press, Honolulu.

Rock, J. 1913. *Indigenous Trees of the Hawaiian Islands*. Published under patronage, Honolulu, Territory of Hawaiʻi.

Scott, J.M., S. Mountainspring, F.L. Ramsey, and C.B. Kepler. 1986. *Forest Bird Communities of the Hawaiian Islands: Their Dynamics, Ecology, and Conservation.* Studies in Avian Biology No. 9. Cooper Ornithological Society. Lawrence, Kansas: Allen Press.

U.S. Fish and Wildlife Service (USFWS). 1993. *Long-term Management Plan for the ʻAlala.* U.S. Fish and Wildlife Service unpublished report.

_____. 1999. *Draft Environmental Assessment: Population Reestablishment of the ʻAlala (Corvus hawaiiensis).* U.S. Fish and Wildlife Service Hawaii Department of Land and Pacific Islands Fish and Wildlife Office Natural Resources, Pacific Islands Ecoregion, Division of Forestry and Wildlife. Honolulu.

_____. 2000. *Threatened and endangered plants in Hawaiʻi.* Washington: GPO

_____. 2003a. *Final Rule: Final Designations and Nondesignation of Critical Habitat for* 46 Plant Species from the Island of Hawaiʻi, HI. 68 FR 39624.

_____. 2003b. *Draft Revised Recovery Plan for Hawaiian Forest Birds*. Portland, Oregon.

_____. 2003c. *Draft Revised Recovery Plan for the ʻAlala (Corvus hawaiiensis).* Portland, Oregon.

_____. 2006. *Revised Recovery Plan for Hawaiian Forest Birds.* U.S. Fish and Wildlife Service, Portland, Oregon.

_____. 2016. USFWS Threatened and Endangered Species System (TESS). Washington: GPO. http://ecos.fws.gov/tess_public/.

U.S. Fish and Wildlife Service and U.S. Bureau of the Census (UWFWS-USCB). 2006. *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (http://www.census.gov/prod/2008pubs/fhw06-hi.pdf) accessed January 16, 2013.

U.S. Geological Survey (USGS). 2000. *Seismic Hazard Maps for Hawaii*. By F.W. Klein, A.D. Frankel, C.S. Mueller, R.L. Wesson and P.G. Okubo.

U.S. Soil Conservation Service. 1973. *Soil Survey of Island of Hawai‘i, State of Hawai‘i.* Washington: U.S.D.A. Soil Conservation Service.

University of Hawai‘i at Hilo, Dept. of Geography. 1998. *Atlas of Hawai‘i.* 3rd ed. Honolulu: University of Hawai‘i Press.

Wilkes, C. 1845. *Narrative of the United States Exploring Expedition During the Years 1838–1842, Under the Command of C. Wilkes, U.S.N.*, Volume 4. Philadelphia: Lea and Blanchard.

Wolfe, E.W. and J. Morris. 1996. *Geologic Map of the Island of Hawai‘i.* USGS Misc. Investigations Series Map i-2524-A. Washington, D.C.: U.S. Geological Survey.

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# ENVIRONMENTAL ASSESSMENT

# Decommissioning of DLNR Poohohoo Reservoir No. 2

**APPENDIX 1a**
**Comments in Response to Early Consultation**

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**William P. Kenoi**
*Mayor*

**Harry S. Kubojiri**
*Police Chief*

**Paul K. Ferreira**
*Deputy Police Chief*

# County of Hawai`i

**POLICE DEPARTMENT**
349 Kapi'olani Street • Hilo, Hawai'i 96720-3998
(808) 935-3311 • Fax (808) 961-2389

June 29, 2015

Mr. Ron Terry, Principal
Geometrician Associates LLC
P.O. Box 396
Hilo, HI 96721

SUBJECT: EARLY CONSULTATION FOR ENVIRONMENTAL ASSESSMENT, PROPOSED DECOMMISSIONING OF PORTION OF DLNR POOHOHOO RESERVOIR NO. 2, TMK (3) 7-4-001:006, NORTH KONA DISTRICT, ISLAND OF HAWAI'I

Dear Mr. Terry:

This is in response to your letter dated June 11, 2015, regarding a request for comments on this early consultation on an environmental assessment in reference to the proposed decommissioning of the Poohohoo Reservoir No. 2 in the North Kona District.

Thank you for allowing the Hawai'i Police Department to make comments regarding this proposed decommissioning of this reservoir. At this time, the Hawai'i Police Department has no comments.

Should you have any questions or concerns, please contact Captain Randal M. Ishii, Commander of the Kona District, 326-4646, extension 299.

Sincerely,

HARRY S. KUBOJIRI
POLICE CHIEF

RMI/jaj
RS150409

**William P. Kenoi**
*Mayor*

**Darren J. Rosario**
*Fire Chief*

**Renwick J. Victorino**
*Deputy Fire Chief*

# County of Hawai'i
## HAWAI'I FIRE DEPARTMENT
**25 Aupuni Street • Suite 2501 • Hilo, Hawai'i 96720**
**(808) 932-2900 • Fax (808) 932-2928**

July 2, 2015

Mr. Ron Terry
Geometrician Associates
PO Box 396
Hilo, HI 96721

Dear Mr. Terry,

| | |
|---|---|
| SUBJECT: | Early Consultation for Environmental Assessment<br>Proposed Decommissioning of Portion of DLNR<br>Poopoo Reservoir No. 2 |
| TMK: | (3) 7-4-001:006<br>North Kona District, Island of Hawai'i |

The Hawai'i Fire Department does not have any comments to offer at this time regarding the above-referenced early consultation on Environmental Assessment.

Thank you for the opportunity to comment. A copy or Notice of Availability of Environmental Assessment is not needed when completed.

Sincerely,

DARREN J. ROSARIO
Fire Chief

KV:nac

*Hawai'i County is an Equal Opportunity Provider and Employer.*

William P. Kenoi
*Mayor*

Duane Kanuha
*Director*

Bobby Command
*Deputy Director*

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
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**County of Hawai'i**
**PLANNING DEPARTMENT**

East Hawai'i Office
101 Pauahi Street, Suite 3
Hilo, Hawai'i 96720
Phone (808) 961-8288
Fax (808) 961-8742

July 16, 2015

Mr. Ron Terry
Geometrician Associates
P.O. Box 396
Hilo, HI 96721

Dear Mr. Terry:

**SUBJECT: Pre-Consultation on Draft Environmental Assessment**
**Applicant: Department of Land and Natural Resources (DLNR)**
**Project: Decommission of Portion of DLNR Poohohoo Reservoir No. 2**
**Tax Map Key: (3) 7-1-001:006, Pu'uwa'awa'a (Mauka) N. Kona, Hawai'i**

This is to acknowledge receipt of your June 11, 2015 letter requesting comments from this office regarding the preparation of a Draft Environmental Assessment (DEA) for the subject project. By email dated July 15, 2015, you noted that the tax map key number of 7-4-001:006 was incorrect and should have been 7-1-001:006.

The DLNR is proposing to decommission a portion of the abandoned earthen Poohohoo Reservoir No. 2. After the liner was damaged by winds, the reservoir has not held water. As it is not planned for future use, it will be decommissioned by removing the remnants of the damaged liner and excavating and breaching the embankments that were built when the reservoir was original constructed.

The subject 13,046.1 acre parcel is designated Agricultural and Conservation by the State Land Use Commission and zoned Agricultural (A-20a) by the County. In addition, the Hawai'i County General Plan Land Use Pattern Allocation Guide (LUPAG) Map designates the parcel as Extensive Agriculture and Conservation. It is not located in the Special Management Area (SMA).

In the DEA, please describe how the proposed activity is consistent with the policies, standards, and courses of action of the County of Hawai'i General Plan. Further, as the project site is located in the Kona Community Development Plan (CDP) planning area, consistency of the project with their goals, objectives, policies and actions must also be discussed.

Thank you for the opportunity to provide preliminary comments on the proposed project. Please provide our department with a copy of the DEA for our review and comment.

If you have questions, please feel free to contact Esther Imamura of our office at 961-8139.

Sincerely,

DUANE KANUHA
Planning Director

ETI:cs
P:\Wpwin60\ETI\Eadraftpre-Consul\Terry Poohohoo Rev TMK 7-1-001-006.Rtf

cc: Planning Department - Kona

# ENVIRONMENTAL ASSESSMENT

# Decommissioning of DLNR Poohohoo Reservoir No. 2

**APPENDIX 2**
**Archaeological Assessment**

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# An Archaeological Assessment of a Portion of Po‘ohoho‘o Reservoir

TMK: (3) 7-1-001:006 (por.)

Pu‘uwa‘awa‘a Ahupua‘a
North Kona District
Island of Hawai‘i

DRAFT VERSION

*Prepared By:*

Teresa Gotay, M.A.
and
Robert B. Rechtman, Ph.D.


*Prepared For:*

Ron Terry
Geometrician Associates, LLC
P.O. Box 396
Hilo, HI 96721

December 2015


ASM Project Number 24480.00



ASM affiliates
Archaeology • History • Ethnography • Architectural History
Office: (808) 969-6066 • Fax: (808) 443-0065

# An Archaeological Assessment of a Portion of Poʻohohoʻo Reservoir

TMK: (3) 7-1-001:006 (por.)

Puʻuwaʻawaʻa Ahupuaʻa
North Kona District
Island of Hawaiʻi

ASM affiliates

# EXECUTIVE SUMMARY

At the request of Ron Terry of Geometrician Associates, LLC., ASM Affiliates conducted an archaeological study of a roughly 6 acre portion of land that includes a section of the Poʻohohoʻo Reservoir located within state land (TMK: (3) 7-1-001:006 [por.]) in Puʻuwaʻawaʻa Ahupuaʻa, North Kona District, Island of Hawaiʻi. The state of Hawaiʻi intends to decommission a portion of the existing reservoir complex by breaching the man-made berm that retains water. This action on state land requires the production of an Environmental Assessment (EA) in compliance with HRS Chapter 343, thus necessitating the current study as a support document to the EA. The current study was undertaken in accordance with Hawaiʻi Administrative Rules 13§13–275, and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawaiʻi Administrative Rules 13§13–276. According to 13§13-275-5(b)(5)(A) when no archaeological resources are discovered during an archaeological survey the production of an Archaeological Assessment report is appropriate. Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawaiʻi Planning Department. Fieldwork for the current study was conducted on May 27, 2015 by Robert B. Rechtman, Ph.D. and Matthew R. Clark B.A. The archaeological surface survey involved a 100% surface inspection of the study area. Ground surface visibility was fair to excellent. As a result of the field survey, there were no archaeological features observed on the surface and given the nature of the substrate, there is virtually no likelihood of encountering subsurface remains. Given the negative findings, it is concluded that the proposed reservoir decommissioning project will not significantly impact any known historic properties. In the unlikely event that any unanticipated archaeological resources are unearthed during development activities, in compliance with HAR 13§13-280 work in the immediate vicinity of the finds should be halted and DLNR-SHPD contacted.

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# 1. INTRODUCTION

At the request of Ron Terry of Geometrician Associates, LLC., ASM Affiliates conducted an archaeological study of a roughly 6 acre portion of land that includes a section of the Poʻohohoʻo Reservoir located within state land (TMK: (3) 7-1-001:006 [por.]) in Puʻuwaʻawaʻa Ahupuaʻa, North Kona District, Island of Hawaiʻi (Figures 1, 2 and 3). The state of Hawaiʻi intends to decommission a portion of the existing reservoir complex by breaching the man-made berm that retains water. This action on state land requires the production of an Environmental Assessment (EA) in compliance with HRS Chapter 343, thus necessitating the current study as a support document to the EA.

The current study was undertaken in accordance with Hawaiʻi Administrative Rules 13§13–275, and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawaiʻi Administrative Rules 13§13–276. According to 13§13-275-5(b)(5)(A) when no archaeological resources are discovered during an archaeological survey the production of an Archaeological Assessment report is appropriate. Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawaiʻi Planning Department.

This report provides a study area description, a detailed culture-historical background, a discussion of prior archaeological studies within the vicinity of the current study area, and the results of the field investigation of the current study area.

## STUDY AREA DESCRIPTION

The current study area measures approximately 6 acres and includes an ovoid-shaped, extant section of the Poʻohohoʻo Reservoir, which covers roughly 2.7 acres, the built environment (man-made berm) that surrounds it, and a construction staging area on the *makai* side of the berm (see Figure 3). The study area is comprised of land managed by the State of Hawaiʻi Division of Forestry and Wildlife. Juvik and Tango (2003) recorded the portion of the Poʻohohoʻo Reservoir within the current study area as "Area 2" (Figure 4) in their report on climate and water resources in Puʻuwaʻawaʻa They described it as follows:

> Area 2: Partially lined (20%), degraded butyl-rubber reservoir: mean perimeter diameter 350 ft.; maximum depth 40 ft.; approximate potential storage capacity 10 – 12 million gallons. (Juvik and Tango 2003:42)

The current study area is a portion of a modified spatter or scoria cone (Geologic Map Unit hc1y; Figure 5) known as Poʻohohoʻo, which formed during an eruption of Hualalai Volcano between 3,000 and 5, 000 years ago. Poʻohohoʻo is surrounded by a concomitant lava flow (Map Unit h1y; see Figure 5) and a more recent lava flow (Map Unit h2) that occurred 1,500 to 3,000 years ago (Wolfe and Morris 1996). The study area is located within *pāhoehoe* shrubland (Figures 6-8) at elevations ranging from about 3,785 to 3,900 feet above sea level. Soil within the majority of the study area is classified as Nawahine gravelly medial silt loam; a well-drained soil that formed from volcanic ash, layered over cinders at a depth of about 20 centimeters below ground surface. The northwestern portion of the study area consists of *pāhoehoe* lava flows classified as part of the Puuiki-Lava flows complex, which may exhibit a thin (2 to 5 inch) layer of very cobbly decomposed plant material over bedrock. Precipitation recorded at the Puʻuwaʻawaʻa Weather Station located at an elevation of 2,326 feet has recorded an annual average rainfall of 28 inches. Vegetation within the current study area includes an understory of various grasses and weeds, and a secondary growth layer of primarily *koa* (*Acacia koa*) and *ʻōhiʻa lehua* (*Metrosideros polymorpha*) (Figure 9), the majority of which are growing through the butyl-rubber material that lines the base of the defunct reservoir. The subject reservoir had a minimal amount of standing water collected within it (Figure 10).

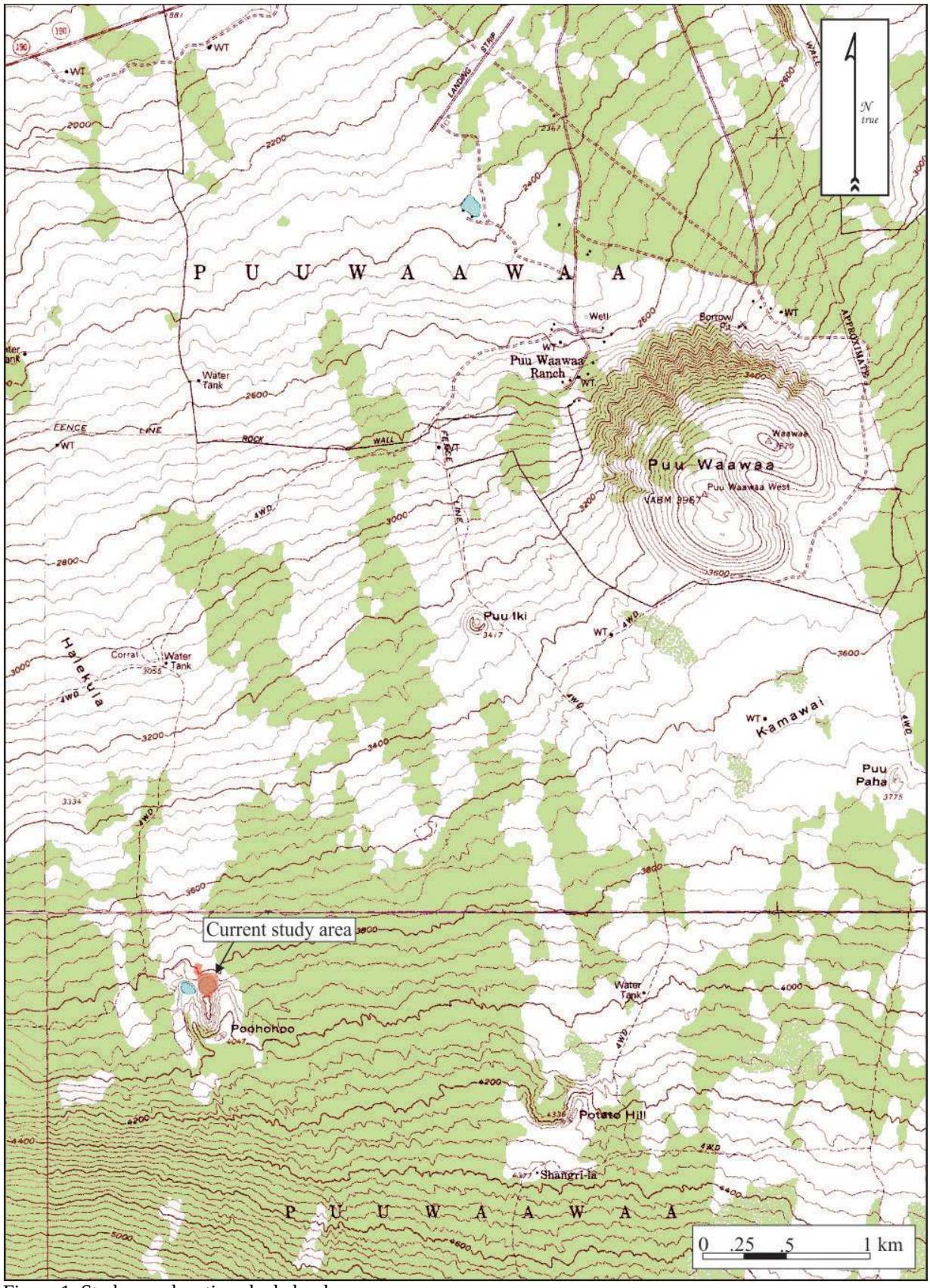


Figure 1. Study area location shaded red.

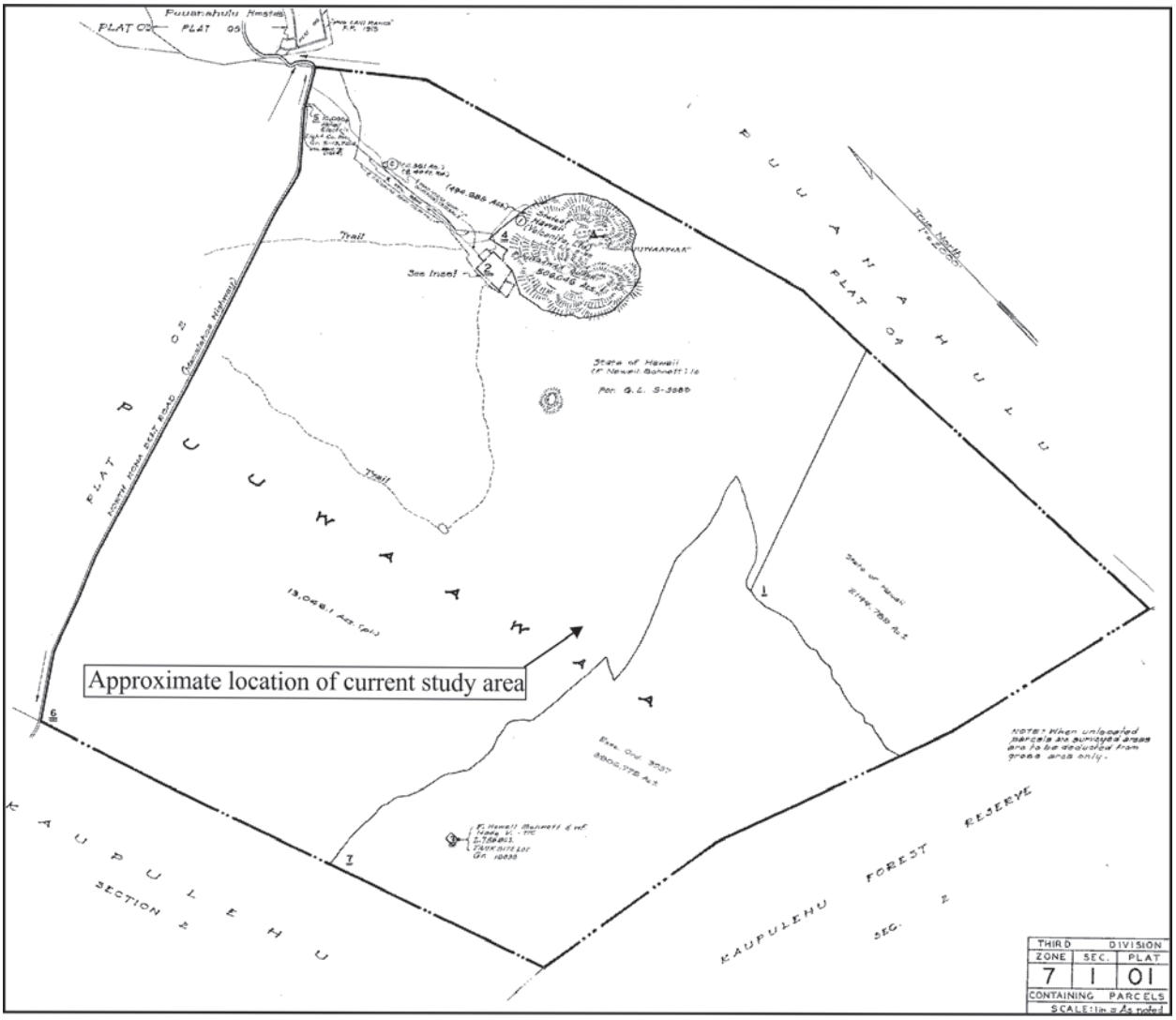


Figure 2. Tax Map Key (3) 7-1-001 showing the approximate location of the current study area within Parcel 006.

Figure 3. 2013 Google Earth™ image showing the current study area outlined in red with approximate reservoir diameter outlined in yellow.

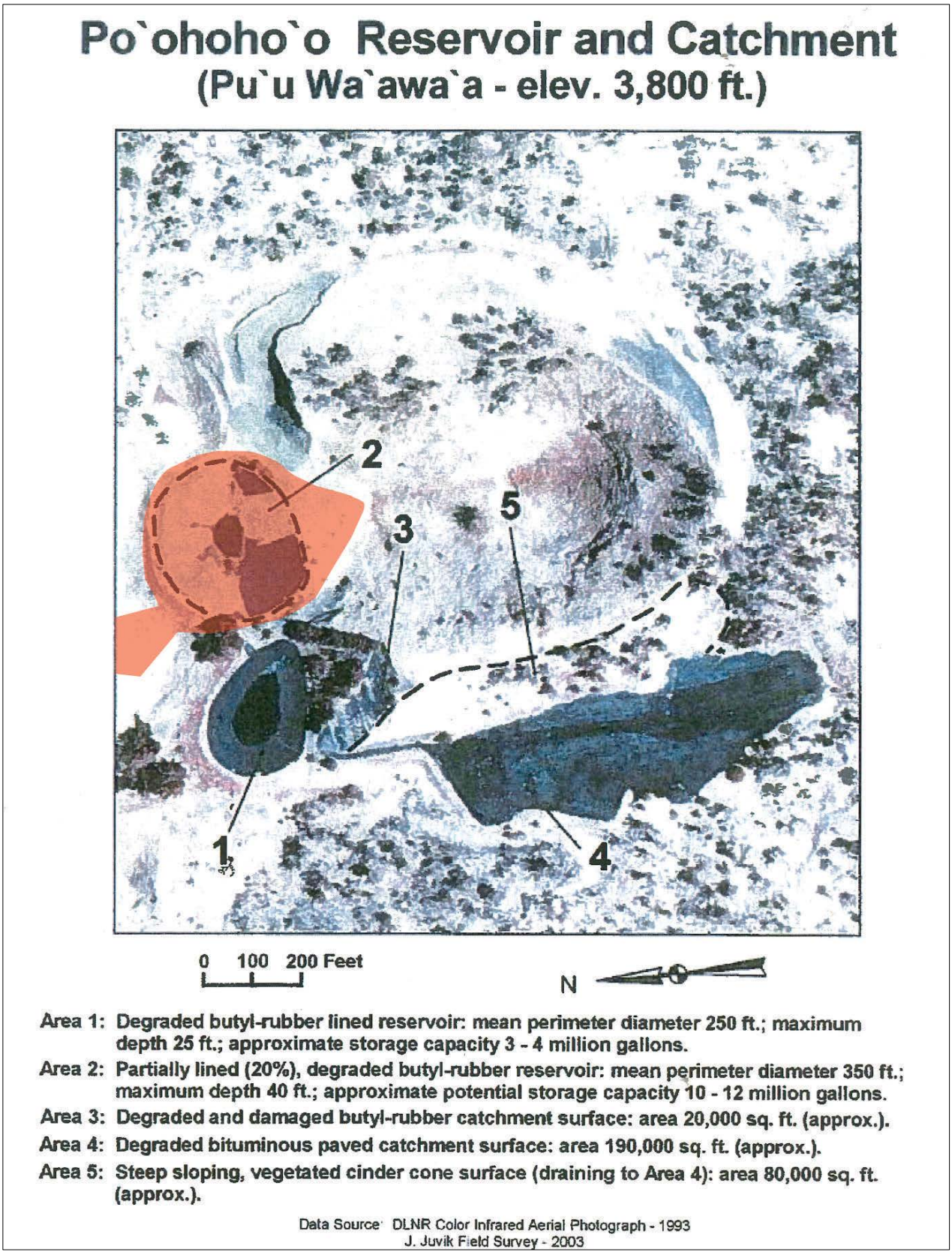


Figure 4. Poʻohohoʻo infrastructure figure from Juvik and Tango (2003:42) with current study area shaded red.

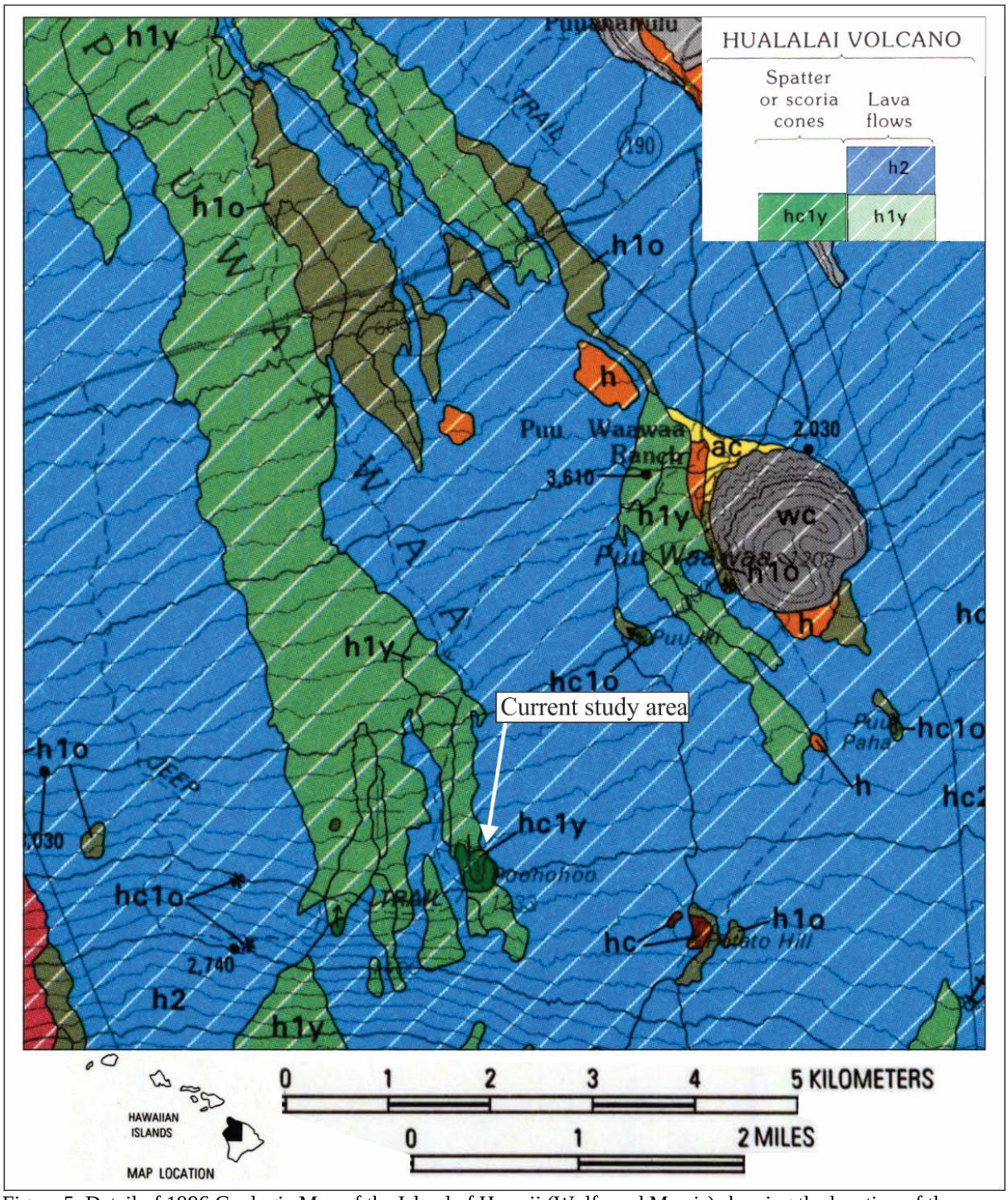


Figure 5. Detail of 1996 Geologic Map of the Island of Hawaii (Wolfe and Morris) showing the location of the current study area.

Figure 6. North berm of reservoir, view to the southeast.

Figure 7. Proposed construction staging area in pasture on uphill side of dirt road, view to the southeast.

Figure 8. Study area, view to the southeast.

Figure 9. Berm along western edge of reservoir, view to the north.

Figure 10. Interior of reservoir showing small amount of collected water, view to the southwest.

# 2. BACKGROUND

This section of the report includes a discussion of the culture-historical background for the region in addition to a synthesis of prior archaeological and historical research relevant to the current study area. This information is provided in order to generate a set of expectations regarding the nature of cultural resources that might be encountered within the study area, and to establish a basis for the assessment of the significance of any such resources.

## CULTURE-HISTORICAL CONTEXT

### Environment and Settlement Patterns in the Vicinity of the Current Study Area

The generalized cultural sequence that follows is based on Kirch's (1985) model, and amended to include recent revisions offered by Kirch (2011) and Athens et al. (2014). The conventional wisdom has been that first inhabitants of Hawai'i Island probably arrived by at least A.D. 300, and focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Kirch 1985; Hommon 1986). However, there is no archaeological evidence for occupation of Hawai'i Island (or perhaps anywhere in Hawai'i) during this initial settlement, or colonization stage of island occupation (A.D. 300 to 600). More recently, Kirch (2011) and Athens et al. (2014) have convincingly argued that Polynesians may not have arrived to the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the currently accepted chronology would alter the timing of the Settlement, Developmental, and Expansion Periods, possibly shifting the Settlement Period to A.D. 1000 to 1100, the Developmental Period to A.D. 1100 to 1350, and the Expansion Period to A.D. 1350 to 1650.

The initial settlement in Hawai'i is believed to have occurred from the southern Marquesas Islands. This was a period of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods Kāne, Kū, and Lono; the *kapu* system of law and order; cities of refuge; the *'aumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. Initial permanent settlements in the islands were established at sheltered bays with access to fresh water and

marine resources. Communities shared extended familial relations and there was an occupational focus on the collection of marine resources. Over a period of several centuries the areas with the richest natural resources became populated and perhaps even crowded, and there was an increasing separation of the chiefly class from the common people. As the environment reached its maximum carrying capacity, the result was social stress, hostility, and war between neighboring groups (Kirch 1985). Soon, large areas of Hawai‘i were controlled by a few powerful chiefs.

The Developmental Period brought about a uniquely Hawaiian culture. The portable artifacts found in archaeological sites of this period reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*ko‘i*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. A few areas in Hawai‘i produced quality basalt for adze production. Mauna Kea, on the island of Hawai‘i, possessed a well-known adze quarry. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *‘ulu maika* stones and *lei niho palaoa*. The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985).

The Expansion Period is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period as did efforts to increase upland agriculture. Rosendahl (1972) has proposed that settlement at this time was related to seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites were occupied during the winter months, with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well, according to Hommon (1976). Hommon argues that kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua‘a* system. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to permanent dispersed occupation of both coastal and upland areas.

By this time the Island of Hawai‘i appears to have been divided into six traditional districts or *moku* (Cordy 2000). The current study area falls within the northern region of the traditional *moku* of Kona, in what is today known as North Kona, on the dry leeward side of the island. Kona extends from the shore across the entire volcanic mountain of Hualālai, and continues to the summit of Mauna Loa. Sometime during the A.D. 1400s, the *moku* were further divided into distinct land units known as *ahupua‘a* (Kirch 1985). *Ahupua‘a* were ideally long wedge-shaped slices of land that incorporated all of the eco-zones from the mountains to the sea and several hundred yards beyond, which afforded their inhabitants unlimited access to a diverse subsistence resource base (Cordy 2000). Entire *ahupua‘a*, or portions of the land were managed by appointed *konohiki*, or lesser chiefs, who acted as overseers under the rule of an *ali‘i ‘ai ahupua‘a*. The *ali‘i ‘ai ahupua‘a* in turn answered to an *ali‘i ‘ai moku*, a higher chief who ruled over the *moku* and claimed the abundance of the entire district. Thus, *ahupua‘a* resources supported not only the *maka‘āinana* (commoners) and *‘ohana* (extended families) who lived on the land, but also provided support to the ruling class of higher chiefs and ultimately the crown. The *moku* of Kona has over 100 *ahupua‘a*, and approximately 20 of these fall within the northern-most region of North Kona known as Kekaha, which refers to an arid coastal place (Dye et al. 2002) that extends from Honokōhau in the south to Pu‘u Ananhulu and includes Pu‘u Wa‘awa‘a, where the current study area is located. (Figure 11). According to Dye et al. (2002), native residents of the Kekaha region referred to their home with affection as "*Kekaha-wai-‘ole o nā Kona*—waterless Kekaha of the Kona District—or simply as the *āina kaha*, referring to the hot dry coast (ibid.:5).

The majority of the *ahupua‘a* in Kekaha are fairly narrow, with the exception of Pu‘u Wa‘awa‘a, Pu‘u Anahulu and Ka‘ūpūlehu; however, most include a combination of forest lands, upland *kula*, coastal *kula*, and offshore resources. The current study *ahupua‘a*, Pu‘uwa‘awa‘a, together with neighboring Pu’uanahalu comprise a smaller district of Kekaha known as Nāpu‘u, which literally translates as "the hills" (Pukui et al. 1974). According to Maly and Maly (2006):

> In ancient times, the land of Puu Waawa‘a, and its neighbor Puu Anahulu were closely linked in traditions, and in supporting residents who shared familial ties with one another (2006: ii).

Pu‘uwa‘awa‘a Ahupua‘a is situated on the northern slopes of Hualālai volcano and takes its name from a prominent local geological feature, a *pu‘u* (cinder cone) marked by deep *wa‘awa‘a* (furrows). The *ahupua‘a’s* namesake cinder cone is also culturally significant because it is "named for a deified ancestor of the families of the land" (Maly and Maly 2006:ii). Pu‘uwa‘awa‘a Ahupua‘a, comprised of approximately 40,000 acres, extends from Kiholo Bay across several environmental zones or *wao* before terminating at elevations between 5,762 and 5,950 feet

near the summit of Hualalai. These *wao* include the near-shore fisheries and roughly 5 miles of shoreline frontage or *kahakai*, the arid lowland (coastal) plains or *kula kai*, and the upper (inland) slopes or *kula uka*, which supported a dryland forest. These regional zones were greatly desired as places of residence in ancient times. People developed small permanent settlements along the coast and in the uplands to an elevation of 3,000 feet, where fields could be planted under the dryland forest canopy. The forest region (*wao nahele*) was also known as the region of the gods (*wao akua*), where people gathered highly valued resources such as feathers from for use in chiefly adornments and *kauila* wood for use in *heiau* and other specialized functions. A network of trails connected these two residential zones, the *wao kanaka* (region of man) and the *wao nahele* (forest region). During the wet months of the year, residents of Nāpuʻu lived in the uplands and would move to the coastal lowland plains during the drier months. As a result, archaeological features such as temporary shelters (modified outcrops and caves), burials, and water catchments are often found in the arid lowland plains.

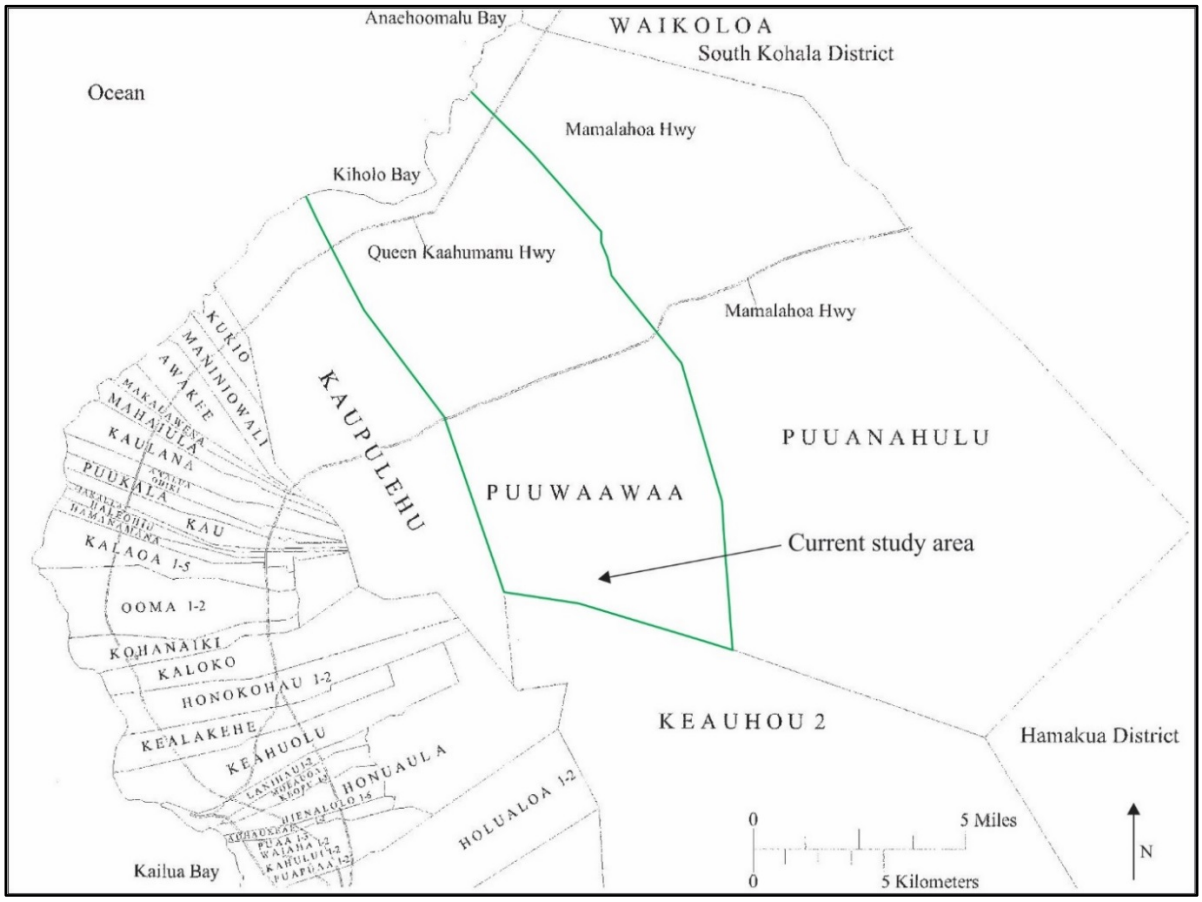


Figure 11. Map showing Puʻuwaʻawaʻa Ahupuaʻa outlined in green with the approximate location of the current study area.

The district of North Kona figured prominently as a royal center in the Proto-Historic Period. Beginning around A.D. 1600-1620, Hawaiian royal centers were established within the nearby shoreline zone of North Kona. Such royal and high chiefly centers included dwellings for chiefs, their court, and local *makaʻāinana* in addition to public structures, such as *heiau*, sporting grounds and places of refuge near the coast (Cordy 1995). However, during the early nineteenth century, following the death of Kamehameha I and the adoption of Western introduced religious practices, *heiau* no longer held their significance as elements of a state-sponsored religion. In fact, at many of these sites in the district of Kona, the wooden god images were burned and the structures themselves were dismantled (Kelly 1983). The stones of the destroyed *heiau* were often used for other building projects throughout the region.

The settlement patterns described above persisted into the early Historic Period, but with the arrival of foreigners, the introduction of new crops, and native population reduction in the early 1800s, major changes were well underway. Another drastic change to the culture, economy, and landscape came as the result of the introduction of cattle ranching in the middle 1800s, which persisted well into the twentieth century in much of North Kona, including within Puʻuwaʻawaʻa Ahupuaʻa and in close proximity to the current study area.

## Puʻuwaʻawaʻa Ahupuaʻa and the Nāpuʻu Region of Kekaha

This section of the study presents *moʻolelo* or native traditions that reference the land and resources of the Kekaha region, spanning several centuries. In addition, a selection of relevant historical accounts will also be presented. Some of these *moʻolelo* and historical accounts have been translated from the original Hawaiian by Kepā Maly (Maly and Maly 2006). Puʻuwaʻawaʻa is often mentioned specifically, and still more traditional and historic accounts refer to Nāpuʻu and the greater Kehaha region.

*Legendary Accounts*

One of the earliest traditions that references the Nāpuʻu-Kekaha region is"*The Legend of Kaulanapokii*", which was collected by Abraham Fornander in 1916-1917, and dates to around the thirteenth century. The legend speaks of traveling through the uplands, viewing Kīholo and Kapalaoa from Huʻehuʻe, and describes the practice of salt making at Puakō, which was also an important practice in the coastal lands of Puʻuwaʻawaʻa.

David Malo, a native historian and prolific writer, wrote that the wood of the *kauila* tree was prized because it "is a hard wood, excellent for spears, *tapa* beaters and a variety of other similar purposes" and was made into spears for the army of Kamehameha I (Malo 1951:21 and 25). As previously mentioned, the *kauila* tree grew wild in the forest region near the current study area in ancient times. As a result Kamehameha I retained Puʻuwaʻawaʻa Ahupuaʻa, among other reasons, because it was "a wise thing for the king to keep as his own the *ahupuaʻa* or districts in which the *kauila*. . . is plentiful." (ibid.:194)

One of the most prolific native writers of the late nineteenth and early twentieth centuries, was born and raised in the Kekaha region. His name was John Whalley Hermosa Isaac Kihe, who also wrote under the penname Kaʻohuhaʻaheoinākuahiwiʻekolu (The proud mist on the three mountains). In the later years of his life, Kihe lived at Puʻuanahulu with his wife, Kaimu and served as the postman of Nāpuʻu. Kihe, who died in 1929, was also one of the primary informants to Eliza Maguire, who translated some of Kihe's writings, publishing them in abbreviated form in her book "*Kona Legends*" (Maguire 1926). Throughout his career, Kihe collaborated with several other noted Hawaiian authors, among them were John Kaʻelemakule, John Wise, and Reverend Steven Desha, Sr., editor of the Hawaiian newspaper, *Ka Hoku o Hawaii*. Kihe was the preeminent historian of Nāpuʻu and Kekaha, and from his pen (with the contributions from his peers), came a rich collection of native traditions, historical commentary and place-based historical accounts. Readers are directed to Maly and Maly (2006) for translations of some of Kihe's contributions to the history, traditions, beliefs, customs, and practices of Nāpuʻu and the Kekaha region.

In the series of articles entitled "*Na Hoonanea o ka Manawa, Kekahi mau Wahi Pana o Kekaha ma Kona*" (Pleasant Passing of Time [Stories] About Some of the Famous Places of Kekaha at Kona), Kihe presented detailed narratives of native traditions of Nāpuʻu and Kekaha (*Ka Hoku o Hawaii*; Dec. 6th 1923 to Feb. 21st 1924). Kihe described some of the famous places (*wahi pana*), and how they came to be named. He also identified some of the early residents of the region, and practices associated with water catchment and agriculture. Kihe also described the changes which had occurred in the Kekaha region since his youth. In the article titled *Na Hoʻomanao o ka Manawa* (in *Ka Hōkū o Hawaiʻi* June 5th & 12th 1924), Kihe wrote about the villages that were once inhabited throughout Kekaha, identifying families, practices, and schools of the Historic Period (ca. 1860-1924). In this two part series he also shared his personal feelings about the changes that had occurred, including the demise of the families and the abandonment of the coastal lands of Kekaha.

A 1917 account written by Kihe (with contributions by John Wise and Steven Desha Sr.), further describes the mobility of the residents of Kekaha and the significance of water during the dry season:

> . . . ʻOia ka wā e neʻe ana ka lā iā Kona, hele a maloʻo ka ʻāina i ka ʻai kupakupa ʻia e ka lā, a o nā kānaka, nā liʻi o Kona, pūheʻe aku la a noho i kahakai kāhi o ka wai e ola ai nā kānaka – It was during the season, when the sun moved over Kona, drying and devouring the land, that the chiefs and people fled from the uplands to dwell along the shore where water could be found to give life to the people. (Ka Hōkū o Hawaiʻi, April 5, 1917)

Native historian, Samuel Kamakau (1992) described a few eighteenth century events in the Kekaha region and Puʻuwaʻawaʻa Ahupuaʻa, in particular. For instance, around 1780, Kalaniʻōpuʻu (King of Hawaiʻi) granted "estate lands" in Kekaha to the twin chiefs Kameʻeiamoku and Kamanawa in recognition of their valor and counsel (ibid. 310). Kamakau also recorded, that at the time of King Kalaniʻōpuʻu's death, Kameʻeiamoku was living at Kaʻūpūlehu, and his twin, Kamanawa was living at Kīholo, Puʻuwaʻawaʻa (ibid.:118). Kamakau also states, "the land of Kekaha was held by the *kahuna* [priestly] class of Ka-uahi and Nahulu" (ibid.:231); to which the twin chiefs are believed to have belonged.

Kamakau also mentions the vicinity of the current study area as the source of raw materials for the building of war canoes to be used in one of Kamehameha I's failed attempts to conquer Kauaʻi:

> One of the lesser chiefs, named Wai-paʻ, built a real ship, the first put together by a native builder since that built for Kamehameha at Kealakekua in 1794 and which Wai-paʻ had inspected. The ribs were *koa* and *hau* wood, the flooring *wiliwili* wood, the nails of *kauila* wood from Napuʻu [near Puʻu Waʻawaʻa]. (Kamakau 1992:187).

Another traditional account retold by Kamakau (1992) speaks of a devastating volcanic eruption on the island of Hawai'i that occurred during the fourth year of Kamehameha's rule. According to the story, the lava flow brought destruction to the Kekaha region as a result of Pele's wrath (ibid.). Kamehameha appeased Pele by providing her with the proper sacrifices and gifts, thereby stopping the flow (ibid.). Today this flow is known as the Kaʻūpūlehu Flow, which originated from Hualālai around 1800-1801 (Haun and Henry 2010).

The coastal area of Puʻuwaʻawaʻa contains the protected bay at Kīholo and was the location of a significant fishpond; as well as numerous springs and water caves. John Papa Iʻi, a native historian and companion to the Kamehameha family, mentions the fishpond known as Kaukana when retelling a tale about Kepaʻalani. According to Iʻi, in the 1790s as a result of his exceptional abilities at canoe racing, Kepaʻalani "became a favorite of the king, and it was thus that he received [stewardship of] the whole of Puuwaawaa and the fishponds Paaiea in Makaula and Kaulana in Kekaha" (Iʻi 1959:132). In 1853, during a sail around Hawaiʻi Island Iʻi stopped at Luahinewai (at the south end of Kīholo Bay in Puʻuwaʻawaʻa) to "bathe and visit that strange water in the lava" (1959:171).

*Post-Contact Missionary and Explorer Accounts*

The writings of early visitors (explorers, missionaries, and local travelers) to Hawaiʻi provide important glimpses into the nature of native communities and history as spoken at the time as well as descriptions of the environment, land use and native cultural practices. Narratives recorded by early visitors to the Kekaha-Nāpuʻu region with specific references to localities such as Kīholo and Lae Manō, which are situated in Puʻuwaʻawaʻa, are provided below. The foreigners looked at the land very differently than the natives, who had strong spiritual and kinship attachments to it. The themes common to most of the narratives of the foreign visitors include descriptions of an arid and desolate land that was only sparsely inhabited by the time of recording the various accounts.

Less than a year after Kamehameha's death in 1819, the first Protestant missionaries arrived from America. In 1823, British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Hawaiʻi seeking out communities in which to establish church centers and schools. Following his last visit to Kawaihae, Ellis visited several of the coastal villages along the way. In coastal Puʻuwaʻawaʻa, Ellis stopped at Kapalaoa, Wainānāliʻi, and Kīholo and made the following observations:

> About four in the afternoon I landed at Kihoro, a straggling village, inhabited principally by fishermen. A number of people collected, to who I addressed a short discourse… …This village exhibits another monument of the genius of Tamehameha. A small bay, perhaps half a mile across, runs inland a considerable distance. From one side of this bay, Tamehameha built a strong stone wall, six feet high in some places, and twenty feet wide, by which he had an excellent fish-pond, not less than two miles in circumference. There were several arches in the wall, which were guarded by strong stakes driven into the ground so far apart as to admit the water of the sea; yet sufficiently close to prevent the fish from escaping. It was well stocked with fish, and water-fowl were seen swimming on its surface. (Ellis 1963:294-5)

On July 16 1832, Lorenzo Lyons (*Makua Laiana*), replaced Reverend Dwight Baldwin as minister at Waimea, Hawaiʻi. Lyons' "Church Field" was centered in Waimea, at what is now the historic church ʻImiola and included both Kohala and Hāmākua (Doyle 1953:40 & 57). The following excerpt is from Lyons' journal, which describes his walk on the *ala loa* (main trail) along the coast from Kohala to Kailua through Puʻuwaʻawaʻa, where he encountered Kīholo Fishpond:

> Aug. 8, 1843. Took the road from Kapalaoa to Kailua on foot. Passed the great fish pond at Kiholo, one of the artificial wonders of Hawaii; an immense work! A prodigious wall runs through a portion of the ocean, a channel for the water, etc. Half of Hawaii worked on it in the days of Kamehameha… (Doyle 1953:137)

In 1840-41, Charles Wilkes of the United States Exploring Expedition traveled through the Kekaha region. Wilkes' narratives offer readers a brief description of agricultural activities in coastal communities and also document the continued importance of fishing and salt making to the people who dwelt in Kekaha:

> . . . A considerable trade is kept up between the south and north end of the district. The inhabitants of the barren portion of the latter [i.e., Kekaha] are principally occupied in fishing and the manufacture of salt, which articles are bartered with those who live in the more fertile regions of the south [i.e. Kailua-Keauhou], for food and clothing. . . (Wilkes 1845, 4:95-97)

The practice of inter-regional trade of salt and other articles described by Wilkes above, was based on traditional customs (cf. Malo 1951; Kamakau 1992), and remained important to the livelihood of residents in the Nāpuʻu-Kekaha region through the 1930s (Maly and Maly 2006 provide additional information in their oral histories).

## Land Tenure in Puʻuwaʻawaʻa Ahupuaʻa and Vicinity

Through the traditions and early historical accounts cited above, we see that there are descriptions of early residences and practices of the native families on the lands of Puʻuwaʻawaʻa and within the greater Kekaha region. Kalaniʻōpuʻu gave Kameʻeiamoku and Kamanawa various lands of Kekaha, as their personal properties (Kamakau 1992). Kamehameha I rose to power with the help of Kameʻeiamoku and Kamanawa, and their rights to the lands were retained, and handed down to their descendants (ibid.). Among the best government records documenting residency in Puʻuwaʻawaʻa are those of the *Māhele ʻĀina*, the Boundary Commission, the Government Survey Division, and the Government lease and homesteading programs. The government documents presented in the discussion below are selected from a larger body of historical texts compiled by Kumu Pono Associates as part of their *Collection of Cultural and Historical Accounts of Puʻu Waʻawaʻa and the Nāpuʻu Region* (Maly and Maly 2006). Their extensive research consists of a review of archival-historical literature from both Hawaiian and English language sources, which includes survey records of the Kingdom and Territory of Hawaiʻi, native accounts from Hawaiian language newspapers (compiled and translated by Kepā Maly), among other sources; as well as detailed oral history interviews with elder *kamaʻāina* documenting their knowledge of the Nāpuʻu-Kekaha region.

*The Māhele ʻĀina*

Profound religious, socioeconomic, and demographic changes also took place in the early 1800s that resulted in the establishment of a Euro-American style of land tenure, and the *Māhele ʻĀina* of 1848 or Great *Māhele* was the vehicle used to divide the land between the crown, government, *konohiki*, and native tenants. Prior to this land reformation, all the land and natural resources of Hawaiʻi were held in trust by the *aliʻi* who, in concert with *konohiki* land agents, meted out use rights to the native tenants at will. During the *Māhele* all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands; all three types of land were subject to the rights of the native tenants therein.

The *aliʻi* and *konohiki* were required to present their claims to the Land Commission to receive a Land Commission Award (LCAw.) for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. The lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission and subsequent land transfers (Chinen 1961). In 1862, the Commission of Boundaries (Boundary Commission) was established to legally set the boundaries of all the *ahupuaʻa* that had been awarded as a part of the *Māhele*. However, boundary descriptions were not collected for all *ahupuaʻa*.

Native tenants could also register claims for land with the Land Commission, and if substantiated, they would receive awards referred to as *kuleana*. Upon confirmation of a claim, a survey was required before the Land Commission could issue a *kuleana* award. According to Kelly (1983) several prominent *konohiki* related in some way to the Kamehameha dynasty received land awards in North Kona District. During the *Māhele* Puʻuwaʻawaʻa Ahupuaʻa, initially claimed by Mikahela Kekauonohi (a granddaughter of Kamehameha I), was retained as Crown Land. Five *kuleana* claims, all in the coastal portion of the *ahupuaʻa* near Kīholo Bay, were made, but none were awarded (Maly and Maly 2006).

*Boundary Commission Proceedings*

As Puʻuwaʻawaʻa was retained as crown lands during the *Māhele*, it was not until 1873 that its boundaries were surveyed. The boundary testimonies and survey records provide a good summary of traditional knowledge of places, and identify localities ranging from the shore to the upper most boundaries of the *ahupuaʻa*. The narratives describe: trails and forest resources of Puʻuwaʻawaʻa; the occurrence of historical features, including residences and agricultural fields; the practice of salt making; and name many localities on the land (please refer to Maly and Maly 2006 for a comprehensive review of this documentation).

*Hawaiian Government Survey Records*

Another significant collection of Historic government records, are the field notebooks of Kingdom Surveyor, Joseph S. Emerson. Born on Oʻahu, J.S. Emerson (like his brother, Nathaniel Emerson, a compiler of Hawaiian traditions) had the ability to converse in Hawaiian, and was greatly interested in Hawaiian beliefs, traditions, and customs. As a result of this interest, his survey notebooks record more than coordinates for developing maps. While in the field, Emerson sought out knowledgeable native residents of the lands he surveyed to use as guides. While he was in the field, he recorded their traditions of place names, residences, trails, and various features of the cultural and natural landscape (including the extent of the forest and areas impacted by grazing). Emerson worked extensively in the Nāpuʻu and the greater Kekaha regions of North Kona and South Kohala.

Emerson's field notebooks were illustrated with detailed sketches drawn by his assistant, J. Perryman, a talented artist. Perryman's sketches help to bring the landscape of that period back to life. In a letter to W.D. Alexander, Surveyor General, Emerson described his methods and wrote that he took readings off of:

> …every visible hill, cape, bay, or point of interest in the district, recording its local name, and the name of the Ahupuaa in which it is situated. Every item of local historical, mythological or geological interest has been carefully sought & noted. Perryman has embellished the pages of the field book with twenty four neatly executed views & sketches from the various trig stations we have occupied… [Emerson to Alexander, May 21, 1882; Hawaiʻi State Archives – DAGS 6, Box 1]

While conducting the Puʻuanahulu survey, Perryman prepared a sketch of the region depicting the area from Puʻuanahulu upland to Puʻuwaʻawaʻa and the southeastern slope of Hualālai in the vicinity of the current study area (Figure 12).

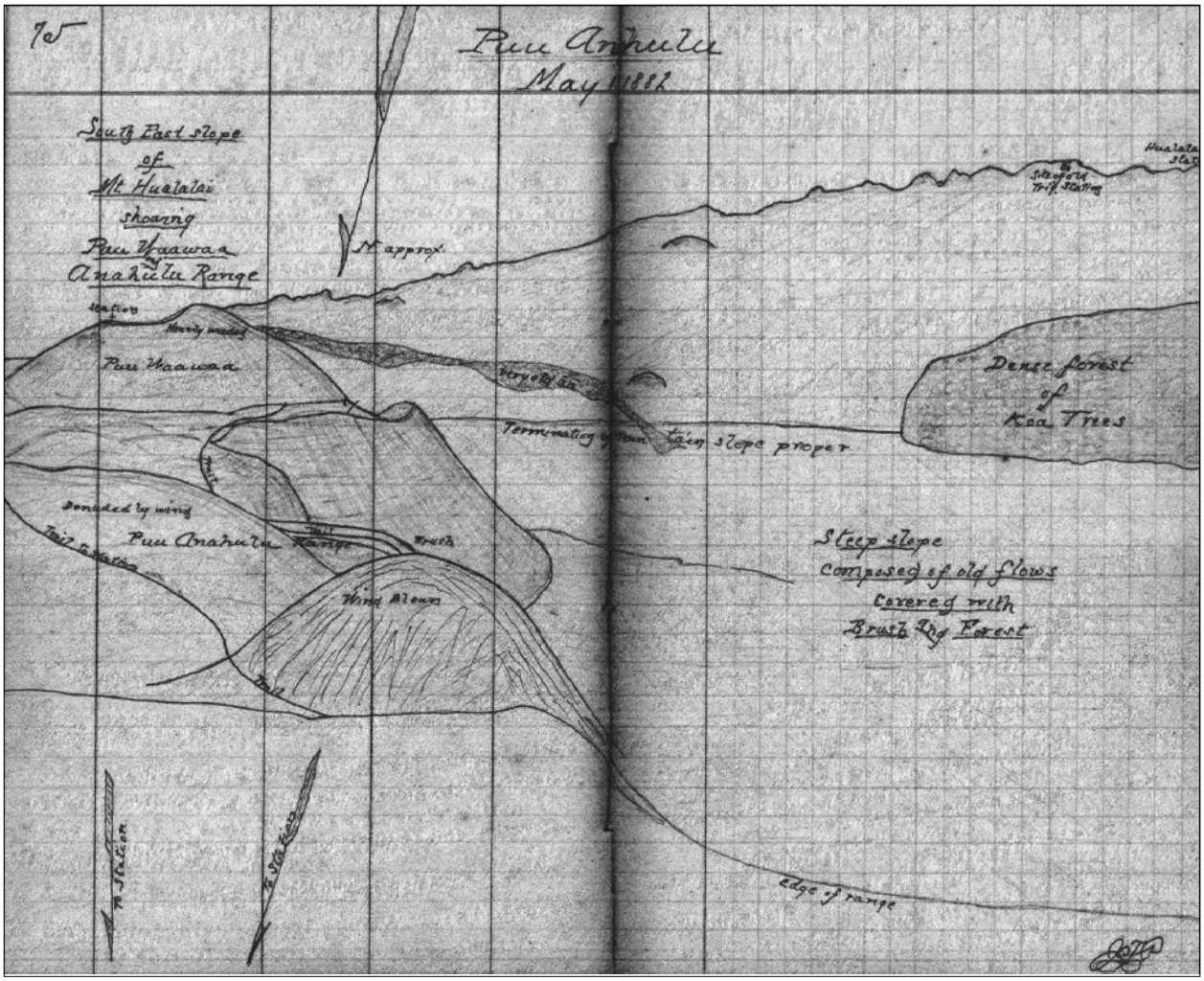


Figure 12. J.S. Emerson, Field Note Book Map – Book 252:75 (State Survey Division).

In August of 1882, Emerson recorded the following notes on the current study *ahupuaʻa*

> Puu Waawaa is too prominent not to be easily found without a description.
>
> A copper triangle and marked stone show the position of the point under ground. The stones above ground are close to the signal. There is a quantity of the cans underground also.
>
> The rocks for the marking purposes had to be brought from the plains below on jackasses as there were none to be found on the hill. *The soil is very soft and rich, and the summit is covered with a dense forest.* [Field Book Vol. 4 Reg. No. 254:123]

*Ranching in Puʻuwaʻawaʻa*

From the 1860s until the 1970s, ranching was the primary, large-scale land use operation in the region with the land area under lease ranging between 4,000 acres to more than 120,000 acres of Puʻuwaʻawaʻa and Puʻuanahulu. In the middle 1860s, an Englishman named Robert R. Hind moved to Maui, where he worked in the developing sugar industry for a time. In the 1870s, Hind relocated to the Island of Hawaiʻi and became the proprietor of the Hāwi Sugar mill, which he operated in conjunction with his son John. Within a few decades Hind would become an influential political figure and the owner and operator of over 100,000 acres of land in the Nāpuʻu Region known as Puʻu Waʻawaʻa Ranch.

According to Maly and Maly (2006), the first formal lease (issued in 1863) for lands in the Nāpuʻu region was for ranching operations. On March 20, 1863, the entire *ahupuaʻa* of Puʻuanahulu was leased to three Hawaiians—G. Kaukuna, M. Maeha, and S. Kanakaole, listed as residents of Honolulu, Oʻahu (State Archives files – General Lease No. 106; DLNR2- Vol. 15). Two years later, they sold their interests to Francis Spencer for incorporation into the holdings of the Waimea Grazing and Agricultural Company. In 1893, Spencer's leases of Puʻuanahulu (Government Land) and Puʻuwaʻawaʻa (Crown Land) were drawing to a close. By 1894, Robert Hind and his partner Eben Low had acquired the lease for 40, 000 acres of land in Puʻu Waʾawaʻa for a period of 25 years and established Puʻu Waʾawaʻa Ranch with a starter herd of 200 head of cattle (Maly and Maly 2006).

Hind and Low had to overcome many challenges to operate the ranch on their lease lands, including its isolated location and inhospitable environment that was crawling with lantana (which needed to be cleared) and cacti, and lacked a reliable water supply. In a July 20, 1894 letter to the Commissioners of Crown Lands, Low claims that of the 40, 000 acres that made up the lease: a mere 1,000 acres were fit for planting year-round, 10, 000 acres were good "when it rains", and only 9,000 acres were suitable for grazing, with the remaining 20, 000 acres deemed "worthless" (Maly and Maly 2006:107). In 1898, Hind and Low acquired 12, 000 acres of land in Puʻu Anahulu (Lease No. 517) and in 1903, Hind acquired all of Low's interests in the ranch. A 1902 map of the Puʻuwaʻawaʻa-Puʻuanahulu lease lands depicts the lands referred to above and below (Figure 13).

Puʻu Waʻawaʻa Ranch offered the only available jobs in the remote Nāpuʻu Region. Because of this the native tenants had to maintain good relations with the ranch. Robert Hind was clearly influential within the emerging sociopolitical climate of Hawaiʻi. In 1916, he was appointed Hawaiʻi Territorial Senator he remained a significant political figure both regionally and nationally for several years. During his tenure as Senator, the Puʻu Waʻawaʻa Ranch was host to dignitaries from around the world. In 1917, Hind leased an additional 74, 000 acres in Puʻu Anahulu and renewed the lease on his other holdings for an additional 21 years. By the late 1920s, Hind began consolidating his interests in Puʻu Waʻawaʻa Ranch (including the lease lands of Puʻuanahulu and Puʻuwaʻawaʻa and the various homestead parcels he acquired) under the corporation name "Robert Hind, Limited." A 1924 USGS Map shows the approximate location of the current study area within Puʻu Waʻawaʻa Ranch (Figure 14).

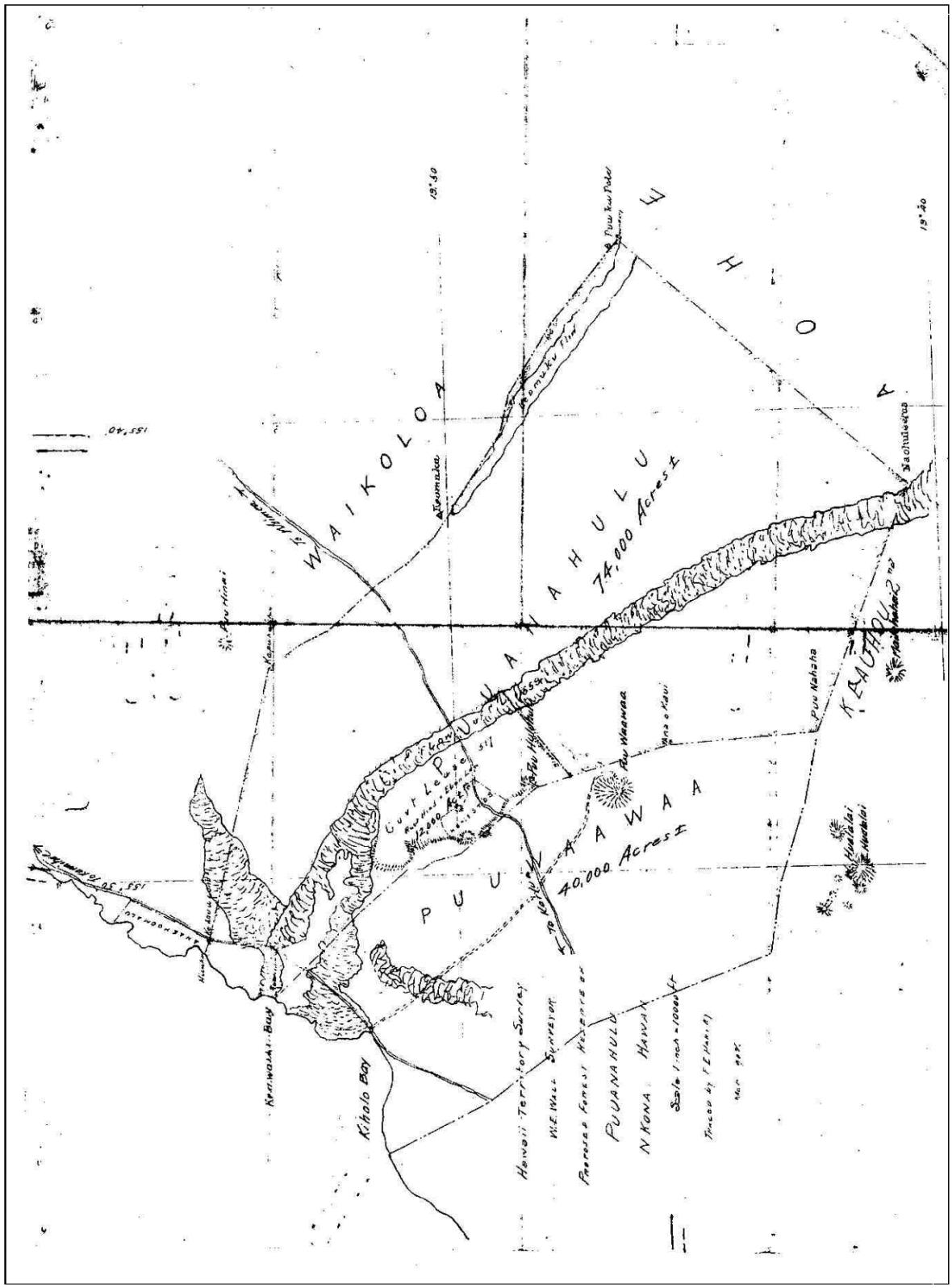


Figure 13. Pu‘u Anahulu and Pu‘u wa‘awa‘a Lease lands (1902). (Lease 971) State Survey Division.

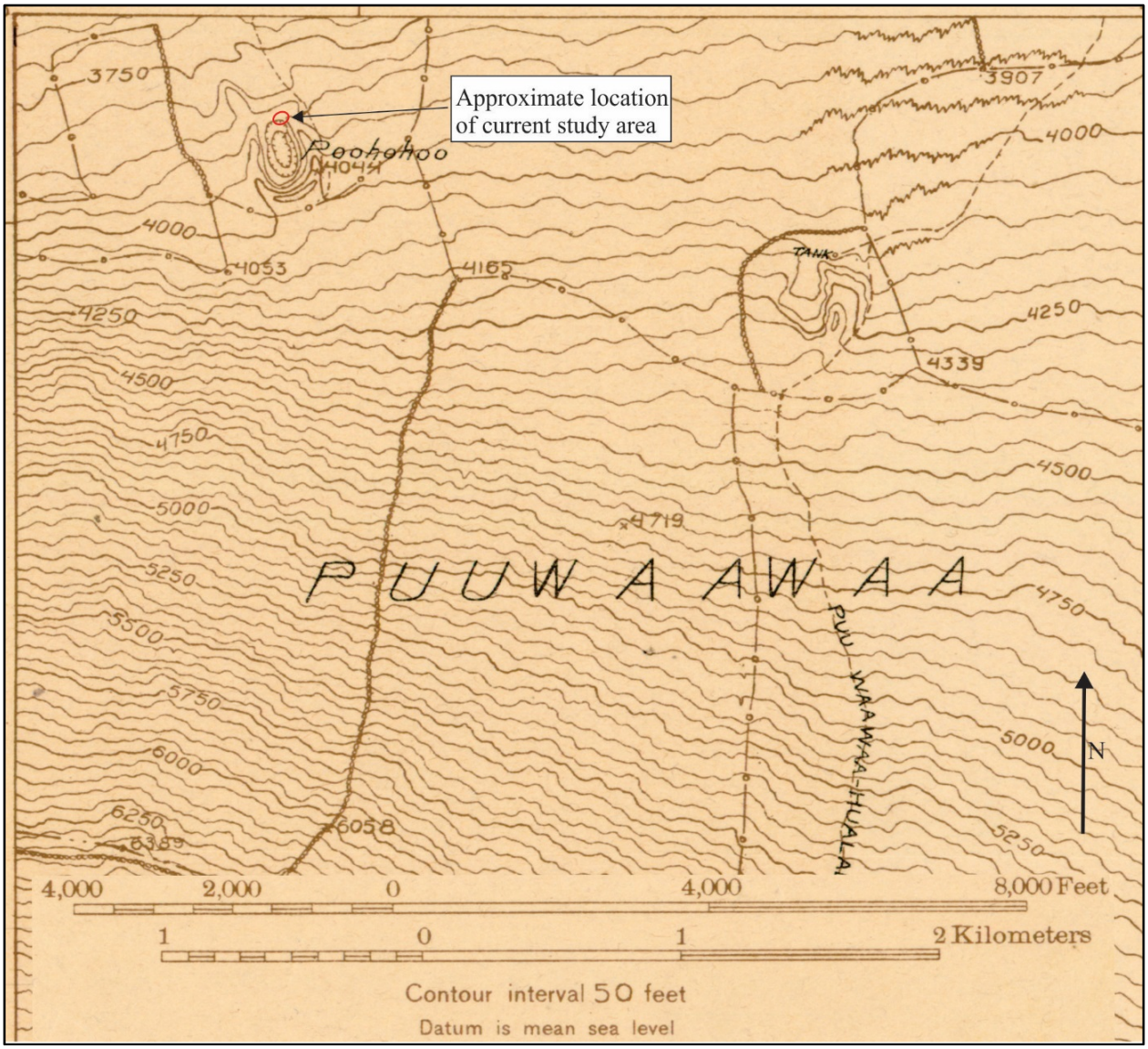


Figure 14. Portion of Hualalai Quadrangle of 1924 USGS Map showing approximate location of the current study area and Puʻu Waʻawaʻa Ranch infrastructure (fences, rock walls, and trails) at that time.

In 1929, L.A. Henke, published a "Survey of Livestock in Hawaii," University of Hawaii Research Publication No. 5. The publication included historical narratives of ranches throughout the Hawaiian Islands. Henke reported the following description of Pu'u Wa'awa'a Ranch, including land tenure, source of livestock, and feed sources:

> Puuwaawaa Ranch in North Kona, with the ranch headquarters beautifully located three miles above the government road, consists of a total of about 128,000 acres, but about 100,000 are waste lands covered with lava flows. Of the remaining 28,000 acres only 1,500 are really good grazing lands. About 100 acres are planted to cultivated crops. All but 300 acres held in fee simple are government leased lands. These lands run from sea level to an elevation of 6,000 feet. Some of the best grazing lands are found at 5,000 feet elevation.
>
> For many years there was practically no water on the ranch other than what the cattle could get from the dew and succulent vegetation. However, as the vegetation became scarcer water was required in all but a few paddocks well supplied with cactus where the cattle still grow to maturity without ever having access to free water. The limited water now available is secured from roofs, and a pipe line from Huehue Ranch.
>
> A total of about thirty miles of fences, half stone and half wire, are found on the ranch. At present, the ranch carries about 2,000 Herefords. All the bulls and thirty of the females are purebred. About 500 head, ranging between two and three years of age and dressing out at 500 pounds are marketed annually,—practically all are sent to Honolulu, being loaded on the steamers at Kailua.
>
> Only rarely are the bulls left with the breeding herd throughout the year. Usually they are turned out only during the seasons when grazing conditions are good, for the owner does not like to risk losing valuable bulls during adverse seasons. The good and bad seasons do not follow the same schedule year after year, so a definite pre-arranged breeding schedule, which would be preferable to get calves at the same time, is impossible.
>
> Calves are weaned at about six months of age, depending on the season. In bad seasons they are weaned earlier and taken to the best paddocks, which helps both the calf and the cow. An 85% calf crop was secured in 1928, but such a good percentage is not always secured.
>
> When bulls range with the cows throughout the year they average about one bull to thirty cows. For restricted breeding seasons more bulls are needed. The ranch carries about sixty light horses and raises about ten mules per year. Practically no swine and no sheep are kept.
>
> About two hundred dairy cattle of the Holstein and Guernsey breeds, ranging in age from four months to about two years can be found on the ranch at all times. These are the young calves from the Hind-Clarke dairy in Honolulu which are carried to the calving age at Puuwaawaa Ranch and then sent back to the dairy in Honolulu again.
>
> Bermuda grass (*Cynodon dactylon*) is considered one of the best grasses. Other grasses that do well are *Kukaipuaa* or crab grass (*Panicum pruriens*), Kentucky blue grass (*Poa priatensis*), Spanish needles (*Bidens pilosa*), Rhodes grass (*Chloris gayana*), Mesquite or Yorkshire fog (*Holcus lanatus*) on high elevations, orchard grass or cocksfoot (*Dactylis glomerata*), *Paspalum compressum*, bur clover (*Medicago denticulata*) and red top (*Agrostis stolonifera*). Native weeds supply some forage and in droughty seasons the cactus (*Opuntia* spp.) is a great asset for the cattle eat not only the young leaves but also manage to break off the spines with their feet and survive. Rat tail or New Zealand Timothy (*Sporobolus elongatus*) has also been introduced and seems to be spreading. (Henke 1929:43-44)

The real beginning of Puuwaawaa Ranch was about 1892 when Robert Hind and Eben Low leased about 45,000 acres from the government and purchased about 2,000 head of cattle, —a mixture of Shorthorned, Angus and Devon breeds, from Frank Spencer, who had previously leased the lands of Puuanahulu, consisting of approximately 83,000 acres from the government. In 1893 Hind and Low acquired the lease on 12,000 acres of this area and in about 1917 Hind acquired the lease on the other 71,000 acres formerly in the Spencer lease. No cattle were carried on these 71,000 acres during the period 1893- 1917, but the land was pretty well overrun with goats… Since 1902 Robert Hind has been the sole owner of Puuwaawaa Ranch and he is still general manager of the ranch.

Another significant problem that Hind encountered in his ranching operation was competition that his herd faced from wild goats. By the turn of the century, the impact of goats on Hawaiian forests and lands valued by ranchers for

economic purposes was causing alarm among land officials. On October 12, 1922, Charles Judd, Superintendent of Forestry in the Territory of Hawaii forwarded a communication to Governor Farrington describing conditions in the Nāpuʻu – Kekaha region. He observed:

> Not only are thousands of acres robbed of valuable forage grasses which should properly go to cattle for the meat supply of this Territory but the undergrowth of bushes, ferns, and herbaceous plants which form valuable ground cover is being consumed or destroyed by goats and the trees which form the complement in the scheme of water conservation are being barked and killed by this voracious pest. At Kiholo in North Kona almost every *algaroba* tree, established in this dry region with great difficulty and most valuable here for the production of forage beans has been girdled by the wild goats… Senator R. Hind of Puuwaawaa, North Kona, Hawaii, is one who has felt, probably the most seriously, losses from an over-population of wild goats and in addition has suffered much loss of forage for cattle from wild sheep…
>
> He has, therefore, undertaken, on his own initiative, active measures to relieve his ranch of this pest and on June 26 and 27, 1922 conducted a drive which resulted in ridding his ranch of 7,000 wild goats…
>
> It was estimated in the 1920s that there was one goat on every five acres of land, and Judd reported that in the ranch lands of Puʻu Waʻawaʻa and Puʻu Anahulu, which comprised 105,000 acres, there were 21,000 wild goats. . . (Hawaii State Archives Territorial Fish and Game Commission; Com-2, Box 15).

Several changes were occurring between the years of 1936 and 1937 with the land leases held by Robert Hind Limited. In October 1936, leases were surrendered for consolidation into one lease (covering an area of approximately 126,000 acres), in an effort to remove private parcels from the existing lease language. By this time, Hind and several friends and associates had acquired fee simple title to beach lots along the shore of Puʻuanahulu and Puʻuwaʻawaʻa. On April 19, 1937, Robert Hind, Limited and the Commissioner of Public Lands entered into an agreement modifying Puʻuanahulu-Puʻuwaʻawaʻa leases (No.'s 1038 and 1039), in which beach lots were removed from Lease No.'s 1038 and 1039 (Land Division Files).

In the same time period, the Commissioner announced that bidding for the leases would be opened, and for the first time, there was active competition against Hind's interests. On October 12, 1937, the bidding closed with Hind retaining the lease, paying almost three times the original asking price, for the period of twenty-one years (effective August 15, 1939). The Commissioner of Public lands subsequently issued a new General Lease, No. 2621 (boundaries described in C.S.F. 8592), with descriptions of the boundaries and consolidation of all lands from General Lease No.'s 971, 1038 and 1039 (see General Leases in Land Division and State Survey Division Files; and Honolulu Advertiser and Star Bulletin articles of October 12 & 13, 1937). C.S.F. 8592 (Figure 15) dated March 24, 1938, provides the survey coordinates for the revised and combined lease, containing a total area of 125,000 acres.

Robert Hind died in December 1938. Robert Hind, Limited, under the direction of Trustee John K. Clarke (who oversaw the trust until his death in 1951), continued operation of the Puʻu Waʻawaʻa Ranch holdings, and various interests both on Hawaiʻi (Puʻuwaʻawaʻa, Captain Cook, and Honomalino) and Oʻahu (Aina Haina). Paddocks of the ranch (both older walled pastures and newer fenced pastures) as they exist in the present-day were basically in place by the 1940s. The paddocks range from approximately the 1,000 foot elevation, through the forest lands, to the upper boundary of Puʻuwaʻawaʻa, and also take in the rich *kula* lands of Puʻuanahulu (that surround the historic homestead lots). In 1948, the ranch contracted surveyor, Charles Murray to prepare a map of the ranch paddocks and fencing projects that were underway. The map (Figure 16) also identifies the names of the paddocks, as they were remembered by the *kamaʻāina* cowboys. The current study area falls within the "Waiho 1 Paddock."

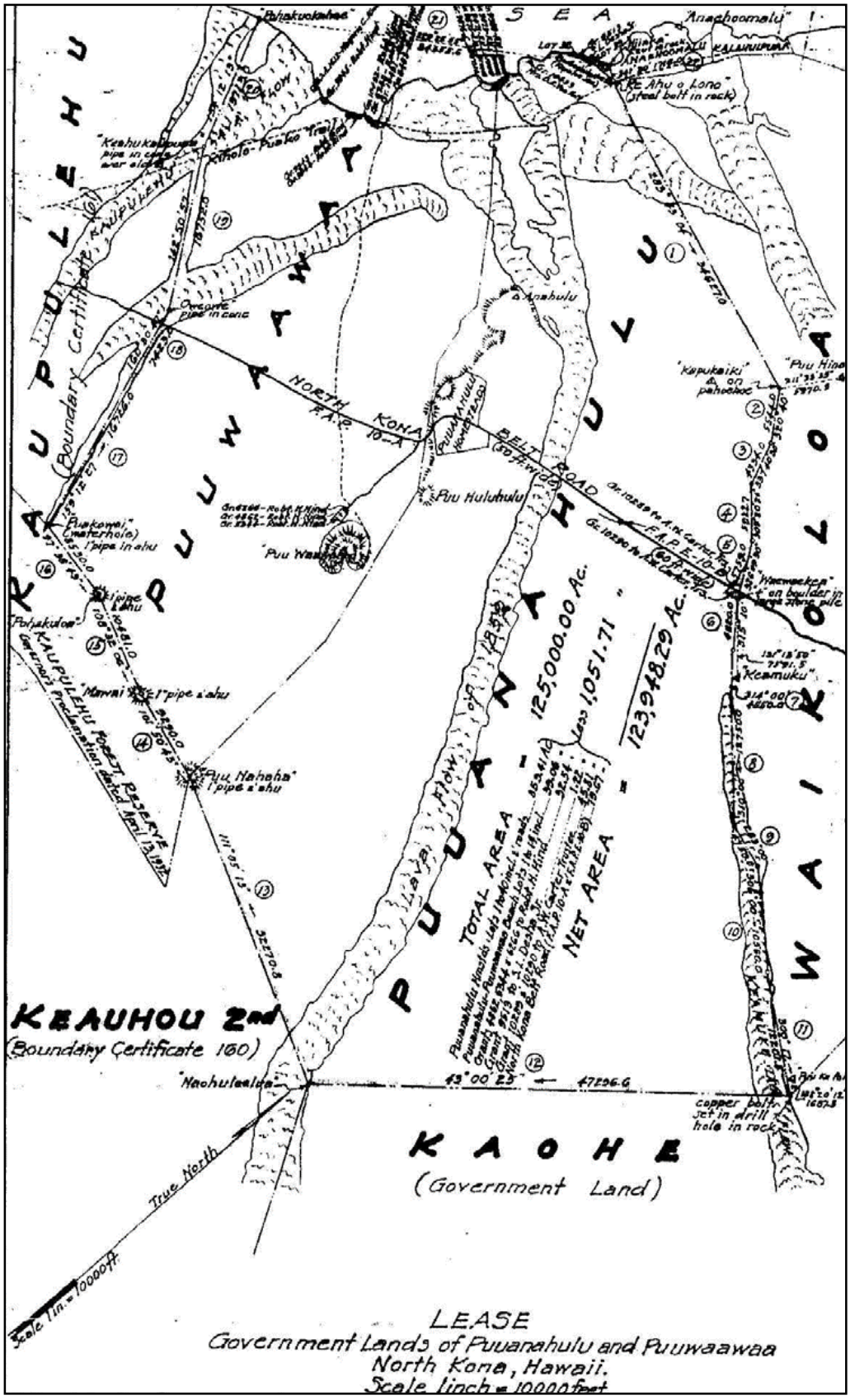


Figure 15. Pu‘uanahulu and Pu‘uwa‘awa‘a (C.S.F. 8592), Feb. 25, 1938.

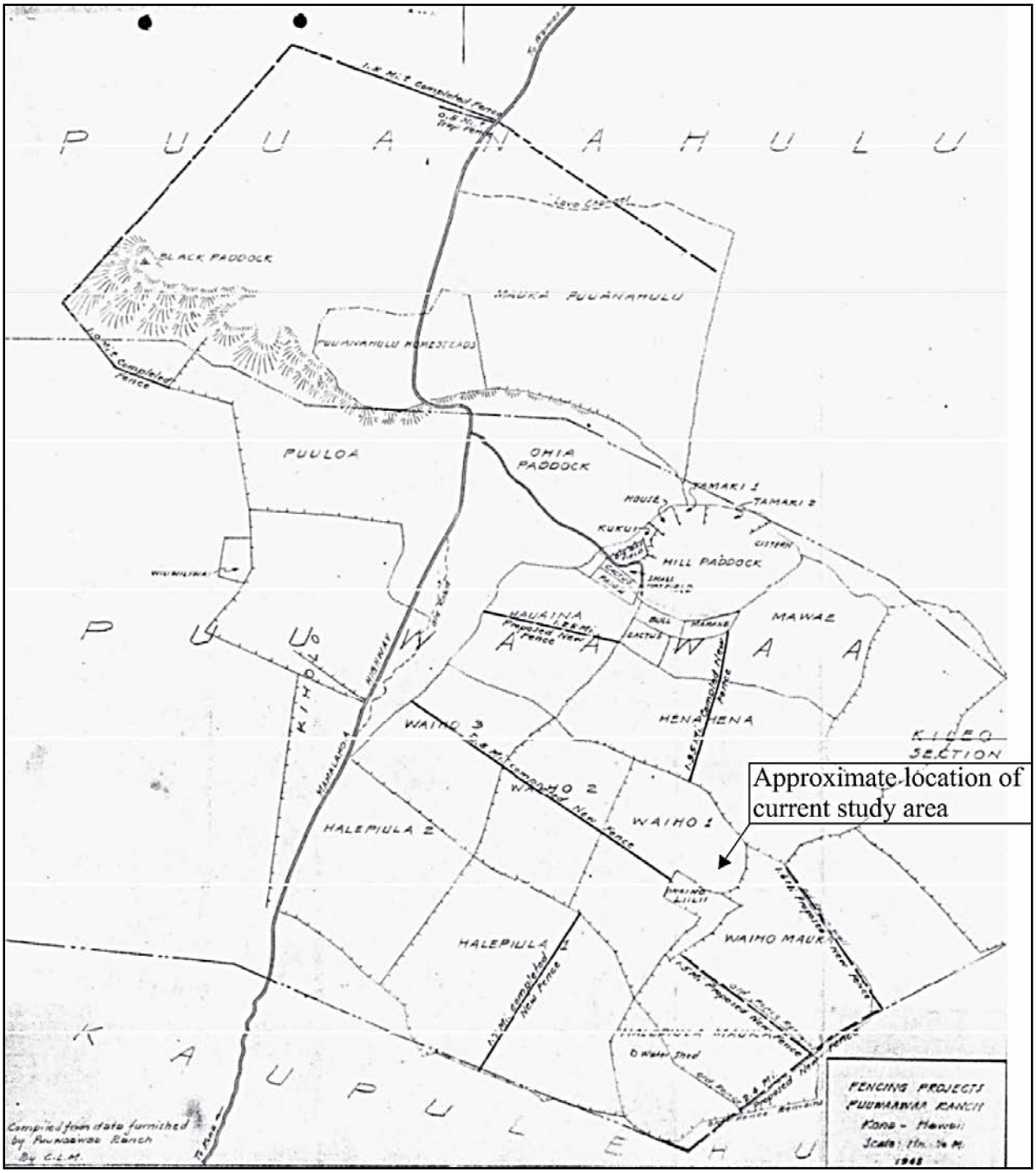


Figure 16. Fencing projects and paddocks of Pu‘u Wa‘awa‘a Ranch with approximate location of current study area (reduction of map compiled by Chas. L. Murray, 1948).

By the late 1950s, officers of R. Hind, Ltd., had decided to end their relationship with the lease-hold properties of Pu‘uanahulu and Pu‘uwa‘awa‘a. General Lease No. 2621 would end June 30, 1958, and the family could not justify the continuation of a negligible business endeavor. General Lease No. 2621 includes background documentation on the lease history, and also provides an “assets” statement detailing the varied resources of the ranch. Summing up the termination of the lease agreement between R. Hind, Ltd and the Territory of Hawai‘i, the Commissioner of Public Lands reported:

> Robert Hind, Limited, the lessee of these lands up to June 30, 1958, was able to operate a reasonably successful cattle operation on the Puuanahulu and Puuwaawaa lands prior to and including 1949. Due to periodic drought to which the area is subject and to increased operating costs the company suffered losses on cattle operations each year thereafter. Recognitions that only by greater beef production could the company meet increased operating costs and only by a large investment in water systems and range improvements could a greater production be achieved, were compelling factors in Robert Hind, Limited's decision to sell its Kona interests to Dillingham Investment Corporation and its wholly owned subsidiaries.
>
> Robert Hind, Limited was not in financial position to undertake the heavy investments necessary to effect more intensive use of its Kona lands. There being no prospect of either the County of Hawaii or the Territory of Hawaii being able to provide water supply for the widespread grazing areas, the only out for the owners of Robert Hind, Limited was sale to companies better able to finance extensive improvements. (G.L. No. 2621; State of Hawaii Land Division)

On July 1, 1958, R. Hind, Ltd., sold its fee-simple holdings (including properties in Puʻu Waʻawaʻa Ranch and the Puʻu Anahulu Homesteads) to Dillingham Ranch, Inc. (Bureau of Conveyances Liber 3469:478-485). In public bidding, Dillingham Ranch, Inc. was the highest bidder at an auction on March 4, 1960, and secured State Lease No. 3589 for the period of forty years, expiring August 14, 2000 (Maly and Maly 2006). On September 15, 1972, State Lease No. 3589 was assigned to F.N. Bohnett. Upon termination of Bohnetts' lease (August 14, 2000), the State of Hawaiʻi entered into short-term leases for sections of Puʻuwaʻawaʻa, while it worked with an Advisory Committee made up of native families of Nāpuʻu, and various parties including neighboring land owners, and others with interests in conservation, hunting, recreation, and business.

## POʻOHOHOʻO RESERVOIR

Poʻohohoʻo Reservoir was constructed in the early 1960s in response to a need for a large reservoir after Dillingham Ranch, Inc. took over the Puʻu Waʻawaʻa Ranch holdings in 1958, as previously discussed. The initial plan was to construct the reservoir immediately downslope from the Halepiula catchment area. However, insufficient fill material and slope conditions near the catchment area resulted in the relocation of the reservoir installation at Poʻohohoʻo. The cinder cone offered ample fill material for the construction of embankments in addition to the inherent shape of the landform lending itself to the development of a reservoir. The Poʻohohoʻo Reservoir and catchment facility is located about two miles east of the Halepiula catchment area, and just outside the northern boundary of the Forest Bird Sanctuary within the Puʻu Waʻawaʻa Ranch lands and consists of five distinct elements referred to as Areas 1-5 in this report as per Juvik and Tango (2003).

As previously mentioned, the focus of the current study, Area 2 of Poʻohohoʻo Reservoir (see Figure 4) was the larger of two butyl-rubber lined reservoirs constructed in the early 1960s. Area 2 had a potential storage capacity of 10 to 12 million gallons a mean diameter of roughly 350 feet and a maximum depth of 40 feet. According to Juvik and Tango (2003), the subject reservoir was built at an elevation slightly below the Area 1 reservoir and connected by an overflow drain. In 2003, Area 1 was recorded as "a still functioning, butyl-rubber lined reservoir, approximately 250 ft in perimeter diameter, with a storage capacity of 3-4 million gallons" (ibid.:43). A 0.46 acre (20, 000 square feet) butyl-rubber sloping catchment surface (Area 3) was designed to collect and channel rainwater into Area 1; while a 4.4 acre (190, 000 square feet) bituminous paved rainwater catchment surface (Area 4), which has since fallen into disrepair, was intended to feed water into both Areas 1 and 2. Area 4 was built after it was discovered that the water line connecting Poʻohohoʻo Reservoir with the Halepiula catchment was insufficient for transporting enough water for the purpose of storage. The fifth and final element of the Reservoir and catchment facility at Poʻohohoʻo (Area 5) is simply the outer slope on the western face of the cinder cone, located just above Area 4. It was hoped that Area 5 would provide rainfall runoff onto Area 4, however even in heavy rains, it appears that the porous substrate does not produce significant runoff at all (ibid.).

Informant Mikio "Miki" Kato, recalls that the liner of the subject reservoir (Area 2) suffered irreparable damage from exposure to high winds and was abandoned shortly after its construction. As a result, Area 2 was never actually utilized as a reservoir (Juvik and Tango 2003). Furthermore, Juvik and Tango (2003) note that over the four decade span between the initial construction of the reservoir facility and their study:

> . . . there has been a general abandonment of facilities maintenance and consequent deterioration of the water collection/storage infrastructure… currently, only a small component of the original catchment/storage system remains functional. (2003:41)

As can be seen in the aerial photographs reproduced below (Figures 17 and 18), construction of the Poʻohohoʻo Reservoir and Catchment facility was carried out in different phases. Figure 17 shows Poʻohohoʻo before the initial construction of the reservoir and catchment facilities. By 1965, one can clearly see Area 1 of the reservoir (Figure 18a) located to the west of the current study area (Area 2) in addition to evidence of associated ground disturbance along the edges of the cinder cone. By 1977 (see Figure 18b) all five features of the reservoir and catchment facility, including the current study area are present.

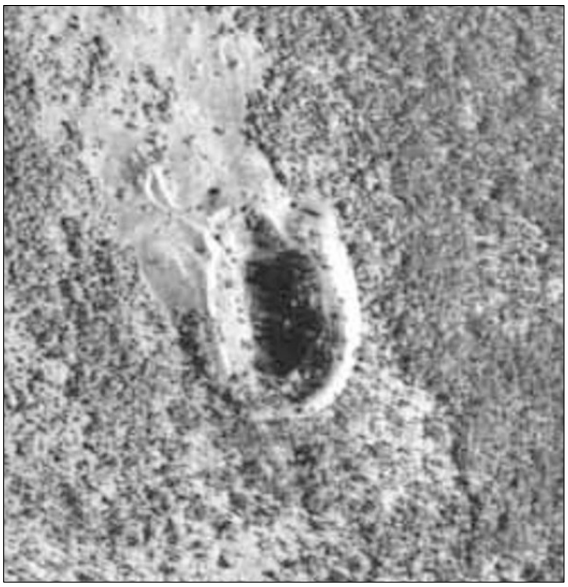

Figure 17. Aerial image of Poʻohohoʻo ca. 1954 prior to the construction of the reservoir and catchment facility.

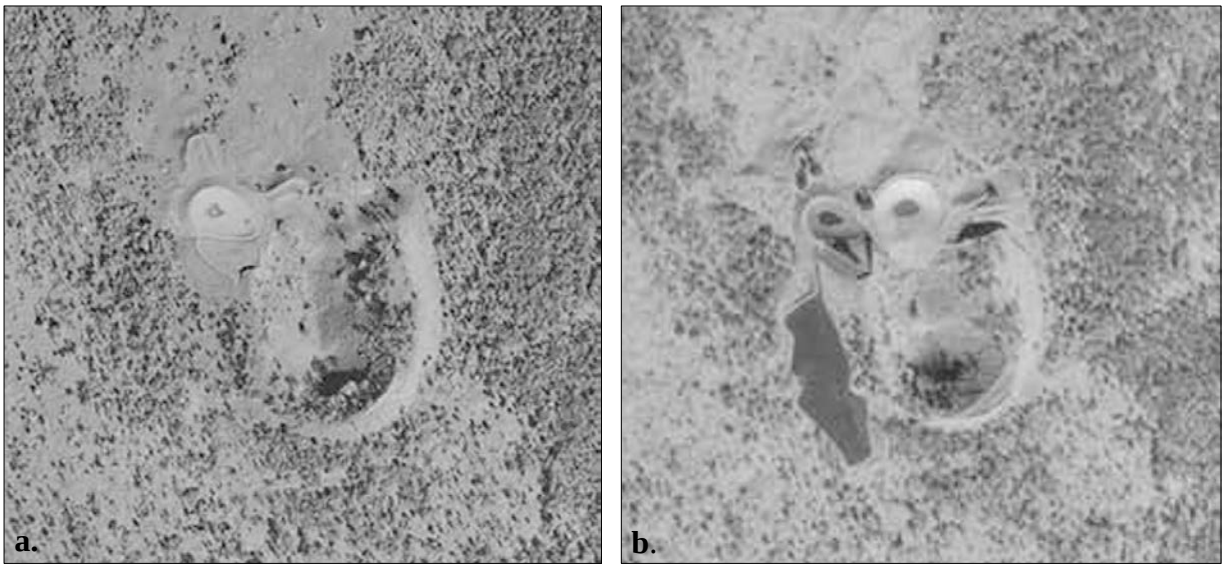


Figure 18. Aerial image comparison of construction sequence of Poʻohohoʻo reservoir: (a.) ca. 1965 (b.) ca. 1977.

In 2003, Juvik and Tango observed that the subject reservoir was partially lined but not currently in use. They also made the following comment regarding the potential inherent in the Poʻohohoʻo facilities:

> It should be noted that, although largely degraded and currently non-functioning, the existing water collection and storage facilities at Poʻohohoʻo represent a substantial past capital investment that it would be difficult or impossible to replicate with new construction (due to costs, and current permitting and environmental restrictions). Thus, the marginal cost of repairing this system to full operational status presents an extremely favorable economic opportunity for providing increased water availability at Puʻu Waʻawaʻa. (Juvik and Tango 2003:44)

## PREVIOUS ARCHAEOLOGICAL STUDIES

The earliest archaeological study that included Puʻu Waʻawaʻa was the first archaeological survey of Hawaiian sites in the Kekaha region conducted in 1929 and 1930 by John Reinecke on behalf of the Bishop Museum. Reinecke recorded six sites along the Puʻuwaʻawaʻa shoreline (Table 1). No studies were conducted for the next forty years in Puʻu Waʻawaʻa Ahupuaʻa. However, since 1971, several archaeological studies have been conducted within Puʻuwaʻawaʻa Ahupuaʻa (Ching 1971; Rosendahl 1973; Ahlo 1982; Rechtman and Wolforth 1999; McGerty and Spear 2000; Ketner et al. 2008; Rechtman 2014a and b; Rechtman et al. 2014) and neighboring Puuanahulu (Barrera 1997; Dye et al. 2002; Walker et al. 1990). Figure 19 and Table 2 show the previous archaeological studies in closest proximity to the current study area; relevant findings from these archaeological studies are presented below.

**Table 1. Archaeological sites recorded by Reinecke (n.d.) in Puʻuwaʻawaʻa Ahupuaʻa.**

| *Site No.* | *Description* |
|---|---|
| 129 | Luahinawai and Waiaelepi ponds; habitation and shelter ruins; concrete salt pans; platform; enclosures |
| 130 | Multiple shelters |
| 131 | One large cave called Keanalele |
| 132 | Two enclosures; four house sites; two platforms; a coral-strewn path; multiple shelters; |
| 133 | Ruins of five modern houses (walls and platforms) |
| 134 | One stone platform (“probably quite modern”) |

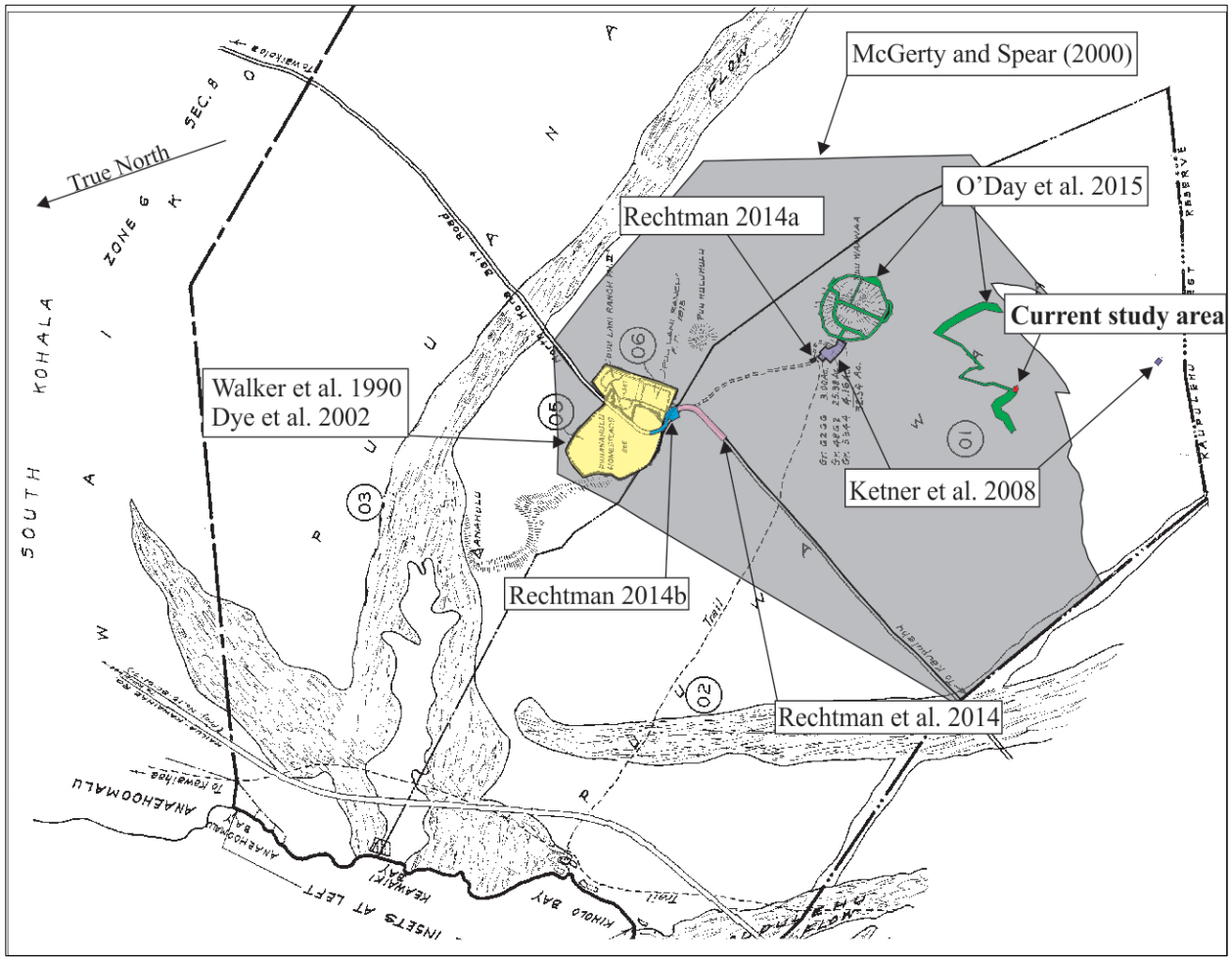


Figure 19. Previous archaeolocial studies conducted within the vicinity of the current study area.

**Table 2. Previous archaeological studies conducted within the vicinity of the current study area.**

| *Year* | *Author* | *Ahupuaʻa* | *Type of Study* |
|---|---|---|---|
| n.d. | Reinecke | Various | Archaeological Survey |
| 1990 | Walker et al. | Puʻuanahulu | Inventory Survey |
| 1997 | Barrera | Puʻuanahulu | Inventory Survey |
| 2000 | McGerty and Spear | Puʻuanahulu/Puʻuwaʻawaʻa | Archaeological Reconnaissance |
| 2002 | Dye et al. | Puʻuanahulu | Supplemental Inventory Survey |
| 2008 | Ketner et al. | Puʻuwaʻawaʻa | Inventory Survey |
| 2010 | Haun and Henry | Puʻuwaʻawaʻa | Archaeological Assessment |
| 2014a | Rechtman | Puʻuwaʻawaʻa | Archaeological Assessment |
| 2014b | Rechtman | Puʻuanahulu | Section 106 |
| 2014 | Rechtman et al. | Puʻuwaʻawaʻa | Inventory Survey |
| 2015 | O'Day et al. | Puʻuwaʻawaʻa | Inventory Survey |

In 1990, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of approximately 400 acres within neighboring Puʻuanahulu Ahupuaʻa (Walker et al. 1990), northeast of the current study area (see Figure 19). As a result of their survey, eleven sites were identified, which included the following feature types: terraces, mounds, enclosures, modified outcrops, cairns, c-shape shelters, rock alignments, cultural deposits, and a possible cistern. No Precontact features were identified during the survey and many of the features were interpreted as related to Historic ranching or homesteading.

In 1999, Scientific Consultant Services, Inc. conducted an archaeological reconnaissance of 22,000 acres (see Figure 19) within both Puʻuanahulu and Puʻuwaʻawaʻa Ahupuaʻa, a portion of which included the current study area (McGerty and Spear 2000) As a result of the reconnaissance four previously recorded sites and thirty-two new sites were encountered. These sites consisted of cave features (temporary habitations and burials), agricultural features (mounds, terraces, and enclosures), cairns, and nineteenth and early twentieth century ranching features (enclosures, rock and a mortar building with water tank). McGerty and Spear (2000) recorded a mortar-lava rock building (TS-27) approximately 500 meters north of Poʻohohoʻo, which they identified as a dairy that dated back to at least 1894. However, no sites were recorded within the current study area.

In 2002, International Archaeological Research Institute, Inc. (IARII) produced supplemental research to support an archaeological inventory survey done by William Barrera in 1997 of approximately 150 acres at Puu Lani Ranch within Puʻuanahulu Ahupuaʻa (Dye et al. 2002), northeast of the current study area (see Figure 19). This supplemental report was conducted in order to bring the original inventory report (Barrera 1997) up to State Historic Preservation Division (SHPD) archaeological inventory survey standards. As a result, most of the twenty-two sites originally recorded by Barrera (1997) were relocated and additional features were added to the existing site data. In addition to the previously recorded sites, IARII identified and recorded eleven new sites. The sites consisted of Historic Period features comprised mainly of core-filled walls, agricultural mounds, house platforms, burials (platform, mound, and soil), overhang shelters, temporary habitation caves, modified outcrops, petroglyphs, enclosures, and a road bed. All of the features were interpreted as relating to Historic ranching or homesteading.

In 2008, Rechtman Consulting, LLC conducted an archaeological inventory survey of a roughly 32.5 acre portion of TMK: (3) 7-1-01:002 and 006, and a roughly 2.7 acre portion of TMK: (3) 7-1-001:003, located in Puʻuwaʻawaʻa Ahupuaʻa (Ketner et al. 2008); the current study area is located roughly in between these two study parcels (see Figure 19). Although no Precontact resources were observed during that study, two historic properties were identified: SIHP Site 26170, Puʻu Waʻawaʻa Ranch; and SIHP Site 26171, the Halepiula water catchment area. Both of these resources date from no earlier than the late nineteenth century and contain mostly architectural elements. The two sites recorded are a part of the larger site (SIHP Site 7190) that was recorded in 1973 during the Statewide Inventory. Site 7190 was described as Puʻu Waʻawaʻa Ranch consisting of 19,000 acres; and thus, although undefined in the 1973 site record, includes the core of the ranch buildings and the surrounding pasture lands. Much of this land, like the current study area, is state-owned, and falls within ranch-named paddocks. As previously mentioned the current study area is situated within the "Waiho 1" paddock of the Puʻu Waʻawaʻa Ranch.

In 2010, Haun & Associates conducted an archaeological survey of a roughly 0.65 acre property for the proposed 0.25 acre Hawaiʻi Permanent Plot Network Weather Station Site (Haun and Henry 2010). Their study area is located approximately 225 meters southwest of the current study area, within the Forest Bird Sanctuary of the Hawaiʻi Experimental Tropical Forest. No archaeological resources were encountered as a result of their study.

In 2014, ASM Affiliates conducted three archaeological studies in the vicinity of the current study area (Rechtman 2014a and 2014b; Rechtman et al. 2014). The first (Rechtman 2014a) consisted of an Archaeological Assessment of a roughly 2 acre portion of TMK: (3) 7-1-001:006 (state-owned land; see Figure 19) located adjacent to the current Puʻu Waʻawaʻa Ranch headquarters. Their study included a cultural consultation with two informants with ties to the area and Puʻu Waʻawaʻa Ranch in particular. The informants knew nothing of cultural practices or archaeological sites within the project area vicinity, and no archaeological features were observed during this study.

The second and third ASM studies (Rechtman 2014b and Rechtman et al. 2014) were conducted on behalf of the Hawaii Department of Transportation (HDOT) on two sections of land in close proximity to the entrance to Puʻu Waʻawaʻa Ranch, situated adjacent to Highway 190 (see Figure 19). The first of these two studies (Rechtman 2014b) was conducted on behalf of HDOT and the Federal Highway Administration in compliance with Section 106 of the National Historic Preservation Act for a proposed drainage improvement project. As a result of that study, several features of the old Waimea-Kona Belt Road, previously recorded SIHP Site 20855, were identified. Site 20855 consists of remnant sections of the former Waimea-Kona Belt Road, and later Māmalahoa Highway and associated walls located on both sides of present day Highway 190. The roadway was constructed between 1916 and 1922, and it served as the main Kona-Waimea connector for 11 years until it was superseded by construction of the Māmalahoa Highway (now Highway 190) in 1933. The third ASM study (Rechtman et al. 2014) consisted of an archaeological inventory survey of a highway right-of-way corridor (TMK: (3)7-1-001/002) in Puʻuwaʻawaʻa Ahupuaʻa located immediately to the west of the Rechtman (2014b) study area (see Figure 19). That study of the highway corridor also produced observations of SIHP Site 20855 within and adjacent to their study corridor, on both sides of present-day Highway 190.

The most recent archaeological investigation conducted near the current study area was an archaeological inventory survey (O'day et al. 2015) of fence line corridors for three proposed exclosure conservation units in the Puʻu Waʻawaʻa Forest Reserve, located within the current study TMK Parcel and neighboring TMK: (3) 7-1-001:004 (see Figure 19). The examined fence line corridors ranged between 50 to 250 meters wide and covered roughly 256 acres. As a result of their study, six previously unrecorded historic properties were identified in addition to features of the previously recorded Puʻu Waʻawaʻa Ranch site (Site 7190). Four of the six sites retained integrity and were determined as significant: a chute and corral complex (Site 30308), a stone wall (Site 30310), a historic stone corral (Site 30311), and the additional features of Puʻu Waʻawaʻa Ranch. While the remaining two sites: a modified outcrop (Site 30307) and a trachyte quarry (Site 30306) were determined as not significant. The majority of these sites were interpreted as associated with Historic ranching activity, with the exception of the modified outcrop, which was likely utilized as a temporary shelter during Precontact times. Section 2 of the Aiea Conservation Unit of the O'Day et al. (2015) study is situated on the northern side of the modern fence that surrounds Poʻohohoʻo Reservoir. O'Day et al. (2015) observed traces of a ranch road and multiple segments of galvanized pipe to the north of the current study area, all of which were interpreted as remnants of infrastructure associated with Puʻu Waʻawaʻa Ranch. According to O'Day et al. (2015:40), the so-called "Poohohoo Reservoir Access Road" appeared to be ungraded and "a relatively new road associated with the development of Poohohoo Reservoir."

# 3. PROJECT AREA EXPECTATIONS

Based on a review of historical information previously collected by Maly and Maly (2006), the results of previous archaeological research within the current project area (McGerty and Spear 2000), historical documentary research, cultural informant data (Rechtman 2014a), and settlement pattern data for the North Kona District, the archaeological expectations for the current survey area are rather low. As a result of the fact that the general vicinity of the study area falls within Puʻu Waʻawaʻa Ranch land, which has been actively used as pasture since the late 1800s, ranch-related features such as stone walls, enclosures, or fence lines can be expected. As previously mentioned the current study area falls within the former Waiho 1 Paddock of the Puʻu Waʻawaʻa Ranch site (SIHP Site 7190), however, the modern development of the water catchment and reservoir features in this area significantly modified this part of the paddock and original elements (i.e., fences and gates) of the paddock may not be present in the current study area. In addition, based on the findings from a Biological Assessment of Puʻuwaʻawaʻa conducted by DLNR (Giffin 2003), which reported the existence of several lava tube systems in close proximity to the current study area; there is the possibility that a cave entrance or other associated feature may be found in the vicinity of the current study area. However, due to the modified nature of the subject reservoir and environs, the chances of finding intact cultural deposits are extremely limited.

# 4. CURRENT FIELD INVESTIGATION AND CONSULTATION

Fieldwork for the current study was conducted on May 27, 2015 by Robert B. Rechtman, Ph.D. and Matthew R. Clark B.A. To insure that no archaeological resources would be impacted during the proposed decommissioning of the Poʻohohoʻo Reservoir, the survey area was approximately 6 acres, which included the portion of the reservoir complex (Area 2 reservoir) to be breached and its immediate surrounding landscape, along with a construction staging area in the pasture to the north of the catchment (see Figure 3). Also visible on Figure 3 is the quarry area (Figure 20) to the east of the Area 2 reservoir where the cinder material to build the retaining berms was mined. The archaeological surface survey involved a 100% surface inspection of the study area. Ground surface visibility was fair to excellent. The interior of the reservoir still retains its butyl-rubber lining across much of the surface (Figures 21 and 22). As a result of the field survey, there were no archaeological features observed on the surface and given the nature of the substrate, there is virtually no likelihood of encountering subsurface remains.

After conducting the archaeological survey of the study area, Robert Rechtman, Ph.D. met with Mikio "Miki" Kato at his residence, which is several miles downslope of the current study area. Miki Kato has lived in Puʻuwaʻawaʻa Ahupuaʻa since about 1962 and worked at the Puʻu Waʻawaʻa Ranch since 1956. Mr. Kato is very familiar with the study area and vicinity. He shared that the subject reservoir was constructed at some point during the middle 1960s and that he did not know of any culturally specific use of the land from the past or present associated with the current study area or of the existence of any archaeological sites within the current study area.

Figure 20. Cinder quarry to the east of the reservoir, view to the east, note modern fencing

Figure 21. Butyl-rubber lining on interior slopes of reservoir area, view to southeast

Figure 22. Butyl-rubber lining on interior floor of reservoir basin, view to the northeast

# 5. CONCLUSION AND RECOMMENDATIONS

Although the current study area is within a named paddock ("Waiho 1") of the larger Puʻu Waʻawaʻa Ranch site (Site 7190), the vicinity of the current study area does not retain aspects of its original condition (i.e., historic fencing materials and other boundary delineations), and there are several modern constructions already present in this area of the paddock; thus it can be concluded that the current proposed decommissioning of a portion of the extant reservoir complex will not significantly alter the nature of the overall Waiho Paddock, which in its entirety could be considered a contributing element to the significance of Site 7190. Given the negative findings of the prior archaeological reconnaissance (McGerty and Spear 2000) and those of the current study, it is concluded that the proposed reservoir decommissioning project will not significantly impact any known historic properties. In the unlikely event that any unanticipated archaeological resources are unearthed during development activities, in compliance with HAR 13§13-280 work in the immediate vicinity of the finds should be halted and DLNR-SHPD contacted.

# REFERENCES CITED


Ahlo, H.

1982 An Archaeological Reconnaissance Survey of a Three-acre Parcel at Kiholo, North Kona, Hawaii (TMK 7-1-02:2). Science management, Inc. Prepared for Carlsmith, Carlsmith, Wichman & Case, Kailua-Kona, Hawaii.

Barrera, W., Jr.

1997 Puu Anahulu, North Kona, Hawaii Island: Archaeological Inventory Survey of TMK: 7-1-05 (multiple). Prepared for Puu Lani Ranch, Inc.

Burtchard, G.

1995 Population and Land Use on the Keauhou Coast, the Mauka Land Inventory Survey, Keauhou, North Kona, Hawai‘i Island. Part I: Narrative Volume. International Archaeological Research Institute, Inc. (IARII). Prepared for Belt Collins and Associates and Kamehameha Investment Corporation, Honolulu.

Chinen, J.

1961 *Original Land Titles in Hawaii.* Honolulu: privately published.

Ching, F.

1971 The Archaeology of South Kohala and North Kona: From the Ahupua‘a of Lalamilo to the Ahupua‘a of Hamanamana. Surface Survey Kailua-Kawaihae Road Corridor (Section III). Hawaii State Archaeological Journal 71-1. DLNR–State Parks Division, Honolulu.

Cordy, R.

1995 Central Kona Archaeological Settlement Patterns. State Historic Preservation Division, Department of Land and Natural Resources, State of Hawaii.

2000 *Exalted Sits the Chief, The Ancient History of Hawai‘i Island*. Mutual Publishing, Honolulu, Hawai‘i.

Doyle, E.

1953 *Makua Laiana*: The Story of Lorenzo Lyons. Compiled from the manuscript journals, 1832-1886. Honolulu Star-Bulletin.

Dye, T., K. Maly, and J. Athens

2002 Final Supplemental Research to Support an Archaeological Inventory Survey of Puu Lani Ranch Phase II, Pu‘u Anahulu, Kona, Hawai‘i (TMK: 3-7-1-05:multiple). International Archaeological Research Institute, Inc., Honolulu, Hawai‘i. Prepared for Puu Lani Ranch, Kāne‘ohe, Hawai‘i.

Ellis, W.

1963 *Journal of William Ellis, Narrative of a Tour of Hawaii, or Owhyee...* Honolulu: Advertiser Publishing Co., Ltd.

Fornander, A.

1969 *An Account of the Polynesian Race: Its Origin and Migrations.* Tokyo: Charles E. Tuttle Co., Inc.

Giffin, J

2003 Pu‘u Wa‘awa‘a Biological Assessment, Pu‘u Wa‘awa‘a, North Kona, Hawaii. State of Hawaii Department of Land and Natural Resources Division of Forestry and Wildlife.

Haun, A. and D. Henry

2010 Archaeological Assessment Pu‘uwa‘awa‘a Hippnet Weather Station Site Portion of TMK: (3) 7-1-01:07, Land of Pu‘uwa‘awa‘a, North Kona District, Island of Hawai‘i. Haun and Associates Report 663-092010 prepared for Institute of Pacific Islands Forestry.

Henke, L.
1929 A Survey of Livestock in Hawaii. University of Hawaii. *Research Publication* No. 5.

Hommon, R.
1976 *The Formation of Primitive States in Pre-Contact Hawaii*. Ph.D. Dissertation (Anthropology), University of Arizona, Tucson. University Microfilms, Inc., Ann Arbor, Michigan.

1986 Social Evolution in Ancient Hawai‘i. IN Kirch, P.V. (ed.), *Island Societies: Archaeological Approaches to Evolution and Transformation*: 55-88. Cambridge: University Press.

I‘i, J.
1959 *Fragments of Hawaiian History*. *Bishop Museum Special Publication* 70. Bishop Museum Press, Honolulu.

Juvik, J. and L. Tango
2003 Climate and Water Resources, Pu‘u Wa‘awa‘a, North Kona, Hawai‘i. Report prepared for the Department of Land and Natural Resources, Division of Forestry and Wildlife.

Kamakau, S.
1992 *Ruling Chiefs of Hawaii.* The Kamehameha Schools Press, Honolulu (Revised Edition).

Kelly, M.
1983 Nā Māla O Kona: Gardens of Kona. A History of Land Use in Kona, Hawai‘i. Departmental Report Series 83-2. Department of Anthropology, B.P. Bishop Museum, Honolulu. Prepared for the Department of Transportation, State of Hawaii.

Ketner, A. R. Rechtman, and A. Yoklavich
2008 An Archaeological Inventory Survey of TMK:3-7-1-01:003 and Portions of Parcels 002 and 006, located in Pu‘u Wa‘awa‘a Ahupua‘a, North Kona District, Island of Hawai‘i. Rechtman Consulting Report RC-464. Prepared for Vincent Paul Ponthieux of Envision Design, Honolulu.

Kirch, P.
1984 *The Evolution of the Polynesian Chiefdoms*. New York: Cambridge University Press.

1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawai’i Press, Honolulu.

2011 When did the Polynesians Settle Hawai‘i? A Review of 150 Years of Scholarly Inquiry and a Tentative Answer. *Hawaiian Archaeology* Vol. 12:3-26.

Maguire, E.
1926 *Kona Legends.* Honolulu: Paradise of the Pacific Press.

Malo, D.
1951 Hawaiian Antiquities. *B.P. Bishop Museum Special Publication* 2. B.P. Bishop Museum Press, Honolulu. (2nd edition) (Translated by N. Emerson).

Maly, K., and O. Maly
2006 He Mahi Mo‘olelo No Pu‘u‘wa‘awa‘a Me Nāpu‘u O Na Kona-A Collection of Cultural and Historical Accounts of Pu‘u‘wa‘awa‘a and the Napu‘u Region-District of Kona on the Island of Hawai‘i. Kumu Pono Associates LLC. HIHTEF116-Pu‘u‘wa‘awa‘a (123006a). Prepared for The Institute of Pacific Islands Forestry USDA Forest Service, Hilo, Hawai‘i.

McGerty, L., and R. Spear
2000 An Archaeological Reconnaissance of Acres of Land Within the Ahupuaʻa of Puʻuanahulu and Puʻuwaʻawaʻa, District of North Kona, Hawaiʻi Island, Hawaiʻi (TMK 7-1-01:04, 7-1-01:06, 7-1-02:13, 7-1-03:16, and 7-1-04:18). Scientific Consultant Services, Inc. Project Number 174-2. Prepared for The Nature Conservancy, Hawaiʻi on behalf of the Hui ʻOhana Mai Puʻuanahulu a me Puʻuwaʻawaʻa.

O'Day, P, M. Desilets, and D. Byerly
2015 Archaeological Inventory Survey of Fenceline Corridors for Three Ungulate Exclosure Conservation Units in the Puʻu Waʻawaʻa Forest Reserve, North Kona District, Puʻu Waʻawaʻa Ahupuaʻa, Hawaiʻi Island, Hawaiʻi TMKs (3) 7-1-001:004 and 7-1-001:006. GANDA Report No. 2282-1 prepared for Department of Land and Natural Resources Division of Forestry and Wildlife, Honolulu.

Pogue J.
1978 Mooleo Hawaii. Hale Paipalapala Aupuni, Honolulu [1858] (Revised Edition).

Pukui, M., S. Elbert, and E. Mookini
1974 *Place Names of Hawaii*. University of Hawaii Press, Honolulu.

Rechtman, R.
2014a Archaeological Assessment of Roughly 2 Acres of State Land Adjacent to Puʻuwaʻawaʻa Ranch TMK: (3) 7-1-001/002. Puʻuwaʻawaʻa Ahupuaʻa, North Kona District, Island of Hawaiʻi. ASM Report No. 21820 prepared for Ron Terry, Ph.D., Geometrician Associates, LLC, Hilo, HI.

2014b Archaeological Inventory Survey of a HDOT Right-of-Way Corridor TMK: (3) 7-1-001:006 (por.). Puʻuwaʻawaʻa Ahupuaʻa, North Kona District, Island of Hawaiʻi. ASM Report No. 21750 prepared for Nāpuʻu Water, Inc, Kamuela, HI.

Rechtman, R., and T. Wolforth
1999 Archaeological Inventory Survey of a Nine-Acre Parcel at Kīholo Bay, Puʻuwaʻawaʻa Ahupuaʻa, North Kona District, Island of Hawaiʻi (TMK: 3-7-1-2:Por. 2). PHRI Report 1998-092499. Prepared for Roy A Vitousek III, Cades Schutte, Fleming, and Wright, Kailua-Kona.

Rechtman R., J. Nelson, and B. Barna.
2014 Archaeological Inventory Survey of a HDOT Right-of-Way Corridor, TMK (3) 7-1-001/002, Puʻuwaʻawaʻa Ahupuaʻa, North Kona District, Island of Hawaiʻi. ASM Report Number 21820. Prepared for Ron Terry, Ph.D., Geometrician Associates, LLC, Hilo, Hi.

Reinecke, J.
n.d. Survey of Sites on West Hawaii. Unpublished manuscript, Department of Anthropology, B.P. Bishop Museum, Honolulu (1930).

Rosendahl, P.
1972 Aboriginal Agriculture and Domestic Residence Patterns in Upland Lapakahi, Island of Hawaii. Ph.D. dissertation, University of Hawaii, Honolulu.

1973 Archaeological Salvage of the Ke-ahole to ʻAnaehoʻomalu Section of the Kailua-Kawaihae Road (Queen Kaahumanu Highway), Island of Hawaii. *Departmental Report Series* 73-3. Department of Anthropology, B.P. Bishop Museum, Honolulu.

Walker, A., L. Kalima, and P. Rosendahl
1990 Archaeological Inventory Survey Royal Vistas Estates Development, Land of Puuanahulu, North Kona District, Island of Hawaii (TMK:3-7-1-05:26-34,39-41). Paul H. Rosendahl, Ph.D., Inc., Report 659-060190. Prepared for Premier Resort Development, Kailua-Kona, Hawaii.

Wilkes, C.
1845 *Narrative of the United States Exploring Expedition During the Years 1838–1842, Under the Command of C. Wilkes, U.S.N.*, Volume 4. Philadelphia: Loa and Blanchard.

Wolfe, E., and J. Morris
1996 Geologic Map of the Island of Hawai‘i. *Geologic Investigations Series Map* 1-2524-A. U.S. Department of the Interior, U.S. Geological Survey.

# ENVIRONMENTAL ASSESSMENT

# Decommissioning of DLNR Poohohoo Reservoir No. 2

**APPENDIX 3**
**Biological Survey**

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# Biological Survey

## Decommissioning of DLNR Poohohoo Reservoir No. 2
## Puʻuwaʻawaʻa State Forest Reserve, North Kona, Hawaiʻi

By Elliott Parsons, Ph.D. Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife. Prepared for DLNR Engineering Division, January 2016

**Introduction**

This biological Survey was prepared as part of the environmental review process for a project of the Department of Land and Natural Resources, Engineering and Forestry & Wildlife Divisions to decommission the old, unused Poohohoo Reservoir No. 2 at Puʻuwaʻawaʻa Forest Reserve, North Kona, on the Island of Hawaiʻi. The main project activity will involve breaching an embankment of the reservoir to reduce the holding capacity to lower the chances of a catastrophic dam breach in the future from extreme weather events. The reservoir is in disrepair and DLNR does not have any future plans to rehabilitate it.

**Survey objectives**

The survey involved an assessment of all plant, mammal, and bird species within and directly adjacent to the project impact area (Figure 1), and was conducted by DOFAW's Elliott Parsons on Friday, January 22nd, 2016. Surveys included foot surveys of the area as well as visual and auditory bird surveys. The objectives of the biological survey were to: 1) describe the vegetation, 2) list all species encountered, and 3) identify and provide locations for any rare, threatened or endangered species as well as any mitigative measures that could be taken to protect these species during project implementation. The majority of species were identified in the field. Species which could not be identified in the field were identified back in the Puʻuwaʻawaʻa office with photographs and sketches using field guides, the *Manual of the Flowering Plants of Hawaiʻi* (Wagner et al. 1999), and with help from Hawaiʻi District Botanist Lyman Perry and other botanists. Special attention was given to the possible presence of any federal or state listed threatened or endangered species (USFWS 2016).

**Vegetation**

The vegetation surrounding Poohohoo reservoir area can be described as pastureland dominated mostly by kikuyu and fountain grasses and other weeds, with occasional native (koa, ʻōhiʻa), and non-native trees (Picture 1). According to Juvik & Tango's November 2003 "Climate and Water Resources Puu Waawaa, North Kona, Hawaii", the Poohohoo reservoir complex was built in the early 1960's by the Puʻuwaʻawaʻa lessee Dillingham and includes 2 butyl rubber-lined reservoirs (an upper and lower reservoir), and a large catchment made of degraded bituminous pavement directly uphill (south) of the upper reservoir. The area is fenced inside a 28-acre ungulate-proof exclosure (hog wire), which replaced an older fence that was removed in the last 10 years. Inside the older fence-line foot print is significant re-growth of ʻōhiʻa (*Metrosideros*

*polymorpha*), and koa (*Acacia koa*) around the outside edges of the reservoirs, as well as non-native pine and occasional silver oak and jacaranda. The koa and ʻōhiʻa are mostly small, dense stands 10-25 feet in height and likely came up after the reservoir area was fenced in the 1960s/1970s. The larger reservoir (10-12 million gallon potential capacity) is currently non-functional, and according to Miki Kato (former Puʻuwaʻawaʻa Ranch manager, current DOFAW employee), the liner was torn during an intensive windstorm soon after project completion (Picture 2) and was never actually utilized as a reservoir. Larger koa can be found growing out of holes in the reservoir liner (Picture 3).

**Native plants**

Intensive biological surveys were conducted between 1:00 and 4:00 PM on 1/22/16 in the proposed cut area (see map), as well as within a 20 m buffer around this area, and approximately 50 m to the north. The surveyed area includes the area proposed to be removed from the reservoir embankment as well as surrounding areas that will likely be disturbed during project implementation (Figure 1). Surveys were a combination of targeted surveys of areas with missing liner and multiple plants, and 6 foot belt transects throughout the proposed cut area. A total of 46 different species (plants, birds, & mammals) were observed including 35 plants, 10 birds, and 1 mammal. Of the plants found (Table 1), 10 were native (including endemic and indigenous species). These were koa (*Acacia koa*), loulu fern (*Coniogramme pilosa*), aʻaliʻi (*Dodonaea viscosa*), ʻōhiʻa (*Metrosideros polymorpha*), sword fern (*Nephrolepis cordifolia*), pāpala kēpau (*Pisonia brunoniana*), golden fern (*Pityrogramma austroamericana*), whisk fern (*Psilotum nudum*), pōpolo (*Solanum americanum*), and māmane (*Sophora chrysophylla*). None of these species is listed as threatened, endangered, or a species of concern (USFWS 2016), however, pāpala kēpau are of local interest as mature trees have only been found in 3 locations at Puʻuwaʻawaʻa. Two individuals of this species were found to the east of the lower Poohohoo reservoir (Picture 4), well away from the proposed impact area.

Although not within the immediate impact area of this project, six individuals of the endangered ʻaiea (*Nothocestrum breviflorum*) have been found previously to the west, south-west of the upper Poohohoo reservoir (Figure 2), exact locations available upon request. There is almost no chance these trees will be impacted by the excavation activities because they are on the opposite side of the impact area, however the ungulate-proof fence must be maintained to prevent ungulate ingress into the unit (see Mitigation Measures).

**Native birds**

A total of 10 bird species were seen in and around the project area (Table 2), two of which are native, the Hawaiian Hawk or ʻIo (*Buteo solitarius*), and the Hawaii ʻAmakihi (*Chlorodrepanis virens*). In addition, 8 non-native species were observed. The ʻIo was seen perched on a dead branch on a tall pine tree about ¼ mile to the south-west of the lower reservoir, and after about 10 minutes it joined a second ʻIo and they spent about 20 minutes soaring above Poohohoo cinder cone (to the south of the lower reservoir) before disappearing. At no point did they land on any trees in the project area and no nests were observed. The Hawaii ʻAmakihi was seen multiple times throughout the survey, looking for insects on koa and ʻōhiʻa.

**Mammals**
Hawai‘i’s only native land mammal, the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) is present at least occasionally in almost all parts of the island of Hawai‘i. Although no Hawaiian hoary bats were observed, a systematic survey with bat detection would likely reveal bats that forage in the area. They could also conceivably roost on some of the growing trees on the site, although the trees appear to be generally too short. The bats are vulnerable to disturbance of vegetation in which they roost during the summer pupping season. A feral pig was disturbed in a bed halfway up the proposed cut area after which pig trails and scat were observed in the area indicating a potential breach in the hog wire fence surrounding the area (Table 2). There were multiple pig wallowing areas in the mud in the pond at the bottom of the lower reservoir that were filled with water, and many birds were seen bathing in these pools (Saffron Finch and Nutmeg Mannikin). The pond seems to serve as a place for the non-native birds to drink and bathe (the Hawaii ‘Amakihi was never seen in the pond drinking or bathing), though it also likely serves as a mosquito breeding pond as there were many mosquitos in the area. For the sake of the native birds in the Forest Bird Sanctuary just above (especially I‘iwi, *Drepanis coccinea*, which are extremely susceptible to mosquito-borne diseases such as avian malaria and pox), this pond should probably be drained or the liner holding in the water should be removed to prevent water-build up and mosquito breeding.

**Insects**
No native insects of concern were observed in the project area (Table 3). Mosquitos were numerous, and honey bees (*Apis meliffera*) and wasps (*Vespula pensylvanica*) were present. While one potential plant host of the endangered Blackburn sphinx moth was found (pōpolo, *Solanum americanum*), this plant is used rarely (E Parsons, *personal observation*) compared with ‘aiea (*Nothocestrum breviflorum*) and tree tobacco (*Nicotiana glauca*), and no eggs or larvae of Blackburn Sphinx Moth (*Manduca blackburnii*) were observed on this plant.

**Impacts**
This project involves the following construction elements with a potential to affect vegetation and animals:

- Removing a section of Poohohoo reservoir fence to gain access/entry
- Excavating a break in the embankment wall to stop the accumulation of water
- Removing approximately 19,000 square feet (+/- 9,600 cubic yards) of material from the north side of the lower Poohohoo reservoir embankment
- Moving the material (above) and depositing it at a location nearby the reservoir area
- Removing damaged butyl liner on, in, and around the lower reservoir
- Accessing the reservoir embankment and reservoir from the main access roads with vehicles and heavy equipment in order to conduct the work.

These activities will impact both native and non-native species in the area, but with the exception of koa and ‘ōhi‘a (which are numerous in the area), this project will mainly affect weeds which are not of conservation concern. Though koa and ‘ōhi‘a will be removed on the embankment,

the removal of the old, degraded butyl liner will provide more space for forest restoration and recovery. The 19,000 square feet of material removed from the embankment will need to be relocated somewhere nearby, but the vast majority of the area is pastureland with herbaceous weeds including fireweed and bull thistle. There were also no areas directly to the north of the proposed cut area that had important native species that would be negatively impacted by this project (Pictures 5, 6).

**Mitigation Measures**

There are a few mitigation measures that if followed before and during project implementation will reduce the impacts on the native species in the area so that there are no adverse effects. These are listed below:

1. Though not directly in the proposed cut area, the two pāpala kēpau trees inside the 28-acre Poohohoo fence (Picture 4) have special importance as they are one of three known populations of this species at Puʻuwaʻawaʻa so they should be protected from disturbance. They are to the east of the lower Poohohoo reservoir and away from the impact area so there should be no impact. If project design is changed and there is impact near these species, DLNR Engineering Division will coordinate with DOFAW to ensure that these trees will have 4-foot high protective fencing, orange, plastic mesh or equivalent accepted by the Engineer, installed around each tree (Each tree should be surrounded with protective fence at a minimum of 10 feet from the trunk, with steel T-posts spaced at a minimum of 5 feet on center).
2. The material excavated from the reservoir embankment should not be placed on top of any native ʻōhiʻa or koa if it can be avoided. There is plenty of space to the north of the lower Poohohoo reservoir that is just pasture grasses and weeds. Once the material is placed in the area and the embankment breach is finished, the Puʻuwaʻawaʻa crew should be contacted so that the area can be replanted with native vegetation as much as is possible. In order to prevent erosion, kikuyu grass clippings can be cut from nearby grasses, the stem can be buried in the soil and the cutting watered. This can be a stop-gap measure before native reforestation is completed.
3. The 28-acre fenced Poohohoo unit contains 6 endangered ʻaiea (*Nothocestrum breviflorum*) trees inside the ungulate proof fence. These trees are well away from the lower Poohohoo reservoir (to the west, see Figure 2). While project activities such as the reservoir embankment breach will not impact these trees, any ungulates (hooved mammals, such as cows, horses, and feral goats, sheep, and pigs) that get inside the fence could impact them through browsing, root trampling, and bark stripping. Therefore, the existing hog-wire Poohohoo fence must be maintained in a way as to prevent access by these ungulates for the entire duration of the project. If these animals get in and damage the endangered ʻaiea trees, this would constitute "take" which is illegal under the State Endangered Species Laws (HRS Chapter 195D).
4. There will be no clearing of woody vegetation taller than 15 feet during the bat pupping season, which runs from June 1 through September 15 each year.
5. There will be no earthmoving or tree cutting during the breeding season for Hawaiian

Hawks (March through September). If this time period cannot be avoided, DLNR will arrange for a hawk nest search to be conducted by a qualified biologist, and if hawk nests are present in or near the project site, all land clearing activity will cease until the expiration of the breeding season.

**References**

Juvik J. O. & Tango, L.K. 2003. Climate and Water Resources, Puu Waawaa, North Kona, Hawaii

U.S. Fish & Wildlife Service (USFWS). 2016. USFWS Threatened and Endangered Species System (TESS). Washington: GPO. http://ecos.fws.gov/tess_public/

Wagner, W.L., Herbst, D.R., & Sohmer, S.H. 1999. Manual of the Flowering Plants of Hawaii, Revised Edition, Volume 2. Bishop Museum, Honolulu.

**Table 1: Plant species within the area of potential impact of the lower reservoir Poohohoo impact area, Pu‘uwa‘awa‘a Forest Reserve, North Kona, Hawai‘i.**

## Plant Species List Poohohoo Botanical Survey

| # | Common name | Genus | Species | Life form | Abundance | Status |
|---|---|---|---|---|---|---|
| 1 | Koa | *Acacia* | *koa* | Tree | High | Native/No Status |
| 2 | Loulu fern | *Coniogramme* | *pilosa* | Fern | Moderate | Native/No Status |
| 3 | A‘ali‘i | *Dodanea* | *viscosa* | Shrub | Low | Native/No Status |
| 4 | ‘Ōhi‘a | *Meterosideros* | *polymorpha* | Tree | High | Native/No Status |
| 5 | Narrow sword fern | *Nephrolepis* | *cordifolia* | Fern | Low | Native/No Status |
| 6 | Papala kepau | *Pisonia* | *brunoniana* | Tree | Low | Native/No Status |
| 7 | Golden fern | *Pityrogramma* | *austroamericana* | Fern | Moderate | Native/No Status |
| 8 | Whisk fern | *Psilotum* | *nudum* | Fern | Low | Native/No Status |
| 9 | Pōpolo | *Solanum* | *americanum* | Herb | Very low | Native/No Status |
| 10 | Māmane | *Sophora* | *chrysophylla* | Tree | Low | Native/No Status |
| 11 | Hamakua pamakani | *Ageratina* | *riparia* | Herb | High | Non-native |
| 12 | Scarlet pimpernel | *Anagallis* | *arvensis* | Herb | Low | Non-native |
| 13 | Balloon plant | *Asclepias* | *physocarpa* | Shrub | Low | Non-native |
| 14 | Spanish needle | *Bidens* | *pilosa* | Herb | Low | Non-native |
| 15 | Kikuyu grass | *Cenchrus* | *clandestinus* | Grass | Very High | Non-native |
| 16 | Fountain grass | *Cenchrus* | *setaceus* | Grass | Very High | Non-native |
| 17 | Bull thistle | *Cirsium* | *vulgare* | Herb | Moderate | Non-native |
| 18 | Cranesbill | *Geranium* | *homeanum* | Herb | Low | Non-native |
| 19 | Silver oak | *Grevellia* | *robusta* | Tree | Low | Non-native |
| 20 | Stinking everlasting | *Helichrysum* | *foetidum* | Herb | Moderate | Non-native |
| 21 | Lawn marsh pennywort | *Hydrocotyle* | *sibthorpioides* | Herb | Low | Non-native |
| 22 | Pukamole | *Lythrum* | *maritimum* | Herb | Moderate | Non-native |
| 23 | Cheese weed | *Malva* | *parviflora* | Herb | Low | Non-native |
| 24 | Molasses grass | *Melinis* | *minutiflora* | Grass | High | Non-native |
| 25 | Tree tobacco | *Nicotiana* | *glauca* | Shrub | Low | Non-native |
| 26 | Yellow wood sorrel | *Oxalis* | *corniculata* | Herb | Low | Non-native |
| 27 | Banana poka | *Passiflora* | *tarminiana* | Vine | Moderate | Non-native |
| 28 | Plantain | *Plantago* | *lanceolata* | Herb | Moderate | Non-native |
| 29 | Fireweed | *Senecio* | *madagascarensis* | Herb | Moderate | Non-native |
| 30 | Kolomona | *Senna* | *septemtrionalis* | Shrub | Low | Non-native |
| 31 | Apple of sodom | *Solanum* | *linnaeanum* | Shrub | Low | Non-native |
| 32 | Jerusalem cherry | *Solanum* | *pseudocapsicum* | Herb | Moderate | Non-native |
| 33 | Turkey mullein | *Verbascum* | *thapsus* | Herb | Moderate | Non-native |
| 34 | Vervain | *Verbena* | *litoralis* | Herb | Moderate | Non-native |
| 35 | Vetch | *Vicia* | *sativa* | Herb | Low | Non-native |

**Table 2: Birds, mammals, and insects observed within or in the area surrounding the proposed impact area of the Poohohoo lower reservoir decommission project, Pu‘uwa‘awa‘a, North Kona, Hawaii.**

## Bird Species List Poohohoo Wildlife Survey

| # | Common name | Genus | Species | Status | Detailed Status |
|---|---|---|---|---|---|
| 1 | Hawaiian Hawk | *Buteo* | *solitarius* | native | Resident endemic |
| 2 | Hawaii Amakihi | *Chlorodrepanis* | *virens* | native | Resident endemic |
| 3 | Northern Cardinal | *Cardinalis* | *cardinalis* | non-native | Resident naturalized |
| 4 | Common Waxbill | *Estrilda* | *astrild* | non-native | Resident naturalized |
| 5 | Erckel's Francolin | *Francolinus* | *erckelii* | non-native | Resident naturalized |
| 6 | Nutmeg Mannikin | *Lonchura* | *punctulata* | non-native | Resident naturalized |
| 7 | Kalij Pheasant | *Lophura* | *leucomelanos* | non-native | Resident naturalized |
| 8 | Yellow-fronted Canary | *Serinus* | *mozambicus* | non-native | Resident naturalized |
| 9 | Saffron Finch | *Sicalis* | *flaveola* | non-native | Resident naturalized |
| 10 | Japanese White-eye | *Zosterops* | *japonicus* | non-native | Resident naturalized |

## Mammal Species List Poohohoo Wildlife Survey

| # | Common name | Genus | Species | Status | Detailed Status |
|---|---|---|---|---|---|
| 1 | Feral pig | *Sus* | *Scrofa* | non-native | |

## Insect Species List Poohohoo Wildlife Survey

| # | Common name | Genus | Species | Status | Detailed Status |
|---|---|---|---|---|---|
| 1 | Honeybee | *Apis* | *meliffera* | non-native | |
| 2 | Monarch Butterfly | *Danaus* | *plexippus* | non-native | |
| 3 | Yellow Jacket | *Vespula* | *pensylvanica* | non-native | |
| 4 | Dragonfly spp. | | | unknown | |
| 5 | Mosquito spp. | | | non-native | |

**Table 3: Locations of plants to be individual fenced during project implementation (see Mitigation Measures) if necessary.**

**Locations of plants of concern location data: UTM UPS NAD 83, Zone 5 N**

| # | Common name | Genus | Species | X | Y |
|---|---|---|---|---|---|
| 1 | Papala kepau | *Pisonia* | *brunoniana* | 0200011 | 2185679 |
| 2 | Papala kepau | *Pisonia* | *brunoniana* | 0200009 | 2185663 |

**Figure 1: Map showing location of proposed cut (reservoir embankment removal) area (hashed lines) on the north (top) side of the larger Poohohoo Reservoir (the one on the right). The approximate biological survey area is within the red line, about 6 acres.**

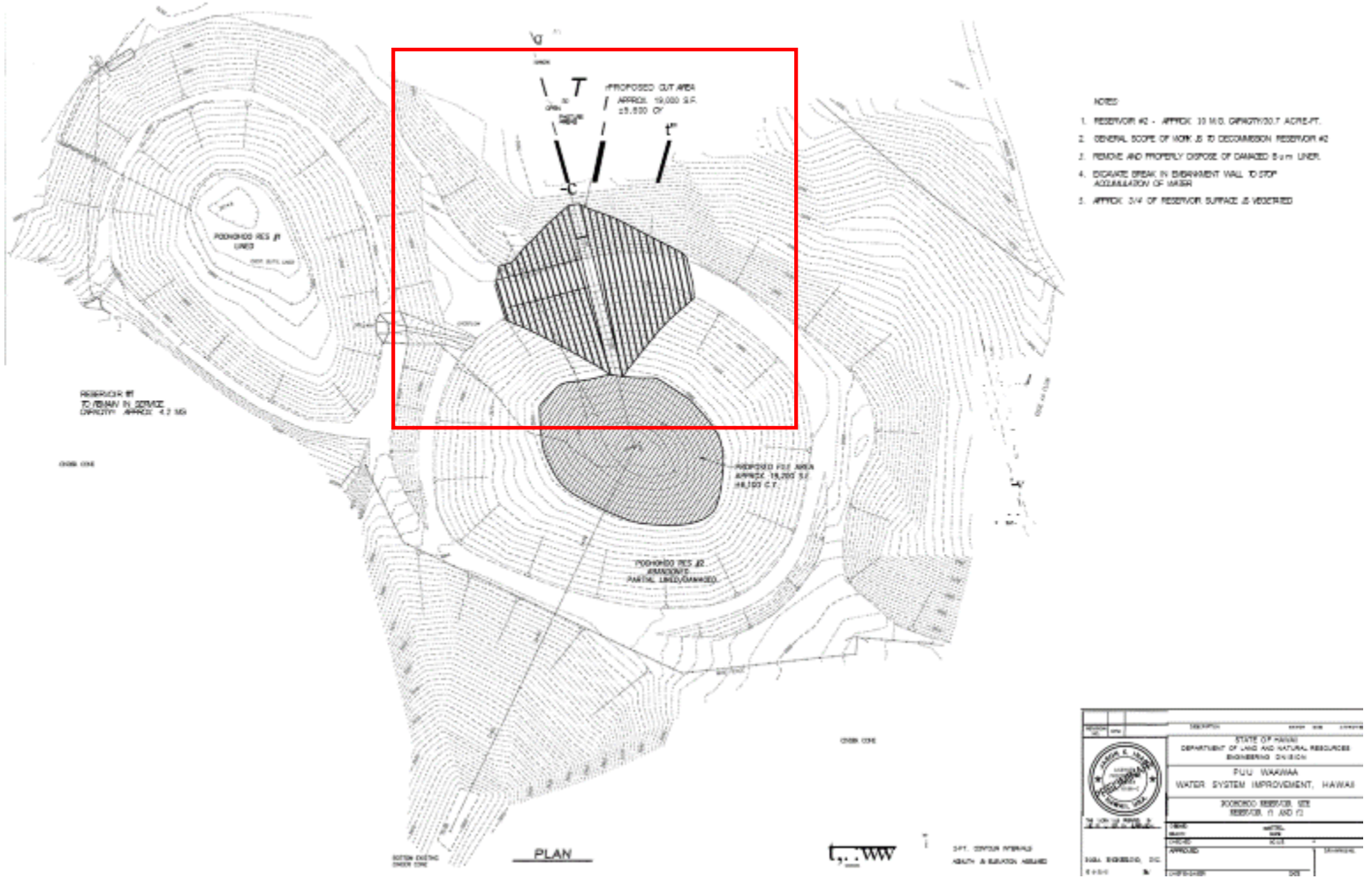

**Figure 2: Map showing 2 reservoirs (upper Poohohoo reservoir on the left, lower Poohohoo reservoir to the right), the fence (in red), and the ʻaiea (green dots). The reservoir on the right (lower Poohohoo reservoir) is the one slated for decommissioning. The fence that surrounds Poohohoo area should be maintained such that no ungulates can enter (see Mitigation Measures).**

**Picture 1: View looking south towards Poohohoo Reservoir. The area is mostly pastureland with scattered koa and ʻōhiʻa. The embankment that is proposed to be removed is shown with the red arrow and orange box. The material that was excavated originally to create the reservoir came from the cut hillside in the upper left.**

**Picture 2: Lower Poohohoo reservoir looking at the south-side of the embankment (facing north). Visible is the degraded butyl liner, held down by old tires. Plants are growing out of the liner including fountain grass, fireweed, molasses grass, ʻōhiʻa, and koa all visible in this picture.**

**Picture 3: View looking north into the bottom of the reservoir where large koa have grown out of holes in the butyl liner. The very bottom of the reservoir contains water and vegetation, and likely plenty of mosquito larvae. Only non-native birds were observed to drink and bathe in the water.**

**Picture 4: Two pāpala kēpau (*Pisonia brunoniana*) trees can be seen looking to the south just inside the Poohohoo fence (white arrows). Also visible are ʻōhiʻa, fountain grass, kikuyu grass, and the cut hillside of Poohohoo cinder cone (background) which was excavated to create the reservoir in the 1960's.**

**Picture 5: The lower Poohohoo Reservoir embankment proposed for partial removal as seen standing on the embankment looking to the west. The slope is dominated by kikuyu grass as well as scattered ʻōhiʻa and koa that have established since the area was fenced from cattle.**

**Picture 6: Looking towards the north while standing on the embankment (panorama picture). The area is dominated by kikuyu grass and other weeds as well as scattered koa that have established since the area was fenced.**