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JUN 23 2019

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

JUN 07 2019

Scott Glenn, Director
Office of Environmental Quality Control
235 S. Beretania Street, Suite 702
Honolulu, HI 96813

Subject: Draft Environmental Assessment (DEA)
Applicant: Paniolo Forestry
Project: Kapoaula Koa Forest Management Plan
TMK: (3) 4-7-007:011, Hamakua 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 proposed Kapoaula Koa Forest Management Plan, located on the subject parcel (TMK) in Hamakua on the Island of Hawai'i for publication in the next available edition of the Environmental Notice.

Enclosed is a completed OEQC Publication Form, a hard copy of the DEA-AFONSI, and Adobe Acrobat PDF file of the same, and an electronic copy of the publication in MS Word.

If you have any question regarding this letter, please contact Tanya Rubenstein at (808) 587-0027 or by email Tanya.Rubenstein@hawaii.gov.

Sincerely,

DGS
SUZANNE D. CASE
Chairperson

RECEIVED
'19 JUN -7 P2 50
OFC. OF ENVIRONMENTAL QUALITY CONTROL

Attachments:
Draft Environmental Assessment for Kapoaula Koa Forest Management Plan
OEQC Publication Form

19-383

APPLICANT
PUBLICATION FORM

Project Name:	EA for Kapoaula Koa Forest Management Plan
Project Short Name:	EA for Kapoaula Koa Forest Management Plan
HRS §343-5 Trigger(s):	Use of State of Hawai'i funds
Island(s):	Hawai'i
Judicial District(s):	Hamakua
TMK(s):	(3) 4-7-007:011
Permit(s)/Approval(s):	Board of Land and Natural Resources: Approval of Forest Stewardship Management Plan – Approval Pending State Department of Land and Natural Resources: Soil and Water Conservation Plan – Approval Pending
Approving Agency:	Department of Land and Natural Resources
Contact Name, Email, Telephone, Address	Tanya Rubenstein, tanya.rubenstein@hawaii.gov, 808-587-0027, 1151 Punchbowl Street, Room 325, Honolulu, Hawaii 96813
Applicant:	Paniolo Forestry
Contact Name, Email, Telephone, Address	Bob Rose, basilbob1@gmail.com, 360-708-1139, PO Box 490, Paauilo, HI 96776
Consultant:	
Contact Name, Email, Telephone, Address	Cardno, Ms. Kerry Kylene Wells, Kerry.Wells@cardno-gs.com 808-349-0929, Pacific Guardian Center, 737 Bishop Street, Mauka Tower, Suite 3050, Honolulu, HI 96813

Status (select one)	**Submittal Requirements**
_x_ DEA-AFNSI	Submit 1) the approving 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 approving 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 approving 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 approving 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 approving agency, 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 approving agency, 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 approving agency simultaneously transmits to both the OEQC and the applicant 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	The approving agency simultaneously transmits to both the OEQC and the applicant a notice that it did not make a timely determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and therefore the applicant's FEIS is deemed accepted as a matter of law.

19-383

____ Supplemental EIS Determination — The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.

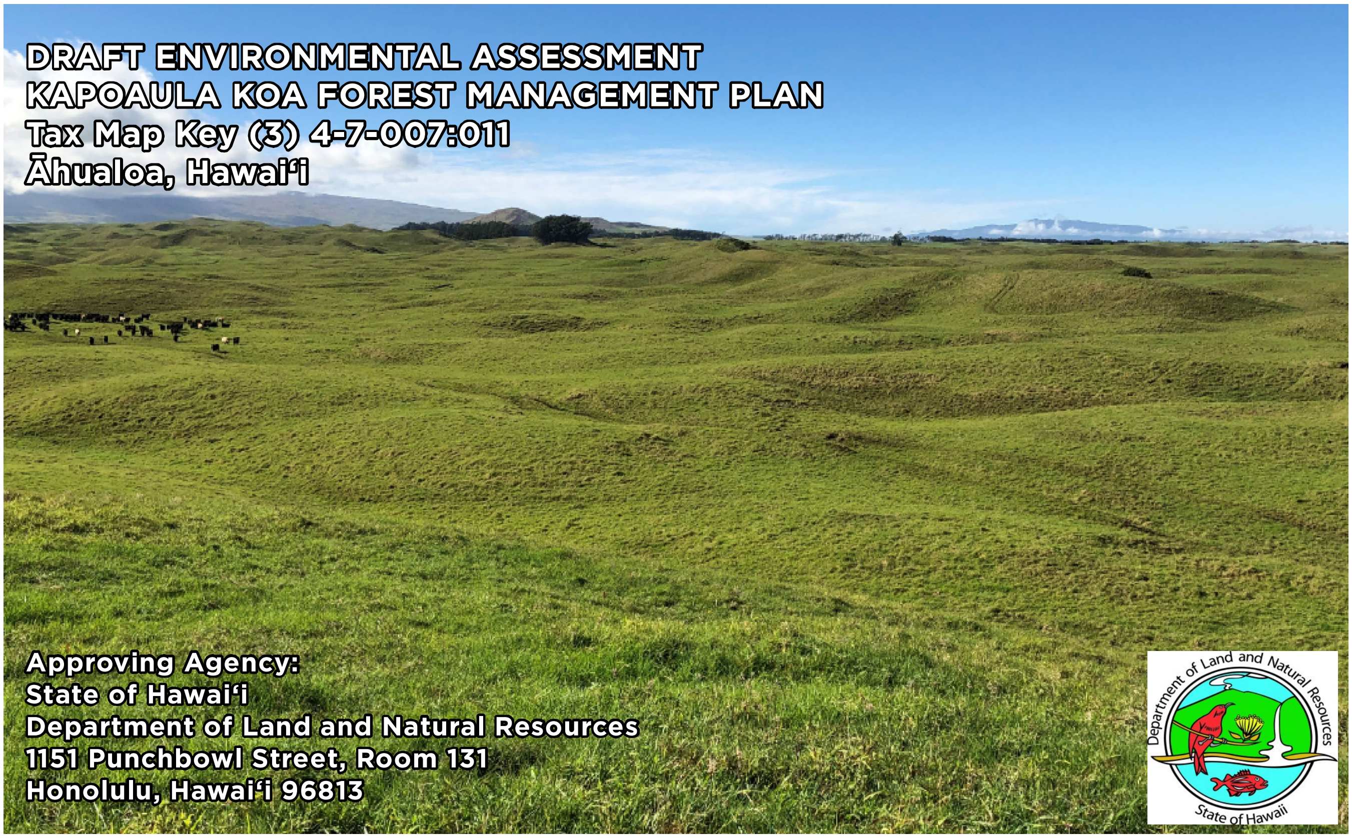
____ Withdrawal — Identify the specific document(s) to withdraw and explain in the project summary section.

____ 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.

Siglo Forest, LLC acquired the 564-acre Kapoaula property from Parker Ranch for the purposes of planting koa trees. The project will convert pastureland back to a semblance of the native koa-'ōhi'a forest that once stood in this area and provide controlled future uses of the forest for commercial products. Forestry Solutions, Inc. has authored a site-specific state-approved Forest Stewardship Plan for the area. Through implementation of the site-specific forestry management plan, in approximately 50 years, the property would consist of a mixed-species native forest with steep sloped areas primarily for native species conservation and less steeply sloped and less erodible areas primarily used for timber production. The resulting koa forest would provide a sustainable, long-term, predictable source of instrument-grade wood, produce high-quality wood for other uses, and provide habitat for native species that could inspire others to plant trees on their land for similar purposes. The 10-year objectives are as follows:

- Reforest the entire property with koa and a complement of associated native forest plants
- Improve the quality of wood to be harvested in the future by:
    - planting seed from known, high-quality sources
    - utilizing planting stock propagated from trees identified as having superior color, figure, and form
- Intensively manage koa for saw timber on those areas of the property with slopes less than 20% – accounting for 70% of the property or 390 acres
- Reforest the remaining upland areas with a multi-species native forest, utilizing koa as a pioneer species – accounting for 30% of the area or 163 acres
- Protect planted forest from wind by planting fast-growing, cattle-resistant windbreaks
- Specialty instrument-grade lumber processing will take place onsite



DRAFT ENVIRONMENTAL ASSESSMENT
KAPOAULA KOA FOREST MANAGEMENT PLAN

Tax Map Key (3) 4-7-007:011
Āhualoa, Hawaiʻi

Approving Agency:
State of Hawaiʻi
Department of Land and Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawaiʻi 96813

Department of Land and Natural Resources
State of Hawaii

Prepared for:
Paniolo Tonewoods

PANIOLO TONEWOODS HAWAII

Prepared by:
Cardno

Cardno

In association with:
Geometrician Associates LLC
and ASM affiliates

GEOMETRICIAN ASSOCIATES

ASM affiliates

June 2019

Draft Environmental Assessment

Kapoaula Koa Forest Management Plan

Tax Map Key (3) 4-7-007:011

Kapoaula, Hawai‘i

June 2019

Approving Agency:
State of Hawai‘i
Department of Land and Natural Resources
1151 Punchbowl Street, Room 131
Honolulu, Hawai‘i 96813

Prepared for:
Paniolo Tonewoods

Prepared by:
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DOCUMENT INFORMATION

Approving Agency:	State of Hawai‘i Department of Land and Natural Resources
Prepared For:	Paniolo Tonewoods
Prepared By:	Cardno
Project Name:	Draft Environmental Assessment Kapoaula Koa Forest Management Plan
Date:	June 2019

This document was prepared pursuant to the Hawai‘i Environmental Policy Act; Chapter 343, Hawai‘i Revised Statutes; and Title 11, Chapter 200, Hawai‘i Administrative Rules.

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DRAFT
ENVIRONMENTAL ASSESSMENT
KAPOAULA KOA FOREST MANAGEMENT PLAN

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APPENDICES

ACRONYMS AND ABBREVIATIONS

%	percent
APE	area of potential effect
BMP	best management practices
CAA	Clean Air Act
CDP	Community Development Plan
CFR	Code of Federal Regulations
CRF	controlled release fertilizer
CWCS	Comprehensive Wildlife Conservation Strategy
CWA	Clean Water Act
DHHL	Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
DOH	Department of Health
EA	Environmental Assessment
ESA	Endangered Species Act
FEMA	Federal Emergency Management Agency
FMP	forestry management plan
FMU	forest management units
FONSI	Finding of No Significant Impact
GHG	greenhouse gas emissions
HAAQS	Hawai‘i Ambient Air Quality Standards
HAR	Hawai‘i Administrative Rules
HRS	Hawai‘i Revised Statutes
IPM	integrated pest management
NAAQS	National Ambient Air Quality Standards
NRCS	Natural Resources Conservation Science
SHPD	State Historic Preservation Division
SHA	safe harbor agreement
TMK	Tax Map Key
U.S.	United States
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WRA	Wind Resource Assessment

PROJECT SUMMARY

Project Name:	Kapoaula Koa Forest Management Plan
Proposed Action:	Implementation of an existing forest stewardship management plan on a 564-acre property acquired from Parker Ranch for the purposes of planting koa trees, located in Kapoaula in the northern area of the island of Hawaiʻi.
Applicant/Developer:	Paniolo Forestry, LLC P.O. Box 490 Paʻauilo, Hawaiʻi 96776 In conjunction with: Paniolo Tonewoods
Tax Map Key:	(3) 4-7-007:011
Location:	47-4521 Old Māmalahoa Highway, Kamuela, Hawaiʻi 96743
Property Owner:	Siglo Forest, LLC
Lessee:	Paniolo Forestry, LLC
State Approving Agency:	State of Hawaiʻi, Department of Land and Natural Resources
State Land Use District:	Agriculture
County Zoning:	40 acres (A-40a)
Ahupuaʻa:	Kapoaula
Hawaiʻi Revised Statutes Chapter 343 Trigger*:*	Use of State of Hawaiʻi funds
Summary:	Siglo Forest, LLC acquired the 564-acre Kapoaula property from Parker Ranch for the purposes of planting koa trees. The project will convert pastureland back to a semblance of the native koa-ʻōhiʻa forest that once stood in this area and provide controlled future uses of the forest for commercial products. A small, specialty instrument-grade lumber processing facility (permit applications in process) is also being developed onsite. The processing facility is a separate project by the property owner and is analyzed as a cumulative impact to the proposed action in this EA. The processing of specialty instrument-grade lumber is analyzed in this EA. Forestry Solutions, Inc. has authored a site-specific Forest Stewardship Plan for the area. Through implementation of the site-specific forestry management plan, in approximately 50 years, the property would consist of a mixed-species native forest with steep sloped areas primarily for native species conservation and less steeply sloped and less erodible areas primarily used for timber production. The resulting koa forest would provide a sustainable, long-term, predictable source of instrument-grade wood, produce high-quality wood for other uses, and provide habitat for native species that could inspire others to

plant trees on their land for similar purposes. The 10-year objectives are as follows:

- Reforest the entire property with koa and a complement of associated native forest plants
- Improve the quality of wood to be harvested in the future by:
  - planting seed from known, high-quality sources
  - utilizing planting stock propagated from trees identified as having superior color, figure, and form
- Intensively manage koa for saw timber on those areas of the property with slopes less than 20% – accounting for 70% of the property or 390 acres
- Reforest the remaining upland areas with a multi-species native forest, utilizing koa as a pioneer species – accounting for 30% of the area or 163 acres
- Protect planted forest from wind by planting fast-growing, cattle-resistant windbreaks
- Specialty instrument-grade lumber processing will take place on site

Determination: Anticipate a Finding of No Significant Impact

SECTION 1
PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 Introduction

1.1.1 Proposed Action

Siglo Forest, LLC acquired the 564-acre Kapoaula property from Parker Ranch for the purposes of planting, managing, and eventually harvesting koa (*Acacia koa*) trees. This will be a concerted effort to convert pastureland back to a semblance of the native koa-ʻōhiʻa forest that once stood in this area. The intent is also to provide controlled future uses of the forest for commercial products. Forest Solutions Inc. has authored a site-specific forestry management plan (FMP) for the area, which is provided in this document as Appendix A. Through implementation of the site-specific FMP, in approximately 50 years, the property would consist of a mixed-species native forest with steep sloped areas primarily for native species conservation and less steeply sloped, less erodible areas primarily used for timber production. The resulting koa forest would provide a sustainable, long-term, predictable source of instrument-grade wood, produce high-quality wood for other uses, and provide habitat for native species, inspiring others to plant trees on their land for similar purposes. The 10-year objectives are as follows:

- Reforest the entire property with koa and a complement of associated native forest plants.
- Improve the quality of wood to be harvested in the future by:
  - planting seed from known, high-quality sources
  - utilizing cuttings propagated from trees identified as having superior color, figure, and form
- Intensively manage koa for saw timber on those areas of the property with slopes less than 20 percent (%) – accounting for 70% of the property or 390 acres.
- Reforest the remaining upland areas with a multi-species native forest, utilizing koa as a pioneer species – accounting for 30% of the area or 163 acres.
- Protect planted forest from wind by planting fast-growing, cattle-resistant windbreaks.

A small, specialty instrument-grade lumber processing facility (permit applications in process) is also being developed in the lowest part of the property near the road onsite (Figures 1.1-2 and 1.1-4). The processing facility for specialty lumber from other areas of the island is a separate project being undertaken by the property owner and is analyzed as a cumulative impact to the proposed action in this Environmental Assessment (EA). The processing of the wood during operations is analyzed in this EA.

1.1.1.1 Project Location

The Kapoaula Koa Forest ("subject property") is located in Hāmākua on the northern side of the island of Hawaiʻi (Figure 1.1-1). The subject property extends in elevation from 2,740 to 3,180 feet above sea level. The nearest towns are Waimea and Honokaʻa. The subject property is identified by Tax Map Key (TMK): (3) 4-7-007:011. The subject property is roughly an L-shape, with the northwestern section bordered by the Edwin DeLuz gravel quarry (TMK: [3] 4-7-007:090). The Old Māmalahoa Highway abuts the subject property to the north. The other surrounding properties are State of Hawaiʻi, Department of Hawaiian Home Lands (DHHL) pastoral leaseholds used for domestic cattle grazing (Figure 1.1-1). Some of these leaseholds have single-family houses and accessory small farm structures. Figure 1.1-2 is a satellite image that illustrates vegetation types in and adjacent to the subject property. The landscape of the subject property and adjacent properties is open, rolling pasture with few trees, punctuated with small hills, outcroppings, and occasional steep and rocky ridges. The area is primarily covered with non-native kikuyu grass (*Cenchrus clandestinus*) with other pasture grasses, with a few remnant ʻōhiʻa (*Metrosideros* *polymorpha*) trees remaining on the edges of steep knolls. The subject property is notably well managed, with lush pasture grass and few pasture weeds (Figure 1.1-3).

Figure 1.1-1. Location Map

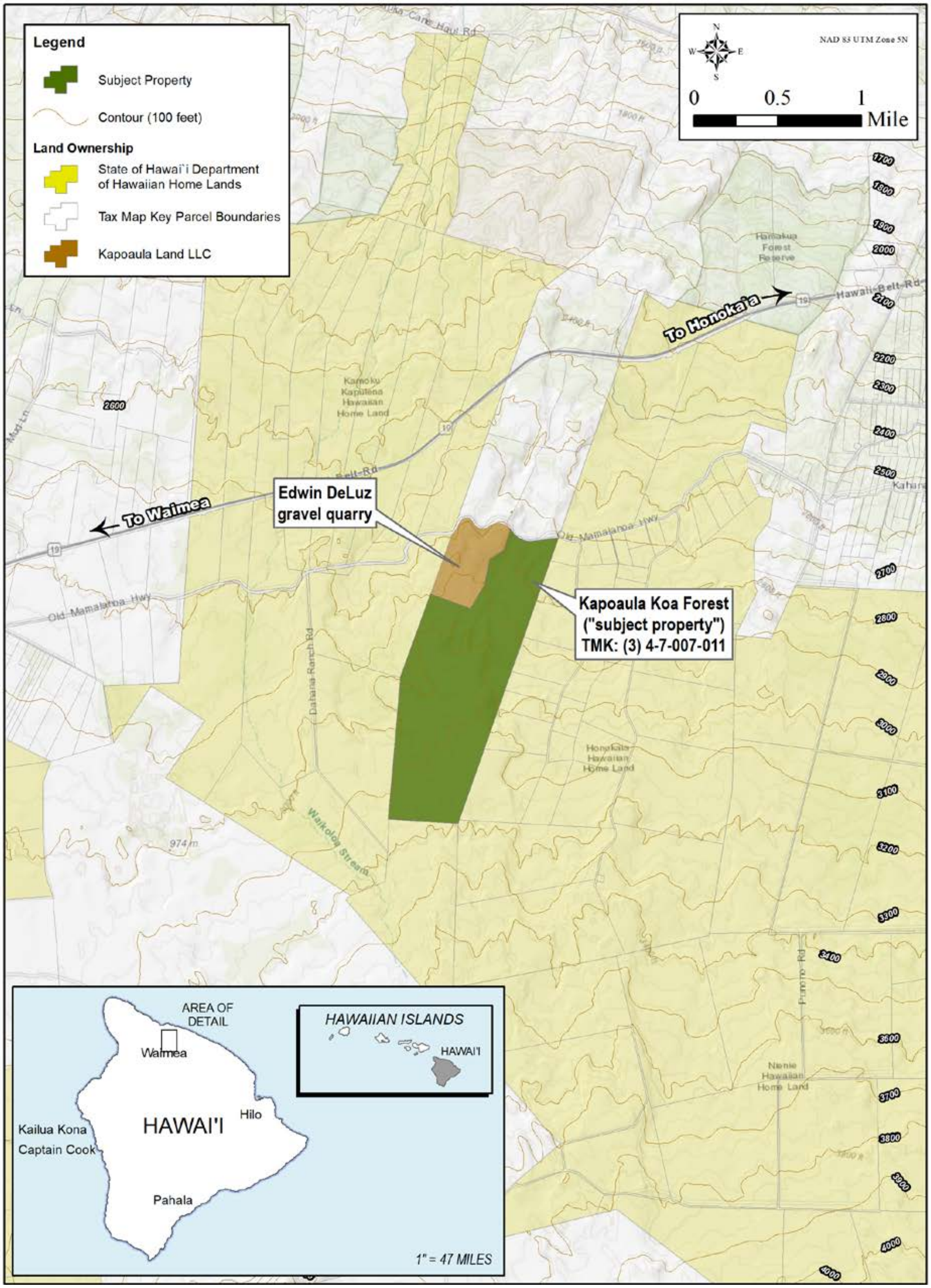


Figure 1.1-2. Aerial Location Map

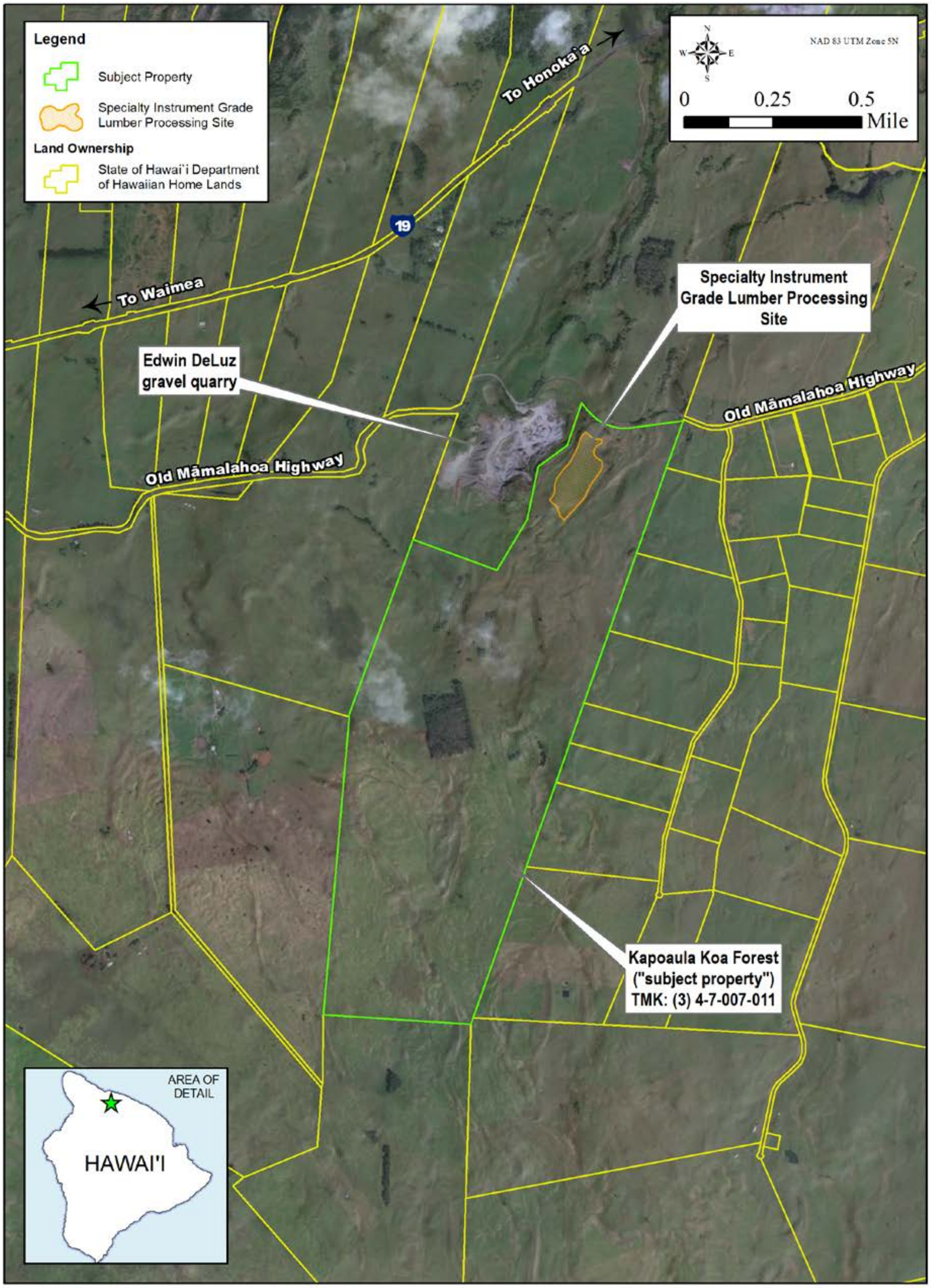


Figure 1.1-3. Photographs of Current Subject Property

Photo 1: The current uses include Angus cattle grazing by Parker Ranch.

Photo 2: The topography is sloping with pronounced ridges.

Photo 3: Less than 100 ‘ōhi‘a trees are on the current property.

Photo 4: A mixed strand dominated by tropical ash is the only significant forest cover currently on the property.

Figure 1.1-4. Photograph of Specialty Instrument-grade Lumber Processing Site

1.1.2 History and Existing Management

The subject property was granted to Prince William Pitt Leleiohoku II of the House of Kalākaua, in 1848 during the division of lands termed the Great Māhele. At the age of 22, Prince William Pitt Leleiohoku II died of rheumatic fever at ʻIolani Palace (The Pacific Commercial Advertiser, 1877). The subject property was subsequently transferred to John Parker in 1862. In March 2018, Siglo Forest, LLC purchased the subject property from Parker Ranch.

Originally, the subject property was approximately 659 acres. The northwest corner of the subject property was subdivided off in 2004 and sold to Kapoaula Land, LLC to continue the long-standing land use as a gravel quarry. The quarry section (Edwin DeLuz quarry) is approximately 95 acres (see Figure 1.1-1).

The current 564-acre property is under a 20-year agricultural tax dedication that will expire in 2021. To keep the dedication and avoid retroactive taxes, the property must be grazed or forested until the expiration date. Siglo Forest, LLC, the current property owner, would continue to graze cattle until proper permitting and assessments, including this EA, allow for the reforestation of all or part of designated sections with koa and other native vegetation.

Historical records indicate that this entire flank of Mauna Kea was once a dense koa-ʻōhiʻa forest. Gagne and Cuddihy (1990) identify this region as "sub-montane ʻōhiʻa -koa forest." However, by the 1850s the forest was evidently nearly eliminated and replaced by grazing land. A mid-nineteenth century account reported:

> "It is in the memory of many foreigners now living here, when the whole of these plains were covered in a thick wood…where hardly a tree stands for miles…Thousands of old dead trees both standing upright and prostrate, from the present boundaries of these woods, exhibit a mode in which the destruction is effected; for while whilst the old trees die of age, no young ones are seen taking their place, as during the last thirty or forty years, the cattle have eaten or trodden them down."..."In former times when I was a boy (said Ha'alelea), Waimea was a thickly wooded region all about there…but of late years round about where I lived, it is as cleared of trees as the Esplanade is."...He explained

> that white settlers had felled the trees for fuel and fences for cattle pens and that "a good many of the young trees were destroyed by the cattle." P.62
>
> "From the nature of the country to the windward of our private lands [Waimea] (a dense forest and almost impenetrable undergrowth covering nearly the whole of it) as the herds increased it became an impossibility to prevent cattle from getting beyond the reach of our control, and gradually they have filled this land with their offspring." P.188 (Fischer 2015)

John Parker's original homestead at Mānā was located about 1 mile mauka of the property boundary. An early account of the ranch reported on the koa milling activity in the area:

> "It was below the koa forest of Hanaipoi that the saw pits were dug in the land known as Makahalau where the purebred bulls and cows are now penned up. This became the great center for koa work, cutting down trees, selecting the best to be sawn up into lumber through the saw pits, the piling up of koa lumber on hilly ground so that the air could get between the boards and season the wood. There was so much lumber piled up in this section that the natives called the place Palihoʻoukapapa (Hill of piled lumber) (Brennan 1974)."

1.1.3 Document Organization

The EA is organized as follows:

- Section 1 introduces the project, the purpose and need, the environmental regulatory review requirements, and the past and proposed public involvement.
- Section 2 describes the Proposed Action and the No Action Alternative. The owner, Siglo Forest, LLC, does not desire to conduct any other land use; therefore, no other alternatives are proposed.
- Section 3 describes the technical approach to the impact analysis by resource, the existing conditions, and the potential impacts of the Proposed Action on each resource.
- Section 4 summarizes the Proposed Action's consistency with existing plans and regulations and identifies potential permits and approvals required.
- Section 5 summarizes the determination criteria for Hawaiʻi Revised Statutes (HRS) Chapter 343 and summarizes how the project is consistent with the criteria.
- Section 6 is a list of preparers of this document.
- Section 7 is a list of references cited in the document.

1.2 Purpose and Need for the Proposed Action

The purpose and need of the Proposed Action is to convert current grazing lands back to native koa-ʻōhiʻa forest. The resulting koa forest will provide a sustainable, long-term, and predictable source of musical instrument-grade wood, produce high-quality wood for other uses, and provide habitat for native species.

1.3 Project Description

A series of management objectives and actions that respond to the purpose and need described above comprise the "action" elements of the FMP (Appendix A). Most of these actions could have either beneficial or adverse effects and thus require examination in this EA. The actions listed below in Section 1.3.2 have been summarized and adapted from Section 5 of the FMP (Appendix A), which contain background and further details.

1.3.1 Overview

Kapoaula was purchased with the intent to create a dedicated, sustainable koa forest for musical instrument-quality wood. Over a 10-year period, this project would plant the entire 553 acres of available land with koa and a range of associated native plants (an additional 11.1 acres are reserved for a specialty instrument-grade lumber processing site and access road). The processing facility is a separate project being undertaken by the property owner and is analyzed as a cumulative impact to the proposed action in this EA. The processing of the wood from the Kapoaula property during operations is analyzed in this EA. The project would combine the production of timber in a plantation format with mixed native forest plantings in less accessible areas. Over time, the surrounding area would be colonized with enrichment species from the mixed forests. This is referred to as the kīpuka restoration strategy in which enriched koa stands extend out and into the adjoining koa plantation stands through bird droppings and natural plant colonization.

Removing cattle from the land and replacing with trees will reduce compaction, erosion, and animal organic wastes and have a positive effect on water quality. Incorporating native species favored by birds and insects would improve wildlife habitat. Planting windbreaks on strategic ridges would reduce the effects of wind distortion on the koa plantings. Historic stock watering ponds would be enhanced with perimeter plantings and predator-proof fencing and traps to improve habitat for migratory and resident waterfowl.

In approximately 30 to 35 years, a selective harvest would be planned that emphasizes tree quality and stand vigor, while also removing useable koa wood. This would cause the natural regeneration of a cohort of koa trees, which would be repeated more or less every 15 years to create a continuity of canopy closure over space and time.

Ideally, this project would encourage others to plant native species. Neighboring property owners are contemplating planting native trees on their DHHL pastoral leaseholds. Such plantings would leverage and expand the positive environmental effects provided by this project.

1.3.1.1 Fence Units

There is active grazing on the property that would be rolled back sequentially as the forest is planted. To keep the grass sward and woody weeds under control and to maintain the land-use designation, cattle would continue to graze the property until it is planted out. For each successive year, a standard 5-foot hogwire fence with a smooth top wire and barbed ground wire would be installed. This would protect each regenerated area from cattle and pigs, protecting both the timber and non-timber species.

In order to minimize wind effects, favorable topography would be exploited in Year 1 through 4, in which hills are used to protect new plantings from the wind while the windbreaks develop stature. Starting in Year 5, plantings would be located behind windbreaks. Table 1.3-1 lists the year, fence length, and acreage of enclosure. Figure 1.3-1 depicts these locations.

Table 1.3-1. Proposed Fence Units

Year	*Fence (Feet)*	*Acres*
1	5,947	53
2	6,173	71
3	5,451	64
4	4,376	60
5	4,890	59
6	3,802	77
7	3,957	70
8	4,408	46
9	5,211	63
Total	**44,215**	**564**

1.3.1.2 Forest Management Units

To facilitate field operations, budgeting, and progress reporting, the subject property has been divided into a series of numbered units, called forest management units (FMUs). A unique identifying number would be assigned to each FMU to distinguish the silvicultural regime, year plantings would occur, and sub-unit of yearly plantings. The unique identifying number of each FMU is determined as follows:

The first number indicates the silvicultural regime as follows:

- 1 = koa timber emphasis
- 2 = koa with native species mixed forest
- 3 = existing non-native trees (ash stand) – special case FMU scheduled for conversion to koa in Year 8
- 7 = mill site – not part of management plan[1].

The second number indicates the year the plantings would occur (Year 1 through 9) and is roughly equivalent to the fence unit. The third number indicates the sub-unit within a specific year's planting. For example, Unit 242 is a koa mixed species unit planted in Year 4, and it is the second of two similar units. Figure 1.3-2 depicts the FMUs.

[1] The specialty instrument-grade processing facility is assessed in this EA and is considered in the cumulative impacts section.

Figure 1.3-1. Fencing

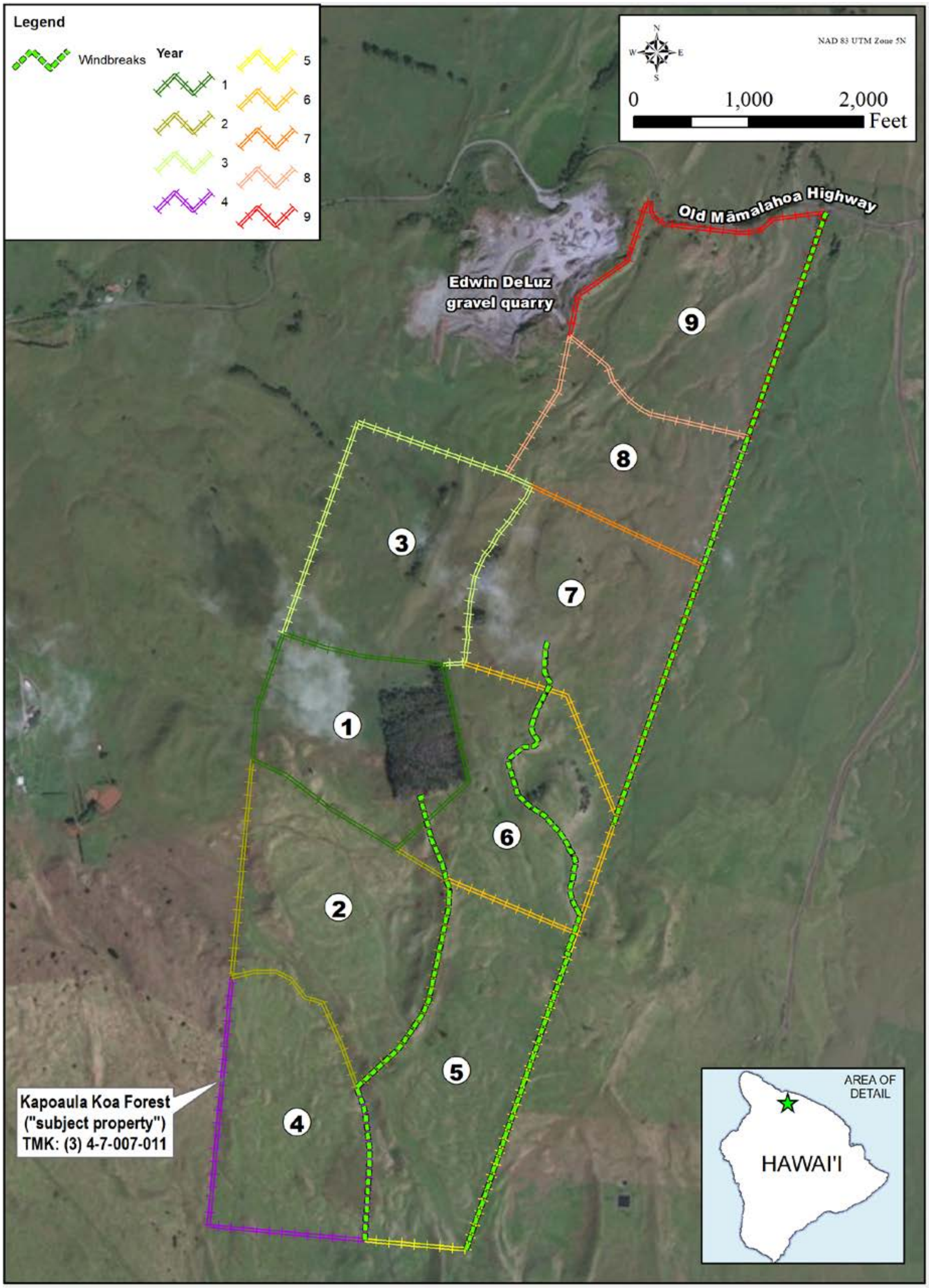
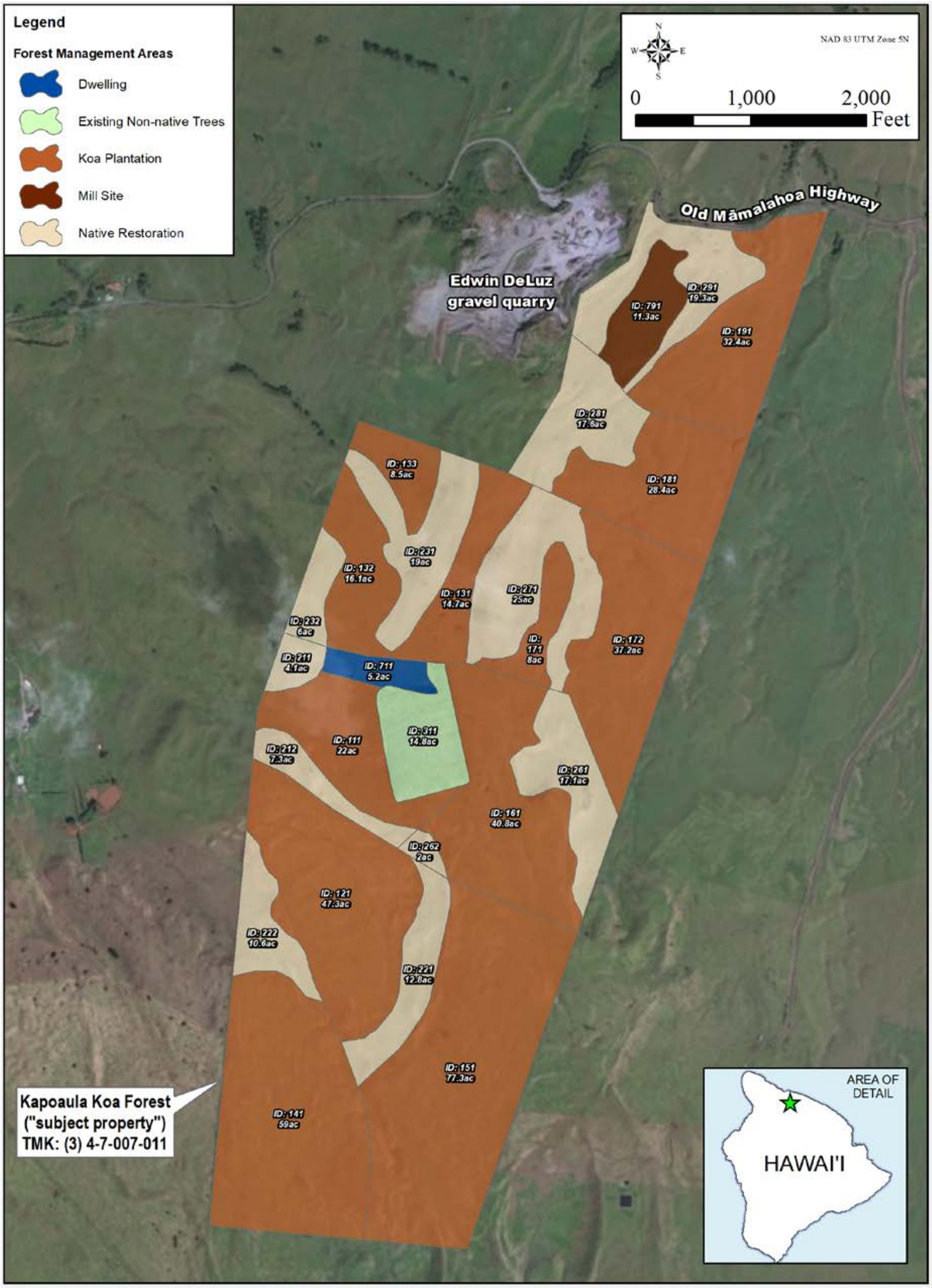


Figure 1.3-2. FMUs



1.3.2 Management Objectives and Actions

To accomplish the koa and other native vegetation re-establishment objectives outlined in the FMP, specific management activities would be implemented on each designated unit as detailed in the following sections.

1.3.2.1 Management Objective 1 – Site Preparation

Goal: Ensure former pasture ground is suitably prepared and cultivated to accept and support koa and other native seedlings. This operation consists of two phases, initial weed control and soil cultivation.

Action – Tree and Shrub Site Preparation: Natural Resources Conservation Science (NRCS) Practice 490

Weed Control

Herbaceous ground cover control would occur before ripping or spot cultivation to increase effectiveness of mechanical treatment and reduce weed competition on planted trees. Two to four months prior to any cultivation, a pre-planting herbicide application to control herbaceous vegetation and grass cover in production planting areas would be carried out using a combined mixture of imazapyr and glyphosate (Roundup). This application would occur in April to May.

Mechanical Site Preparation

The purpose of this practice is to improve site conditions to be suitable for the purposeful establishment of desired trees and shrubs. In the case of Kapoaula, the entire property, except for exposed rocks and cliffs, is densely covered with long established cattle pasture. Because of the history of cattle grazing and associated compaction, deep ripping and bedding or deep spot cultivation would be required to assure that koa roots have a minimally compacted soil profile to penetrate. Depth of this operation should be at least 24 inches and ideally 36 inches to provide for ease of root penetration and enhanced growth.

After the ground cover vegetation has died and begun to decompose, a tractor pulling a long shank ripper and bedding plow (line cultivation) or an excavator equipped with a spot cultivation attachment ("chicken foot") would be used to prepare planting spots at a spacing of approximately 10 feet by 11 feet and average stem density of 400 spots (trees) per acre for timber stands. On slopes of 20% or greater, where a mixed forest is the objective, stocking would drop to 200 trees per acre, roughly 15 feet by 15 feet. Site preparation should not take place more than two months before first planting, cultivation by either means must prepare soils to a depth of 24 to 36 inches, depending on substrate and operating conditions. Better site preparation would be evident in the medium- and long-term stand performance, where enhanced root penetration results in taller, and more wind-firm trees.

1.3.2.2 Management Objective 2 – Windbreaks

Goal: Protect young seedlings and saplings from occasional high winds, improve stem architecture, and shelter native forest stands from storms.

Action – Windbreak/Shelterbelt Establishment: NRCS Practice 380

The combined factors of regional lack of tree cover, 3,000-foot elevation, and persistent and occasionally gusty trade winds from the east create challenging conditions for minimizing wind stress on young seedlings and saplings. As a fast-growing vertical species, koa is particularly susceptible to deformation and leader damage due to strong winds.

The operational plan is based on installing early koa plantings in those areas already orographically protected from wind (see Figure 1.3-1). Most of the site after fence unit four (Year 5 and after) is quite exposed to wind. The traditional name for these legendary winds with driving rain is kipu'u pu'u, the name King Kamehameha gave his first in-battle assault soldiers who trained in these harsh conditions.

Minimizing wind stress on young trees can protect plants from wind-related damage and alter the microenvironment to enhance plant growth. Wind protection can be accomplished by planting fast-growing windbreaks on strategic high points and ridge crests. Luckily, the topography of the land seems to run perpendicular to prevailing wind conditions, thus providing a suitable setting for installation of windbreak plantings.

The goal of this plan is to install all windbreak plantings within the first year to develop evolving protection for future plantings as rapidly as possible, certainly by Year 5. In addition, as protected koa plantings become established, they would provide some additional protection for subsequent plantings. They would be planted in three rows with one species per row. Rows would be 10 feet apart and trees would be 20 feet apart along the row. Trees would be arranged so as to alternate with each other.

Windbreak/shelterbelt species by row, from shortest to tallest, from east to west row:

- Podocarpus (*Podocarpus gracilior*) – Wind Resource Assessment (WRA) 0 low windbreak, medium growth rate
- Tallow-wood (*Eucalyptus microcorys*) – WRA 1 or blood-leaf gum (*Eucalyptus torelliana*) – WRA 4 medium windbreak, fast growth
- Norfolk Island Pine (*Araucaria heterophylla*) – WRA -5 tall windbreak, medium growth rate or Chinese fir (*Cunninghamii lanceolata*) – no WRA available

The State of Hawaiʻi or federal government does not consider any of these windbreak trees invasive or noxious species.[2]

Rule of thumb calculations for windbreaks indicate a wind protection distance of 10 times the height of mature trees. As shown in Figure 1.3-2, ridge crest planting locations would, over time, provide shelter for the entire site, assuming the Norfolk Island pine and the blood-leaf gum plantings reach a height of 100 feet or more after the first 20 years of establishment.

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[2] The windbreak species are not contained on the official State of Hawaiʻi or federal noxious species lists (https://plants.usda.gov/java/noxious?rptType=State&statefips=15; https://plants.usda.gov/java/noxious). They are also not noted as invasive on the Hawaiʻi Invasive Species Council's list of invasive species (http://dlnr.hawaii.gov/hisc/info/invasive-species-profiles/). However, according to the Hawaiʻi Invasive Species Council: "The federal and state definitions for "invasive species" are broad, non-regulatory terms that describe any non-native species that causes or could cause harm to agriculture, natural resources, economy, or human health. In Hawaiʻi, there are thousands of species that fit this broad definition of 'invasive species. There is currently no regulatory list of "invasive species" in Hawaiʻi. The Hawaiʻi Invasive Species Council is in the process of developing administrative rules that would describe a small subset of species for which control and eradication over a large geographic area are still possible." Forest Solutions Inc. has determined based on field knowledge and invasive species profiles that these specified windbreak species are not likely to be invasive.

1.3.2.3 Management Objective 3 – Fencing

Goal: Exclude domesticated, feral and non-native mammals from the reestablished native forest.

Actions – Fence: NRCS Practice 382

Cattle

The property has been a cattle ranch since the mid-nineteenth century. The property is surrounded by perimeter fencing consisting of five-strand barbed wire. Some sections of the fence are adequate, but some of the sections are in need of repair. One of the conditions of purchase agreed upon in early 2018 was that Parker Ranch can continue to graze cattle on those sections of the property not yet scheduled for afforestation. On the three sides of the property not fronting the Māmalahoa Highway, DHHL pastoral lessees run cattle and horses in various conditions of husbandry. Exclusion of cattle is a fundamental requirement for successful koa forest re-generation (see Table 1.3-1).

Investment in a koa forest at this scale would require the highest level of protection from cattle or sheep. Small herds of black feral pigs (*Sus scrofa*) have been occasionally observed during site visits. To protect the investment in select growing stock and especially sensitive native understory species, pigs must also be excluded from the planting.

A perimeter 5-foot hogwire fence with smooth wire for stability on the top and barbed wire at ground level (outside) to deter pig grubbing would be installed in each fence unit (see Figure 1.3-1). This fence would also serve to exclude neighboring cattle. Every year or more frequently fences would be inspected and maintained if needed. A formal maintenance entry is planned starting in Year 5 (four years after installation), including tightening wires, fixing loose sections and re-staking sections that have come loose.

Cattle are an essential management tool to execute this reforestation stewardship plan. They keep pasture grasses and invasive woody species, especially tropical ash (*Fraxinus uhdei*), sourbush (*Pluchea carolinensis*), guava (*Psidium guajava*), and strawberry guava (*Psidium cattleianum*) under control until a unit is scheduled for site preparation and planting. An essential and critical protection aspect for this significant investment is a system of cross fencing to create paddocks that securely contains cattle from temptation grazing on adjacent koa saplings.

As each subsequent pasture unit is converted to koa forest, cattle would be replaced by native vegetation. At the end of this 10-year plan, all cattle would be eliminated from the property and a permanent fencing system would be in place to localize, contain, and minimize any potential cattle trespass that might occur from adjacent pastoral leasehold herds.

Other Mammals

Signs of several deleterious mammals have been noted during site visits, particularly around and near the open stock watering ponds. These include rats (*Rattus rattus* and possibly *R. norvegicus*), feral pigs, mongoose (*Herpestes javanicus*), and cats (*Felis catus*) it is likely that domestic or feral dogs (*Canis lupus familiaris*) also visit the ponds.

Three of these species do not represent, at this time, a threat to the forest restoration objective of this project. Pigs uproot tender seedlings, and rats occasionally chew bark on koa trees.

The long-term objective of a restored koa-ʻōhiʻa forest means that, over time, there would be an increase in native bird habitat, which may, in the future, be affected by the presence of rats and cats. Rats eat tree fruits and seeds as well as eggs and nestlings. Cats eat birds at various life stages. As native forest areas are restored and enriched during the course of this project, invasive animal control protocols may be necessary.

Recent experience in New Zealand and in Hawaiʻi with "good nature" traps have shown great success in controlling rodent and cat damage. These traps use a carbon dioxide cylinder to power a strike bolt that instantly kills animals attracted to the bait. The design allows for upwards of 12 kills/trap before requiring re-arming. As native and migratory birds begin to frequent the property, vector control would be used to reduce the population of these mammals to promote a safe haven for nesting and foraging. In addition it may be prudent to incorporate this control feature on the high-value, select "elite" seedlings planting sites to avoid bark damage by rats.

Due to the low cost, location specificity and iterative nature of vector control, this is included under the monitoring and not separated as a budget item in this management plan. Most of the cost, as with other monitoring activities, is in the technician time needed to get the work done.

1.3.2.4 Management Objective 4– Tree/Shrub Establishment

Goal: Re-establish a koa-dominant forest with ʻōhiʻa and associated native understory on land historically managed as cattle pasture.

Actions – Tree/Shrub Establishment: NRCS Practice 612

Hand planting would be carried out using a tree spade or dibble as appropriate for the available nursery stock. Soil surface should be perforated to a depth slightly greater than the length of the seedling stock and the seedling should be placed into this hole. The root collar should be marginally lower than the level of the soil between 0.125 to 0.25 inch with the root mass oriented vertically so the tip of the root does not bend outward ("J-rooting"). Soil is then compacted lightly around the root system. Subsequent silvicultural activities would include fertilizer application, competition control, timber stand improvement (pruning), and native species enhancement.

Koa and mixed forest plantings would be planted at the same time, the only difference being their spatial arrangement and seedling count. Mixed forest stands, as their name implies should be a mix of species across the area, not a patchwork of monotypic stands. Table 1.3-2 lists the stand stocking type and relative area by each stand type.

Table 1.3-2. Summary of Stocking by Stand Type and Relative Area Occupied by each Stand Type

Type	*Description*	*Seedling/Acre*		*Acres*
		Koa	*Other*	
1	Timber	350	50	385
2	Restoration	125	75	148
3	Timber (ash)*	650	50	15

Note: *Higher number to overcrowd out other reproducing ash.

Seedlings and Seed Sourcing

Seeds need to be collected in advance to allow adequate time for growth in the nursery setting. There are very limited supplies of ʻōhiʻa on the property and no koa. Therefore, seedlings would be grown from collected seed supplies with first preference for the Waimea area followed by upper elevations in Hāmākua and then Kaʻū. However, due to historic forest clearing, there is an extremely limited gene pool of koa growing at elevations lower than 4,000 feet on the Big Island.

Paniolo Forestry, LLC currently has a working relationship with Native Nursery on Maui, who could supply most of the seedlings. Additionally, seedlings may be sourced from the State Tree Nursery in Kamuela, the local charter school, Kanu o ka ʻĀina or other nurseries in Hawaiʻi.

Koa seed procurement strategy is to keep sources as local (island of Hawaiʻi) as possible. There are several reasons for this: increased project flexibility by having a stable source of seedlings, safeguarding against outside pathogen spread (especially Rapid ʻŌhiʻa Death), promoting genetically conserved adaptations to local conditions, and introducing volunteers to this aspect of forestry. However, the laudable objective of using locally sourced seedlings must not come at the expense of achieving overall forest management goals. Because the overall project goal is to produce the highest quality koa wood with desirable characteristics, seed sources from other islands may also be included into yearly plantings to ensure as robust a genetic base as possible.

In addition, working relationships with Haleakalā Ranch and Kamehameha Schools have generated propagation material from selected "elite" lines of koa, which show desired and valuable characteristics such as figure, color, and vertical form. The Haleakalā stock was originally propagated from island of Hawaiʻi seed stock 32 years ago. These selected lines of improved planting stock would be planted in identified highest quality growing areas for propagation purposes. One or several seed orchards are contemplated as part of this project to capture and track the progress of these elite genetic sources.

Seedling size would necessarily depend on the species in question. Pioneer species such as koa would be 10 to 12 inches in height with a small dibble pot size of 4 to 6 cubic inches, which is sufficient for a more aggressive species.

Enrichment and enclosure species would be 8 to 16 inches in height in a small to medium pot of 12 to 31 cubic inches, with the objective of providing an older, more robust seedling for these more sensitive species. At least nine months should be allowed for māmane (*Sophora chrysophyll*a) and ʻōhiʻa seedlings; six months for maile (*Alyxia stellata*), ʻōlapa (*Cheirodendron trigynum*) and pilo (*Capparis sandwichiana*) seedlings; and three to four months for koa seedlings.

Koa Plantings

Koa and aʻaliʻi (*Dodonaea viscosa*) seedlings would be planted three to six months after weed control and site preparation. The planting sequence would begin with spot cultivation of planting sites for individual seedlings. Approximately 10 foot by 11 foot spacing would yield the target 400 spots per acre, of which 350 are for koa and 50 are for aʻaliʻi, mixed. However, natural variations in site would result in densities that are slightly higher or lower than the target.

Each koa or aʻaliʻi seedling would then be manually planted along the line or in the prepared hole. Hand planting crews would use a tree spade or dibble as appropriate for the nursery stock. Mechanical site preparation facilitates planting, and it is expected that planting rates would exceed 800 trees per day on flatter ground (less than 20% slope). Production would drop to 500 trees per day on sloping soil and 200 per day in areas where machine site preparation is not possible and hand preparation would be needed.

Standard planting techniques would be followed, with planting holes dug to the depth of the seedling root stock, root collars buried marginally lower than the level of the soil, and all seedlings oriented vertically. After seedlings are placed in the ground, loose soil would be firmly packed around the roots to bring the root collar level with the soil surface.

Mixed Forest Plantings (Kīpuka Enrichment Planting)

At this time, the only significant native vegetation on the property are scattered ʻōhiʻa, found mostly on cliff faces and steep, rocky areas. Given the history of Parker Ranch pasture management and grazing for over 150 years, it is assumed that seed sources for native understory plants would be non-existent, thereby requiring use of seedlings for enrichment species.

The goal for enrichment species establishment is a net average of 75 trees per acre on those units with slope greater than 20%. Koa would be used as a pioneer species to carry the stand and provide initial cover, planted at a density of 125 trees per acre.

The focus is to initiate a trajectory of recovery to re-create the native forest that once stood on this land, thereby providing habitat for native species and improving the overall environmental quality of the property, including aquifer recharge, and erosion control. These ridge units would effectively serve as "kīpukas", islands of native vegetation, which, slowly, over time, would provide seed sources and spread throughout the site.

The following list of proposed enrichment species is representative, in order of planned abundance, other species would also be utilized as appropriate for the site and as available.

- ʻŌhiʻa
- Aʻaliʻi
- Māmaki (*Pipturus albidus*)
- ʻŌlapa
- Kōlea (*Myrsine lessertiana*)
- ʻIʻo nui (*Dryopteris wallichiana*)
- ʻŌhelo (*Vaccinium calycinum*)
- Hōʻawa (*Pittosporum glabrum*)
- Pilo
- Ulei (*Osteomeles anthyllidifolia*)
- Maile
- ʻIeʻie (*Freycinetia arborea*)
- Hāpuʻu pulu (*Cibotium glaucum*)
- Hāpuʻu iʻi (*Cibotium menziesii*)
- ʻIliahi (*Santalum paniculatum*)

1.3.2.5 Management Objective 5 – Nutrient Management

Goal: Provide koa and other seedlings with nutrient inputs to ensure health and productivity while minimizing non-point pollution of surface and groundwater.

Actions – Nutrient Management: NRCS Practice 590

Long-term grazing has likely reduced soil fertility in this area. Post-planting fertilizer application reduces the future weed control burden by helping seedlings to grow more quickly to heights at which weed competition is less intense. Application using controlled release fertilizer (CRF) would minimize movement of nutrients and other potential contaminants to surface and/or groundwater.

At planting, a crown fertilizer treatment assists with early seedling growth and development, and would consist of a 4-ounce dose of high phosphate (11-52-00 or similar) CRF distributed evenly within a 12-inch diameter area centered on the seedling stem or on slopes in a half-moon shape on the uphill side of the seedling. The property is located in a high-rainfall area (70 inches or more per year), so nutrient leaching is a concern, which is partially mitigated by the use of CRF fertilizers.

If in the unlikely event that a second application is needed, the crown application would be 6 ounces per seedling of 11-52-0 with micronutrients or other high-phosphate, low potash mix with micronutrients at 6 ounces per seedling CRF.

1.3.2.6 Management Objective 6 – Weed Control

Goal: Control herbaceous weed competition until canopy closure and establishment of trees and shrubs.

Actions – Herbaceous Weed Control: NRCS Practice 315

Creating a "new" koa forest on previously pastured and grazed land would require significant inputs of weed control agents to ensure the successful survival and health of the newly-planted seedlings. Site preparation activities would temporarily diminish competitive herbaceous weed pressure through chemical and mechanical means. However, in the months following planting, there would be inevitable recurrence of resident grasses that would need attention.

For timber stands, a single weed control (aside from that applied during site preparation) application would be used. For mixed species restoration stands, which feature lower stocking and slower growing species, two entries would be used in the first year. All stands would receive two further entries during the integrated pest management (IPM) applications, which also include control of psyllids, anticipated for the second and third years.

Selective or broad-spectrum herbicides, depending on actual weed pressure would be used as needed for post-planting competition control until trees are two years old or until the canopy has closed. Grasses would be the main targets for this operation; annual herbaceous species such as bull thistle (*Cirsium vulgare*) and fireweed (*Senecio madagascariensis*) in moderate numbers are not as damaging to young seedlings. A manual spot treatment is an option for outbreaks of broadleaf weeds in early development stage (less than 10 feet in height).

Because of the history of pasture management, the dominant weed species on site are grasses. Herbicides with grass-specific modes of action may, therefore, be applied over the entire planting area. These compounds do not affect broadleaf biochemistry and are thus safe to use without chemical barriers around seedlings. Examples of these grass-specific herbicides are fluazipop (Fusilade DX) and quizalofop (Assure II).

Monitoring would reveal which particular weed species have emerged and would be used to determine the precise formula to control weeds. Depending on the weed species composition, other herbicides that may be applied include Streamline (aminocyclopyrachlor), Polaris AC (imazapyr), Element 4 (triclopyr), Roundup PowerMax (glyphosate), and Escort (metsulfuron methyl). All label regulations would be observed for broadcast or spot treatments as appropriate.

1.3.2.7 Management Objective 7 – Integrated Pest Management

Goal: Protect growing koa trees with timely and effective treatment of insects and pathogens.

Actions – Forest Stand Improvement: NRCS Practice 666

Maintaining healthy trees is the first and best defense against pests and pathogens, but some level of disease or pest infestation may be unavoidable even in healthy plantings. Stand management is best accomplished in the context of an IPM approach to dealing with pests and pathogens. The IPM framework involves three sequential assessments, (1) monitoring potential pest agents, (2) identifying threshold densities or populations at which pests cause unacceptable economic damage, and (3) identifying and applying the most effective control agent.

To control insect pests using IPM, the first step is to identify potential pest species. This requires a monitoring program that can take on varying degrees of sophistication. When damaging levels of the pest are discovered, the first option for control methods is typically a pheromone-based trapping system or adhesive traps. Chemical insecticides are used if control is impossible with more benign methods.

Likely insect pests on koa include the acacia psyllid (*Acizzia uncotoides*), a non-native sap-sucking insect, the koa moth (*Scotorythra paludicola*), a native defoliating insect, and the koa borer (*Xylosandrus compactus*).

Psyllid infestations may threaten performance of entire stands by feeding on growing tips and causing extreme branching in the following growth phase. Koa is attacked by psyllids in the second year after planting. This causes stunting and loss of apical dominance, with concomitant branchiness. The forest health practice here is to use IPM techniques to reduce the psyllid population during the critical spring time of Year 2 and 3. Koa moth is usually constrained to a few individuals in a given stand.

Chemical options for controlling the psyllid include dinotefuran (Safari 20 SG) or spirotetramat (Movento), both of which have labeling appropriate or adaptable to use in koa plantings on Hawaiʻi island. The koa moth may also respond to these treatments, although such a use is not explicitly defined for Movento.

A combined treatment, utilizing one of the agents above plus a grass-control herbicide would be applied in the spring of the second and third year using helicopter as an application method. This is an extremely cost-effective way to reduce pest presence and reduce pressure from grasses in the understory. The application would be used in both koa and mixed forest stands. This application would be minimized to approximately 150-acres, occur 1 time per year; or approximately 10 hours per year limited to the forest establishment period (approximately 9 years).

1.3.2.8 Management Objective 8 – Pruning and Singling

Goal: Improve the stem form, quality, and value of planted koa stems through judicious and timely stem correction.

Actions – Tree/Shrub Pruning: NRCS Practice 660

Koa has poor apical dominance which results in heavy branching, control of which would require several entries for both singling in Year 1 (removal of competing leaders to favor only a single growing tip) and pruning (removal of lateral branches up to a height of 6 to 8 feet).

Koa shows a strong tendency to branch and fork even when grown at relatively high stem densities. At the planting geometries prescribed herein, pruning and singling treatments would be necessary to enhance form and growth rates. The singling operation (pruning to a dominant leader) should occur when trees first begin to show evidence of competing leaders. The most vigorous leader should be promoted by cutting the inferior leader tips back by a third of their length. This operation usually occurs between 10 and 15 months of age.

At a point between 14 and 20 months, depending on growth performance, the first pruning treatment would likely be required. Lower branches should be pruned up to a height of approximately 50% to 65% of the crown depth, with the smaller percentage crown depth removed from unhealthy/shorter trees, and the larger percentage from healthy/taller trees. Branches must be pruned when their basal diameter is less than 0.5 inch. Depending on growth rates, a second pruning entry may be required after 24 months of age.

A third pruning after 24 months of age is not included in the budget tables for this management plan due to the uncertainty of its need. This treatment should be used only if additional clear wood height is needed and comes at a relatively nominal cost per entry.

The final objective should be to yield an expanse of tree trunk free of branches for at least 8 to 10 feet above the ground. Subsequent entries scheduled as necessary according to tree growth rates. Pruning should result in koa trees with no lower branches to interfere with clear wood growth.

1.3.2.9 Management Objective 9 – Ash Stand Replacement (Year 8)

Goal: Replace existing tropical ash stand and regenerate a new koa forest.

Actions – Site Preparation: NRCS Practice 460; Brush Management: NRCS Practice 314

The ash stand is approximately 80 years old (estimated planting date in 1930's by Civilian Conservation Corps) and apparently has never been thinned or managed in any active way. The impressive height of these existing trees is evidence of the site's productivity for timber production and one of the reasons for the acquisition of this property. Tropical ash is a known invasive species. Evidence of prolific volunteer re-generation is evident on the forest floor, kept in check by constant cattle presence.

As these cattle transition off the property in coordination with koa plantings on successive units, herbicide applications would be necessary to control the spread of volunteer starts. The location of this stand provides an advantageous existing windbreak for that portion of the property directly to the west.

The ash stand is also a significant amenity on the property, providing shade and shelter from wind and rain for visitors and a windbreak for young saplings in Year 1 and 2. Until other components are established on site, retaining a portion of this grove is desirable. However, the grove would increasingly become a nuisance as cattle are removed and more seedlings begin to germinate inside the koa and mixed forest planted stands. Therefore, it must be removed.

As discussed in Section 1.1.1, plans for the property call for a small, specialty instrument-grade lumber processing facility (permit applications in process) that would be able to mill materials from off-site as well as this initial harvest and would be capable of milling the final harvest of the residual stand. Final harvest of these trees and subsequent conversion to a koa stand would occur in Year 8 (see Figure 1.1-2 for specialty instrument-grade processing facility site location).

The conversion of an ash stand to koa is no small feat, thus the following measures are to be used, based on experience of converting such stands in Hōnaunau Forest in 2005-2010:

1. Site preparation (ash only): remove all remaining standing trees and treat (with imazapyr) or remove stumps. Preferably keep stumps in place to avoid soil disturbance.
    a. Clear brush into windrows no less than 200 feet apart in neat stacks so that they block the wind
2. Brush management: Treat seedlings and sprouting root fragments with imazapyr or Garlon 3A/4
3. Plant stands at a high 700 koa seedlings/acre to promote rapid site occupation and shading
4. Control weeds (ash seedlings) a second time in Year 1 using imazapyr at low rates with glyphosate

Controlling ash is a necessary step for the long-term integrity of the forest and surrounding properties. Ash is very susceptible to imazapyr, however koa is less susceptible. This single factor, combined with high stocking, would assist the conversion of this stand from the aggressive ash seedlings to koa. Ash seeds only last 2 to 3 years in the ground, so the weed pressure would be short-term.

1.3.2.10 Management Objective 10 – Monitoring

Goal: Actively monitor and adaptively manage silvicultural activities and their results and incorporate this information into future management decisions. Monitor and control vectors if these are preying upon forest birds.

<u>Actions – Access Control: NRCS Practice 472; and Upland Wildlife Habitat Management: NRCS Practice 643</u>

A critical element of forest management is an active and effective monitoring program. Monitoring would take place in three areas every year, using the following practices:

1. Monitor integrity of fences and gates, fix as necessary to maintain pig and cattle exclusion
2. Growth and yield of production koa plantings – establish two permanent sample plots of eight to ten trees each for annual measurements, ideally these are circular, using variable area or a fixed area approach. In the first two years, tree height and survival would be the two data categories. Once trees reach sufficient size to have a measurable diameter at 3.6 feet above the ground, diameter would also be recorded. Data analysis would follow standard statistical methods to quantify koa growth rates and projected timber yields, as well as evolving species composition of the restored forest.
3. Record sign of deleterious mammals near water bodies, consider deployment of control measures if these are affecting native or migratory birds.

1.4 Environmental Assessment Process

This EA was prepared in accordance with Chapter 343 of the HRS. Chapter 343, HRS, along with its implementing regulations, Title 11, Chapter 200.1, of the Hawaiʻi Administrative Rules (HAR), is the basis for the environmental impact assessment process in the State of Hawaiʻi. Board of Land and Natural Resources approval is required to finalize the FMP and provide funding for implementation of the proposed action through a Forest Stewardship Agreement (Chapter 195F, HRS).

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. Use of state funding is among the criteria in HRS Chapter 343 that trigger the need for a state EA. Part 4 of this document states the finding (anticipated in the Draft EA) that no significant impacts are expected to occur, and Part 5 lists each criterion and presents the findings by the approving agency. If approving agency finds after considering comments to the Draft EA that no significant impacts would be expected to occur, then it issues a Finding of No Significant Impact (FONSI), and the action would be permitted to occur. If the agency concludes that significant impacts are expected to occur as a result of the Proposed Action, then it determines that an Environmental Impact Statement must be prepared for the action to proceed.

The goal of this EA is to ensure that comprehensive and systematic consideration is given to potential environmental impacts that may result from implementing the Proposed Action, or any reasonable alternative action, upon the natural, man-made, or social environment. Information presented in this EA would result in either a FONSI, preparation of an Environmental Impact Statement, or no action on the proposal.

1.5 Public Involvement and Agency Coordination

Public involvement is an important component of the EA development process as a means to:

- accurately assess the scope of the EA
- identify resources and issues of concern
- disclose potential impacts
- develop mitigation measures
- inform minority and disadvantaged populations
- coordinate with regulatory agencies

- refine project design

Public outreach has been conducted through formal early consultation letters, informal meetings, and communications with parties who have inquired about the project. The following agencies, organizations and individuals were contacted by mail, email, or phone. Those with whom the team conducted presentations, attended meetings, or had interviews are indicated by an asterisk:

Individuals and Organizations:

- Cory Harden for Sierra Club
- Dahana Ranch
- Elizabeth B. Camara
- Glenn Bertelmann
- Hawaiian Cultural Center of Hāmākua
- Irene L. Fergerstrom
- Jolette A. Rapozo Trust
- Kalawaianui, Paʻakaula Kalawaianui, Kuʻuipoʻokala Kaʻaihue, Micah
- Kapoaula Land, LLC
- Mālama Hāmākua*
- Pamela Jean Ramos
- Paul, David, and Cindy Lou Andrade
- Paula Iwalani Boteilho
- Parker Ranch Mauna Kea, LLC
- Walter L. Puhi Jr.
- Yvonne L. K. Deluz

County Agencies and Officials:

- Civil Defense Agency
- District 1, County Councilmember Valerie T. Poindexter
- Department of Environmental Management
- Department of Public Works
- Fire Department
- Planning Department
- Police Department

State Agencies and Officials:

- Department of Health (DOH), Environmental Planning Office
- Department of Land and Natural Resources (DLNR)
- Office of Hawaiian Affairs

Early EA consultation letters were distributed to the above via mail or email. Responses to the consultation letters were received from Department of Environmental Management, Department of Public Works, and the Hawaiʻi Police Department. The early EA consultation letter and responses to the consultation letters are provided in Appendix E. On February 24, 2019, the organization Mālama Hāmākua held a community outreach event and invited the EA preparers to attend. Cardno representative Kerry Kylene Wells and Forest Solutions representative William Rice attended the event that was announced via social media.

The event was held on a Sunday from 5:00 p.m. to 8:00 p.m. The event consisted of an open house format with one topography poster of the subject property on display, the early EA consult letter and the FMP for perusal, and the two EA preparers present to orient attendees and answer questions. Almost 50 Hāmākua residents and others from around the island attended the meeting. Most individuals had general positive comments about the project. Several individuals mentioned the request to volunteer to assist in tree plantings on the subject property.

Copies of written communications received in response to early consultation efforts are included in Appendix E1. Appendix E2 will contain written comments on the Draft EA and the responses to these comments at the appropriate time. Various places in the EA have been modified to reflect input received in the comment letters; additional or modified non-procedural text is denoted by double underlines, as in this paragraph.

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SECTION 2
PROPOSED ACTION AND ALTERNATIVES

2.1 No Action Alternative

Under the No Action Alternative, the suite of actions described in the Kapoaula FMP would not be undertaken. General management would continue under the status quo and the property would potentially remain as a grazing area for cattle. The no action alternative does not meet the purpose for acquisition but provides a useful baseline by which to compare environmental effects from the project.

2.2 Action Alternatives

As described in Section 1.1.1 of this EA, the Proposed Action is the preferred alternative and environmental effects are examined based upon implementation of the FMP.

Siglo Forest, LLC acquired the 564-acre Kapoaula property from Parker Ranch for the purposes of planting, managing, and harvesting koa trees. This will convert pastureland back to a semblance of the native koa-ʻōhiʻa forest that once stood in this area and provide controlled future uses of the forest for commercial products. Forest Solutions Inc. has authored a site-specific FMP for the area, which is provided in this document as Appendix A. The FMP was reviewed and recommended for state approval by the State Forest Stewardship Advisory Committee in October 2018. Through implementation of the site-specific FMP, in approximately 50 years, the property would consist of a mixed-species native forest with steep sloped areas primarily for native species conservation and less steeply sloped, less erodible primarily used for timber production. The resulting koa forest would provide a sustainable, long-term, predictable source of instrument-grade wood, produce high-quality wood for other uses, and provide habitat for native species, inspiring others to plant trees on their land for similar purposes. The objectives are as follows:

- Reforest the entire property with koa and a complement of associated native forest plants
- Improve the quality of wood to be harvested in the future by:
  - planting seed from known, high-quality sources
  - utilizing cuttings propagated from trees identified as having superior color, figure, and form
- Intensively manage koa for saw timber on those areas of the property with slopes less than 20% – accounting for 70% of the property or 390 acres
- Reforest the remaining upland areas with a multi-species native forest, utilizing koa as a pioneer species – accounting for 30% of the area or 163 acres
- Protect planted forest from wind by planting fast-growing, cattle resistant windbreaks
- Specialty instrument-grade lumber processing of koa from Kapoaula to be completed onsite

A small, specialty instrument-grade lumber processing facility (permit applications in process) is also being developed in the lowest part of the property near the road onsite (see Figures 1.1-2 and 1.1-4). The processing facility for specialty lumber from other areas of the island is a separate project being undertaken by the property owner and is analyzed as a cumulative impact to the proposed action in this EA. The processing of the wood during operations is analyzed in this EA.

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SECTION 3
AFFECTED ENVIRONMENT AND POTENTIAL IMPACTS

This section defines the environmental resources, technical approach to analysis, existing resource conditions and potential impacts due to the Proposed Action, including the No Action Alternative. The potential impacts of construction (short-term) and operations (long-term), and direct and indirect impacts are considered. Indirect impacts are defined in HAR 11-200-2 as “effects which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable.” Indirect effects could include induced changes in the pattern of land use and related effects on air and water and other natural systems. Cumulative impacts of the action alternative are assessed in Section 3.12. Section 5.2 summarizes the Hawaiʻi Environmental Policy Act significance criteria and the lead/approving agencies determinations.

The FMP identified seven resource concerns. These concerns are common to pasture areas in Hawaiʻi. They are ranked, with EA analysis section in parentheses:

1. Soil erosion and soil compaction (Geology, Topography, and Soils)
2. Undesirable air movement (Air Quality)
3. Water quality and excess sediment (Water Resources)
4. Insufficient flow in watercourses (Water Resources)
5. Hydrologic cycle: capture and storage of rainfall (Water Resources)
6. Threatened and endangered species (Biological Resources)
7. Inadequate cover and food for wildlife (Climate Change)

These concerns are analyzed in this EA, along with noise, scenic, hazardous materials, cultural and archaeological, roads/traffic, utilities/public facilities and services, and cumulative resource impacts. Additionally, a comprehensive Biological Assessment is included as Appendix B, and an Archaeological Assessment Survey and a Cultural Impact Assessment are included as Appendix C1 and C2, respectively.

3.1 Geology, Topography, and Soils

Geology describes the characteristics of surface and subsurface materials that make up land. These characteristics include stability, slope, compatibility, shear strength, and productivity. Soil characteristics determine the ability of the ground to support structures and facilities and determine the likelihood of erosion and run-off. Topography describes surface features of an area and is usually described with respect to elevation, slope, aspect, and landforms.

3.1.1 Technical Approach

3.1.1.1 Area of Potential Effect

The area of potential effect (APE) would be the area of ground disturbance for construction and operation of the Proposed Action and adjacent areas.

3.1.2 Existing Conditions

The elevation of the property ranges from approximately 2,740 feet to 3,180 feet above sea level (Figure 3.1-1). The overall average slope of the property is 5%, with numerous intermittent steep hills and ridges with slopes as steep as 100%. Geologically, the property is located on the flanks of Mauna Kea volcano lava flows that erupted from 14,000 to 250,000 years before the present (Wolfe and Morris 1996). All lava flows are mantled with a thick layer of volcanic ash derived from Kohala and Mauna Kea volcanoes (United States [U.S.] Geological Survey [USGS]-Hawaiian Volcanoes Observatory: 2009). The resulting ash-derived soils of the Hāmākua coast were the basis for highly productive farming and/or grazing from early Hawaiian times until today.

Soils on the property are classified by the U.S. Natural Resources Conservation Service (formerly Soil Conservation Service) as Honokaʻa silty clay loam in the lower elevations and Maile silt loam in upper elevations (Figure 3.1-2). The Honokaʻa series consists of deep, well-drained soil that formed in basic volcanic ash. It is found on mid-elevation, windward slopes of Mauna Kea with slopes ranging from 0 to 35%, and it is potentially highly erodible. Maile silt loam is a very deep, well-drained soil that formed in basic volcanic ash over ʻaʻa lava flows. It is found at mid-elevations on the windward slopes of Mauna Kea and has slopes of 0 to 20%. It is not highly erodible. Both soils are used principally for pasture and timber plantations, although some areas of native forest remain (U.S. Soil Conservation Service 1973).

The land is fully stocked with high-quality pasture grasses and there are no obvious signs of soil erosion or sediment transport. Sheet and rill erosion are minimal owing to the thick grass sward. Some erosion may be occurring under the grass sward on the ridges during large storm events.

The project area has a very low risk of volcanic hazard – zone 8 on a scale of ascending risk 9 to 1 – because Mauna Kea is not an active volcano (Heliker 1990). 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. On Sunday, October 15, 2006, two damaging earthquakes of magnitude 6.7 and 6.0 struck the west side of Hawaiʻi island, causing extensive damage in West Hawaiʻi. An even stronger magnitude 6.9 occurred under Kilauea Volcano on May 3, 2018. None of these earthquakes appear to have caused any damage on the subject property.

3.1.3 Proposed Action

3.1.3.1 Construction

As described in Section 1.3.2.1, mechanical site preparation for re-forestation would include deep ground ripping and possible grading for access roads. These site preparations would be temporary and short term, and would involve typical earth moving equipment such as tractor-pulled ripping implements and bucket loaders. Because of the temporary and low impact nature of site preparation activities, it is anticipated that these activities would result in negligible soil erosion and compaction related impacts.

Fencing would be constructed at various times and in various locations throughout the life of the project using mainly hydraulic rams with minimal air quality impacts. Because of the temporary and low impact nature of fencing activities, it is anticipated that these activities would result in no soil erosion and compaction related impacts.

Best management practices (BMPs) to maintain soil in place and minimize disturbance of erodible soils will be implemented.

3.1.3.2 Operations

Operations such as pruning activities (see Section 1.3.2.8) may displace soils. There would be negligible during forest establishment adverse and additionally positive impacts on soil displacement associated with pruning and vegetation management activities.

<u>Specialty Instrument-grade Lumber Processing Operations</u>

There would be no direct, adverse impact on soil erosion and compaction associated with specialty instrument-grade lumber processing activities.

Pesticide, fertilizer, and chemical application may be applied in various ways including application by helicopter. Because this is expected to be infrequent and short-term (approximately 10 hours, once per year, approximately 150 acres, limited to the forest establishment period (approximately 9 years), impacts to soils due to pesticide application are expected to be negligible.

3.1.4 No Action Alternative

Under the No Action Alternative, no changes to the proposed site would occur. Therefore, there would be no change to the erosion or compaction of soils on the subject property.

3.1.5 Impacts and Mitigation

3.1.5.1 Impacts

In general, geologic conditions impose no constraints on the forestry project, which would promote appropriate agricultural use of the property in conformance with zoning, and the Proposed Action is not imprudent to implement. See Table 3.1-1 for a summary of impacts during all phases of the Proposed Action.

Table 3.1-1. Geology, Topography, and Soils Impacts

	Proposed Action	***No Action***
Construction Phase		
Site Preparation	Negligible	No Impact
Fencing	No Impact	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	No Impact	No Impact
Pesticide Application	No Impact	No Impact
Pruning and Maintenance	Negligible	No Impact

3.1.5.2 Mitigation

All site preparation, road and pond construction, planting, and silvicultural activities would be conducted with standard BMPs that maintain soil in place and minimize disturbance of erodible soils. BMPs would ensure that the high current level of organic material in the soil would be retained and that no sediments would escape the property through surface water transport (see Section 3.3).

Figure 3.1-1. Topography and Slope

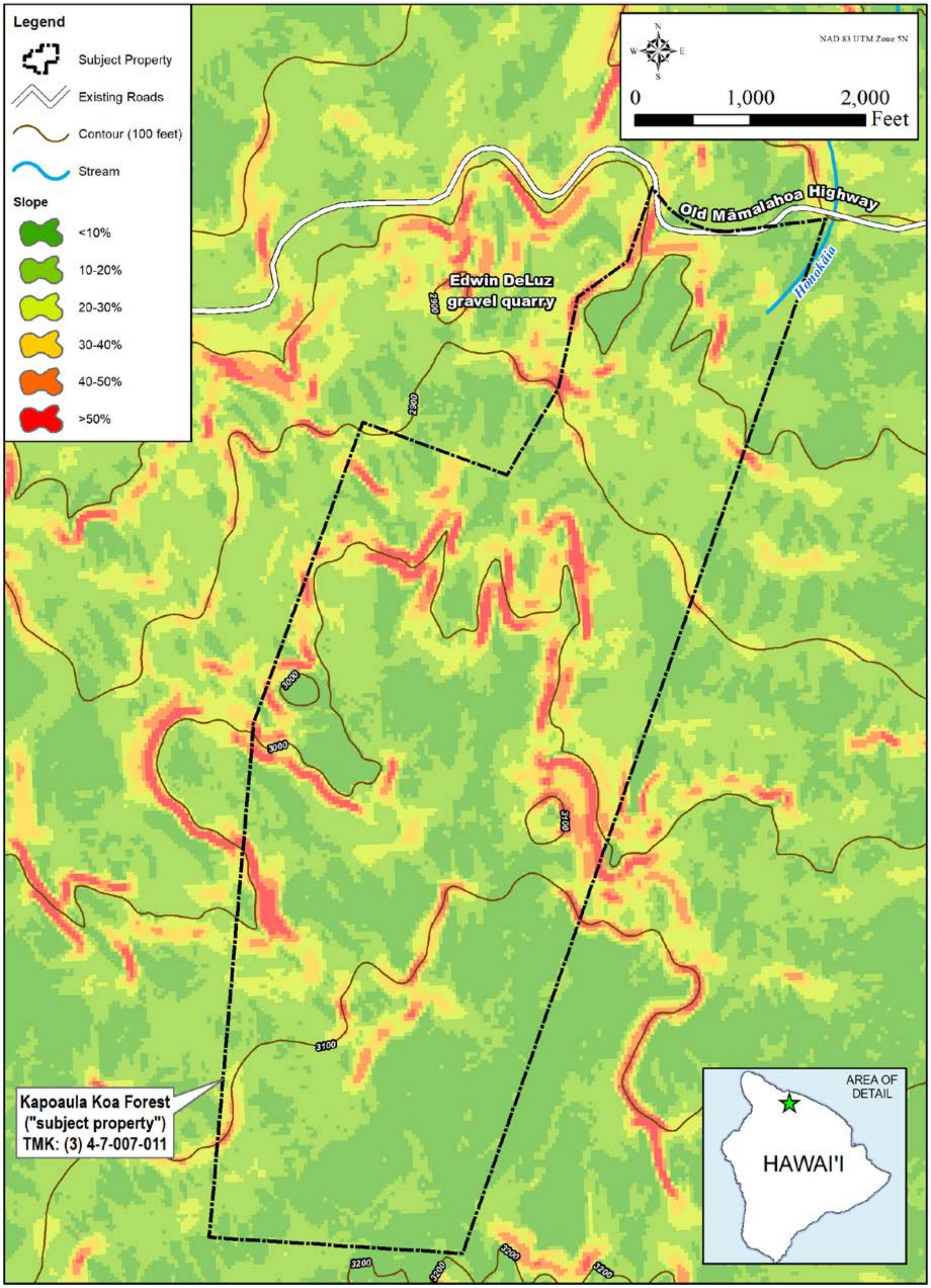
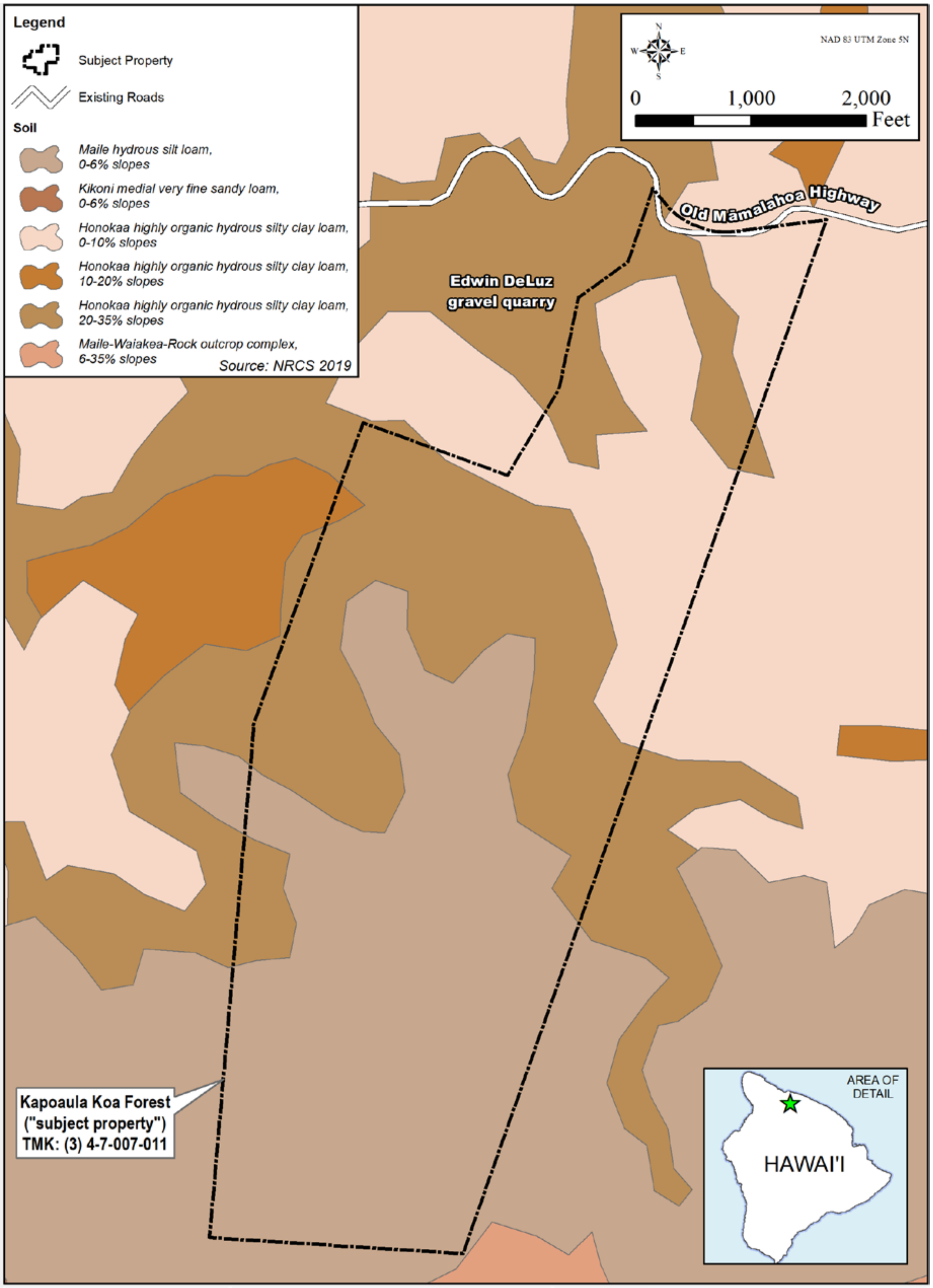


Figure 3.1-2. Soils



3.2 Air Quality

Air quality is defined as the ambient air concentrations of pollutants determined by the U.S. Environmental Protection Agency to be of concern to the health and welfare of the general public. The designated criteria pollutants include:

- ozone
- carbon monoxide
- nitrogen dioxide
- sulfur dioxide
- particulate matter less than 2.5 microns in diameter
- particulate matter less than 10 microns in diameter
- lead

The Clean Air Act (CAA) of 1970 established air quality regulations and National Ambient Air Quality Standards (NAAQS). The DOH enforces air pollution regulations and sets guidelines to maintain the NAAQS and Hawaiʻi Ambient Air Quality Standards (HAAQS) within the State of Hawaiʻi.

Table 3.2-1 lists NAAQS and HAAQS in parts per million and micrograms per cubic meter. These are the maximum concentrations of criteria pollutants considered allowable to protect human health and welfare. NAAQS have both primary and secondary standards. Primary standards are aimed at protecting human health in areas that are considered sensitive, such as residential neighborhoods, churches, libraries, schools, and parks. Secondary NAAQS are aimed at protection of plants and animals.

Table 3.2-1. NAAQS and HAAQS

Criteria Pollutant	***Averaging Time***	***HAAQS***	***NAAQS***	
			Primary	***Secondary***
Hydrogen Sulfide	1-hour Maximum	0.025 ppm (35 μg/m^3)	--	--
Ozone	8-hour Maximum	0.08 ppm (157 μg/m^3)	0.075 ppm (147 μg/m^3)	0.075 ppm (147 μg/m^3)
Carbon Monoxide	1-hour Maximum	9 ppm (10 mg/m^3)	35 ppm (40 mg/m^3)	--
	8-hour Maximum	4.4 ppm (5 mg/m^3)	9 ppm (10 mg/m^3)	--
Lead	Average Over 3 Months	--	0.15 μg/m^3	0.15 μg/m^3
	Quarterly Average	1.5 μg/m^3	1.5 μg/m^3	1.5 μg/m^3
Nitrogen Dioxide	Annual Mean	0.04 ppm (75 μg/m^3)	0.053 ppm (100 μg/m^3)	0.053 ppm (100 μg/m^3)
PM_{10}	Annual Mean	50 μg/m^3	--	--
	24-hour Average	150 μg/m^3	150 μg/m^3	150 μg/m^3
$PM_{2.5}$	Annual Mean	--	15.0 μg/m^3	--
	24-hour Average	--	35 μg/m^3	--
Sulfur Dioxide	Annual Mean	0.03 ppm (80 μg/m^3)	0.03 ppm (80 μg/m^3)	--
	24-hour Maximum	0.14 ppm (365 μg/m^3)	0.14 ppm (365 μg/m^3)	--
	3-hour Maximum	0.5 ppm (3,000 μg/m^3)	--	0.5 ppm (3,000 μg/m^3)

Legend: HAAQS = Hawaiʻi Ambient Air Quality Standards; μg/m^3 = micrograms per cubic meter; NAAQS = National Ambient Air Quality Standards; $PM_{2.5}$ = particulate matter less than 2.5 microns in diameter; PM_{10} = particulate matter less than 10 microns in diameter; ppm = parts per million

Air quality can be affected by both stationary and mobile sources. Examples of stationary sources include combustion and industrial stacks. Examples of mobile sources include vehicular traffic and aircraft. Areas that exceed ambient air quality standards are designated as nonattainment areas and areas that comply with ambient air quality standards are designated as attainment areas. Areas without data to determine whether they are in attainment or nonattainment status are considered unclassified and are assumed to be in attainment.

The DOH Clean Air Branch regulates stationary sources of air pollutants and issues permits. Permits limit emissions of pollutants and require monitoring. The State does not regulate mobile sources; however, these sources must meet NAAQS.

The CAA requirements (see Table 3.2-1) are used to determine if impacts of the Proposed Action are significant. Since the area is currently in attainment, any emissions causing any criteria pollutants to rise above attainment levels would be significant. Additionally, air emissions that would expose sensitive receptors (e.g., schools, housing, childcare centers, etc.) to substantial pollutants or create odors are also considered significant.

In addition to meeting regulatory standards for air emissions, there are climate change and global warming considerations. Greenhouse gas emissions (GHG) trap heat within the lowest portion of the earth's atmosphere causing heating at the surface of the earth. The increase in global temperature results in sea level rise and changing weather patterns. The GHG include carbon dioxide, methane, and nitrous oxide that occur naturally in the atmosphere but increase due to man-made activities.

3.2.1 Technical Approach

3.2.1.1 Area of Potential Effect

The APE would be limited to the subject property and immediate vicinity. It is important to note that the "property line boundary" as used in the DOH regulations would be the TMK parcel boundary, which is the same area as the project area (see Figure 1.1-1). The impacts of GHG and climate change is presumed to be county-wide.

3.2.2 Existing Conditions

The project area and vicinity are undeveloped and characterized by open space, preservation, and agricultural land uses. There are no known point sources of air pollution in the APE. Mobile sources include vehicular traffic and agricultural activities, but the low traffic levels are unlikely to contribute significantly to the degradation of ambient air quality. The existing Edwin DeLuz gravel quarry located at the northern end of the project area likely has historically and would continue to generate periodic fugitive dust events. The DOH maintains thirteen air quality monitoring stations on Hawaiʻi island, the nearest monitoring station to the APE is located at Waikoloa, approximately 15 miles southwest of the APE boundary. The station currently monitors only for particulate matter less than 2.5 microns in diameter. The APE area is characterized as rural and no industrial stationary sources of air pollutants were identified in the APE. The study area is in attainment with both the HAAQS and NAAQS for all criteria pollutants and is not subject to the CAA General Conformity Rule.

Winds in the study area are generally from the northeast.

3.2.3 Proposed Action

3.2.3.1 Construction

As described in Section 1.3.2.1, mechanical site preparation for re-forestation would include deep ground ripping and possible grading for access roads. These site preparations would be temporary and short term, and would involve typical earth moving equipment such as tractor-pulled ripping implements and bucket loaders. Because of the temporary and low impact nature of site preparation activities, it is anticipated that these activities would result in negligible air quality related impacts.

Fencing would be constructed at various times and in various locations throughout the life of the project using mainly hydraulic rams with minimal air quality impacts. Because of the temporary and low impact nature of fencing activities, it is anticipated that these activities would result in no air quality related impacts.

BMPs to control dust during construction would be required by county grading and grubbing permit conditions. BMPs may include dust fences to keep the dust on-site, and watering to minimize the amount of dust produced. All construction activities would comply with regulations for fugitive dust control under HAR Section 11-60.1-33 that require reasonable precautions to prohibit visible fugitive dust beyond the property line.

The project vicinity is agricultural in nature and there are no sensitive receptors (i.e., schools or medical facilities) adjacent to the work areas; therefore, none would be adversely impacted by the temporary air emissions. Emissions are not expected to exceed the CAA major source threshold of 250 tons per year for construction. Construction emissions would be less than significant with implementation of the BMPs.

3.2.3.2 Operations

Operations such as pruning activities (see Section 1.3.2.8) would not involve equipment other than transportation vehicles, hand tools, and elevated bucket trucks. There would be no direct adverse impact on air quality associated with pruning and vegetation management activities.

<u>Specialty Instrument-grade Lumber Processing Operations</u>

Specialty instrument-grade lumber processing operations as an allowed agricultural processing use would include modern equipment that is designed and manufactured to meet regulatory guidelines for air pollution as much as possible at the time of installation. A small state of the art generator (approximately 14,000 watts) will run the processing unit. The generator will produce negligible amounts of air pollution while running; however, this amount will be low compared to the adjacent landowner. Additionally, the processing site would be spatially associated near the existing Edwin DeLuz quarry, which currently utilizes mobile equipment, rock crushers, and trucks and generates a level of fugitive dust. There would be negligible additional direct, adverse impact on air quality associated with specialty instrument-grade lumber processing activities.

Pesticide and chemical application may be applied in various ways including application by helicopter. Because this is expected to be infrequent and short-term (approximately 10 hours, once per year, approximately 150 acres, limited to the forest establishment period (approximately 9 years), impacts to air quality due to pesticide application are expected to be negligible.

3.2.4 No Action Alternative

Under the No Action Alternative, no changes to the proposed site would occur. Therefore, there would be no adverse significant impact to air quality under the No Action Alternative.

3.2.5 Summary of Impacts and Mitigation

3.2.5.1 Impacts

As shown in Table 3.2-2, the Proposed Action would collectively result in a less than significant impact on air quality during construction with the implementation of BMPs. Operations of the preferred alternative would result in no direct impact on air quality.

Table 3.2-2. Air Quality Impacts

	Proposed Action	*No Action*
Construction Phase		
Site Preparation	Negligible	No Impact
Fencing	No Impact	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	Negligible	No Impact
Pesticide Application	Negligible	No Impact
Pruning and Maintenance	No Impact	No Impact

3.2.5.2 Mitigation

BMPs to control dust would need to meet permit requirements and are assumed to be included in the Proposed Action. Pesticide spraying would be subject to weather related restrictions.

3.3 Floodplains, Drainage, and Water Resources

Water resources include surface water, groundwater and wetlands. Surface water includes all water found on land, such as stormwater, lakes, canals, streams and rivers. Groundwater is found in aquifers beneath the surface of the earth, and its quality is of great importance because it is often used as potable water. For the purposes of this document, nearshore waters are defined as coastal waters extending from the shore to a depth of 60 feet.

In 1972, the Clean Water Act (CWA) was enacted to protect water resources. The U.S. Army Corps of Engineers (USACE) is the enforcing agency for the CWA. The purpose of the CWA is to restore and maintain the health of water resources in the U.S. by preventing pollution and assisting in proper wastewater management (U.S. Environmental Protection Agency 2009). Wetlands and the CWA are addressed in Section 3.3. Hazards related to water include flooding and tsunami waves.

3.3.1 Technical Approach

3.3.1.1 Area of Potential Effect

The APE for the surface water assessment is limited to the project area because no surface water bodies were identified in the vicinity that that would potentially be affected by the Proposed Action. The APE for the assessment of groundwater and tsunami and flood risks is expanded to include the Kekaha-Waimea Region.

3.3.2 Existing Conditions

The Federal Emergency Management Agency (FEMA) has prepared Flood Insurance Rate Maps for the general area (Panel No. 155166 0225F), and there are no mapped flood hazards on or near the Kapoaula property (Figure 3.3-1). The area is considered to be within Flood Zone X, outside of the 500-year floodplain.

No lakes or permanent streams are present. Several unnamed gullies with poorly defined channels drain the property. There is also a roughly 1,400 foot-long headwater segment of an intermittent stream, a third-order tributary of Honokāia Stream, depicted on USGS topographic maps (see Figure 3.1-1).

Fieldwork and consultation of USGS maps and U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory maps indicate that there are no mapped wetlands on the property. Three small, unlined stock watering ponds are located near a planted windbreak in the mid-section of the property. During wet season observations, these three ponds have consistently been partially full. They have not been observed during dry season to determine if they continue to hold water in the face of naturally well-drained soils and evapotranspiration. In addition to the stock ponds, several natural and human-induced small depressions are present in this landscape and form temporary or even sometimes semi-permanent ponds. All ponds have fringing wetlands with primarily non-native vegetation but offer some habitat for wetlands fauna (see Section 3.4).

3.3.3 Proposed Action

3.3.3.1 Construction

As described in Section 1.3.2.1, mechanical site preparation would include deep ground ripping and possible grading for access roads. These site preparations would be temporary and short term, and would involve typical earth moving equipment such as tractor-pulled ripping implements and bucket loaders. Because of the temporary and low impact nature of site preparation activities, it is anticipated that these activities would result in negligible water quality and excess sediment related impacts.

Fencing would be constructed at various times and in various locations throughout the life of the project using mainly hydraulic rams with minimal air quality impacts. Because of the temporary and low impact nature of fencing activities, it is anticipated that these activities would result in no water quality and excess sediment related impacts.

3.3.3.2 Operations

Operations such as pruning activities (see Section 1.3.2.8) could lower excess sedimentation rates on the subject property. There would be negligible adverse impact on water quality and excess sediment associated with pruning and vegetation management activities.

Specialty Instrument-grade Lumber Processing Operations

There would be no direct, adverse impact on water quality and excess sediment associated with specialty instrument-grade lumber processing activities.

Pesticide and chemical application may be applied in various ways including application by helicopter. Because this is expected to be infrequent and short-term (approximately 10 hours, once per year, approximately 150-acres, limited to the forest establishment period (approximately 9 years), impacts to water quality due to pesticide application are expected to be negligible.

3.3.4 No Action Alternative

Under the No Action Alternative, no changes to the proposed site would occur. Therefore, there would be no change to the water quality and excess sediment on the subject property.

3.3.5 Impacts and Mitigation

3.3.5.1 Impacts

Planting of trees as part of the forestry project would not involve any impacts to floodplains and would generally benefit watersheds. Whenever soil is disturbed, however, there is at least some potential for excess sediment from soil erosion during and after disturbance to impact natural watercourses, water quality and flooding potential. If the activity involves compaction, it can hinder rainfall infiltration. However, all activities will be conducted using BMPs to minimize soil disturbance.

Contaminants associated with forestry, primarily with fertilization and herbicides, also have the potential to impact downstream water bodies if not mitigated effectively.

Water bodies, including gullies, the one intermittent stream, and the various natural and artificial ponds, would not be altered or adversely impacted. See Table 3.3-1 for a summary of impacts during all phases of the Proposed Action.

Table 3.3-1. Floodplains, Drainage, and Water Resources Impacts

	Proposed Action	*No Action*
Construction Phase		
Site Preparation	Negligible	No Impact
Fencing	No Impact	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	No Impact	No Impact
Pesticide Application	Negligible	No Impact
Pruning and Maintenance	Negligible	No Impact

3.3.5.2 Mitigations

The project involves minimal spot grading in order to ensure passable unpaved roads, and a County Grading Permit is required for the mill site and associated access road. In order to minimize the potential for sedimentation and erosion, the contractor shall perform all earthwork and grading in conformance with Chapter 10, *Erosion and Sediment Control*, Hawaiʻi County Code. In order to properly manage stormwater runoff, the project would incorporate standard erosion and sedimentation BMPs for the project. These BMPs may include, but would not be limited to, the following:

- Limiting the amount of surface area graded at any given time to reduce the area subject to potential erosion;
- Utilizing soil erosion protective materials such as mulch or geotextiles on areas where soils have a high potential for erosion until permanent vegetation is in place;
- Planting vegetation as soon as grading operations permit to minimize the amount of time soils are exposed to possible erosion; and
- Installing silt fences along the downhill perimeter of any disturbed areas to collect sediment from stormwater runoff.

The project plans would be regulated through review and approval by the Department of Public Works to ensure compliance with standards related to storm runoff containment. It is not expected that unpaved forest road improvements would have a long term negative impact on water quality in any area.

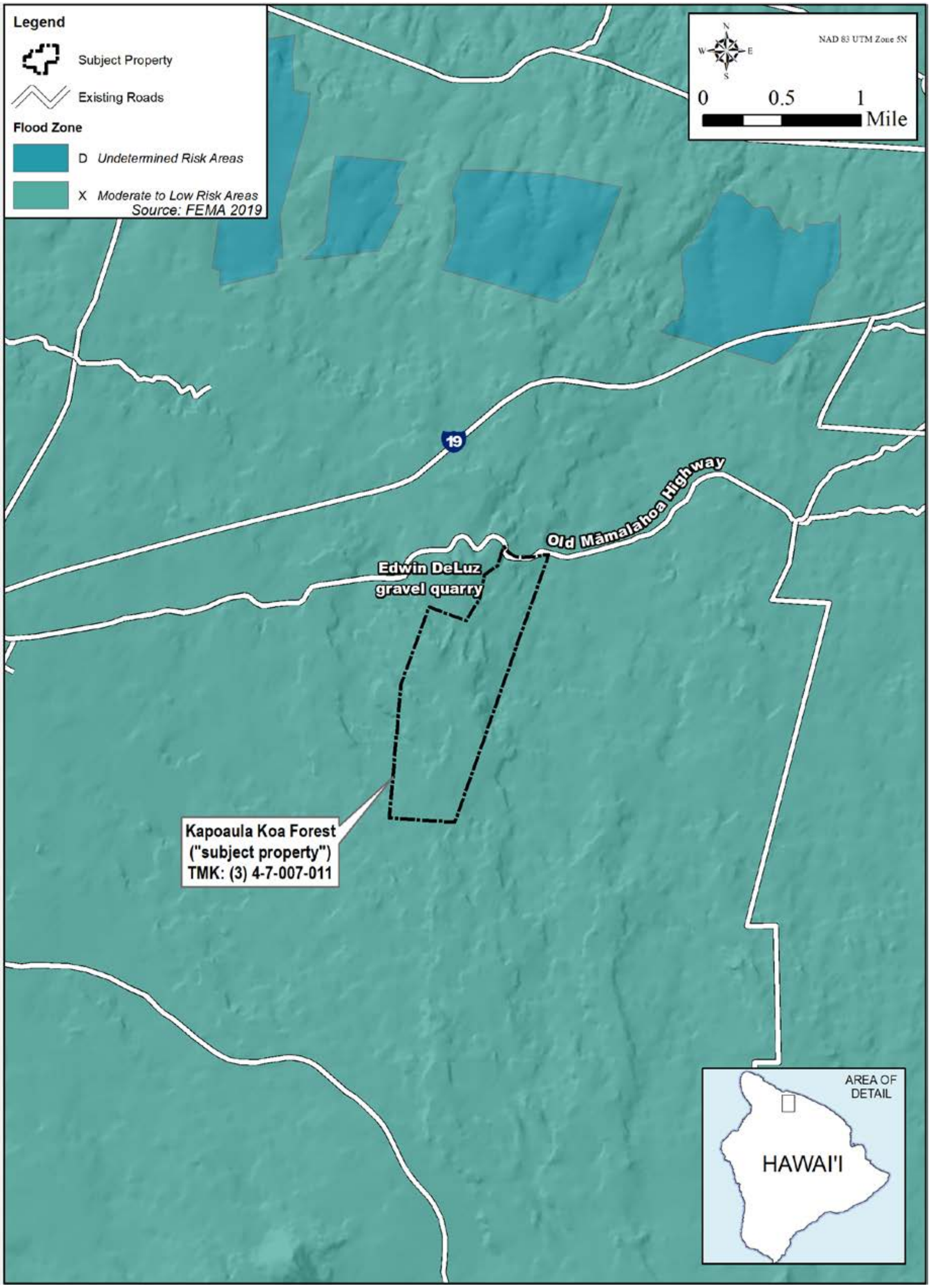
To mitigate the soil disturbance during the Proposed Action, BMPs would include controlled loosening the soil, which combined with a growing forest cover would reduce the quantity of rainfall arriving at the soil level and improve infiltration. This in turn would reduce overland flow and provide a slow, steady water supply to nearby gulches during high rainfall events.

Potential contaminants associated with forestry, primarily with fertilization and herbicides, also have the potential to impact downstream water bodies if not mitigated effectively. Application using CRF would minimize movement of nutrients and other potential contaminants to surface and/or groundwater. The FMP specifies fertilization regimes that have been scientifically designed to require the minimum amount necessary for effective growth. CRF help mitigate the nutrient leaching concern. The FMP and specific measures would be adapted to feedback received in monitoring field conditions to ensure optimum fertilizer delivery while minimizing contamination.

Similarly, as discussed in Chapter 1, herbicide application utilizing elective or broad-spectrum herbicides, depending on actual weed pressure, would be used as needed pre-planting and for post-planting competition control until trees are two years old or until the canopy has closed. Monitoring would reveal which particular weed species have emerged and would be used to determine the precise formula to control weeds while avoiding overapplication that could impact water quality.

Water bodies, including gullies, the one intermittent stream, and the various natural and artificial ponds, would not be altered or adversely impacted. No filling or channel altering work is proposed.

Figure 3.3-1. FEMA Flood Insurance Rate Map



3.4 Biological Resources

The discussion of biological resources below is divided for convenience into a Vegetation and Flora section and a Fauna section, although it is recognized that these resources are part of an integrated ecosystem whole. Included in these sections are discussions of threatened and endangered species. Federal and State of Hawaiʻi endangered species laws require government agencies to ensure that their actions are not likely to jeopardize the continued existence of federal- or state-listed threatened or endangered species (16 U.S. Code §1536[a][2] and [4]; Chapter 195D, HRS). The Endangered Species Act (ESA) defines critical habitat as areas that may or may not be occupied by a threatened or endangered species but are essential to the conservation of the species. These areas may require special management considerations or protection (16 U.S. Code §1532 [5]). Federal and state agencies also have an interest in protecting rare species. Biological resources are treated in greater detail in the Biological Survey; readers interested in additional information are referred to Appendix B.

3.4.1 Technical Approach

Potential impacts to biological resources are significant if they affect an important, sensitive, or unique resource, a large portion of a biological resource, or cause long-term impacts to biological resources. Special-status species are protected by law and any impact to those species is significant.

General principles used to evaluate impacts are:

- The extent, if any, that the action would permanently lessen ecological habitat qualities that ESA-listed species depend upon, and which partly determines the species' prospects for conservation and recovery,
- The extent, if any, that the action would diminish population sizes, distribution, or habitat of regionally important native plant or animal species,
- The extent, if any, that the action would be likely to jeopardize the continued existence of any ESA-listed species and
- The extent, if any, that the action would be inconsistent with the goals of USFWS recovery plans or other conservation plans.

A biological survey was prepared for the project and it is the primary source of resource information in this section. It is included as Appendix B.

3.4.1.1 Area of Potential Effect

The APE for the biological resources assessment involved a full assessment of flora and vegetation of the Subject Property. The assessment was based on walking the main access road and the perimeter fence line; inspection of existing groves of trees; wandering transects focused on areas with the highest potential for native species; inspection of a number of wetlands; and periodic excursions into random areas not selected for examination for other reasons. No marine biological resources were assessed because the Proposed Action would not affect the ocean.

3.4.2 Existing Conditions – Vegetation and Flora

The volcanic geology and resulting rich soils along with the moderate slopes and moist, cool climate discussed in other sections of this EA greatly influence the flora and vegetation of the Kapoaula property. The ephemeral drainages on the property are minimally developed and do not offer distinct riparian habitats, but both natural and human-created small depressions form temporary or sometimes semi-permanent ponds.

It is difficult to speculate on the precise pre-human vegetation of the area, since the area has been completely transformed by removal of tree cover and introduction and promotion of pasture grasses maintained by heavy cattle grazing. In *The Manual of the Flowering Plants of the Hawaiian Islands*, Gagne and Cuddihy (1990) described the natural vegetation in fairly undisturbed areas with similar geology and climate in this part of Hāmākua as sub-montane rain forest dominated by ʻōhiʻa, koa and hāpuʻu (Cibotium spp.). Historical records indicate that this entire flank of Mauna Kea was once a dense koa-ʻōhiʻa forest, but the in 1850s the forest was evidently nearly eliminated and replaced by grazing land, as discussed in Chapter 1 of this EA. Where trees are present, they are generally non-native. There is a single 14.8-acre grove of forestry trees likely planted during the 1930s (see Figure 1.1-2). It is composed mainly of tropical ash, with two rows of sugi pine (*Cryptomeria japonica*), two rows of swamp mahogany (*Eucalyptus robusta*) in poor condition, and scattered turpentine tree (*Syncarpia glomulifera*). A few remnant patches of ʻōhiʻa reflect the original vegetation. No threatened and endangered plant species are known from this general area, and no plant critical habitat is present on or near the property (USFWS 2019a). The closest plant critical habitat is at about 3 miles south on a pair of hills that provide specialized habitat for a group of cinder cone species.

A full list of flora found on the property is contained in Table 1 of Appendix B. Only a small proportion of the plant species found are native, and they make up generally a very small part of the vegetative cover and biomass. The most numerous native plants are ʻōhiʻa, the fern palaʻā (*Sphenomeris chinensis*) and the sedge *Cyperus polystachyos*. Also present are the herb popolo (*Solanum americanum*), the fern ally moa (*Psilotum nudum*), and several more ferns: uluhe (*Dicranopteris linearis*), *Microlepia speluncae*, *Christella cyatheoides*, and sword fern (*Nephrolepis exaltata*).

Although the pasture is generally very healthy and low in weeds, non-native plants of some concern include the widespread fireweed, which sickens cattle, and strawberry guava.

No listed or proposed threatened and endangered plant species were found. Given the current context, in an area almost completely devoted to regularly grazed pasture and groves of non-native forestry trees, it is unlikely that threatened or endangered species would be found.

3.4.3 Existing Conditions – Fauna

3.4.3.1 Property and Regional Habitat

The quality of habitat for native animals is determined primarily by vegetation and the degree of disturbance. At the Kapoaula property, as in similar locations along the Hāmākua Coast, both the bird and invertebrate fauna would be expected to be dominated by non-native species that are adapted to open grassland habitats. A few widespread native species will tend to be present and forest patches may attract native birds. Unlike the situation with plants, a number of widespread endangered species may fly over, and, in some cases, nest, roost, forage, or otherwise utilize some features of the habitat on the property. However, no animal critical habitat is present on or near the property (USFWS 2019a). The closest animal critical habitat is 8 miles away on Mauna Kea and on the Hakalau Forest National Wildlife Refuge, which are critical habitat units for various endangered birds.

A number of native forest bird species are found in the montane forests along the Hāmākua Coast above the mosquito belt (generally above 4,000 feet in elevation), where native plant resources are still present and *Culex* mosquitos are absent or scarce. Threatened and endangered birds that may be found in certain areas include the threatened ʻiʻiwi (*Drepanis coccinea*), as well as the endangered ʻakiapōlāʻau (*Hemignathus munroi*), Hawaiʻi creeper (*Loxops mana*) and Hawaiʻi ʻākepa (*Loxops coccineus*). Other native forest birds occur at least occasionally along the Hilo-Hāmākua coast at lower elevations, within the 2,000 to 3,000 feet elevation range of the Kapoaula property. These include honeycreepers such as the

ʻapapane (*Himatione sanguinea*) and ʻamakihi (*Chlorodrepanis virens*) (one of the few native forest birds that has adapted somewhat to mosquitos and thus low elevations), the ʻelepaio (*Chasiempis sandwicensis* – a monarch flycatcher), the ʻōmaʻo thrush (*Myadestes obscurus*), and the Hawaiian hawk (*Buteo solitarius*). All of these species generally require ʻōhiʻa forest, but the hawk is known to breed successfully in both native and non-native forests. These lowland ʻōhiʻa forests can also support endangered Hawaiian hawks, which forage in forests and nearby agricultural tracts and nest in tall trees. At low elevations there has been widespread recovery of this species and a changing composition of the forest bird community; nevertheless, lowlands dominated by non-native vegetation and bird species continue to have few forest birds, with limited exceptions.

By contrast, some native migratory birds and water birds are common in both upland and lowland environments. A very common native resident migratory bird, the Pacific golden-plover, or kōlea (*Pluvialis fulva*), is often seen in grassy areas far from the coast throughout the region during its winter residency in Hawaiʻi. In the Hāmākua Coast in general, water birds may be found in streams, estuaries, natural and artificial ponds, and wetlands. The most common native water bird at lower elevations is the indigenous black-crowned night heron, or ʻaukuʻu (*Nycticorax nycticorax hoactli*), a wetland bird. It is also not unusual to spot the endangered Hawaiian goose, or nēnē (*Branta sandwicensis*), a wide-ranging bird, in a variety of environments and elevations throughout the island. Conceivably present in isolated ponds in the uplands are three endangered water birds: Hawaiian ducks, or koloa maoli (*Anas wyvilliana*); Hawaiian stilt, or aeʻo (*Himantopus mexicanus knudseni*); and the Hawaiian coot, or ʻalae ke’oke’o (*Fulica alai)*. Of these three birds, only the koloa maoli is likely in the project area, as aeʻo are generally found only below 600 feet in elevation, and ʻalae below 1,320 feet (DLNR 2015).

While seabirds are not generally observed directly in the region, they may actually be transiting it at night. The Hawaiian petrel (*Pterodroma sandwichensis*), the Hawaiian sub-species of Newell’s shearwater (*Puffinus newelli*), and the band-rumped storm-petrel (*Oceanodroma castro*) have been recorded over-flying various areas on the island of Hawaiʻi between mid-March and December each year. The Hawaiian petrel and band-rumped storm-petrel are listed as endangered, and Newell’s shearwater as threatened, under both federal and State of Hawaiʻi endangered species statutes. The petrels and shearwaters hunt over the ocean during the day and fly to higher elevations at night to nest. The Hawaiian petrel and the band-rumped storm petrel generally nest well above 5,000 feet on the Big Island, but some nests have recently been found at lower elevations on Kohala volcano. Both the Newell’s shearwater and Hawaiian petrel are known to burrow under ferns on forested mountain slopes. These burrows are used year after year and usually by the same pair of birds. Although capable of climbing shrubs and trees before taking flight, they need an open downhill flight path through which they can become airborne. The primary cause of mortality in these species in Hawaiʻi is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with manmade structures and, if not killed outright, become easy targets of predatory mammals.

Hawaiʻi’s only native land mammal is the endangered Hawaiian hoary bat, or ōpeʻapeʻa (*Lasiurus cinereus semotus*). These solitary, nocturnal bats roost in tall shrubs and trees and rarely in lava tubes, cracks in rocks, or man-made structures. They are found at all elevations on Kauaʻi, Maui, Hawaiʻi and Oʻahu. They roost in native and non-native vegetation alike, utilizing ʻōhiʻa, hala (*Pandanus tectorius*), coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccanus*), kiawe (*Prosopis pallida*), avocado (*Persea americana*), shower trees (*Cassia fistula*), and even fern clumps, as well as possibly eucalyptus and sugi pine. Prime foraging areas include forest and pasture interfaces, forest road corridors, streams, bays, and inlets. They use echolocation to find and capture native and non-native night-flying insects such as moths (*Lepidoptera* spp.), beetles (*Coleoptera* spp.), crickets (*Gryllidae* spp.), mosquitoes (*Culicidae* spp.), and termites (*Isoptera* spp.). Ōpeʻapeʻa have adapted to urban and agricultural land uses fairly successfully, probably because of high levels of insect prey found there. Research indicates that bats reproduce in the lowlands but move to higher elevations during the winter, possibly in order to utilize the cooler temperatures to achieve a lower metabolic rate while roosting. Maps produced by DLNR (2015) indicate that they have been sighted throughout the Hāmākua Coast, and indeed, the island.

Bats are vulnerable to habitat loss, pesticides, predation, snagging in barbed wire, and roost disturbance. During clearing, grubbing or tree trimming/cutting, the removal of tall, woody vegetation can temporarily displace bats using the vegetation for roosting. As bats use multiple roosts within their home territories, this disturbance from the removal of vegetation is likely to be minimal. However, during the pupping season, from about June 1 to September 15 each year, female bats carrying pups may be less able to rapidly vacate a roost site when the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage, and very small pups may be unable to flee a tree that is being felled (Bonaccorso 2010; DLNR 2005a).

There are no native terrestrial reptiles or amphibians in Hawaiʻi. Several species of gecko (*Gekkonidae*), anole (*Anolis* spp.), and skink (*Scincidae* spp.), as well as a cryptic, wormlike blind snake (*Indotyphlops braminus*), are common throughout the island. Bufo toads (*Bufo marinus*), bullfrogs (*Rana catesbeiana*) and the highly invasive coqui frog (*Eleutherodactylus coqui*) are found in all of the rainier lowlands of the island of Hawaiʻi, including the Hāmākua Coast.

Twenty-three species of invertebrate are currently listed as threatened or endangered in the State of Hawaiʻi (USFWS 2019b). These include a spider, an amphipod, a moth, snails, picturewing flies, yellow-faced bees and damselflies. Very few if any of these species have a high potential to be present at the Kapoaula property. Most of the listed species are restricted to other islands or found at substantially higher elevations with intact native forest, often with specific host plant species that are lacking on the properties.

Native insects are highly associated with native vegetation. Invertebrate fauna in active agricultural areas are almost exclusively non-native species, because of the lack of native plants and the periodic application of insecticides. Few of the endangered insects listed above are common in the pastures of the region. However, there is one endangered insect, the orange black Hawaiian damselfly (*Megalagrion xanthomelas*), that lives in streams and wetlands at locations around the coastline on the Island of Hawaiʻi, primarily in estuaries and ponds at sea level. On other islands, it has been sighted as high as 3,280 feet above sea level. According to conservationists, its limited habitat and small scattered populations may affect long-term stability. The species is susceptible to the effects of habitat loss and introduced species (Xerces Society 2019; USFWS 2019c; DLNR 2005b; Polhemus 1993; Polhemus and Asquith 1996).

3.4.3.2 Findings of Survey on Kapoaula Property

The endangered ōpeʻapeʻa is ubiquitous throughout the Island of Hawaiʻi, and they are thus presumed to be present in a limited area on the property. The bats are known to favor eucalyptus groves, which are present on the property and in the general region. Bats may forage for flying insects near the large grove of tropical ash and eucalyptus and the small groves of ʻōhiʻa on a seasonal basis. They may roost in some of the trees and shrubs on the property. In addition to unaided visual detection in the dawn and dusk hours, ōpeʻapeʻa can be detected by night vision binoculars and goggles using available light; thermal infrared scopes and cameras; sound detectors using high-frequency ultrasonic microphones with a range above 20,000 hertz; and modified marine surveillance radar. The visual-only surveys conducted for this EA took place in daylight, and none of these techniques were employed on the property, because the bats are presumed to be present and no information valuable in a biological reconnaissance would be obtained by employing the technologies.

Only a few species of birds were detected during the surveys, most of them non-native and typical of those found in similar pasture habitats: skylark (*Alauda arvensis*), Japanese white-eye (*Zosterops japonicus*), Kalij pheasant (*Lophura leucomelanos*), domestic chickens (*Gallus gallus domesticus*), wild turkeys (*Meleagris gallopavo*) and scaly-breasted munia (*Lonchura punctulata*). It is likely that repeated or extended observations at different times of the day and year would generate a much larger list of non-native birds. One would expect ring-necked pheasant (*Phasianus colchicus*), Erckel's francolin (*Francolinus erckelii*), mourning dove (*Zenaida macroura*) and a variety of other birds.

Several native birds were also present. The most frequently seen native bird was the protected migratory bird kōlea. A pair of pueo (*Asio flammeus sandwichensis*), the Hawaiian endemic sub-species of the short-eared owl, was seen in the lower elevations near the adjacent quarry. This diurnal bird of prey is regularly seen within the grasslands of South Kohala into Hāmākua. This species is currently widespread in South Kohala and does not have special protected status under either the state or federal endangered species statutes. Two endangered bird species were also present. A pair of endangered Hawaiian hawks that appear to have been a parent and a juvenile from the previous year were seen from a distance and then close-up as they approached and remained nearby out of curiosity. It is somewhat likely given the size of the grove and its relationship to adjacent habitat that Hawaiian hawks utilize the grove for nesting. On two occasions, a pair of what were either koloa maoli or, more likely, Hawaiian duck-mallard hybrids were observed in two separate small ponds in the lower part of the property.

Although the elevation of the land at 2,740 to 3,180 feet above sea level is within the range of native forest birds such as the Hawai'i 'amakihi, 'elepaio, 'i'iwi, 'apapane, and 'ōma'o, the lack of native forest cover means that such birds are unlikely to be found, and several bird observations at different times of the day did not detect them.

The threatened and endangered seabirds discussed above, including the Hawaiian petrel, Newell's shearwater and band-rumped storm petrel may be present in this part of Hāmākua and may overfly, roost, nest, or utilize resources here. No advanced seabird detection technologies (e.g., radar) were employed, and it is difficult to speculate on whether these birds pass over the property.

The only live mammals seen during the survey were domestic cattle. It is likely that small Indian mongooses, mice (*Mus* spp.), rats (*Rattus* spp.), feral cats, feral pigs, and domestic dogs are occasionally present on the property. None of these wild alien mammals have conservation value and all are deleterious to native flora and fauna. No reptiles and amphibians were detected during the survey.

No systematic invertebrate survey was conducted for the property, given the low probability of the presence of threatened and endangered or rare species, and the low likelihood that reforestation activities would adversely affect them. Several damselflies, likely one of the common native species, as well as an indigenous dragonfly, the common green darner (*Anax junius*) were observed in several of the ponds that occupy the property.

3.4.4 Proposed Action

3.4.4.1 Construction

As described in Section 1.3.2.1, mechanical site preparation would include deep ground ripping and possible grading for access roads. These site preparations would be temporary and short term, and would involve typical earth moving equipment such as tractor-pulled ripping implements and bucket loaders. Because of the temporary and low impact nature of site preparation activities, it is anticipated that these activities would result in no impact to biological resources.

Fencing would be constructed at various times and in various locations throughout the life of the project using mainly hydraulic rams with minimal air quality impacts. Because of the temporary and low impact nature of fencing activities, it is anticipated that these activities would result in no impact to biological resources.

3.4.4.2 Operations

Operations such as pruning activities (see Section 1.3.2.8) would not involve equipment other than transportation vehicles, hand tools, and elevated bucket trucks. There would be no direct adverse impact to biological resources associated with pruning and vegetation management activities.

<u>Specialty Instrument-grade Lumber Processing Operations</u>

There would be no direct, adverse impact on biological resources associated with specialty instrument-grade lumber processing activities.

Pesticide and chemical application may be applied in various ways including application by helicopter. Because this is expected to be infrequent and short-term (approximately 10 hours, once per year, approximately 150-acres, limited to the forest establishment period (approximately 9 years), impacts to biological resources due to pesticide application are expected to be negligible.

3.4.5 No Action Alternative

Under the No Action Alternative, no changes to the proposed site would occur. Therefore, there would be no change to the biological resources due to the No Action Alternative.

3.4.6 Impacts and Mitigation

3.4.6.1 Impacts

Both the vegetation and flora of the Kapoaula property are typical of former native forests that were cleared for pasture many decades ago. A stable assemblage of pasture grasses and some herbs have come to dominate the biomass and cover, except in the limited forestry planting. Very few natives are present besides a few scattered groves of ʻōhiʻa. All rare, threatened or endangered plants and any traces of intact native ecosystems are long gone and unlikely to return without intensive human intervention. Habitat for native animals is very limited and in general, only the most widespread endangered animals (i.e., ōpeʻapeʻa and Hawaiian hawks) are present. Interestingly, the pair of koloa maoli (or more likely, koloa-mallard hybrids) seen in one of the property's small ponds signals that there is potential for nesting habitat for this species, although the areas around such ponds would need to be managed with rat, mongoose, and cat predator control to allow breeding. Other less manageable threats exist as well, including avian diseases and predation by ʻaukuʻu, cattle egrets (*Bubulcus ibis*), and barn owls (*Tyto alba*), each of them present in the area.

The reforestation of virtually the entire property with koa and a complement of associated native forest plants will significantly improve the vegetation, watershed qualities and faunal habitat of the property. The majority of the property will be intensively managed to grow koa for saw timber, but where high slopes are present – about 30% of the property – the vegetation will be managed for a multi-species native forest where koa is not planned for harvest. Even in the saw timber areas, the encouragement of a native species understory rather than a plantation-style arrangement, coupled with the planting and harvesting rotation of stands of varying ages, will maintain a healthy native forest over most of the property at any given time. In addition to diversifying the native flora, this restoration will reduce soil compaction and provide cover and food for native wildlife.

- The kōlea is unlikely to be disturbed by the forestry operations but because of the growth of trees may become less abundant on the property in the future. It will continue to find abundant habitat in the thousands of acres of pasture and other grasslands in the area, as well as agricultural and urban areas throughout the island.
- Forestry operations in the short-term and the eventual growth of tree cover will displace short-eared owls, but there is abundant additional suitable pasture habitat within the area for any displaced owls to move into, and no adverse impacts would be expected.

See Table 3.4-1 for a summary of impacts during all phases of the Proposed Action.

Table 3.4-1. Biological Impacts

	Proposed Action	*No Action*
Construction Phase		
Site Preparation	No Impact	No Impact
Fencing	No Impact	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	No Impact	No Impact
Pesticide Application	Negligible	No Impact
Pruning and Maintenance	No Impact	No Impact

3.4.6.2 Mitigations

There will be minor impacts to some native faunal species, all of which are either insignificant or can be mitigated to insignificant levels through simple project management measures.

In order to avoid impacts to endangered but widespread native birds and the ōpeʻapeʻa:

- To minimize impacts to the endangered ōpeʻapeʻa, trees taller than 15 feet will not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Barbed wire shall not be used on fences with the exception of the bottom strand, which is required for excluding feral pigs.
- To minimize impacts to Hawaiian hawks, earthmoving and tree cutting during the breeding season for Hawaiian hawks (March through September) will be avoided. If this time period cannot be avoided, arrange for a hawk nest search to be conducted by a qualified biologist. If hawk nests are present in or near the project site, all land clearing activity will cease until the expiration of the breeding season.
- If any activities incorporate outdoor lighting, they may attract endangered seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these seabirds through interaction with outdoor lighting, no construction lighting or unshielded equipment maintenance lighting after dark will be used between the months of April and October. All permanent lighting will be shielded in strict conformance with the Hawaiʻi County Outdoor Lighting Ordinance (Hawaiʻi County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

Chapter 6 of the FMP for the project contains “detailed practices and objectives,” a variety of specific and detailed best practices for forest management, that include measures to protect the biological environment. These recommendations are incorporated by reference here.

There is a significant potential for the project to accomplish some or all of the following conservation benefits:

- Reduced habitat fragmentation;
- Maintenance, restoration, or enhancement of existing habitats;
- Increases in habitat connectivity;
- Stabilized or increased numbers or distribution; and
- Opportunities to test and develop new habitat management techniques.

As the project proceeds, it is expected that a baseline survey will be conducted to establish the levels of listed species currently on the property, and an SHA will be developed.

3.5 Climate Change

In addition to meeting regulatory standards for air emissions, there are climate change and global warming considerations. The GHG trap heat within the lowest portion of the earth's atmosphere causing heating at the surface of the earth. The increase in global temperature results in sea level rise and changing weather patterns. The GHG include carbon dioxide, methane, and nitrous oxide that occur naturally in the atmosphere but increase due to man-made activities.

There is a scientific consensus that the earth is warming due to manmade increases in greenhouse gases in the atmosphere, according to the United Nations' Intergovernmental Panel on Climate Change (Sea Grant 2014). Global mean air temperatures are projected to increase by at least 2.7 degrees Fahrenheit by the end of the century. This would be accompanied by the warming of ocean waters, expected to be highest in tropical and subtropical seas of the Northern Hemisphere. Wet and dry season contrasts will increase, and wet tropical areas in particular are likely to experience more frequent and extreme precipitation. For Hawaiʻi, where warming air temperatures are already quite apparent, not only is the equable climate at risk but also coastal infrastructure, agriculture, ecosystems, the visitor industry and public health.

3.5.1 Technical Approach

3.5.1.1 Area of Potential Effect

The APE would be limited to the subject property and immediate vicinity. It is important to note that the "property line boundary" would be the TMK parcel boundary, which is the same area as the project area (see Figure 1.1-1). The impacts of GHG and climate change is presumed to be county-wide.

3.5.2 Existing Conditions

Winds in the area are dominantly northeast trades, replaced periodically by winds with a southerly component that can bring with them volcanic haze, or vog, when Kilauea Volcano is active (Baerman et al 1998). Kapoaula receives abundant rainfall. The average annual rainfall is 83 inches on the makai end of the property at an elevation of 2,740 feet and 56 inches at the mauka end at 3,180 feet (Figure 3.5-1). Monthly averages vary from about 4 inches in the comparatively dry summer months to more than 12 inches in the relatively wetter months of November through March (Giambelluca et al 2013). The mean annual temperature is 61 to 72 degrees Fahrenheit, with a mean annual soil temperature of 66 degrees Fahrenheit.

3.5.3 Proposed Action

3.5.3.1 Construction

As described in Section 1.3.2.1, mechanical site preparation would include deep ground ripping and possible grading for access roads. These site preparations would be temporary and short term, and would involve typical earth moving equipment such as tractor-pulled ripping implements and bucket loaders.

Because of the temporary and low impact nature of site preparation activities, it is anticipated that these activities would result in negligible climate change related impacts.

Fencing would be constructed at various times and in various locations throughout the life of the project using mainly hydraulic rams with minimal air quality impacts. Because of the temporary and low impact nature of fencing activities, it is anticipated that these activities would result in no climate change related impacts.

BMPs to control dust during construction would be required by county grading and grubbing permit conditions. BMPs may include dust fences to keep the dust on-site, and watering to minimize the amount of dust produced. All construction activities would comply with regulations for fugitive dust control under HAR Section 11-60.1-33 that require reasonable precautions to prohibit visible fugitive dust beyond the property line.

The project vicinity is agricultural in nature and there are no sensitive receptors (i.e., schools or medical facilities) adjacent to the work areas; therefore, none would be adversely impacted by the temporary air emissions. Emissions are not expected to exceed the CAA major source threshold of 250 tons per year for construction. Construction emissions would be less than significant with implementation of the BMPs.

3.5.3.2 Operations

Operations such as pruning activities (see Section 1.3.2.8) would not involve equipment other than transportation vehicles, hand tools, and elevated bucket trucks. There would be no direct adverse impact on climate change associated with pruning and vegetation management activities.

<u>Specialty Instrument-grade Lumber Processing Operations</u>

Specialty instrument-grade lumber processing operations as an allowed agricultural processing use would include modern equipment that is designed to reduce air pollution as much as possible at the time of installation. Additionally the mill would be spatially associated near the existing Edwin DeLuz quarry, which currently utilizes mobile equipment, rock crushers, and trucks and generates a level of fugitive dust. There would be negligible direct, adverse impact to climate change associated with specialty instrument-grade lumber processing activities.

Pesticide and chemical application may be applied in various ways including application by helicopter. Because this is expected to be infrequent and short-term (approximately 10 hours, once per year, approximately 150-acres, limited to the forest establishment period (approximately 9 years), impacts to climate change due to pesticide application are expected to be negligible.

3.5.4 No Action Alternative

Under the No Action Alternative, no changes to the proposed site would occur. Therefore, there would be no adverse significant impact to climate change under the No Action Alternative.

3.5.5 Impacts and Mitigation

3.5.5.1 Impacts

The weather and climate conditions at the Kapoaula property area currently ideal for forestry with koa and associated native species. Orographic rainfall at this elevation ensures adequate rainfall, with little risk for drought. Although winds can be brisk and require consideration for seedling planting, windbreak design, and crown maintenance, damaging winds have historically been very infrequent. No adverse effects to air quality would occur.

For actions in far mauka areas such as Kapoaula, which has a minimum elevation of 2,740 feet and does not depend on coastal roads for access, the key direct consideration is not sea level rise but instead the potential for increased runoff from storms, increased fire risk from droughts, and higher wind loads from more frequent hurricanes. Greater rainfall on an hourly, daily, seasonal or annual basis can lead to increased runoff and gulch flow. The property is not vulnerable to flooding, excessive runoff or erosion, and the very minor scale of proposed land alteration would not lead to any appreciable additional runoff concerns, and the growth of a native forest would indeed alleviate them. Larger storms may also lead to higher peak winds, which could pose issues if there is a severe increase. Uncertainties regarding regional circulation make it possible that instead of more annual rainfall, climate change may also involve long droughts and even overall drier conditions, increasing wildfire risk, which presently is minimal. Finally, plant diseases such as koa wilt that are not currently a major potential issue at the property could become more severe if substantial warming occurs. See Table 3.5-1 for a summary of impacts during all phases of the Proposed Action.

Table 3.5-1. Climate Change Impacts

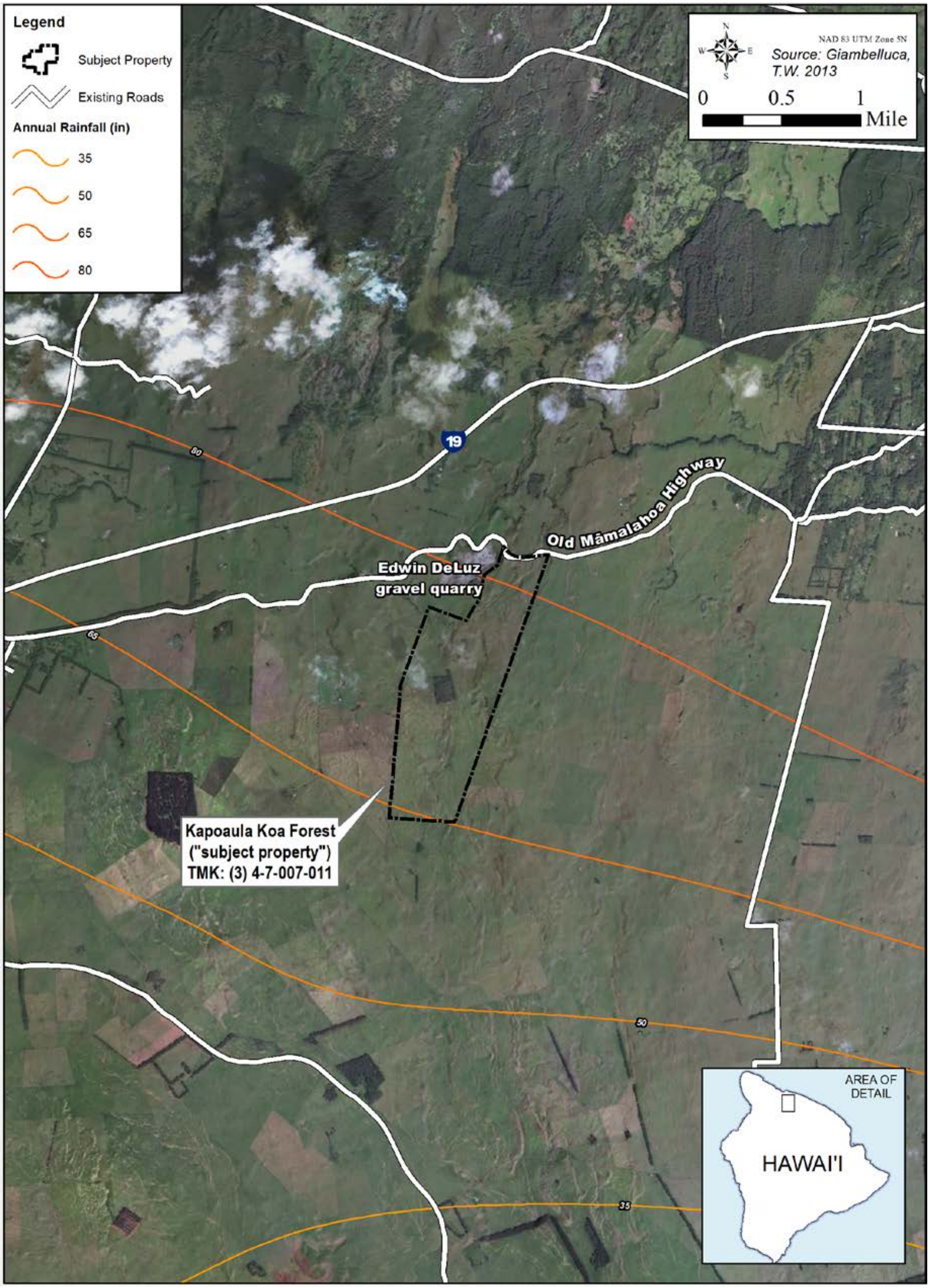
	Proposed Action	***No Action***
Construction Phase		
Site Preparation	Negligible	No Impact
Fencing	No Impact	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	Negligible	No Impact
Pesticide Application	Negligible	No Impact
Pruning and Maintenance	No Impact	No Impact

3.5.5.2 Mitigations

The project proponents are highly aware that hardwood trees are a long-term investment. The longer time span introduces risks not normally associated with investments, such as climate change. The project would utilize adaptive management and monitor climate as areas are successively planted to deal as effectively as possible with the still unknown consequences of climate change.

Forestry projects such as this also represent an opportunity for long term net sequestration of carbon, as koa growing absorbs substantial quantities of carbon dioxide. Koa’s use in high-value products such as musical instruments and cabinetry provides for a long extended product lifetime.

Figure 3.5-1. Isohyet Map



3.6 Noise

Noise is defined as an unwanted or annoying sound. Sound is made up of waves that travel to the auditory organs. Sound, often described by the relative term "loudness," is measured in decibels. A decibel is a logarithmic ratio, thus an increase of 10 decibels is perceived as a doubling of sound. Noise may be generated by both natural and human-created sources and may have negative effects on physical and psychological health, affect workplace productivity, and degrade quality of life.

Human perception of sound is influenced by factors other than the actual sound level, including the duration of the sound, the frequency of the sound, fluctuations in sound level, and time of day. The human ear can recognize frequencies between 20 and 20,000 hertz, but is most sensitive to frequencies of 1,000 to 8,000 hertz. Because there are multiple factors contributing to perception of sound, sound levels are weighted. A-weighted sound levels place emphasis on frequencies between 1,000 and 8,000 hertz.

Construction noise, often created by heavy machinery, is generally limited to day-time hours due to local regulations or ordinances. Construction noise exceeding regulatory limits requires a permit or variance from the DOH. The maximum permissible sound level for stationary noise sources and equipment related to agriculture, construction and industrial activities adopted by DOH for various zoning classes are listed in Table 3.6-1. The noise level relative to this table is measured at or beyond the *property line boundary* of the source property. The subject property for this EA would be considered Class C (agriculture, country, industrial, etc.) Zoning District.

Table 3.6-1. DOH Maximum Permissible Noise Levels (A-weighted sound levels)

Zoning District	*Day (7:00 a.m. – 10:00 p.m.)*	*Night (10:00 a.m. – 7:00 p.m.)*
Class A (residential, conservation, preservation or open space)	55	45
Class B (multi-family dwelling, apartment, commercial, etc.)	60	50
Class C (agriculture, country, industrial, etc.)	70	70

Source: HAR, Title 11, Chapter 46, 3 and 4

Construction equipment varies in noise levels produced and Table 3.6-2 lists some typical equipment and the estimated noise levels at a 50-foot distance from the noise source.

Table 3.6-2. Typical Construction Equipment Noise

Equipment	*Typical Noise Level at 50 feet from Source*
Air Compressor	81
Backhoe	80
Concrete Mixer	85
Crane mobile	83
Dozer	85
Generator	81
Grader	85
Pneumatic Tool	85
Scraper	89
Truck	88

Source: Federal Highway Administration 2006.

3.6.1 Technical Approach

3.6.1.1 Area of Potential Effect

The APE would be limited the subject property and immediate vicinity. It is important to note that the "property line boundary" as used in the DOH regulations would be the TMK parcel boundary, which is the same area as the project area (see Figure 1.1-1).

3.6.2 Existing Conditions

The project area and vicinity are undeveloped and characterized by open space, preservation and agricultural land uses. There are DHHL pastoral lease home resident populations on the adjacent properties surrounding the Subject Property. There are no schools, hospitals or other sensitive receptors that would be affected by changes in noise levels at the project site. The existing Edwin DeLuz gravel quarry located at the northern end of the project area likely has historically, and would continue to generate periodic noise events within the APE. The Class C (agriculture) DOH maximum permissible levels would apply (see Table 3.6-1).

3.6.3 Proposed Action

3.6.3.1 Construction

As described in Section 1.3.2.1, mechanical site preparation would include deep ground ripping and possible grading for access roads. These site preparations would be temporary and short term, and would involve typical earth moving equipment such as tractor-pulled ripping implements and bucket loaders. Because of the temporary and low impact nature of site preparation activities, it is anticipated that these activities would result in negligible noise related impacts.

Fencing would be constructed at various times and in various locations throughout the life of the project using mainly hydraulic rams with minimal noise. Because of the temporary and low impact nature of fencing activities, it is anticipated that these activities would result in no noise related impacts.

3.6.3.2 Operations

Operations such as pruning activities (see Section 1.3.2.8) would not involve equipment other than transportation vehicles, hand tools and elevated bucket trucks. There would be no direct adverse impact on ambient noise levels associated with pruning and vegetation management activities.

Pesticide and chemical application may be applied in various ways including application by helicopter. Because this is expected to be infrequent and short-term (approximately 10 hours, once per year, approximately 150-acres, limited to the forest establishment period (approximately 9 years), impacts to ambient noise levels due to pesticide application are expected to be negligible.

<u>Specialty Instrument-grade Lumber Processing Operations</u>

Specialty instrument-grade lumber processing operations would occur within enclosed buildings and would include modern equipment that is designed to be as noise attenuating as would be readily available upon installation. Additionally the mill would be spatially associated near the existing Edwin DeLuz quarry, which currently utilizes mobile equipment, rock crushers and trucks. There would be negligible direct, adverse impact on ambient noise levels associated with specialty instrument-grade lumber processing related activities.

3.6.4 No Action Alternative

Under the No Action Alternative, there would be no changes to existing conditions and therefore no significant impact to ambient noise.

3.6.5 Impacts and Mitigation

3.6.5.1 Impacts

As shown in Table 3.6-3, construction of the Proposed Action would result in elevated noise levels associated with the use of heavy equipment. The adverse impact is considered less than significant due to the short duration, lack of sensitive receptors and compliance with applicable regulations. Operations phase of the preferred alternative would result in negligible impact and indirect impact on noise levels. A small generator (approximately 14,000 watts) will run the processing unit. The generator will produce negligible amounts of noise while running; however, this amount will be low compared to the adjacent landowner (Edwin DeLuz gravel quarry).

Table 3.6-3. Summary of Noise Impacts

	Proposed Action	*No Action*
Construction Phase		
Site Preparation	Negligible	No Impact
Fencing	No Impact	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	Negligible	No Impact
Pesticide Application	Negligible	No Impact
Pruning and Maintenance	No Impact	No Impact

3.6.5.2 Mitigation

All equipment would be equipped with original-equipment; manufacturer-installed noise attenuation features (mufflers, baffles, etc.) that meet all current regulatory requirements. Construction and maintenance workers would adhere to Occupational Safety and Health Administration requirements for hearing safety.

3.7 Scenic Resources

Visual resources are aesthetically-pleasing places or views. These resources may be views to a specific point (e.g., monument, waterfall, historic site, architectural feature), or a landscape (e.g., valleys, mountain ranges, shorelines, open space, national or state historic property). The valued visual resources are typically identified by the community and documented in planning guidance documents or tourist brochures or other published media. Visual resources are an important part of the quality and sensory experience of an area. Users often encounter an area first and foremost through a visual interaction or their “view” of a place.

3.7.1 Technical Approach

A site visit was conducted to identify and photo document those viewpoints that may be impacted by the Proposed Action, with consideration of the effects of topography and existing vegetation screening.

3.7.1.1 Area of Potential Effect

The APE for visual impacts includes sites where the public can readily view the Proposed Action, such as public roadways. The lower (northern) portions of the Proposed Action would be south of Māmalahoa Highway. The APE consists of views in the direction of the Proposed Action from this roadway.

There are no residents or other adjacent land users that would be directly impacted by a change in views related to the Proposed Action. There are no recreational (i.e., hunting, fishing) uses that occur in the project vicinity.

3.7.2 Existing Conditions

The Hawaiʻi County General Plan (Hawaiʻi County Planning Department 2005) identifies areas of natural beauty and exceptional trees in each district. None of the sites, viewpoints or trees identified within the Hāmākua District are associated with the Kapoaula property or general project area. Nonetheless, the drive along the winding Old Māmalahoa Highway Waimea and Honokaʻa is highly scenic, with views of pasture, rock faces, and individual trees or groves of trees (see Figure 1.1-3). The Hāmākua Community Development Plan (CDP) (Hawaiʻi County Planning Department 2018) has priorities for natural and cultural resources and community infrastructure that include protection of "open space, areas with natural beauty, and scenic view planes." The property has a relatively narrow frontage between a rock aggregate quarry and DHHL pastoral leaseholds used for cattle grazing and residences. Because of the slope in the area, no public vantage point has clear views of the upper half of the property, which is clearly visible only from the air.

3.7.3 Proposed Action

3.7.3.1 Construction

As described in Section 1.3.2.1, mechanical site preparation would include deep ground ripping and possible grading for access roads. These site preparations would be temporary and short term, and would involve typical earth moving equipment such as tractor-pulled ripping implements and bucket loaders. Because of the temporary and low impact nature of site preparation activities, it is anticipated that these activities would result in negligible scenic resource related impacts.

Fencing would be constructed at various times and in various locations throughout the life of the project using mainly hydraulic rams with minimal air quality impacts. Because of the temporary and low impact nature of fencing activities, it is anticipated that these activities would result in no scenic resource related impacts.

3.7.3.2 Operations

Operations such as pruning activities (see Section 1.3.2.8) would not involve equipment other than transportation vehicles, hand tools, and elevated bucket trucks. There would be no direct adverse impact on scenic resources associated with pruning and vegetation management activities.

<u>Specialty Instrument-grade Lumber Processing Operations</u>

There would be no direct, adverse impact on scenic resources associated with specialty instrument-grade lumber processing activities.

Pesticide and chemical application may be applied in various ways including application by helicopter. Because this is expected to be infrequent and short-term (approximately 10 hours, once per year, approximately 150-acres, limited to the forest establishment period (approximately 9 years), no impacts to scenic resources due to pesticide application are expected.

3.7.4 No Action Alternative

Under the No Action Alternative, the proposed construction would not occur, thus there would be no impact to scenic resources.

3.7.5 Impacts and Mitigation

No adverse scenic impacts would occur. Although it would not be highly visible, the growth of a koa forest will enhance the general scenic values of the property by providing an example of the forest type that was native to the area. It will help perpetuate the rural scenic values of the area. The small specialty instrument-grade lumber processing operation would be sited in an area not visible from public vantage points.

3.7.5.1 Impacts

See Table 3.7-1 for a summary of impacts during all phases of the Proposed Action.

Table 3.7-1. Climate Change Impacts

	Proposed Action	*No Action*
Construction Phase		
Site Preparation	No Impact	No Impact
Fencing	No Impact	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	No Impact	No Impact
Pesticide Application	No Impact	No Impact
Pruning and Maintenance	No Impact	No Impact

3.7.5.2 Mitigation

Sense there is no anticipated impacts to scenic resources no mitigation is proposed.

3.8 Hazardous Materials and Wastes

3.8.1 Technical Approach

Hazardous wastes and materials include a wide range of liquids, gases, and solid waste and materials that can potentially harm humans, animals, and the environment. Chemicals or materials released unsafely or in abundance into the community can become hazards to the community, and in certain forms, can cause serious injury, health problems, property damage, and death (FEMA 2010).

Federal regulations that enforce proper storage and disposal of hazardous materials and wastes include:

- Comprehensive Environmental Response, Compensation, and Liability Act
- Resource Conservation and Recovery Act
- Toxic Substances Control Act
- Federal Water Pollution Control Act
- CAA
- CWA
- Safe Drinking Water Act
- Federal Insecticide, Fungicide and Rodenticide Act
- Emergency Planning and Community Right-to-Know Act
- Pollution Prevention Act

Toxic materials are specific hazardous materials identified in regulations. Toxic materials include Diisocyanates, Dioxins, and Dioxin-like Compounds, to name a few.

Hazardous wastes are specifically defined or determined as such based on their ignitability, corrosiveness, reactivity, and toxicity. Toxic materials include: products used for various maintenance or repairs and identified as hazardous on manufacturer material safety data sheets; petroleum, oils, lubricants; antifreeze; and miscellaneous other waste streams.

Resource Conservation and Recovery Act, as amended by the Hazardous and Solid Waste Amendments (and corresponding Hawai‘i HARs), define hazardous waste as:

> *A solid waste not specifically excluded from being classified as a hazardous waste under 40 Code of Federal Regulations (CFR) 261.4(b) that exhibits any of the characteristics (i.e., ignitability,*

> *corrosivity, reactivity, toxicity) described in 40 CFR 261; or is listed in 40 CFR 261 Subpart D; or a mixture containing one or more listed hazardous wastes from 40 CFR 261 Subpart D. Any combination of wastes that poses a substantial present or potential hazard to human health or the environment that has been discarded or abandoned is a hazardous waste.*

Resource Conservation and Recovery Act requires that hazardous waste be tracked from cradle-to-grave. This hazardous waste tracking system mandates the collection and retention of key information including: the generator of the waste, how the waste is routed to the receiving facility, a description of the waste, the quantity of the waste, identification of the facility that receives the waste, and other relevant data.

The U.S. Environmental Protection Agency and Hawaiʻi universal waste regulations streamline hazardous waste management standards for federally designated “universal wastes,” which include batteries, pesticides and mercury-containing materials. Universal wastes are considered hazardous however they are unique in that they are not considered in the determination of generator status.

3.8.1.1 Area of Potential Effect

The APE for the hazardous materials assessment includes the project site, for which a Phase I Environmental Site Assessment was conducted (see Appendix D), and other areas in the vicinity that could be affected by the Proposed Action through environmental pathways, such as surface water, groundwater, or air.

3.8.1.2 Significance

The potential for release of hazardous or toxic materials into the environment could result in a potentially adverse impact, especially if there is potential for human exposure. However, the transport, use, storage and disposal of these materials and related wastes are subject to numerous federal and local regulations that would minimize the potential impact to the environment.

3.8.2 Existing Conditions

A 2018 Phase I Environmental Site Assessment (Myounghee Noh & Associates 2018) was prepared for the entire 564-acre property (Appendix D). The purpose of the Phase I Environmental Site Assessment was to conduct an evaluation for the potential presence of hazardous and/or toxic materials (otherwise known as recognized environmental conditions) at the subject property or in the vicinity. The Phase I Environmental Site Assessment met the requirements of the American Society for Materials and Testing Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, Designation E 2247-08.

The key tasks in the 2013 Phase 1 Environmental Site Assessment included user provided information, records review, site reconnaissance, and interviews.

3.8.2.1 User Provided Information

Siglo Forest, LLC provided records and information concerning environmental liens or activity and use limitations, specialized knowledge, commonly known or reasonably ascertainable information, valuation reduction for environmental issues, and owner information. A review of these documents demonstrated no threat of hazardous materials on the subject property (Appendix D).

3.8.2.2 Records Review

A records search of government agency environmental databases was requested from Environmental Data Resources that lists the presence of Comprehensive Environmental Response, Compensation, and Liability Act; Resource Conservation and Recovery Act; State Hazardous Waste Site; Underground Storage Tanks; Leaking Underground Storage Tanks; and brownfield sites in the vicinity of the project.

The records review did not identify any instances of hazardous or toxic materials on the project site or topographically up gradient or adjacent to the project site (Appendix D). No Sanborn Fire Insurance maps were available for the subject property.

A review of historical topographic maps of the site was completed from maps created in 1916, 1930, 1957, 1982, 1995, and 2013. A review of historic aerial photography of the subject property was conducted from photographs taken in 1954, 1965, 1977, and 2002. The maps and photographs show that the property and surrounding areas has been historically managed as pasture developed with quarries, water tanks, and jeep trails. No historic buildings appear to have been present. No RECs were identified (Appendix D).

3.8.2.3 Site Reconnaissance

A survey of the project site was conducted on February 5, 2018 by Myounghee Noh & Associates personnel to obtain information indicating the likelihood of any recognized environmental conditions in connection with the project site. Myounghee Noh & Associates looked for a variety of environmental hazard indicators including, but not limited to, stained surface soil, dead or stressed vegetation, hazardous substances, aboveground and underground storage tanks, disposal areas, groundwater wells, drywells, and sumps. The site reconnaissance did not identify any visible recognized environmental conditions (Appendix D).

3.8.2.4 Interviews

Interviews with persons familiar with the project site were conducted. Keoki Wood, Livestock Operations Manager of Parker Ranch, stated that he has worked at the subject property since 2002 and since then, the property has only been used for cattle grazing. Harry “Haia” Auweloa, Grazing Unit Ranch Hand of Parker Ranch, has worked on the subject property since September 2016, and is responsible for overseeing the general day to day operations of the cattle pasture. He said that to his knowledge, the subject property has always been used as pasture for cattle. The adjoining properties were also once all owned by Parker Ranch and used as pasture. He indicated that approximately 15 years ago, many of the adjoining properties were acquired by Hawaiian Homelands and were subdivided. Mr. Auweloa indicated that there was one water aboveground storage tank on the site. He also stated that there were four year-round ponds on the site, and eight seasonal ponds. Mr. Auweloa said that there was no green waste or dump site on the subject property. Both Mr. Wood and Mr. Auweloa indicated that they had no knowledge of any spills, chemical releases, environmental cleanups, environmental cleanup liens, engineering controls, land use restrictions, or institutional controls at the site.

3.8.3 No Action Alternative

Under the No Action Alternative, the property would not be reforested and would continue to be used for grazing, and there would be no significant impacts from hazardous materials or wastes with implementation of the No Action Alternative.

3.8.4 Impacts and Mitigation

3.8.4.1 Impacts

As discussed in detail in Section 1.3.2.6, the project will involve the use of fertilizers, herbicides and insecticides that will be applied strictly in conformance with label instructions and environmental regulations. A pre-planting herbicide application to control herbaceous vegetation and grass cover in production planting areas will be carried out using a combined mixture of imazapyr and glyphosate (Roundup). Selective or broad-spectrum herbicides, depending on actual weed pressure, will be used as needed for post-planting competition control until trees are two years old or until the canopy has closed.

Herbicides with grass-specific modes of action may be applied over the entire planting area. Examples of these grass-specific herbicides are fluazipop (Fusilade DX) and quizalofop (Assure II). Monitoring will reveal which particular weed species have emerged and will be used to determine the precise formula to control weeds. Depending on the weed species composition, other herbicides that may be applied include Streamline (aminocyclopyrachlor), Polaris AC (imazapyr), Element 4 (triclopyr), Roundup PowerMax (glyphosate), and Escort (metsulfuron methyl).

Although insect pests on koa will be subject to IPM that emphasizes non-chemical means at first, chemical options for controlling the psyllid and perhaps koa moth include dinotefuran (Safari 20 SG) or spirotetramat (Movento), both of which have labeling appropriate or adaptable to use in koa plantings on Hawaiʻi island. A combined treatment utilizing one of the agents above plus a grass-control herbicide will be applied twice during the growing cycle. A CRF will be applied to minimize movement of nutrients and other potential contaminants to surface and/or groundwater. Fertilizer will be applied at planting, consisting of 4-ounce dose of high phosphate (11-52-00 or similar) CRF distributed evenly within a 12-inch diameter area centered on the seedling stem. Additional applications may be made later, with 11-52-0 CRF with micronutrients or other high-phosphate, low potash mix with micronutrients at 6 ounces per seedling.

In addition, the use of heavy equipment during site preparation will involve the use of minor quantities of hazardous materials (e.g., diesel and gasoline fuels, hydraulic oil). Herbicides, insecticides, and fertilizers are normally applied in many types of agriculture and silviculture and are safe if applied correctly and will not damage water, soil or air quality, or affect human health. All of these materials can also be hazardous or toxic if spilled or improperly stored or applied. In order to prevent contamination, the following BMPs will be implemented. See Table 3.8-1 for a summary of impacts during all phases of the Proposed Action.

Table 3.8-1. Summary of Hazardous Material Management Impacts

	Proposed Action	***No Action***
Construction Phase		
Site Preparation	Negligible	No Impact
Fencing	No Impact	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	Negligible	No Impact
Pesticide Application	Negligible	No Impact
Pruning and Maintenance	No Impact	No Impact

3.8.4.2 Mitigation

A Health and Safety Plan and Hazardous Material Management Plan would be prepared and implemented. The Health and Safety Plan, at minimum, would identify the following:

- All appropriate worker, public health, and environmental protection equipment and procedures, including label regulations that must be observed for broadcast or spot treatments as appropriate.
- Proper housekeeping and BMP procedures to prevent spills
- Emergency response procedures
- Most direct route to a hospital
- Site Safety Officer

The purpose of a Hazardous Material Management Plan is to have an established plan for management of all hazardous materials handled on site, as well as protocols for the management of accidental releases. The Hazardous Material Management Plan would contain the following:

- Definition of a protocol for proper handling, transport, and disposal of hazardous materials
- Definition of a protocol for proper emergency procedures and handling, transport, and disposal of hazardous materials if an accidental spill occurs during storage or application.
- Establishment of BMPs to reduce the potential for spills may include, but are not limited to:
  - Having a spill prevention control and countermeasure plan with a designated supervisor to oversee and enforce proper spill prevention procedures if over 1,320 gallons of petroleum, oils and lubricants are held onsite;
  - Provide spill response and prevention education for employees and subcontractors;
  - Stocking appropriate clean-up materials onsite near material storage, unloading and use areas;
  - Designating hazardous waste storage areas away from storm drains or watercourses;
  - Minimizing production or generation of hazardous waste on-site or substituting chemicals used on-site (e.g. herbicides during restoration) with less hazardous chemicals;
  - Designating areas for construction vehicle and equipment maintenance and fueling with appropriate control measures for runoff; and
  - Arranging for regular hazardous waste removal to minimize onsite storage.

3.9 Archaeological and Architectural Resources

3.9.1 Technical Approach

Archaeological resources are areas of physical evidence of human alteration of the earth. In Hawai‘i, pre-Western contact resources include but are not limited to stone structures associated with residential, agricultural, transportation, military and ceremonial uses, as well as modified ground surfaces that are evidence of agriculture or trails. Historic-era resources include such features as cattle walls, historic homestead remains, and agricultural and industrial features. Architectural resources are structures of historic significance, including but not limited to dwellings and other buildings, reservoirs, dams, and bridges.

Under HRS Chapter 6e, significant archaeological cultural resources must be considered for potential adverse impacts from the Proposed Action. Archaeological and architectural resources generally must be greater than 50 years old and features must be preserved and recognizable to be considered eligible for the State Register of Historic Places. To be determined a significant cultural resource, archaeological or architectural resources must meet one or more criteria as established by the DLNR State Historic Preservation Division (SHPD) and contained in the HAR 13§13-284-6:

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

3.9.1.1 Area of Potential Effect

The impact to physical elements of the archaeological landscape were assessed for the Proposed Action footprint, which was considered the entire 564-acre property. No direct or indirect effects to archaeological or architectural resources would occur outside the property boundaries.

3.9.2 Methods

A review of previous archaeological studies and historic documents for the area was conducted in order to arrive at model for expected historic resources in the general area. As discussed in Chapter 1, traditional accounts, boundary commission testimonies and historical maps indicate that the study area was forested until the second half of the nineteenth century. Traditional uses of the forests on the slopes of Mauna Kea are understood to have included the harvesting of upland resources such as timber, plants products, and bird feathers, as well as for travel, ceremonial or ritual purposes, and associated temporary habitation. After the introduction of cattle to the area in the early to mid-nineteenth century, the area became deforested and converted to pasture. The land was acquired by Parker Ranch in 1874, and it has been used for cattle grazing since that time. Potential resources still present in the general area include ancient trails and temporary shelters and historic-era cattle walls and pens.

In the field, the ground surface of the entire project site, which was defined by fencing along the property boundary, was visually examined for archaeological resources during the survey. A field crew of four people walked in systematic transects paralleling the survey area boundaries, spaced no more than 131 feet apart. The low, recently-grazed grass covering most of the study area resulted in excellent visibility. In addition to walking transects, a thorough inspection was made of vegetated areas and bedrock overhangs with potential for concealing archaeological features and lava tubes, as well as prominent and anomalous landforms. Exposed soil cuts created by roads and cattle were inspected to ascertain the soil stratigraphy throughout the study area. Given the erosional concern of the study area, no subsurface testing was conducted.

3.9.3 Findings

In their Archaeological Assessment report prepared for the proposed project (Appendix C1), ASM Affiliates reported that no historic properties are present and that there will be no historic properties affected. As HRS Chapter 6E review of the project by the SHPD had not yet been initiated by the time the Draft EA was published, the Final EA will report on the response of the SHPD.

In the unlikely event that significant archaeological resources are discovered during the implementation of the proposed project, work should cease in the area of the discovery and SHPD contacted pursuant to HAR 13§13-284-12, following the procedures of HAR 13§13-280.

3.9.4 Impacts and Mitigations

Given the negative findings of the current study with respect to archaeological resources, it is concluded that the proposed project will not impact any known historic properties. The determination of effect for the proposed project is “no historic properties affected.” With respect to the historic preservation review process of the SHPD, the archaeologist’s recommendation is that no further work needs to be conducted within the current study area prior to or during project implementation. In the unlikely event that significant archaeological resources are discovered during the proposed ground disturbing activity, work should cease in the area of the discovery and SHPD contacted pursuant to HAR 13§13-280-3. Given the absence of archaeological or architectural resources, no impact to such resources would occur, and no mitigation is necessary for the forestry project.

3.10 Cultural Resources

3.10.1 Technical Approach

A cultural impact assessment focusing on identification and impact analysis for valued cultural, historical, or natural resources was conducted by ASM Affiliates and is attached as Appendix C2. In the interest of readability, the summary below does not include all scholarly references; readers interested in extended discussion and sources may consult the appendix.

3.10.2 Cultural Background

A generalized model of Hawaiian pre-history that explains the settlement of the islands, the development of a unique culture that utilized diverse resources and spread into both the dry and the wet areas of the islands, and the creation of a stratified society with a complex social and material culture is presented in Appendix C2 and will not be repeated here. This section focuses the cultural practices that developed in Kapoaula, what remained of them after profound socioeconomic changes of the nineteenth and twentieth centuries, and which cultural practices continue to be important in the region today.

Kapoaula, an ahupuaʻa located along the northeast facing shores of the moku (district) of Hāmākua, is one of six traditional districts on Hawaiʻi Island. The lands contained within the Hāmākua District possess a unique environment with knife-edged valleys and sea coasts usually defined by abrupt, high cliffs. This setting played a large role in determining its boundaries and shaping its history from the time of Polynesian settlement. The sheer size of this district coupled with its access to a variety of environments and resources set the foundation for a thriving population. The ʻōlelo noʻeau “Hāmākua i ka wakawaka” or “irregular and rough Hāmākua” celebrates this district’s uniquely steep and rugged terrain (Pukui 1983).

Traveling on foot via the ancient alaloa and ala hele trails of Hāmākua was done with much difficulty. These trails required the ancient travelers to, at times, descend cliff faces with ropes and ladders woven together from natural fibers. This treacherous method of travel is recorded in a portion of an ancient chant titled Kū E Hoʻopio Ka Lā or Kūhaupio, which is often chanted in performance with the art of hei or string figures. This chant “recites in turn the divisions of the island of Hawaiʻi, alluding to some well-known feature of each division, relating through metaphor a love tale” (Dickey 1928). Both the chant and the accompanying string figure repertoire were recorded by Lyle Dickey (1928.) sometime between 1915 and 1917 from informants living on the islands of Oʻahu, Kauaʻi, and Niʻihau. In summarizing this chant Dickey (1928) opines that “Up Rose The Sun” (Kū E Hoʻopio Ka Lā) is the most famous of Hawaiian string figures.” Dickey goes on to explain that “[t]he accompanying chant is regarded has having a higher literary quality than that of any other figures” (1928). That portion of the chant describing Hāmākua reads thus:

> O Hāmākua ia, lawe i ka pali Koʻolau
>
> Ke kuʻukuʻu ala i ke kaula, ke aki ala ka niho i ka ipu i ka pali o Koholālele, o Waipiʻo, a o Waimanu.
>
> This is Hāmākua with Koʻolau cliffs
>
> Lowering rope ladders, holding fishing gourds in the teeth on the cliffs of Koholālele, Waipiʻo and Waimanu. (Dickey 1928)

In the forested zones of the portion of Hāmākua that contains Kapoaula ahupuaʻa, various resources were collected that supported the traditional subsistence lifestyle of the people. Such gathering practices included the collection of bark from māmaki, ʻākōlea fern (*Athyrium* sp.), and wauke (*Broussonetia papyrifera*), whose fibers were prepared and used to make items such as fish nets and kapa cloth; the catching of birds, whose feathers were assembled and fashioned into ahuʻula (feathered cloaks), lei hulu (feathered lei), and mahiole helmets that used exclusively by those of royal bloodline; and the chopping of timbers, from which canoes, houses, and kiʻi (wooden images) were carefully carved. While the forested areas provided an array of natural resources, the grassy kula lands were transformed into cultivatable fields where both staple and supplemental crops such as maiʻa (banana), kalo (taro), ʻuala (sweet potato) were grown in fields and plantations. The “habitually underestimated” uhi (yam), a food crop that was often cultivated in the forests to sustain the people during dry seasons and droughts, was also part of the repertoire of staple crops favored by the Hawaiians of Hāmākua (Handy and Handy 1991). Within Kapoaula specifically, especially in lower elevations, crops such as kalo, ʻuala, and wauke were traditionally cultivated in kuleana plots. In the book, *Native Planters in Old Hawaiʻi: Their Life, Lore and Environment*, Handy and Handy (1991) described a traditional agricultural technique called waele that occurred on the kula lands, where fire was used to prepare the land for planting.

The Polynesian-introduced kō (sugarcane; *Saccharum officinarum*) was extensively cultivated in pre-contact Hawaiʻi and served a variety of important uses. Kō was traditionally planted in the lowland plains and slopes, as found in the makai portion of Kapoaula. Another culturally important plant, olonā, was heavily cultivated in the upland reaches of Hāmākua, and was traditionally grown near māmaki and wauke in kīhāpai by transplanting tight-knit cuttings in a patch:

Olonā was much the best fiber for fishlines and fishnets. When used for cord (aho olonā) the strands of the cleaned fiber were simply spun on the thigh and twisted (nino or milo). Olonā cord has a tensile strength greater than that of hemp, but its great value for fishlines and nets lies in the facts that it does not kink and that it lasts longer than any other material. The cord was also used for making nets (kōkō) to carry containers and as a base for ti leaf raincoats and feather capes. The fresh bark and leaf buds were thought to have medicinal value (Handy 1940).

Prior to first contact with Europeans in the late 18th century and the development of a written Hawaiian language, the history of ancient Hawaiʻi was transmitted orally from generation to generation. After the arrival of the first missionaries in 1820, Hawaiian culture underwent major transformations, one of which included the adoption of the written language. Although oral traditions were still maintained, many natives and foreigners began inscribing generations worth of knowledge onto paper. As such, these writings provide us with invaluable insight into Hawaiʻi's past as they describe historical figures, beliefs, traditions, wahi pana (legendary places), inoa ʻāina (place names) in moʻolelo (legendary accounts, stories, and myths), mele and oli (songs and chants), and ʻōlelo noʻeau (proverbs and sayings). All contribute to an in-depth understanding of the people, their culture and place. One of the hallmarks of traditional legendary accounts is their ability to transcend place and time, all while bringing cohesion to landscapes that have been subjected to artificial divisions and boundaries. While traditional moʻolelo specifically associated with Kapoaula are limited, there are many that concern the greater Hāmākua region. They include references to the ʻAeloa, Koholālele, and Holopoʻopoʻo winds, exalted deities such as Kamapuaʻa, renowned chiefs such as Wanuʻa and Aiohikupua, and famed figures such as Lāʻiekawai. These moʻolelo are discussed in depth in Appendix C2.

Traditional life in Hāmākua and throughout Hawaiʻi took a sharp turn on January 18, 1778 with the arrival of British Captain James Cook in the islands. On a return trip to Hawaiʻi ten months later, Kamehameha visited Cook aboard his ship, *Resolution*, off the east coast of Maui and helped Cook navigate his way to the island of Hawaiʻi. Cook exchanged gifts with Kalaniopuʻu during a long stay at Kealakekua Bay the following January. Although he tried to depart the island in February, one of his ships sustained damage to a mast in a severe storm off Kohala, and the party returned to Kealakekua, setting the stage for his death on the shores of the bay.

During the Proto-historic Period, there was a continuation of the trend toward intensification of agriculture, aliʻi-controlled aquaculture, settling of upland areas and development of traditional oral history. The Ku cult, luakini heiau, and the kapu system were at their peaks, but the influence of western civilization was being felt in the introduction of trade for profit and a market-system economy. By 1810, the sandalwood trade established by Europeans and Americans twenty years earlier was flourishing. That contributed to the breakdown of the traditional subsistence system, as farmers and fishermen were required to toil at logging, which resulted in food shortages and a decline in population.

The rampant sandalwood trade also resulted in the first Hawaiian national debt, as promissory notes and levies granted by American traders were enforced by American warships. The assimilation of western ways continued with the short-lived whaling industry to the production of sugar cane, which was more lucrative but carried a heavy environmental price.

Following the death of Kamehameha I in 1819, the customary relaxing of kapu took place. But with the introduction of Christianity shortly thereafter, his successor, Kamehameha II, renounced the traditional religion and ordered that heiau structures either be destroyed or left to deteriorate. The family worship of ʻaumakua images was allowed to continue

By the mid-nineteenth century, the ever-growing population of Westerners in Hawaiʻi forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. In 1848, the Māhele ʻĀina became the vehicle for determining ownership of native lands. This change in land tenure was promoted primarily by the missionaries and Western businessmen, who were generally hesitant to enter business deals on leasehold land. The Māhele (division) defined the land interests of Kamehameha III (the King), the high-ranking chiefs, and the konohiki. The Māhele placed all lands in the Kingdom of Hawaiʻi in one of three categories: (1) Crown Lands (for the occupant of the throne); (2) Government Lands; and (3) Konohiki Lands. The chiefs and konohiki were required to present their claims to the Land Commission to receive awards 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. Native tenants could claim and acquire title to kuleana parcels that they actively lived on or farmed at the time of the Māhele.

In the Māhele, the disposition of the lands of Kapoaula is a complicated matter and there are inconsistencies in the Māhele-era recordkeeping that are detailed in Appendix C2. In the end, though, the entire 1,697-acre ahupuaʻa of Kapoaula lands was awarded to William Pitt Leleiōhoku posthumously as Land Commission Award 997. The land was not patented for another eighty years, when A.W. Carter, manager of Parker Ranch, which by then owned the land, was issued Land Patent Grant 8451 on January 8, 1934. No kuleana awards were made within the subject Kapoaula property. In the makai portion of Kapoaula, however, nine claims for kuleana parcels totaling 116.5 acres were made by eight claimants, all of which were awarded.

The testimony for the Māhele supplemented information derived from moʻolelo on place names. As stated in Appendix C2, place names "serve as vehicles of ancestral memory, and when we remember the old name of a place, we remember the words of the kūpuna (ancestors), and we recall the wisdom of their teachings (Olivera 2009)." As presented in detail in Appendix C2, place names were given for trails, roads, and boundaries in and around the Kapoaula property that were generally derived from natural features such as plants and animals.

The decades that followed the Māhele of 1848 in all of Hawaiʻi saw foreigners arrive and introduce a western economy, which combined with disease and migration contributed to the decline of traditional subsistence activities. Life in Hāmākua began to change drastically, and as a result the population of the district also declined rapidly as native populations were decimated by disease and a depressed birth rate. Epidemics in 1848 and 1849 killed more than 10,000 people in twelve months throughout the Hawaiian Islands. After 1848, when land became a commodity, Hawaiians were often forced off their house lots and out of their livelihoods simply for lacking the cash to buy land or pay property taxes. The creation of private property also altered the traditional mauka-to-makai management of entire ahupuaʻa, as certain industries with unrelated management occupied large swaths of land, such as livestock ranching in the dwindling upper forests of Hāmākua and commercial sugarcane cultivation in more coastal areas.

Livestock were brought to Hawaiʻi in the ships of Western explorers during the late eighteenth century. Upon presenting the first cattle to Kamehameha I in 1789, Captain George Vancouver advised him to place a protective ten-year kapu on the animals to allow them to multiply and roam freely all throughout Hawaiʻi Island. Within a few decades, the rampant livestock had become a nuisance to the native farmers. Vaqueros, who were cowboys of Mexican, Indian, and Spanish descent, were brought to Hawaiʻi to train Hawaiians how to handle both horses and wild cattle. Although Hawaiians quickly adopted these skills, organized ranching would not prosper in Hāmākua until the mid-nineteenth century. The tools and practices brought by the vaqueros added to the cultural tapestry of the islands and helped create Hawaiʻi's paniolo (cowboy) culture. The introduction of European livestock had a profound effect on upland Hāmākua and neighboring lands in Kohala.

By the time the Māhele began in 1848, John Palmer Parker had struck out on his own, having received 2 acres of land at Mānā where he built a family house and first ranch buildings. He rapidly expanded his landholdings, purchasing 640 acres surrounding Mānā in 1850, and in 1852 he purchased another 1,000 acres [Bergin 2004]). The growth of Parker Ranch and its rivals inevitably led to legal clashes over land and cattle. Parker Ranch purchased Kapoaula from Ruth Keʻelikōlani, William Pitt Leleiōhoku's widow, on August 5, 1874, for a sum of two hundred dollars.

The history of the Hāmākua District since 1860 is inextricably linked to the growth of the sugar cane industry. In 1876, Hawaiian laborers planted the first sugar cane crop at the 500-acre Honokaʻa Sugar Plantation. The plantation was expanded with the creation of the Honokaʻa Sugar Company in 1878.

Although not cultivated on the subject Kapoaula property, the social context and demographics of the area were transformed by the migration of laborers from lands across the world, including China, Japan, Portugal, and Puerto Rico.

By the end of the nineteenth century, a “new” road to Waimea (the Old Government Road now currently known as the Old Māmālahoa Highway) was constructed across Kapoaula Ahupuaʻa, forming the makai boundary of the subject Kapoaula property. Not until 1964 was the modern highway constructed and the old road was relegated into a sleepy byway.

3.10.3 Consultation and Cultural Informant Interviews

When assessing potential cultural impacts to resources, practices, and beliefs, input gathered from community members with genealogical ties and/or long-standing residency relationships to the study area is vital. It is precisely these individuals who ascribe meaning and value to traditional resources and practices. Community members may also retain traditional knowledge and beliefs unavailable elsewhere in the historical or cultural record of a place.

As stated in the Office of Environmental Quality Control Guidelines for Assessing Cultural Impacts, the goal of the oral interview process is to identify and help determine the significance of potential cultural resources, practices, and beliefs associated with the affected study area, along with potential cultural impacts and appropriate mitigation as necessary. A notice describing the proposed action and its location and inviting consultation was published in the Office of Hawaiian Affairs (OHA) newspaper Ka Wai Ola (April 2019). No responses were received as a result of this notice. In addition, eight individuals were contacted via email and/or phone, several of whom kindly consented to interviews.

Appendix C2 provides details concerning the consultation process and summaries of interviews, which were conducted with veterinarian and historical expert Dr. William Bergin, Mauna Kea Forest Restoration Project Coordinator Chauncy “Kalā” Lindsey-AhSing, and Gary Rapozo, a former Parker Ranch paniolo. To summarize, to the extent each was familiar with the area, none identified any sensitive resources or practices, and one voiced support for native reforestation and the sustainable harvest of those resources in appropriate areas. Although there were no explicit objections to the proposed project, they expressed a desire for the project proponent to be mindful of the cultural, social, and environmental uniqueness of Hawaiʻi. It should be noted that separate from the cultural impact assessment consultation efforts, the EA team notified the Office of Hawaiian Affairs, other agency officials and neighbors by mail or email to inquire concerning information on natural or cultural resources that might be present or affected. Those contacted did not respond with information concerning cultural resources or practices

3.10.4 Cultural, Historical, or Natural Resources Impacts and Mitigation Measures

No ongoing cultural traditions, beliefs, or practices were identified during the current consultation efforts and culture-historical background research, and no culturally valued historic properties were identified during those efforts. Thus, no mitigation measures per se were required or proposed. However, the project has the potential to synergistically combine native reforestation and Hawaiian cultural revitalization efforts in Hāmākua. From the information obtained during this study, it is evident that the apparent absence of ongoing cultural traditions, beliefs, and practices is in part related to the transformation of the *mauka* portion of Kapoaula from a dense koa and ʻōhiʻa forest to open pasture lands. This history of timber harvesting, ranching, and other associated agricultural endeavors in Hāmākua contributed to the demise of the natural resources that were vital to the traditional lifeways of the Hawaiian people of Hāmākua. Implementation of the proposed project would help re-introduce native plants and other resources that were once collected and used as part of Hawaiian cultural traditions. By reducing erosion and eliminating cattle-caused compaction, the proposed project also has the potential to enhance the condition of the surrounding watershed, which could improve the supply of fresh water, which itself is a profound cultural resource in Hawaiʻi. These positive impacts of the proposed project can create opportunities to promote educational programs that would promote an understanding of Hawaiʻi's cultural heritage for residents and visitors alike.

In sum, the proposed project can have a net positive impact on cultural resources. By replacing non-native pasture land with native forest, the project promises the return of flora, fauna, and fresh water resources that were integrated into traditional Hawaiian cultural practice. The positive impacts may be further enhanced through adoption of recommendations from the cultural consultant concerning harvesting, educational opportunities, and potential reuse of the traditional mauka-makai route. Each of these recommendations is provided in the context of deforestation in Hāmākua, which has in part contributed to the erosion of traditional Hawaiian cultural practices, beliefs, and traditions in the area. Appendix C2 contains the full text of the recommendations, which are summarized here:

Reforestation and harvesting. Access to a mixed native forest appropriately planted with native species with cultural importance should be provided to education partners or cultural practitioners. This would help extend the project's positive impacts directly to traditional Hawaiian cultural practices and beliefs. The use of sustainable harvest practices will also help make the project more culturally appropriate.

Educational opportunities. The project should develop opportunities for local students to participate in the reforestation and forest management efforts. As an oral culture, Hawaiians have for generations relied on the tradition of haʻi moʻolelo or the verbal presentation of stories and histories, which can be utilized in educational excursions. As the forest grows back, the physical evidence of the land's ranching history will disappear, and moʻolelo and memories of paniolo will be among the few sources of information about that ranching history. Given that the property was frequented by paniolo, many of whom have generational ties to these lands, the project should continue and expand its working relationships with the paniolo. The project should also help perpetuate Kapoaula's history by utilizing the traditional place names in maps and in the designation of forest management units.

Reuse of traditional trail alignment (Alanui piʻi uka i ka mauna). Historical maps document a trail, the "alanui piʻi uka i ka mauna," ascending through the proposed project area as the main mauka-makai route through Kapoaula. At present, no physical evidence of the trial exists, but the current two-track access road appears to partially follow the old trail alignment. As the project area becomes reforested, the proposed project's access and logging roads will become the de facto mauka-makai route through this portion of Kapoaula. It is recommended that the traditional route through the ahupuaʻa become incorporated into the logging and access roads, and that maps used within the forest could indicate this route and use the traditional name.

These recommendations have been incorporated into the operating principles of the project, which has already established a relationship with Kanu O Ka ʻAina Public Charter School and Parker Ranch and several of its paniolo. The project intends to work with the school and other organizations to promote not only cultural uses of the forest and forest material but also to help incorporate place names, uses of traditional access, and perpetuation of the history of this ahupuaʻa.

Given the above consultation and assessment, it was the conclusion of the cultural impact assessment that the proposed reforestation effort would not result in impacts to any traditionally valued cultural or historical resources nor will it impact any traditional cultural practices or beliefs. The Draft EA was distributed to agencies and groups who might have knowledge in order to confirm this finding.

3.11 Roads and Traffic

3.11.1 Technical Approach

3.11.1.1 Area of Potential Effect

The APE would be limited the subject property and immediate vicinity. It is important to note that the "property line boundary" as used in the DOH regulations would be the TMK parcel boundary, which is the same area as the project area (see Figure 1.1-1).

3.11.2 Existing Conditions

The existing roadway and traffic network within the APE is rural in nature with one secondary roadway, The Old Māmalahoa Highway providing access to the property. The Old Māmalahoa Highway travels parallel to the Māmalahoa Highway (Highway 19), a primary arterial, with the two highways being approximately 0.5 mile apart. The access point of the Old Māmalahoa Highway is located approximately 5 miles east of the town of Waimea. The Old Māmalahoa Highway is located approximately 0.5 mile from the project boundary and travels in a generally east-west direction. The Old Māmalahoa Highway provides the main access to the property and comprises the northern boundary of the parcel.

The annual average daily traffic count for the Māmalahoa Highway at the location of the project is 8,600 vehicles. There are no traffic counts and no congestion on Old Māmalahoa Highway.

3.11.3 Proposed Action

3.11.3.1 Construction

Traffic increases due to construction would consist of trucks used in the transportation of equipment used in planting. Generally, once equipment has been transported to the project area, it would remain and not require additional transportation of equipment unless for replacement purposes. Daily workers for construction projects would likely be consistent and minimal (less than 10 per day) with minor peaks in workforce during construction of specific components of the facilities.

Additional access roads would be developed as needed to access planting and fencing areas as well as pest control access. These access roads may be temporary or permanent depending on location and use. Access roads would not be made accessible to the public and would be for project use only.

Daily transportation of workers involved in planting and fence construction would generally be consistent throughout the construction life of the project.

3.11.3.2 Operations

Traffic increases due to operation would consist of vehicles used in the transportation of daily operations. Approximately, one log truck a day incoming to the subject property and a couple of container trucks a week leaving would utilize Old Māmalahoa Highway and Māmalahoa Highway. Workers who would be carrying out daily operations activities such as planting, facilities maintenance and pesticide application would also utilize Old Māmalahoa Highway and Māmalahoa Highway. As with construction, generally, once equipment has been transported to the project area, it would remain and not require additional transportation of equipment unless for replacement purposes. Daily workers for operation and maintenance of the site would likely be consistent and minimal (less than 10 per day) with minor peaks in workforce during some harvest activities.

3.11.4 No Action Alternative

Under the No Action Alternative, there would be no changes to existing conditions and therefore no significant impacts to traffic and roadway use.

3.11.5 Impacts and Mitigation

3.11.5.1 Impacts

As shown in Table 3.11-1, construction of the Proposed Action would result in elevated traffic levels associated with the addition and use of equipment. The adverse impact is considered less than significant due to the short duration of activities. Operations phase of the preferred alternative would result in no direct impact or indirect impact on traffic levels.

Table 3.11-1. Summary of Roadway and Traffic Impacts

	Proposed Action	*No Action*
Construction Phase		
Site Preparation	Negligible	No Impact
Fencing	Negligible	No Impact
Operations Phase		
Specialty Instrument-grade Lumber Processing Facility	Negligible	No Impact
Pesticide Application	Negligible	No Impact
Pruning and Maintenance	Negligible	No Impact

3.11.5.2 Mitigation

Construction and maintenance workers would be encouraged to carpool to and from the project. The log trucks and container trucks will be scheduled on and off the subject property outside of peak hours. Peak traffic hours on Māmalahoa Highway are 0700 to 0800 HST and 1500-1700 HST.

3.12 Cumulative Impacts

Cumulative impacts can result from incremental impacts of an action when added to other past, present and reasonably foreseeable future actions regardless of what agency or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (HAR 11-200). The Council on Environmental Quality regulations similarly define "cumulative effects" as:

> *… the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."(40 CFR 1508.7).*

Analysis of cumulative impacts was conducted on a qualitative basis, and included an assessment of known activities and developments occurring or planned within the Hāmākua Community. The recent past, present and future projects identified are listed in Table 3.12-1. Unless otherwise stated the projects are limited geographically to within the Hāmākua Community boundary. The Proposed Action and other projects approved within the community would be consistent with the community plans.

Table 3.12-1. Cumulative Projects

Title	***Proponent***	***Description***	***Location***	***Date of Completion***	***Impacts Identified***
Māmālahoa Highway Widening in Waimea	Hawai‘i County Department of Public Works	Widen 2.8 miles of Māmālahoa Highway; notice to proceed occurred on 15 March 2018 with up to 60 days to begin. Project should be completed in 480 days, conditions permitting. $19.6 million bid won by Goodfellow Bros. Inc.	Māmālahoa Highway between Mānā Road and Mud Lane	Summer of 2019	The impacts to traffic from the Proposed Action would be minimal as Year 1 from the FMP may overlap with the road widening project. Additional trucks may utilize the intersection of Mud Lane, Māmālahoa Highway, and Old Māmālahoa Highway.
Onsite Specialty Instrument-grade Lumber Processing Site	Building Permit Granted	A small specialty instrument-grade processing site will be located on the northwest portion of the subject property (see Figure 1.1-2). The capacity of the site will be approximately 200,000 board feet per year. See Figure 1.1-4 for a photograph of the specialty instrument-grade lumber processing site.	On the subject property	Summer of 2019	The impacts from the processing site to traffic, noise, air quality will be negligible. The adjacent landowner (Edwin DeLuz gravel quarry) produces a significantly larger volume of traffic, noise, and air pollution then the processing site.
Waimea Regional Safety Study	State of Hawai‘i Department of Transportation	To identify potential projects that would improve safety and operations, relieve congestion and enhance multi modal travel options in the Waimea region and that can be accomplished within the resources available to the Department of Transportation and can be ready for design and construction within the next two years.	South of Kawaihae Road from west of the Kawaihae/Waiemi Place intersection to the Māmālahoa Highway/Church Road intersection. Area covers approximately 13,000 acres	Projects are only being considered over the next two years (2019/2020); however, the Safety Study may have funding up through a 4-year period (through 2022).	The Safety Study area is approximately 8 miles from the Proposed Action project site location. No impacts are expected from the Proposed Action.
The Historic Honoka‘a Town Project	Local residents and dedicated friends of the town	The Historic Honoka‘a Town Project is an effort by local residents and dedicated friends of the town to celebrate Honoka‘a and help foster employment, boost cultural tourism in the region, and provide visitors with a richer experience of the Hawaiian plantation town, all while preserving the	Honoka‘a Town	Ongoing as long as funding persists from the public and private assistance	Honoka‘a Town is approximately 7 miles for the Proposed Action project site location. No impacts are expected from the Proposed Action.

Title	***Proponent***	***Description***	***Location***	***Date of Completion***	***Impacts Identified***
		unique character and historical resources of the area. Many members of the project have backgrounds in historic preservation, and with the community's help are working with private and federal programs designed to aid small historic rural communities that have proven very successful across the U.S. These programs are based upon low-impact cultural tourism which emphasizes the unique heritage resources such as architecture, customs, and ceremonies. The program involves historic research, rehabilitating the town's buildings, encouraging new enterprises, and promoting Honokaʻa to visitors.			
Honokāia Non-potable Water System	State of Hawaiʻi DHHL	DHHL is proposing a gravity fed non-potable water system consisting of a County DWS connection, a 104,600-gallon metal storage tank reservoir, 32,000 linear feet of transmission lines and laterals, submeters and appurtenant infrastructure. The benefitted properties are 46 leased pastoral lots within a DHHL pastoral subdivision near Honokaʻa. For ranching needs, the project would distribute 4,800 gallons a day to the lessees, sufficient for 320 head of cattle. Beneficial effects include facilitating the subdivision's intended land use and lifestyle.	TMK (3) 4-6-001:001-046; (3) 4-7-007:005; immediately adjacent to the Proposed Action subject property	300 days after Notice to Proceed is issued; bids were required for submittal on December 19, 2018	This project location is directly next to the Proposed Action project site. Year 1 and possibly Year 2 of the FMP may overlap with the Honokāia Non-Potable Water System project. It is not anticipated that the combination of these projects would produce any adverse cumulative effects.

Legend: DHHL = Department of Hawaiian Home Lands; DWS = Department of Water Supply; FMP = forest management plan; TMK = Tax Map Key; U.S. = United States.

3.12.1 No Action Alternative

Under the No Action Alternative, there would be no changes to existing conditions and therefore no adverse impact to cumulative impacts would occur. However, if no action occurs the condition of the subject property would remain grazing land with no native forest or incentive for adjacent property owners to plant native trees.

3.13 Irretrievable and Irreversible Commitment of Resources

Resources that are committed irreversibly or irretrievably are those that cannot be recovered if the Proposed Action is implemented. The Proposed Action does not include any irreversible or irretrievable loss.

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SECTION 4 CONSISTENCY WITH EXISTING PLANS, POLICIES AND CONTROLS

4.1 Regulatory Overview

In addition to the laws and regulations cited in Section 3, this section lists federal, state, and county laws and consultations that were considered for relevance to the Proposed Action.

4.1.1 Hawaiʻi State Plan

Adopted in 1978 and last revised in 1991 (HRS Chapter 226, as amended), the Hawaiʻi State 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. Implementation of the FMP would be consistent with the State's goals and objectives that call for preservation and restoration of natural, cultural and recreational resources.

The FMP is in keeping with one of the goals in the Hawaiʻi State Plan, which is maintaining stable natural systems, as stated in Section 226-4:

> *In order to guarantee, for present and future generations, those elements of choice and mobility that insure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve: ... (2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.*

The FMP also conforms with the "overall direction" of the Hawaiʻi State Plan, namely that of improving the quality of life through proper management of the State's land resources, as presented in Section 226-102:

> *The State shall strive to improve the quality of life for Hawaiʻi's present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education.*

Discussion: Implementation of the FMP would help fulfill the overall direction of the Hawaiʻi State Plan by contributing to management of land resources, namely native forests that are being degraded by ungulates and invasive plants, along with the watersheds and other values these forests protect.

Among the sections of the Hawaiʻi State Plan most relevant to the FMP are those centered on the theme of the physical environment. The following objective and policies are taken from Section 226-11, which deals with land-based, shoreline, and marine resources in the physical environment:

Objectives: Planning for the State's physical environment with regard to land-based, shoreline and marine resources shall be directed towards achievement of the following objectives: (1) prudent use of Hawaiʻi's land-based, shoreline and marine resources and (2) effective protection of Hawaiʻi's unique and fragile environmental resources. To achieve those objectives, the Hawaiʻi State Plan notes it shall be the policy of the state to:

a) *Exercise an overall conservation ethic in the use of Hawaiʻi's natural resources.*

b) *Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.*
c) *Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.*
d) *Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaiʻi.*
e) *Pursue compatible relationships among activities, facilities, and natural resources.*
f) *Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.*

And from Section 226-12, regarding the scenic, natural beauty, and historic resources of the physical environment:

Objective: Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawaiʻi's scenic assets, natural beauty, and multi-cultural/historical resources. To achieve that objective, it shall be the policy of this State to:

a) *Promote the preservation and restoration of significant natural and historic resources.*
b) *Provide incentives to maintain and enhance historic, cultural, and scenic amenities.*
c) *Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.*
d) *Protect those special areas, structures, and elements that are an integral and functional part of Hawaiʻi's ethnic and cultural heritage.*

Also relevant is Section 226-13, which concerns land, air, and water quality of the physical environment:

Objectives: Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following: (1) Maintenance and pursuit of improved quality in Hawaiʻi's land, air, and water resources, and (2) Greater public awareness and appreciation of Hawaiʻi's environmental resources. To achieve those objectives it shall be the policy of the State to:

a) *Foster educational activities that promote a better understanding of Hawaiʻi's limited environmental resources.*
b) *Promote the proper management of Hawaiʻi's land and water resources.*
c) *Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.*
d) *Foster recognition of the importance and value of the land, air and water resources to Hawaiʻi's people, their cultures and visitors.*

Discussion: Hawaiʻi's natural resources continue to be threatened by invasive species, including feral ungulates and weeds, which diminish the scenic beauty, biodiversity, and watershed values of the native forest. Implementation of the FMP would help protect rare and or endangered plant as well as animal species dependent upon native food and habitat. The FMP also includes enhancement of access, recreational activities, education, and involvement of the Hāmākua residents as well as the wider community in the management and enjoyment of the Subject Property. This involvement would increase the "stake" the community has in the sound management of resources.

Other sections of the Hawaiʻi State Plan relevant to the FMP are those centered on the theme of socio-cultural advancement. The following objective and policies are taken from Section 226-25 dealing with culture:

Objective: Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawai'i's people. To achieve the objective, it shall be the policy of this State to:

- *a) Foster increased knowledge and understanding of Hawai'i's ethnic and cultural heritages and the history of Hawai'i.*
- *b) Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawai'i's people and which are sensitive and responsive to family and community needs.*
- *c) Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawai'i.*

The following objective and policies are taken from Section 226-23 regarding leisure and socio-cultural advancement:

Objective: Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations. To achieve the leisure objective it shall be the policy of the State to:

- *a) Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.*
- *b) Ensure opportunities for everyone to use and enjoy Hawai'i's recreational resources.*
- *c) Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.*
- *d) Assure adequate access to significant natural and cultural resources in public ownership.*

Also relevant to the FMP project is the objective from Section 226-27 pertaining to government and socio-cultural advancement:

Objective: Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of efficient, effective, and responsive government services at all levels in the State. To achieve that objective, it shall be the policy of this State to:

- *a) Provide for necessary public goods and services not assumed by the private sector.*

Other relevant portions of the sections pertaining to socio-cultural advancement include §226-20, which calls for the fulfilling of basic individual health needs and maintaining environmentally healthful conditions in Hawai'i's communities through the prevention of contamination by pesticides and other potentially hazardous substances; and §226-21, which seeks the promotion of educational programs which enhance understanding of Hawai'i's cultural heritage. Also applicable is §226-8, objective and policies for the economy as it involves the visitor industry, which calls for the fostering of an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawai'i's culture and values.

Discussion: Implementation of the FMP would help protect native plants and other resources that are traditionally collected and used for cultural purposes, as well as the watershed that ensures a continual supply of fresh water, which itself is a profound cultural resource in Hawai'i. Protecting those resources would further the Hawai'i State Plan's objective to promote educational programs which enhance the understanding of Hawai'i's cultural heritage for residents and visitors alike. It would also improve access for cultural practitioners and others interested in experiencing the forest firsthand, whether residents or visitors.

4.1.2 Hawai‘i’s Comprehensive Wildlife Conservation Strategy

Hawai‘i’s Comprehensive Wildlife Conservation Strategy (CWCS) is an interagency initiative that comprehensively reviewed the status of the full range of the State’s native terrestrial and aquatic species (DLNR 2015). The DLNR took the lead in preparing the CWCS. A combination of traditional outreach, such as public meetings and technical workshops, with “modern” outreach, such as the development of a website and use of email, was used to invite and expand participation in the development of the CWCS. The collaborative nature of the effort, which involved resource managers, biologists, and concerned individuals statewide, indicates broad support and the likelihood that the conservation strategies identified would be implemented by multiple partners, including DLNR. Development of the CWCS allows as participation in the State Wildlife Grant program administered by the USFWS. The CWCS of every state required the following eight elements:

1. Information on the distribution and abundance of species of wildlife identified as “species of greatest conservation need,” including low and declining populations, as the State’s fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State’s wildlife;
2. Descriptions of the locations and relative condition of key habitats and community types essential to the conservation of species identified in (1);
3. Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats;
4. Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions;
5. Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions;
6. Descriptions of procedures to review the plan at an interval not to exceed ten years;
7. Plans for coordinating the development, implementation, review, and revision of the plan with federal, state, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats;
8. Provisions to ensure public participation in the development, revision, and implementation of projects and programs.

As part of the research and policy formulation, the CWCS determined the major threats facing Hawai‘i’s native wildlife, including degradation of habitat, invasive species, uneven management, extractive uses, and inadequate funding, among others.

To address these threats, the CWCS identifies multiple strategies to implement the following seven priority conservation objectives for the state:

1. Maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow native species to thrive;
2. Combat invasive species through a three-tiered approach combining prevention and interdiction, early detection and rapid response, and ongoing control or eradication;
3. Develop and implement programs to obtain, manage, and disseminate information needed to guide conservation management and recovery programs;

4. Strengthen existing and create new partnerships and cooperative efforts;
5. Expand and strengthen outreach and education to improve understanding of our native wildlife resources among the people of Hawaiʻi;
6. Support policy changes aimed at improving and protecting native species and habitats; and
7. Enhance funding opportunities to implement needed conservation actions.

Discussion: Successful implementation of the CWCS includes efforts by the State of Hawaiʻi in partnership with private and other government parties to manage its Forest Reserves to protect native habitat and watershed value. The FMP is specifically designed to accomplish this and is fully consistent with the CWCS.

4.1.3 Hawaiʻi County General Plan and Hāmākua Community Development Plan

4.1.3.1 Hawaiʻi County General Plan

The General Plan for the County of Hawaiʻi is a policy document expressing the broad goals and policies for the long-range development of the island of Hawaiʻi. The plan was adopted by ordinance in 1989 and revised in 2005 (Hawaiʻi County Planning Department). The General Plan itself 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 Hawaiʻi. Most relevant to the proposed project are the following Goals, Policies and Standards of particular chapters of the General Plan:

Environmental Quality – Goals

- Define the most desirable use of land within the county that achieves an ecological balance providing residents and visitors the quality of life and an environment in which the natural resources of the island are viable and sustainable.
- Maintain and, if feasible, improve the existing environmental quality of the island.
- Control pollution.

Environmental Quality – Policies

- Take positive action to further maintain the quality of the environment.
- Advise the public of environmental conditions and research undertaken on the island's environment.

Environmental Quality – Standards

- Pollution shall be prevented, abated, and controlled at levels that would protect and preserve the public health and wellbeing, through the enforcement of appropriate federal, state and county standards.
- Incorporate environmental quality controls either as standards in appropriate ordinances or as conditions of approval.
- Federal and state environmental regulations shall be adhered to.

Discussion: The Plan would fulfill the specifications of the Hawaiʻi County General Plan by maintaining and improving the environmental quality of the island through protecting native forest habitat and watershed values.

Natural Beauty – Goals

- Protect, preserve, and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.

- Protect scenic vistas and view planes from becoming obstructed.
- Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

Discussion: Implementation of the Plan would help restore and preserve the native vegetation of the Reserve, one of the contributing scenic elements. It would also provide additional accesses and trails and other facilities to enable users to enjoy different vantages and vistas.

Natural Resources and Shoreline – Goals

- Protect and conserve the natural resources from undue exploitation, encroachment and damage.
- Protect and promote the prudent use of Hawaiʻi's unique, fragile, and significant environmental and natural resources.
- Protect rare or endangered species and habitats native to Hawaiʻi.
- Protect and effectively manage Hawaiʻi's open space, watersheds, shoreline, and natural areas.

Natural Resources and Shoreline – Policies

- Encourage a program of collection and dissemination of basic data concerning natural resources.
- Coordinate programs to protect natural resources with other government agencies.
- Encourage public and private agencies to manage the natural resources in a manner that avoids or minimizes adverse effects on the environment and depletion of energy and natural resources to the fullest extent.
- Encourage an overall conservation ethic in the use of Hawaiʻi's resources by protecting, preserving, and conserving the critical and significant natural resources of the County of Hawaiʻi.
- Encourage the protection of watersheds, forest, brush and grassland from destructive agents and uses.
- Work with the appropriate state, federal agencies, and private landowners to establish a program to manage and protect identified watersheds.
- Create incentives for landowners to retain and re-establish forest cover in upland watershed areas with emphasis on native forest species.

Natural Resources and Shoreline – Standards

- The following shall be considered for the protection and conservation of natural resources:
- Areas necessary for the protection and propagation of specified endangered native wildlife, and conservation for natural ecosystems of endemic plants, fish and wildlife.
- Lands necessary for the preservation of forests, park lands, wilderness and beach areas.

Discussion: The Plan is designed to protect native forests and watersheds, specifically fulfilling the Natural Resources and Shoreline elements of the Hawaiʻi County General Plan.

Land Use – Public Lands – Goal

- Utilize publicly owned lands in the best public interest and to the maximum benefit for the greatest number of people.

Land Use – Public Lands – Policy

- Encourage uses of public lands that would satisfy specific public needs, such as housing, recreation, open space and education.

Land Use – Public Lands – Standard

- Public lands with unique recreational and natural resources shall be maintained for public use.

Discussion: The Plan maintains and enhances recreational opportunities. Although the establishment of fenced management units from which ungulates would be removed reduces total hunting area, the improvements to access and facilities would counteract this loss, which is necessary to balance the management of the Reserve towards the intended goals of preserving native habitat and watershed values. Ultimately, it is these values that would provide the soundest basis for public land use.

4.1.3.2 Hāmākua Community Development Plan

The project site is located in the Hāmākua CDP planning area. The Hāmākua CDP (Hawai‘i County Planning Department 2018) has been adopted and was finalized in August 2018. The final Hāmākua CDP is available for public view here: http://www.hawaiicountycdp.info/hamakua-cdp/recommended-cdp-2018. The Hāmākua CDP stresses the value of having a rural community of distinctive small towns and villages thriving on sustainable agriculture and ranching to provide itself and the rest of Hawai’i with healthy food and locally grown products. The Proposed Action to restore grazing lands to native forest is highly consistent with goals of protecting the ‘āina and managing natural and cultural resources, preserving and strengthening community character, building a robust local economy, and building and strengthening community capacity, and it is not inconsistent with any aspect of the plan to date.

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SECTION 5
DETERMINATION

5.1 Comparison of the Environmental Consequences of the Alternatives

The Proposed Action would convert roughly 555 acres of grazing land to native forest. A summary of potential impacts and mitigation measures is provided in Table 5.1-1. Environmental protection measures that are required by law or as conditions to permits are not considered mitigation but are considered part of the Proposed Action.

Table 5.1-1. Summary of Impacts and Potential Mitigation

Resource	***Proposed Action Potential Impacts***	***Mitigation Proposed for Consideration***	***No Action***
Land Use	No significant adverse impact. Consistent and compatible with existing and planned land uses for overall beneficial impact.	Not applicable	No impact
Air Quality	No significant adverse impact with construction and operation BMPs	Implementation of BMPs during operations phase of the specialty instrument-grade lumber processing facility and BMPs to control dust would need to meet permit requirements and are assumed to be included in the Proposed Action. Pesticide spraying would be subject to weather related restrictions.	No impact
Noise	No significant adverse impact with construction and operation BMPs	All equipment would be equipped with original-equipment; manufacturer-installed noise attenuation features (mufflers, baffles, etc.). Construction and maintenance workers would adhere to Occupational Safety and Health Administration requirements for hearing safety.	No impact
Geology and Soils	No significant adverse impact with BMPs and adherence to permit conditions to control erosion	All site preparation, road and pond construction, planting, and silvicultural activities would be conducted with standard BMPs that maintain soil in place and minimize disturbance of erodible soils. BMPs would ensure that the high current level of organic material in the soil would be retained and that no sediments would escape the property through surface water transport	No impact
Water Resources	No significant adverse impact with BMPs to control stormwater onsite and adherence to permit conditions	In order to properly manage stormwater runoff, the project would incorporate standard erosion and sedimentation BMPs for the project. These BMPs may include, but would not be limited to, the following: • Limiting the amount of surface area graded at any given time to reduce the area subject to potential erosion; • Utilizing soil erosion protective materials such as mulch or geotextiles on areas where soils have a high potential for erosion until permanent vegetation is in place; • Planting vegetation as soon as grading operations permit to minimize the amount of time soils are exposed to possible erosion; and • Installing silt fences along the downhill perimeter of any disturbed areas to collect sediment from stormwater runoff.	No impact
Biological Resources	There will be minor impacts to some native faunal species. There is a significant potential for the project to accomplish some or all of the following conservation benefits: • Reduced habitat fragmentation;	Can be mitigated to insignificant levels through simple project management measures. In order to avoid impacts to endangered but widespread native birds and the ōpeʻapeʻa: • To minimize impacts to the endangered ōpeʻapeʻa, trees taller than 15 feet (5 meters) will not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Barbed wire shall not be used on fences	No impact

Resource	Proposed Action Potential Impacts	Mitigation Proposed for Consideration	No Action
	• Maintenance, restoration, or enhancement of existing habitats; • Increases in habitat connectivity; • Stabilized or increased numbers or distribution; and • Opportunities to test and develop new habitat management techniques. As the project proceeds, it is expected that a baseline survey will be conducted to establish the levels of listed species currently on the property.	with the exception of the bottom strand, which is required for excluding feral pigs. • To minimize impacts to Hawaiian hawks, earthmoving and tree cutting during the breeding season for Hawaiian hawks (March through September) will be avoided. If this time period cannot be avoided, arrange for a hawk nest search to be conducted by a qualified biologist. If hawk nests are present in or near the project site, all land clearing activity will cease until the expiration of the breeding season. • If any activities incorporate outdoor lighting, they may attract endangered seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these seabirds through interaction with outdoor lighting, no construction lighting or unshielded equipment maintenance lighting after dark will be used between the months of April and October. All permanent lighting will be shielded in strict conformance with the Hawaiʻi County Outdoor Lighting Ordinance (Hawaiʻi County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.	
Archaeological Resources	The determination of effect for the proposed project is "no historic properties affected." With respect to the historic preservation review process of the SHPD, the archaeologist's recommendation is that no further work needs to be conducted within the current study area prior to or during project implementation.	Given the absence of archaeological or architectural resources, no impact to such resources would occur, and no mitigation is necessary for the forestry project. In the unlikely event that significant archaeological resources are discovered during the proposed ground disturbing activity, work should cease in the area of the discovery and SHPD contacted pursuant to HAR 13§13-280-3.	No impact
Socioeconomics and Cultural Environment	Incentive for adjacent property owners (DHHL lands) to plant native trees. No significant adverse impact on socioeconomics and cultural environment.	Not applicable	No incentive for adjacent property owners (DHHL lands) to plant native trees
Hazardous Materials and Wastes	No significant impact with adherence to applicable laws and regulations	A Health and Safety Plan and Hazardous Material Management Plan would be prepared and implemented	No impact
Visual Resources	No significant impact	Not applicable	No impact
Utilities and Public Services	No significant impact	Not applicable	No impact

Legend: BMP = best management practices; DHHL = Department of Hawaiian Home Lands.

5.2 Hawaiʻi Environmental Policy Act Significance Criteria

The Significance Criteria in HAR Title 11, 200-12 for environmental impacts were reviewed and the proposed project was assessed for significant impacts. The evaluation included all phases of the Proposed Action, both direct and indirect impacts and short-term and long-term effects, and the cumulative effects. Short-term is considered to be construction phase and long-term is the operations phase in the discussion below. Each of the significance criteria listed below is followed by the evaluation.

1. *Involves an irrevocable commitment or loss or destruction of any natural or cultural resource.*

   There will be minor impacts to some native faunal species, all of which are either insignificant or can be mitigated to insignificant levels through simple project management measures (See Section 3.4.6.2).

   There are no cultural sites within the development area. No negative impacts to National Register of Historic Places/Hawaiʻi Register of Historic Places eligible archaeological resources are anticipated under the Proposed Action.

   During operation, there would be no irrevocable commitment, loss or destruction of any identified natural or cultural resource. There would be a commitment to protect those resources within the project area resulting in a net beneficial impact. There would be no significant cumulative adverse impact on natural and cultural resources.

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

   The Proposed Action augments the range of beneficial uses of the environment. The Proposed Action offers the following benefits to the agricultural, cultural, etc. uses in the community:

   - Incentive for adjacent property owners (DHHL lands) to plant native trees.
   - The project intends to work with local schools and other organizations to promote not only cultural uses of the forest and forest material but also to help incorporate place names, uses of traditional access, and perpetuation of the history of this ahupuaʻa.

3. *Conflicts with the State's long-term environmental policies or goals and guidelines as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders.*

   The Proposed Action supports the State's long term environmental policies or goals in HRS Chapter 344. Specifically:

   HRS §344-3. *Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which would foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaiʻi.*

   The Proposed Action would not have direct adverse impacts to land, water, mineral, visual, air and other natural resources.

   The HRS §344-4 guidelines are generally not relevant to the Proposed Action; however, the Proposed Action is consistent with those that are relevant, as listed below:

HRS §344-4 *Guidelines*

(2) Land, water, mineral, visual, air, and other natural resources.
(A) Encourage management practices which conserve and fully utilize all natural resources;
(3) Flora and fauna.
(A) Protect endangered species of indigenous plants and animals and introduce new plants or animals only upon assurance of negligible ecological hazard;
(5) Economic development.
(A) Encourage industries in Hawaiʻi which would be in harmony with our environment;
(7) Energy.
(A) Encourage the efficient use of energy resources.

The Proposed Action would not have a significant adverse impact on the environment. It would be consistent with the State of Hawaiʻi's long-term environmental policies, goals, and guidelines.

4. *Substantially affects the economic or social welfare of the community or State.*

The Proposed Action would have beneficial impacts on socioeconomics during construction related to employment opportunities and purchase of materials.

5. *Substantially affects public health.*

During both construction and operation of the proposed project, no adverse impacts to public health are anticipated. Construction and operation would be accomplished in compliance with all federal, state, and county regulations.

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

The Proposed Action would not induce population growth or adversely impact public infrastructure. There would be minimal increase in commuter traffic associated with the work force at the site.

7. *Involves a substantial degradation of environmental quality.*

During construction and operation, there would be short-term air quality and noise impacts. The BMPs required as permit conditions would be implemented to minimize construction impacts. During operations, there would be minimal adverse impact on environmental quality. The minimal amounts of hazardous and regulated materials used onsite would be managed in accordance with applicable regulations. Therefore, no substantial degradation of environmental quality is anticipated.

8. *Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions.*

Section 3.12 presents a cumulative impact analysis and there was no indication that the project would have significant cumulative adverse impacts. The project is a stand-alone project that would not require future actions.

9. *Substantially affects a rare, threatened, or endangered species or its habitat.*

No rare, threatened or endangered species were identified in the proposed development area. No direct, indirect or cumulative significant adverse impacts to species or habitats were identified.

10. *Detrimentally affects air or water quality or ambient noise levels.*

During the construction phase, there would be short-term air quality and ambient noise impacts. To minimize air quality impacts during construction, dust control measures would be implemented to minimize wind-blown emissions. Noise impacts from construction would be minimized by limiting construction activities to daylight hours and by following all applicable regulations. During operations, there would be minimal impacts to air and noise and these impacts are unlikely to be unnoticeable beyond the property boundary.

No stormwater would leave the site during construction or operation. BMPs would be implemented as part of permit conditions to protect water resources.

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

    The Proposed Action is not located in any of the environmentally sensitive areas listed. No increased risk to or from the development is anticipated. No indirect or cumulative impacts are anticipated on environmentally sensitive areas.

12. *Substantially affects scenic vistas and view planes identified in county or state plans or studies.*

    The Proposed Action would not directly or indirectly affect any identified scenic views or view planes as described in Section 3.7. No cumulative impacts to visual resources are anticipated.

13. *Requires substantial energy consumption.*

    The Proposed Action would not require substantial energy during construction or operations.

5.3 Unresolved Issues

No unresolved issues were identified.

5.4 Determination

Based on analysis of the Hawaiʻi Environmental Policy Act significance criteria, the Proposed Action would not result in significant adverse environmental impacts. The Proposed Action is anticipated to be a FONSI.

SECTION 6
LIST OF PREPARERS

6.1 Cardno

Kerry Kylene, Project Manager/Geographic Information Systems
M.S., Ocean Engineering
B.S., Physics

Benjamin Berridge, Environmental Scientist
B.S., Environmental Science

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B.S., Coastal Environmental Science

6.2 Geometrician

Ron Terry, Project Manager, Ph.D.

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6.3 ASM

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B.A., Anthropology
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SECTION 7
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APPENDIX A
FOREST MANAGEMENT PLAN

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Kapoaula Koa Forest
Paniolo Forestry, LLC

Forest Stewardship Management Plan

Center portion of the Kapoaula property, Island of Hawaiʻi

PO Box 250
Paʻauilo, HI 96776
Tel +1 808 776 9900
Fax +1 808 776 9901

Bob Rose & Nicholas Koch
September 25,2018

Table of Contents

1. CLIENT AND PROPERTY INFORMATION

1.1. Client

Applicant Name: Paniolo Forestry LLC

Address: Attn: Nicholas Koch, Manager
Po Box 490, Paauilo HI 96776

Landowner Name: Siglo Forest, LLC

Leaseholder Name: Paniolo Forestry, LLC

Effective Date /Term of Lease: January 1, 2019, 50 years

Address: 47-4521 Old Māmalahoa Highway, Kamuela, HI 96743

TMK number: (3)-4-7-007-011

State and County Zoning: Agriculture district, 40 acres (A-40a)

Farm Service Agency Tract No: None

Total property acreage: 564.1 acres

Proposed stewardship area: 552.8 acres

Elevation range: 2,740 – 3,180 ft ASL

Slope: 440’ rise makai to mauka, over distance of 9,546 ft = average 5% slope
80% of TMK is <20% slope
0-10% (+/-) 302 acres
10-20% (+/-) 162 acres
>20% (+/-) 100 acres w/ areas of extreme slope & exposed rock

Perennial/intermittent steams: There is a short segment of blue-line intermittent gulch on the NW corner of the property, adjacent to Mamalahoa Highway

1.2. Consultant

Company: Forest Solutions, Inc.

Name: Nicholas Koch

Title: General Manager

Address: P.O. Box 250, Paauilo HI 96776

Email: nick_koch@forestsolutionsinc.com

Phone | Fax: +1 (808) 776-9900 x 2 | +1 (808) 776-9901

Date of Plan Completion: **September 25, 2018**

2. Signature Page

(Appendix D) – With signatures of the applicant, consultant, approval date by Forest Stewardship Advisory Committee and State Forester

Signature Applicant: ____

(on behalf of Paniolo Forestry, LLC)

Signature Consultant: ____

(on behalf of Forest Solutions, Inc.)

Approval Date by Forest Stewardship Advisory Committee: ______________________

Signature State Forester: ______________________________________

3. Introduction

3.1. Vision and long-term goals

3.1.1. Vision

Siglo Forest, LLC acquired the Kapoaula property from Parker Ranch to provide it with long term access to planted koa wood and convert pastureland back to a semblance of the native koa-ʻōhiʻa forest that once stood in this area. The resulting koa forest will provide a long-term, predictable source of instrument grade wood for Taylor Guitars, one of the venture partners, and produce high-quality wood for other uses.

In 50 years, this property will be a mixed-species native forest with flatter, less erodible areas that emphasize timber production, and other areas that emphasize native species, which are steeper. The forest will produce a sustainable yield of instrument grade koa timber while also providing habitat for native species and inspiring others to plant trees on their land for similar purposes.

3.1.2. Ten-year objectives

- Reforest the entire property with koa and a complement of associated native forest plants
- Improve the quality of wood to be harvested in the future by:
    - Planting seed from known, high-quality sources
    - Utilizing cuttings propagated from trees identified as having superior color, figure and form
- Intensive management of koa for saw timber on those areas of the property with slopes less than 20% accounting for 70% of the property or 390 acres
- Reforest the remaining upland areas with a multi-species native forest, utilizing koa as a pioneer species, accounting for 30% of the area or 163 acres
- Protect planted forest from wind by planting fast-growing, cattle resistant windbreaks

3.2. Description of property and history

During the Great Mahele of 1848 this property was granted to Prince William Pitt Leleiohoku II, one of the 4 members of the royal family. At his untimely death at age 22, the land was transferred to John Parker, a close family friend, in 1862. The property remained in Parker Ranch ownership until its recent sale in March 2018 to Siglo Forestry, LLC, the third owner.

This 565-acre TMK is locally identified as Kapoaula owing to its namesake Ahupuaʻa. The original property was approximately 660 acres. In 2004, the quarry on the northwest corner of the roughly rectangular-shaped parcel (approximately 95 acres) was divided off and sold to Kapoaula Land, LLC to continue its long-standing (and continued use) as a gravel quarry (Edwin DeLuz quarry).

The property abuts the Old Māmalahoa Highway midway between Waimea and Honokaʻa. Aside from the quarry, it is surrounded by Department of Hawaiian Homelands pastoral leaseholds used for cattle grazing. Some of these leaseholds have single family houses and attendant small farm structures. Its general slope aspect is north facing with constant exposure to East-West Tradewinds. The overall landscape is open, rolling pasture with few trees, punctuated with small hills, outcroppings and occasional steep and rocky ridges. It is primarily covered in non-native kikuyu grass (*Pennisetum clandestinum*) with other pasture grasses, with a few remnant ʻōhiʻa trees remaining on the edges of steep knolls. The subject property is notably well managed, with lush pasture grass and few pasture weeds. Under the terms of the property sale, Parker Ranch has a year to year license to continue to graze cattle until owner Siglo Forest is ready to reforest all or part of the designated sections with koa and other native vegetation. There is a 20-year agricultural tax dedication on the property that expires in 2021, to keep this and avoid retroactive taxes, the property must be grazed or forested until then.

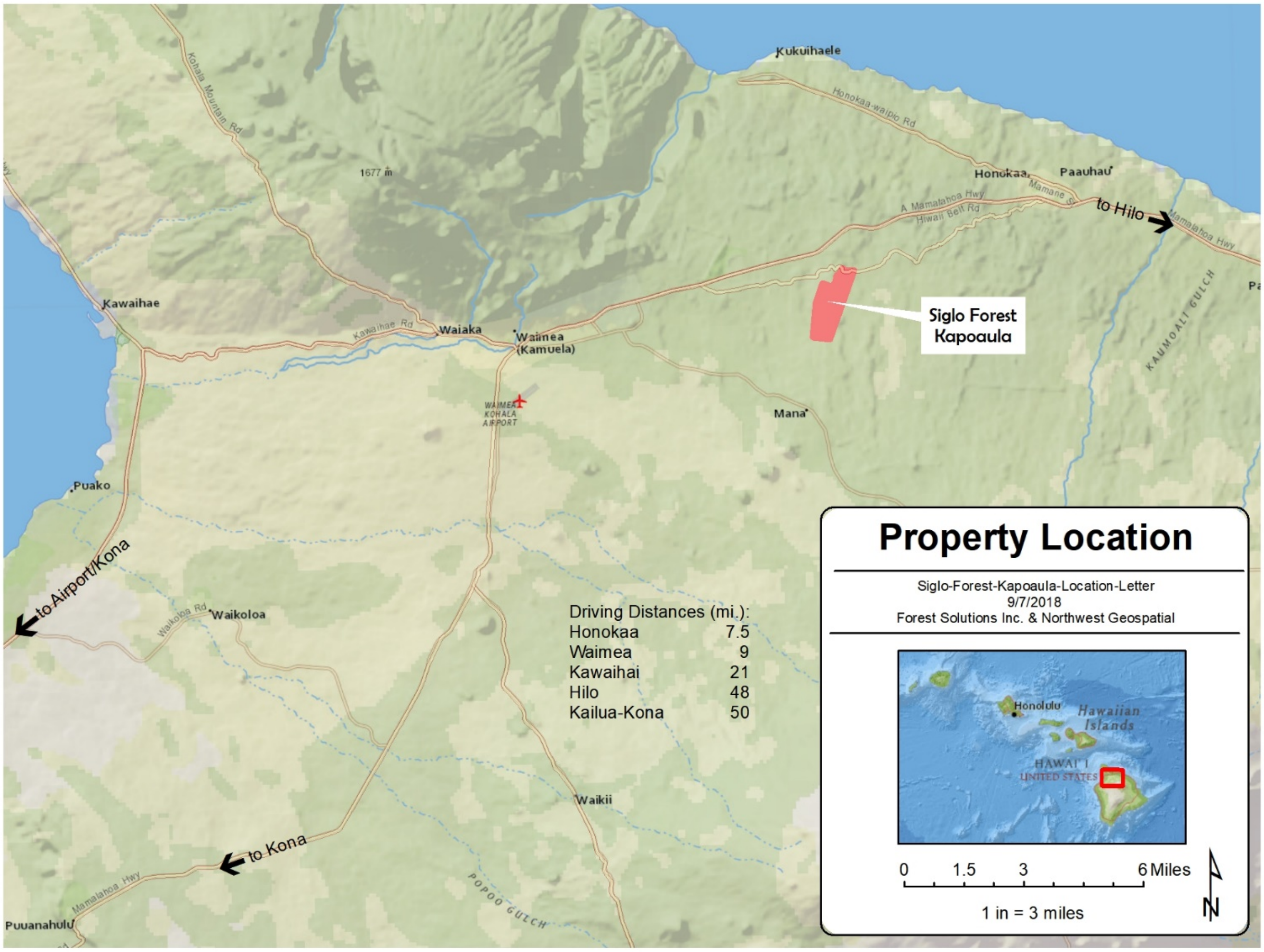
Historical records indicate that this entire flank of Mauna Kea was once a dense koa-ʻōhiʻa forest. Gagne and Cuddihy (1990) identify this region as "sub montane ʻōhiʻa -koa forest." However, by the 1850's the forest was evidently nearly eliminated and replaced by grazing land. A mid nineteenth century account reported:

> *"it is in the memory of many foreigners now living here, when the whole of these plains were covered in a thick wood…where hardly a tree stands for miles…….Thousands of old dead trees both standing upright and prostrate, from the present boundaries of these woods, exhibit a mode in which the destruction is effected; for while whilst the old trees die of age, no young ones are seen taking their place, as during the last thirty or forty years, the cattle have eaten or trodden them down."….."In former times when I was a boy (said Ha'alelea), Waimea was a thickly wooded region all about there…. but of late years round about where I lived, it is as cleared of trees as the Esplanade is."….. He explained that white settlers had felled the trees for fuel and fences for cattle pens and that "a good many of the young trees were destroyed by the cattle." P.62*
>
> *"From the nature of the country to the windward of our private lands [Waimea] (a dense forest and almost impenetrable undergrowth covering nearly the whole of it) as the herds increased it became an impossibility to prevent cattle from getting beyond the reach of our control, and gradually they have filled this land with their offspring." P.188*
>
> *[1856 edition of Sandwich Island Monthly Magazine, from: <u>Cattle Colonialism-</u> John Ryan Fischer, 2015, U. North Carolina Press]*

John Parker's original homestead at Mana was located about a mile mauka of the property boundary. An early account of the ranch reported on the koa milling activity in the area:

> *"it was below the koa forest of Hanaipoi that the saw pits were dug in the land known as Makahalau where the purebred bulls and cows are now penned up. This became the great center for koa work, cutting down trees, selecting the best to be sawn up into lumber through the saw pits, the piling up of koa lumber on hilly ground so that the air could get between the boards and season the wood. There was so much lumber piled up in this section that the natives called the place Palihooukapapa [Hill of piled lumber]."*
>
> <u>The Parker Ranch of Hawaii - The saga of a Ranch and a Dynasty</u>, Joseph Brennan, Mutual Publishing, Honolulu, 1974/2006; p.82

This sawpit area is about 3 miles mauka and 1,000 higher from the upper property boundary of the property.



3.3. Overview of Project Specific Management Objectives

The specific forest management objectives for this property include:

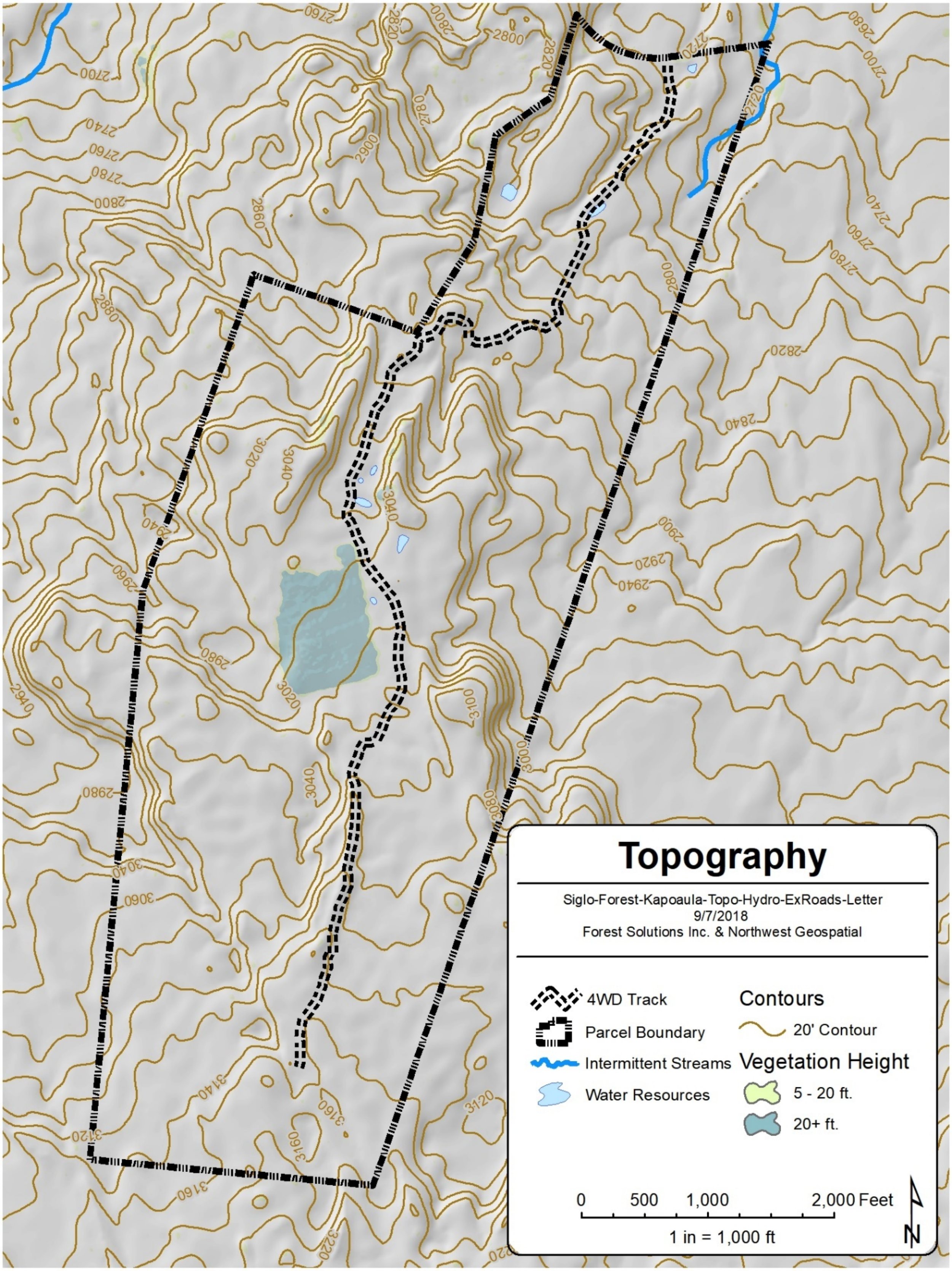
- Improve the quality of wood to be harvested in the future by planting seeds from known, high-quality sources and utilizing cuttings from trees identified as having superior color, figure and form (timber stands)
- Focus intensive management of koa for saw timber on those areas of the property with slopes less than 20%, accounting for 70% or 390 acres
- Re-vegetate slopes and erosion-prone ridges with a multi-species combination of koa and native trees, shrubs and groundcover plants, accounting for estimated 30% or 163 acres
- Protect planted stands from the effects of persistent and sometimes extreme wind by establishing 15,800 feet of cattle resistant windbreaks
- Emphasize the planting of native frugivorous species to increase habitat for native forest-dwelling birds

A planted koa forest will provide a reliable farmed source of high-quality koa for guitars, ukuleles and other wood products, thereby reducing pressure on natural forests and the concomitant habitat disturbance. Kapoaula and the surrounding area was historically known for its abundance of koa. This project returns that key “forest engineer” species -koa- to the landscape, initiating the reversal of nearly two centuries of deforestation and grazing.

Planting native species at this scale will increase the habitat for forest dwelling birds including ʻio (already sighted on the property), ʻopeʻapeʻa (*Lasiurus cinereus semotus*) (likely), ʻiʻiwi (*Vestiaria coccinea*) (threatened, not seen), ʻAmakihi (*Hemignathus virens*), ʻApapane (*Himatione sanguinea*), ʻŌmaʻo (*Myadestes obscurus*), Hawaiʻi ʻElepaio (*Chasiempis sandwichensis*), and Nēnē (*Branta sandvicensis*).

Once the new koa forest is established, the forest management plan (below) calls for a continuing series of pre-commercial thinning, commercial thinning (at age 30 to 35) and patch clearing or individual tree selection of mature trees (age 50 to 65+). The closest model for this type of management is the long-standing and accepted silvicultural practices used in managing eastern U.S. hardwood forests such as maple and cherry. While the initial thrust is for plantation establishment, this is a means to the objective of rapid forest cover rather than the direction of long term forest management. The intention is to have a continuous forest cover composed of trees in various age and size classes throughout. Each harvest activity will be designed to generate its own replacement cohort by virtue of soil disturbance combined with natural seeding. Potentially, this will be improved by using genetically superior seedlings as available and desirable, enriching the stand genetics.

Figure 1. The property is currently used for grazing angus cattle by Parker Ranch, who has maintained the pasture in excellent condition.


Topography
Siglo-Forest-Kapoaula-Topo-Hydro-ExRoads-Letter
9/7/2018
Forest Solutions Inc. & Northwest Geospatial
4WD Track
Parcel Boundary
Intermittent Streams
Water Resources
Contours
20' Contour
Vegetation Height
5 - 20 ft.
20+ ft.
0 500 1,000 2,000 Feet
1 in = 1,000 ft
N

4. Land and Resource Description

4.1. Resource concerns

The following resource concerns have been identified, listed from highest to lowest concern, these concerns are common to pasture areas in Hawaiʻi:

1. Soil erosion & soil compaction
2. Undesirable air movement
3. Water quality, excess sediment
4. Insufficient flow in watercourses
5. Hydrologic cycle: capture and storage of rainfall
6. Threatened and endangered species
7. Inadequate cover & food for wildlife

4.2. Existing vegetation and forest cover

Until March of this year, the property was owned and managed by Parker Ranch as a cattle pasture since its acquisition in the 19th century. The deep and fertile soils, used only for grazing for the past century and a half have never been disrupted or compacted by sugar cane or other plantation crops.

The pastures are surprisingly clean. There is a single Christmasberry (*Schinus terebenthifolius*) tree, and scattered fireweed (*Senecio madagascariensis*) as well as some joee (*Stachytarpheta cayennensis*), bullthistle (*Cirsium vulgare*), sourbush (*Pluchea carolinensis*), smutgrass (*Sporobulus indicus*), Yorkshire fog (*Holcus lanatus*) and sourgrass (*Digitaria insularis*) which are common to all pastures in the area. The dominant pasture grasses are Kikuyu grass (*Pennisetum clandestinum*) and pangola grass (*Digitaria eriantha*).

There is a single 14.8-acre grove of planted trees likely planted during the Civilian Conservation Corps era, in the 1930's. It is composed of mainly of tropical ash (*Fraxinus uhdei*), with two rows of tsugi pine (*Cryptomeria japonica*), two rows of swamp mahogany (*Eucalyptus robusta*) in poor condition and scattered turpentine tree (*Syncarpia glomulifera*). The windward edge of the stand, composed of tsugi pine and swamp mahogany has been stunted by wind, the rest of the ash stand is beginning to show signs of mechanical deterioration, owing to the mature condition of the trees. While this grove is not spreading on account of the cattle grazing the emerging ash seedlings, this stand will need to be managed carefully to avoid its spread.

Figure 2. There are less than 100 ʻōhiʻa trees on the property, clinging to the steep sides of steep hills. The objective of this plan is to plant a mixed koa-ʻōhiʻa forest on these slopes.

There are also a two or three small clumps of 5-10 trees each of Monterey pine (*Pinus radiata*) on the lower ridges. There are few (less than 100) remnant ʻōhiʻa trees remaining on the edges of steep knolls.

Resource Concern/objective: Reforesting the property with koa and associated native species will ensure that the landscape is, once again, covered with appropriate native tree and ground cover. Removal of cattle in favor of native trees will minimize soil compaction, provide cover and food for native wildlife, and provide a significant area of continuous tree cover in the context of extensive open grazing ground.

Figure 3. A mixed stand dominated by tropical ash is the only significant forest cover on the property.

4.3. Existing Forest Health and Function

As noted above, the only "forest" resources located on the property are either scattered ʻōhiʻa found on cliff faces or rocky slopes, a small stand of mechanically deteriorating Monterey pine on a ridge just north of the forest grove and the 14.8-acre grove of ash trees.

Resource Concern: Brush management, weed control. Tropical ash was planted in numerous locations during the mid-20th century. It is now listed as an invasive species. The grazing Parker herd has kept emergent seedlings in this planted stand under control. Stand replacement with native trees and control of volunteer tropical ash seedlings will be addressed in the management practices section.

4.4. Soils and Their Conditions

Geologically, the property is located on the north east flank of Mauna Kea on ash-covered lava flows. Soils on the property are classified by the U.S. Natural Resources Conservation Service (NRCS) as Honokaʻa silty clay loam in the lower elevations and Maile silt loam in the upper elevations. Both soil types are listed as "highly erodible." These soils have an 8-10% organic material content. This part of the island is noted as having a low risk of volcanic events (8 on a 1-9 scale) and a moderate earthquake hazard level (4 -moderate). There are no subsidence or landslide risks. The land is fully stocked with high-quality pasture grasses and there are no obvious signs of soil erosion or sediment transport. However, we suspect that erosion occurring under the grass sward on the ridges during large storm events. Sheet and rill erosion are minimal owing to the thick grass sward.

The following is paraphrased from the NRCS web soil descriptions:

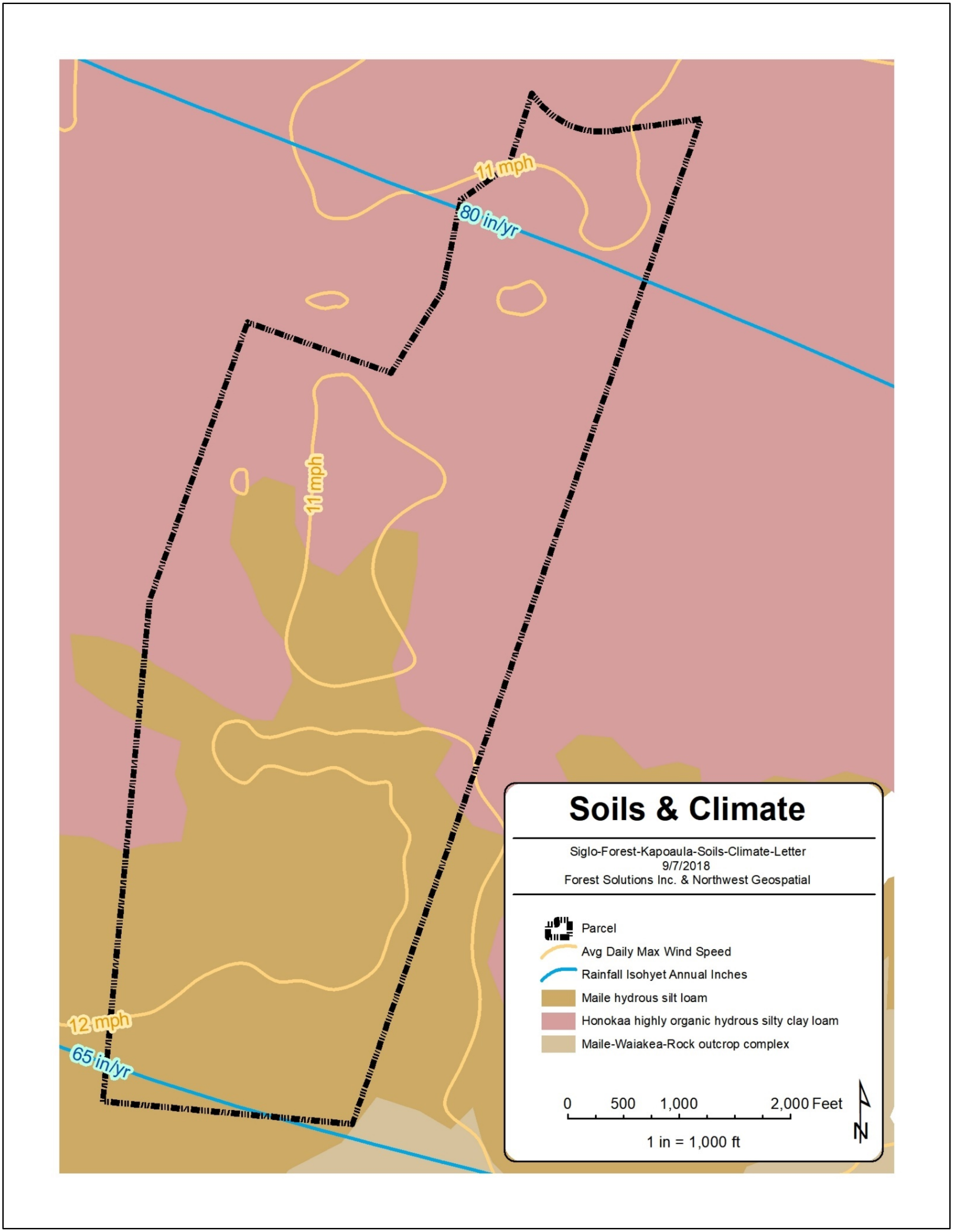
> *The HONOKAA series consists of deep, well drained soils that formed in basic volcanic ash. Honokaa soils are on mid-elevation, windward slopes of Mauna Kea at elevations from 335 to 1,222 meters (1,100 to 4,000 feet) and have slopes ranging from 0 to 35 percent. This humid volcanic ash soil is found on low and intermediate rolling mountain slopes in the Hāmākua and Mauna Kea Districts, Island of Hawaii. Honokaa soils are classified as "Well drained." Runoff is low to high. Permeability is rapid. Little standing water is present, even during high rainfall events.*
>
> *Steep and narrow drainage gulches dissect the landscape. The soils are on summit, shoulder, backslope, and footslope hillslope profile positions of ash fields that overlie 64,000 to 300,000 year-old lava flows. Slope gradients typically range from 0 to 35-percent but can be as great as 100 percent in gulches. The soils formed in basic volcanic ash. The mean annual rainfall is 2,000 to 3,800 millimeters (78 to 150 inches). The mean annual temperature is 16 to 22 degrees C (61 to 72 degrees F) and the mean annual soil temperature is 19 degrees C (66 degrees F).*
>
> *Honokaʻa soils are typically used for tree plantations and pasture. In the past, at lower elevations, they were used extensively for growing sugarcane (up to 640 meters – 2,100 feet elevation). Natural vegetation includes ʻōhiʻa lehua (Metrosideros polymorpha), hāpuʻu tree fern (Cibotium glaucum), Hilo grass (Paspalum conjugatum), and kikuyu grass (Pennisetum clandestinum).*
>
> *The MAILE series consists of deep and very deep, well drained soils that formed in basic volcanic ash over `a`a lava flows on Mauna Kea. Maile soils are on ash fields of mid elevation (915 to 1,375 meters – 3,000 to 4,500 feet), on windward mountain slopes of 0 to 20 percent. Mean annual rainfall is about 1,900 millimeters (75 inches) and mean annual temperature is 17 degrees C (63 degrees F). The soils are on all hillslope profile positions of undulating ash fields that overlie 11,000 to 300,000-year-old lava flows. Cloud cover and fog are common. The mean annual temperature is 16 to 18 degrees C (61 to 64 degrees F) and the mean annual soil temperature is 18 degrees C (64 degrees*

F). The Maile soils are well drained with low to medium runoff and moderately rapid permeability.

Maile soils are used principally for pasture and timber plantations. Some areas of native forest remain. The vegetation is dominated by kikuyugrass (Pennisetum clandestinum), rattailgrass (Sporobolus indicus), and sweet vernalgrass (Anthoxanthum odoratum) and Yorkshire fog (Holcus lanatus) at the higher elevations. Natural vegetation includes koa (Acacia koa), ʻōhiʻa (Metrosideros polymorpha), hāpuʻu tree fern (Cibotium glaucum), and ʻōlapa (Cheirodendron trigynum).

Resource Concern: Erosion. All site preparation, road and pond construction, planting, and silvicultural activities will be conducted with focused attention on maintaining soil in place and minimizing situations where these highly fertile and erodible soils will be disturbed. Best management practices will ensure that the high current level of organic material in the soil will be retained and that no sediments will escape the property through surface water transport.

Figure 4. The property presents deep, flat areas with pronounced ridges resembling the surface of a meringue pie. The flat areas will be used for timber, the ridges for mixed forest.



11 mph
80 in/yr
11 mph
12 mph
65 in/yr
Soils & Climate
Siglo-Forest-Kapoaula-Soils-Climate-Letter
9/7/2018
Forest Solutions Inc. & Northwest Geospatial
Parcel
Avg Daily Max Wind Speed
Rainfall Isohyet Annual Inches
Maile hydrous silt loam
Honokaa highly organic hydrous silty clay loam
Maile-Waiakea-Rock outcrop complex
0 500 1,000 2,000 Feet
1 in = 1,000 ft
N

4.5. General Slope and Aspect

The property is long rectangle with the northwest corner of about 95 acres previously subdivided as a separate TMK, now a quarry. It is oriented in a north to south direction, facing north, and running mauka from Old Māmalahoa Highway to the surveyed and fenced southern boundary. The elevation of the property fronting the highway, is approximately 2,740 feet. The mauka boundary, approximately 9,500 ft from the highway, is at elevation of 3,180 feet, a 440' elevation gain. The overall average slope of the property is 5% (440 elevation gain over 9,500 ft distance) with numerous intermittent steep hills and ridges up to 100% slope. A GIS analysis of the publicly available digital elevation model revealed the following slope classes:

Slope class	Acres	% Land area
0-10%	302	54%
10-20	162	29%
20-30	57	10%
30-40	29	5%
>40	14	2%

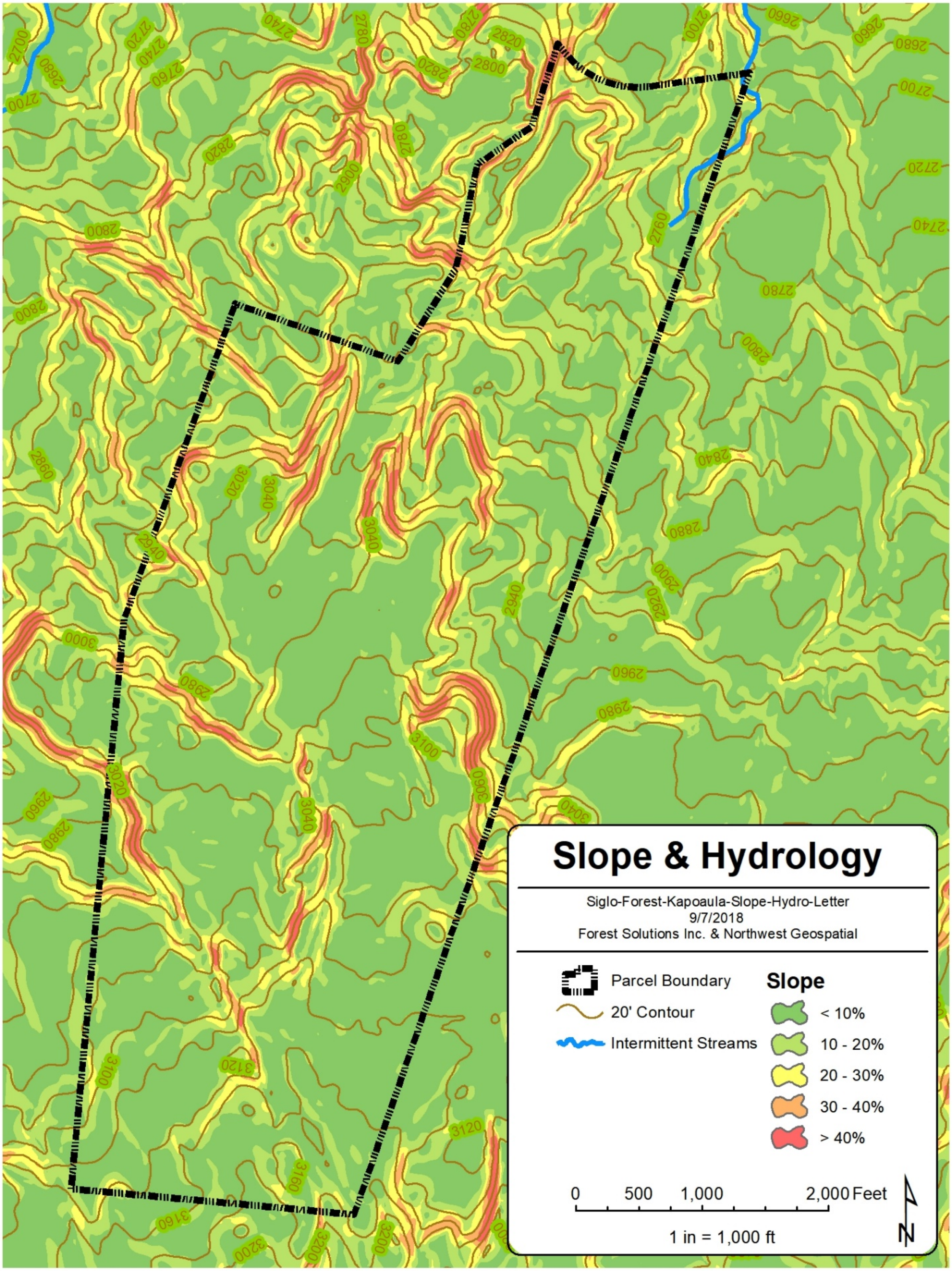
Table 1. Summary of land area by slope class

green = easy mechanical preparation (crawler/exc)

yellow = difficult mechanical preparation (excavator reach)

orange = hand planting only (some excavator reaching)

Resource Concern: Erosion and compaction. Soil disturbance is far more likely on steeper exposed and rocky areas. Intensive forest management activities will take place on those portions of the property <20% slope. Steeper areas will be accessed less often, and prepared using spot cultivation with minimal soil/topographic disruption.



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4.6. Water Resources

Kapoaula is located on the windward side of Hawaiʻi (see location map) and receives abundant rainfall. The average rainfall is 83 inches on the makai end of the property (2,740 feet) and 56 inches mauka at 3180 feet. Area rainfall averages approximately 70 inches per year. Mean annual rainfall in this location is quite high, ranging from above 4 inches per month in the comparatively dry summer months to more than 12 inches monthly in the relatively wetter months of November through March. The area is at virtually no risk of drought.

There is one small segment of blue-line intermittent gulch on the northeastern flank of the property, intersecting the highway, which does not significantly affect management activities as it is near the property boundary and no channel altering work is planned.

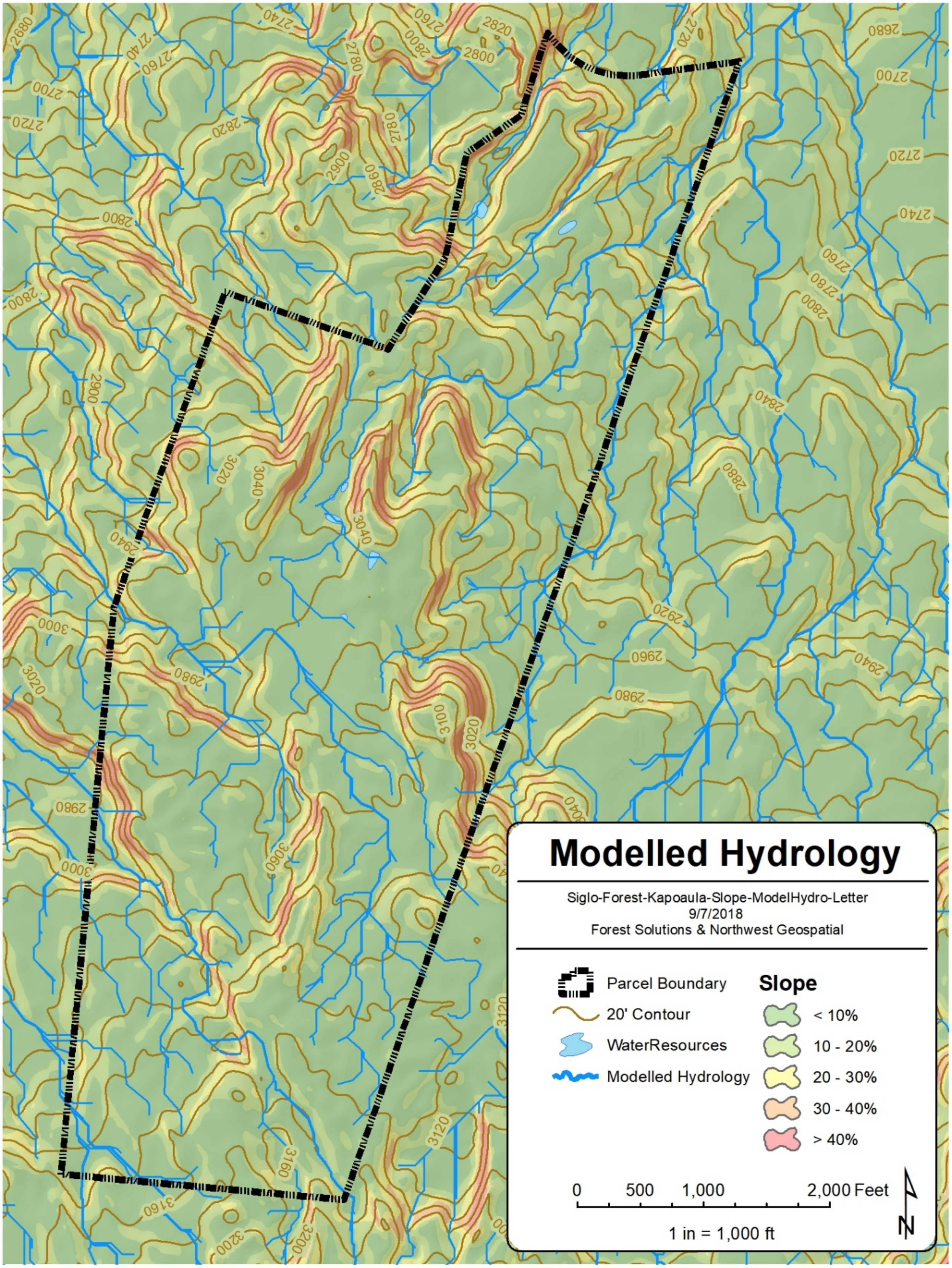
Model hydrology using NEXTMap 5-meter IFSAR bare earth Digital terrain Model (DTM) using catchment area of 1 acre shows a theoretical network of waterways along the depressions. However, the well-drained, highly permeable soils only allow water to accumulate and flow in these topographical depressions during storm events (see Modelled hydrology map). Observations during heavy rain events March-June, 2018, revealed small channels of surface water movement in these mapped areas. Increasing forest cover will likely reduce the flashiness of these channels and possibly eliminate overland flow altogether.

There are a number of un-named gullies on the property that flow only in storm events. There are no perennial streams or seasonal watercourses on the parcel other than the previously noted short blue-line gulch segment which is intermittent. There are no National Wetland Inventory wetlands.

Three un-lined stock watering ponds are located in the vicinity of the previously planted windbreak grove. (see Hydrology map). During wet season observation, these three ponds were partially full. They have not been observed during dry season to determine if they continue to hold water in the face of naturally well-drained soils and evapotranspiration. These ponds will not be planted or disturbed, rather they will continue to provide stock water and, as cattle are removed, habitat for native species.

Parker Ranch maintains a water supply system for stock watering, using remote county water sources and agreements with neighboring properties. This system has served the property for many years. Current plans for the property include the gradual removal of the Parker water system as cattle are removed.

Resource Concern: Lack of infiltration due to compaction. Loosening soil and planting a forest cover will reduce rainfall arriving at the soil level and improve infiltration. This, in turn, will reduce overland flow and provide a more steady water supply to nearby gulches should rainfall be sufficient.


Modelled Hydrology
Siglo-Forest-Kapoaula-Slope-ModelHydro-Letter
9/7/2018
Forest Solutions & Northwest Geospatial
Parcel Boundary
20' Contour
WaterResources
Modelled Hydrology
Slope
< 10%
10 - 20%
20 - 30%
30 - 40%
> 40%
0
500
1,000
2,000 Feet
1 in = 1,000 ft
N

4.7. Timber Resources

Except for the above-noted 14.8-acre grove of tropical ash, there are no timber resources currently on this property. Over the course of this management plan, the entire property will be reforested with approximately 70% of the area dedicated to commercial forest production of instrument quality koa. The ash stand will be converted to koa in year 8.

Figure 5. There is a stand of senescent tropical ash in the center portion of the property. This will be converted to koa in year 8. Below: There are a few clumps of Monterey pine that will also be removed and replaced with mixed koa forest. The conifers are not significant in quantity but do speak to the wind effects, see crowns of background trees.

Resource Concern: Koa timber supply, habitat. Reforesting with native koa and associated species will ensure that invasive species do not re-capture the site and provide habitat for native species. As each planted unit (+/- 50 acres/year over a 10-year period) reaches canopy closure (Year 3), native species will begin to re-inhabit the area and provide additional inputs of native species to enhance intentional planting efforts. The intention of this plan is to reforest the entire site and then manage it as a sustainable forest with small patch (< 1-acre) and individual tree selection harvests.

4.8. Wetland Resources

Except for the one "blue-line" intermittent gulch adjacent to the Old Māmalahoa Highway, there are no identified wetland resources on this property. Existing cattle stock watering ponds may provide an opportunity for enhancement as wildlife habitat and installation of a fire-control pond may also provide additional habitat opportunities.

Resource Concern: Potential habitat. There may be an opportunity to enhance on-site potential wetland resources. However, a site visit with NRCS biologist (May, 2018), seemed to indicate that fencing and protection of existing stock watering ponds to prevent predation by cats, mongoose and other invasive mammals, rather than the depeening and lining of the ponds may be the preferred way to address the possible use of these area by resident and migratory wildlife. Planting of trees will likely reduce or eliminate the ponds due to higher evapotranspiration.

4.9. Significant Historic and Cultural Resources

Based on the environmental history of this area which indicates an original “nearly impenetrable” ko-ʻōhiʻa forest and the fact that by the mid-19th century, this entire landscape was in the process of conversion from forest to pasture, there is little likelihood of any historic or cultural resources being found on the property. This property would have been part of the Wao Akua, or land of the gods, where most Hawaiians did not enter.

The Final Environmental Assessment and Anticipated FONSI prepared by DHHL for the Honokaia Non-Potable Water System (2016), prepared for property immediately adjacent to Kapoaula’s eastern property boundary states:

> “The entirety of the project site is utilized by Native Hawaiian lessees for grazing. The area is fenced off in order to protect cattle and rationalize grazing, and no public access is allowed. There is no indication that individuals other than the lessees and persons they allow to utilize the land gather or perform other cultural activities on the land. ***Research in historic records, reconnaissance of the sites, and discussions with lessees did not reveal any caves, springs, pu’u, native forest groves, gathering resources or other culturally significant features in or near the area***.” (emphasis added).

As part of the owner’s application to construct an access road and small saw mill on the northwest corner of the property (approximately 11.3 acres, not included in this Stewardship Plan), an application has been submitted to the State Historical Preservation Division (SHPD) to verify there are no archeological, burial or historic sites present on this entire 565-acre TMK. However, no formal archeological assessment has been conducted by the current landowner and none is known from the previous owner, Parker Ranch.

Resource Concern: None

4.10. Existing Wildlife

Because the entire property (except for 14.8 acres of non-native mature tropical ash) has been a managed cattle pasture for over a century, there is little evidence of native wildlife. On site visits earlier this year (March, May 2018), ʻio (*Buteo solitarius*) was seen on the property. There was also possible evidence (bird tracks in mud adjacent to stock ponds), of nēnē, though these could also have been from ducks. Hoary bats likely use the thick, non-native mature tropical ash stand as well.

Non-native bird species likely include Japanese bush-warbler (*Horornis diphone*), melodius laughing-thrush (*Garrulax leucolophus*), northern cardinal (*Cardinalis cardinalis*), common myna (*Acridotheres tristis*), Japanese white-eye (*Zosterops japonicus*), kalij pheasant (*Lophura leucomelanos*), and Erckel's Francolin (*Francolinus erckelii*).

Non-native mammals likely include black rat (*Rattus rattus),* small Asian mongoose (*Herpestes javanicus*), feral pigs (*Sus scrofa*), feral cats (*Felis catus*) and dogs (*Canis lupus*). Evidence of rats and possibly mongoose were seen along the fringes of existing stock ponds. A small herd of small, feral black pigs has been observed in this woodlot.

Resource Concern: Bird predation. A Biological Assessment will be carried out during the breeding and nesting season (winter/spring 2018-2019) to confirm these findings and establish a baseline population. Based on this information, vector control methods and/or protective fencing will be deployed to enhance bird survival.

4.11. Threatened and Endangered Species Existing on Property

Fauna:

ʻio – seen once, flying overhead near forest grove
Nēnē – not seen, possible tracks on pond fringe, though these could also have been from ducks
ʻopeʻapeʻa – not seen, likely use the thick tropical ash stand to roost

Flora:

None encountered thus far. It is unlikely that any threatened and/or endangered species would be encountered given the managed and manipulated aspects of this landscape over the past 150+ years.

Resource Concern: Habitat improvement. Property owner has already initiated preliminary discussions with USFWS regarding application for a Habitat Conservation Plan or Safe Harbor Agreement in anticipation of native plantings attracting currently listed or potentially listed wildlife.

4.12. Existing Recreational and Aesthetic Values

This property has been in private (Parker Ranch) ownership since the 1860's. The only recreational use has been occasional hunting of pigs by Parker employees and picnicking and small gatherings of employees and families in the ash grove. There is and has been no public use or access.

Aesthetically, the property has been described by local realtors and the surveyor who confirmed property corners and fence lines as "one of the most beautiful pieces of land they had seen on the island." Rolling, verdant pastures, separated by exposed cliff faces and small "meringue like" hills, with expansive views of the Waipio Bay/Kohala Mountains and the Pacific Ocean. At night, the lights from Waimea are visible from upper ridges and stars are readily visible as there is little nearby light pollution.

Open vistas will, over time, be reduced or eliminated by rapidly growing koa and other woody species. This will produce its own aesthetic complex that will be the subject of interpretive signage and other informational material.

Resource concern: None

4.13. Infrastructure and Access Conditions

As noted above, the mauka boundary of Kapoaula is defined by the easily accessed Old Māmalahoa Highway, which is asphalted and publicly maintained. Presently, there is a 5-strand barbed wire perimeter fence with one standard pipe gate entry located approximately midway between the eastern and western property corners. The historic road layout creates a blind corner from each direction, making the narrow pull out area adjacent to the fence quite dangerous for loading and unloading equipment. Projected plans include widening this pull-out area and pulling back the fence line to accommodate low-boy trailer equipment delivery. The interior of the property has only unimproved jeep and cattle trails. There are no graveled roads.

As shown on the attached maps, approximately 11.3 acres for a mill site and access road have been removed from the active forest management regime. The mill site will be self-contained with on-site power and water. There are no projected plans for bringing public water or power to the site owing to prohibitive cost.

Resource Concern: Minimizing transport of any sediments off-site onto a public road. Ensuring safe and easy access for highway vehicles (cars and trucks) as well as for delivery of equipment for on-site work. Such work will be conducted outside of the auspices of this management plan.

5. Management Objectives and Practice

5.1. Overview

Kapoaula was purchased with expressed intention of creating a dedicated, sustainable koa forest for musical instrument wood. This project will plant, over a ten (10) year period, the entire 553 acres of available land with koa and a range of associated native plants (11.3 additional acres are reserved for a saw mill site and access road). The project will combine the production of timber in a plantation format with mixed native forest plantings in less accessible areas. Over time – decades or century – we anticipate the colonization of the plantation area with the enrichment species from the mixed forests, from bird droppings and natural plant colonization. We call this a kīpuka restoration strategy whereby nuclei of enriched koa stands extent out and into the adjoining koa plantation stands.

As cattle are removed from the land and replaced by trees, compaction, erosion and animal organic wastes will be eliminated with positive consequences for water quality. Incorporating intentional plantings of native species favored by birds and insects will dramatically improve wildlife habitat. Windbreaks planted on strategic ridges will allow the koa trees to grow with minimum wind-caused distortion. Historic stock watering ponds may be enhanced with perimeter plantings and predator proof fencing and traps to favor migratory and resident waterfowl.

Beginning in year 30-35 a selection harvest is planned, emphasizing tree quality and stand vigor, while also removing useable koa wood. This will cause the natural regeneration of a cohort of koa trees, which will be repeated more or less every 15 years to create a continuity of canopy closure over space and time.

Ideally this project will inspire others. Early indications are that neighboring property owners are now also contemplating planting native trees on their DHHL pastoral leaseholds. Such plantings will leverage and expand the environmental gains provided by this project.

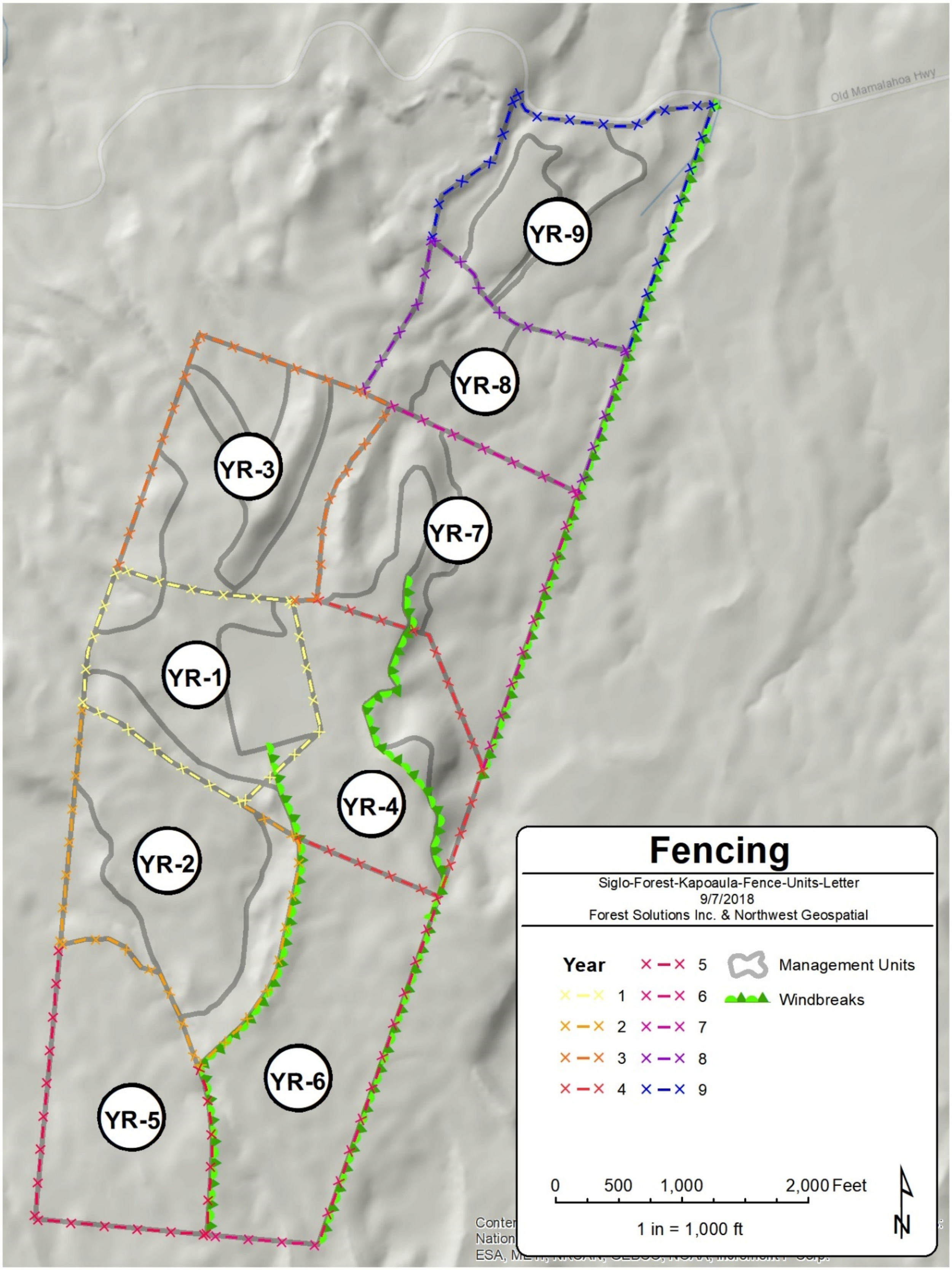
5.1.1. Fence units

There is active and obligate grazing on the property, which will be rolled back sequentially as the forest is planted. To keep grass sward and woody weeds under control and to maintain the land-use designation, cattle will continue to graze the property until it is planted out. Therefore, for each successive year a standard 5' hogwire fence with a smooth top wire and barbed ground wire is planned. This will remove cattle and pigs from each regenerated area, protecting both the timber and non-timber species.

The sequence of fencing is important. In order to minimize wind effects, orographic conditions are exploited in years 1-4, where hills are used to “hide” new plantings from the wind while the windbreaks develop stature. Starting in year 5, plantings will be behind windbreaks.

Table 2. Proposed fence units

Year	Fence ft	Acres
1	5,947	53
2	6,173	71
3	5,451	64
4	4,376	60
5	4,890	59
6	3,802	77
7	3,957	70
8	4,408	46
9	5,211	63
Total	44,215	564


Old Mamalahoa Hwy
YR-9
YR-8
YR-3
YR-7
YR-1
YR-4
YR-2
YR-6
YR-5
Fencing
Siglo-Forest-Kapoaula-Fence-Units-Letter
9/7/2018
Forest Solutions Inc. & Northwest Geospatial
Year
1
2
3
4
5
6
7
8
9
Management Units
Windbreaks
0
500
1,000
2,000 Feet
1 in = 1,000 ft
N

5.1.2. Forest management units

To accomplish the koa and other native vegetation re-establishment objectives outlined for this plan, specific management activities will be implemented on each designated unit. To facilitate field operations, budgeting, and progress reporting, the property has been divided into a series of numbered units, called Forest Management Units or FMU's. A unique identifying number is assigned to each FMU. (See 10-year Forestry Plan Map and implementation schedule).

The first number indicates the silvicultural regime

1 = koa timber emphasis
2 = koa with native species mixed forest
3 = existing non-native trees (ash stand) – special case FMU scheduled for conversion to koa in year 8
7 = mill site – not part of management plan

The second number indicates the year the plantings will occur

year 1-9, roughly equivalent to fence unit

The third number indicates the sub-unit within a specific year's planting

Examples:

Unit 242 is a koa mixed species unit, planted in year 4 it is the second of two similar units

2 – Mixed forest silviculture

4 – Year 4 planting

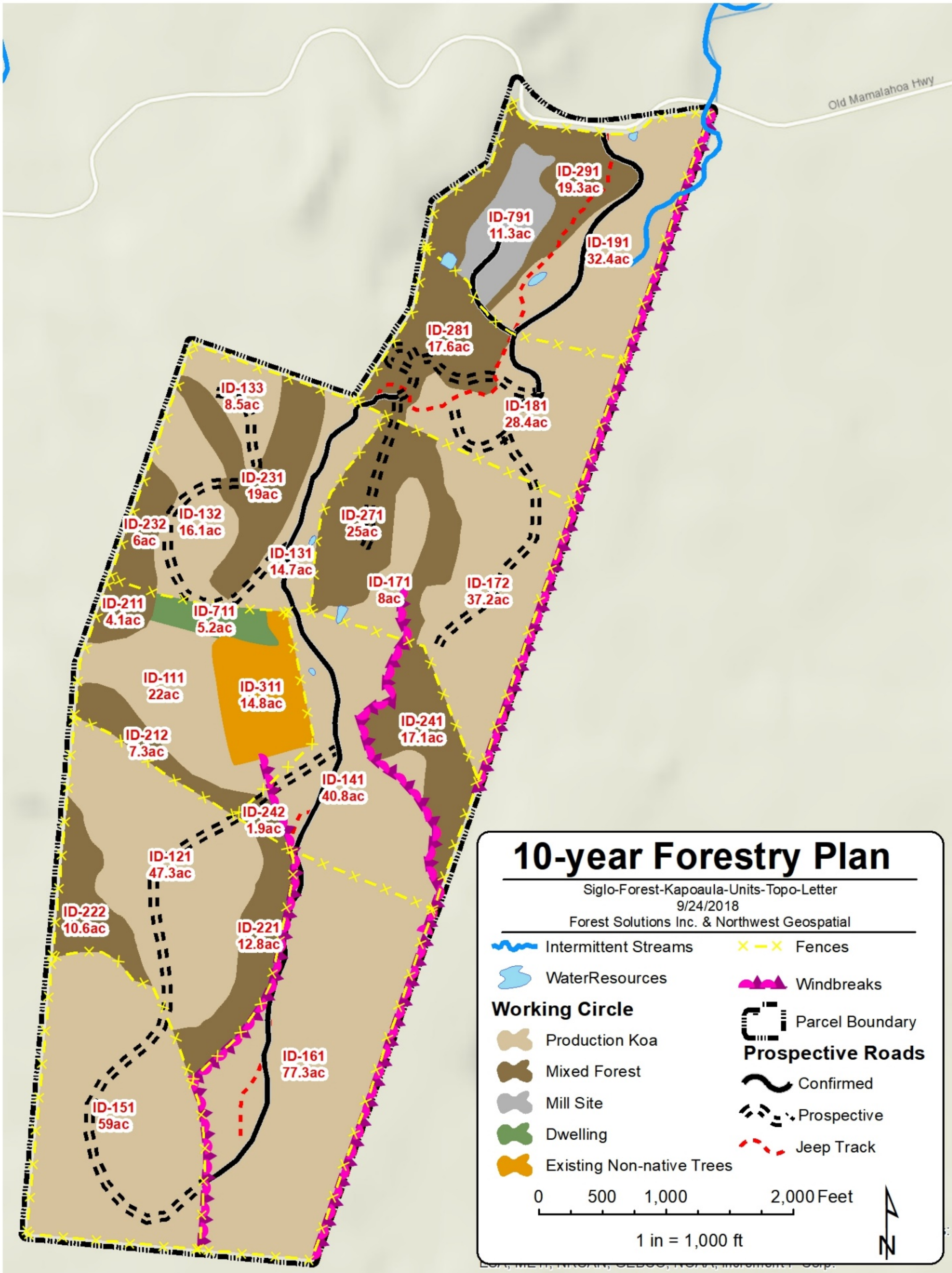
2 – Second unit

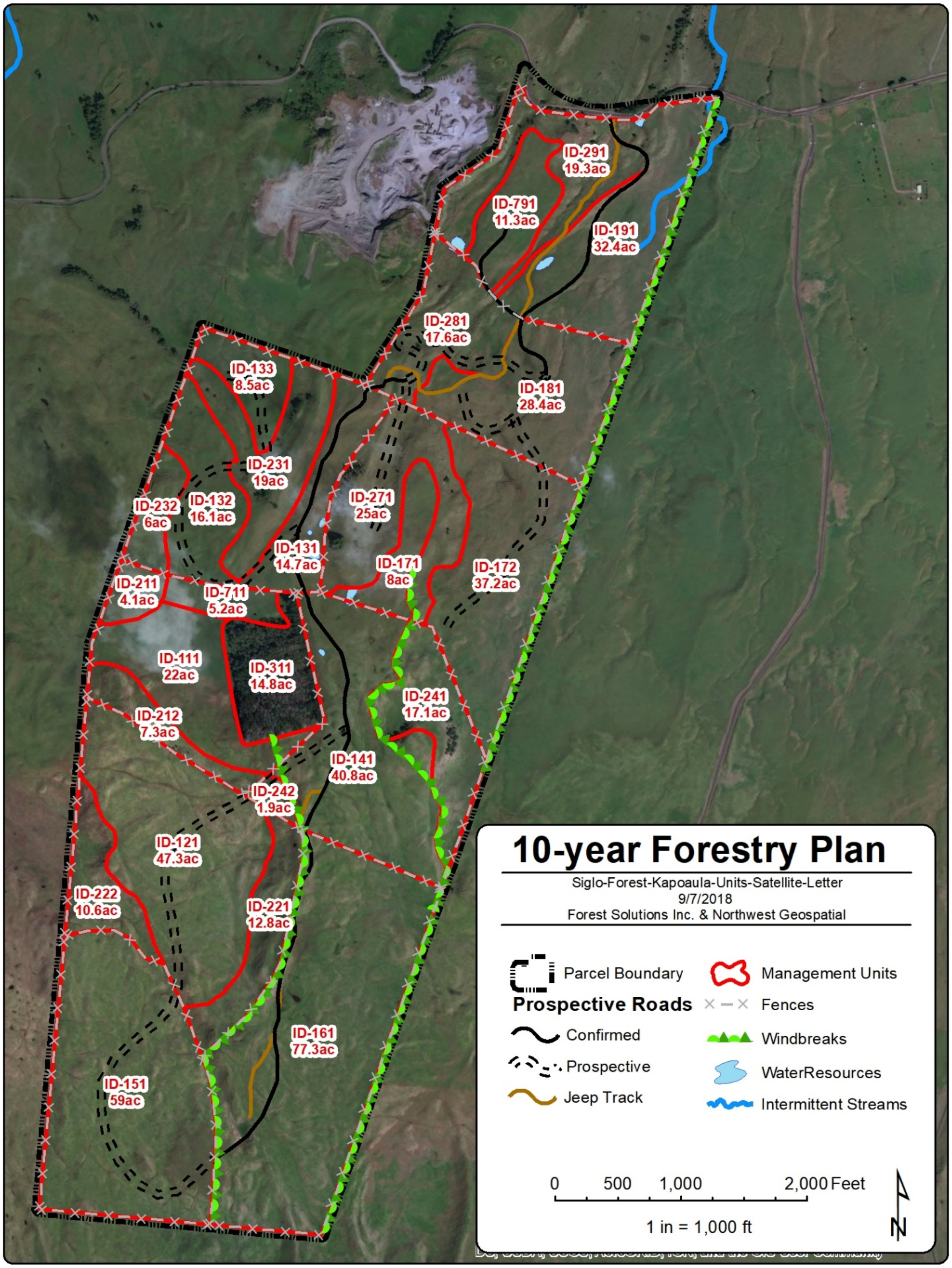
Unit 131 is a koa timber stand to be planted in year 3, it is the first sub-unit.

1 – Koa plantation silviculture

4 – Year 3 planting

2 – First (maybe only) unit


Old Mamalahoa Hwy
ID-291
19.3ac
ID-791
11.3ac
ID-191
32.4ac
ID-281
17.6ac
ID-181
28.4ac
ID-133
8.5ac
ID-231
19ac
ID-232
6ac
ID-132
16.1ac
ID-271
25ac
ID-131
14.7ac
ID-171
8ac
ID-172
37.2ac
ID-211
4.1ac
ID-711
5.2ac
ID-111
22ac
ID-311
14.8ac
ID-241
17.1ac
ID-212
7.3ac
ID-141
40.8ac
ID-242
1.9ac
ID-121
47.3ac
ID-222
10.6ac
ID-221
12.8ac
ID-161
77.3ac
ID-151
59ac
10-year Forestry Plan
Siglo-Forest-Kapoaula-Units-Topo-Letter
9/24/2018
Forest Solutions Inc. & Northwest Geospatial
Intermittent Streams
Fences
WaterResources
Windbreaks
Working Circle
Parcel Boundary
Production Koa
Prospective Roads
Mixed Forest
Confirmed
Mill Site
Prospective
Dwelling
Jeep Track
Existing Non-native Trees
0
500
1,000
2,000 Feet
1 in = 1,000 ft
N


10-year Forestry Plan
Siglo-Forest-Kapoaula-Units-Satellite-Letter
9/7/2018
Forest Solutions Inc. & Northwest Geospatial
Parcel Boundary
Management Units
Prospective Roads
Fences
Confirmed
Windbreaks
Prospective
WaterResources
Jeep Track
Intermittent Streams
0 500 1,000 2,000 Feet
1 in = 1,000 ft
N
ID-291 19.3ac
ID-791 11.3ac
ID-191 32.4ac
ID-281 17.6ac
ID-133 8.5ac
ID-181 28.4ac
ID-231 19ac
ID-232 6ac
ID-132 16.1ac
ID-271 25ac
ID-131 14.7ac
ID-171 8ac
ID-172 37.2ac
ID-211 4.1ac
ID-711 5.2ac
ID-111 22ac
ID-311 14.8ac
ID-241 17.1ac
ID-212 7.3ac
ID-141 40.8ac
ID-242 1.9ac
ID-121 47.3ac
ID-222 10.6ac
ID-221 12.8ac
ID-161 77.3ac
ID-151 59ac

6. Detailed practices and objectives

6.1. Summary of stands, activity year and objective

Table 3. Detail of Forest Management Units (FMUs), prescriptions and areas. Colors differentiate between fence units. There are several FMUs within each fence unit.

FMU	Type	Year	Fence unit ac	Perimiter ft	FMU ac	Type	Objective
111	1	1	53.4	5,947	22.0	koa timber	high quality koa timber on 40-60 year rotation
211	2	1			4.1	native forest	native forest and timber
212	2	1			7.3	native forest	native forest and timber
711	***7***	***1***			***5.2***	***dwelling***	***not part of management plan***
121	1	2	70.7	6,173	47.3	koa timber	high quality koa timber on 40-60 year rotation
221	2	2			12.8	native forest	native forest and timber
222	2	2			10.6	native forest	native forest and timber
131	1	3	64.3	5,451	14.7	koa timber	high quality koa timber on 40-60 year rotation
132	1	3			16.1	koa timber	high quality koa timber on 40-60 year rotation
133	1	3			8.5	koa timber	high quality koa timber on 40-60 year rotation
231	2	3			19.0	native forest	native forest and timber
232	2	3			6.0	native forest	native forest and timber
141	1	4	59.7	4,376	40.8	koa timber	high quality koa timber on 40-60 year rotation
241	2	4			17.1	native forest	native forest and timber
242	2	4			1.9	native forest	native forest and timber
151	1	5	59.0	4,890	59.0	koa timber	high quality koa timber on 40-60 year rotation
161	1	6	77.3	3,802	77.3	koa timber	high quality koa timber on 40-60 year rotation
171	1	7	70.1	3,957	8.0	koa timber	high quality koa timber on 40-60 year rotation
172	1	7			37.2	koa timber	high quality koa timber on 40-60 year rotation
271	2	7			25.0	native forest	native forest and timber
181	1	8	46.0	4,408	23.6	koa timber	high quality koa timber on 40-60 year rotation
182	1	8			4.4	koa timber	high quality koa timber on 40-60 year rotation
281	2	8			13.2	native forest	native forest and timber
282	2	8			4.8	native forest	native forest and timber
311	3	8	part of unit 1	part of unit 1	14.8	ash stand	replace ash with koa timber
191	1	9	63.5	5,211	26.1	koa timber	high quality koa timber on 40-60 year rotation
291	2	9			19.3	native forest	native forest and timber
292	2	9			6.8	native forest	native forest and timber
791	***7***	***9***			***11.3***	***sawmill & dwelling***	***not part of management plan***
			564.1	**44,215**	**547.6**	**Stewardship sub-total**	
791	7	9	part of unit 1		11.3	sawmill	not part of management plan
711	7	1	part of unit 9		5.2	dwelling	not part of management plan
				Property total:	**564.1**	**Entire TMK area**	

6.2. Summary of stocking & seedling needs

Table 4. Forest Management Units (FMUs), area and stocking

FMU	Type	Year	Area (ac)	Koa stocking	Other stocking	Koa seedlings	Other seedlings
111	1	1	22.0	350	50	7,700	1,100
211	2	1	4.1	125	75	510	300
212	2	1	7.3	125	75	920	550
311	3	1	14.8	650	50	9,620	740
121	1	2	47.3	350	50	16,560	2,370
221	2	2	12.8	125	75	1,610	960
222	2	2	10.6	125	75	1,320	790
131	1	3	14.7	350	50	5,140	730
132	1	3	16.1	350	50	5,650	810
133	1	3	8.5	350	50	2,970	420
231	2	3	19.0	125	75	2,380	1,430
232	2	3	6.0	125	75	750	450
141	1	4	40.8	350	50	14,280	2,040
241	2	4	17.1	125	75	2,140	1,280
242	2	4	1.9	125	75	230	140
151	1	5	59.0	350	50	20,640	2,950
161	1	6	77.3	350	50	27,050	3,860
171	1	7	8.0	350	50	2,790	400
172	1	7	37.2	350	50	13,030	1,860
271	2	7	25.0	125	75	3,120	1,870
181	1	8	23.6	350	50	8,260	1,180
182	1	8	4.4	350	50	1,530	220
281	2	8	13.2	125	75	1,650	990
281	2	8	4.8	125	75	590	360
191	1	9	26.1	350	50	9,120	1,300
291	2	9	19.3	125	75	2,410	1,450
292	2	9	6.8	125	75	850	510
Total/avg:			**547.6**	**297**	**75**	**162,820**	**31,060**

6.3. Site Preparation

Objective: Ensure former pasture ground is suitably prepared and cultivated to accept and support koa and other native seedlings

Practice- Tree and Shrub Site Preparation: NRCS Practice 490

This operation consists of two phases, initial weed control and soil cultivation.

Weed control:

Herbaceous ground cover control must occur before ripping or spot cultivation to increase effectiveness of the mechanical treatment and reduce weed competition on planted trees. Two to four months prior to any cultivation, a pre-planting herbicide application to control herbaceous vegetation and grass cover in production planting areas will be carried out using a combined mixture of imazapyr and glyphosate (Roundup). This application should occur in April to May.

Figure 6. Mechanical site preparation reduces planting costs and improves tree growth and wind resistance by improving root penetration. These effects are expressed in the first 5-10 years of growth.

Mechanical site preparation[1]:

The purpose of this practice is to improve site conditions to be suitable for the purposeful establishment of desired trees and shrubs. In the case of Kapoaula, the entire property, except for exposed rocks and cliffs, is densely covered with long established cattle pasture. Because of the history of cattle grazing and associated compaction, deep ripping and bedding or deep spot cultivation will be required to assure that koa roots have a minimally compacted soil profile to penetrate. Depth of this operation should be at least 24 inches (60cm) and ideally 36 inches (90 cm) to provide for ease of root penetration and enhanced growth.

After the vegetation has died and begun to decompose, a tractor pulling long shank ripper and bedding plow (line cultivation) or an excavator equipped with a spot cultivation attachment (“chicken foot”) will be used to prepare planting spots at a spacing of approximately 10’ x 11’ and average stem density of 400 spots (trees) per acre for timber stands. On slopes of 20% or greater, where a mixed forest is the objective, stocking will drop to 200 trees per acre, roughly 15 x 15. Site preparation should not take place more than 2 months before first planting, cultivation by either means must prepare soils to a depth of 24”–36”, depending on substrate and operating conditions. Better the site preparation will be evident in the medium and long-term stand performance, where enhanced root penetration results in taller, more wind-firm trees.

Figure 7. Spot cultivation, using a specialized tool built for the purpose will be used in less accessible terrain and reaching onto steeper slopes. Ripper shank is 3 ft (90 cm) long, proving ample rooting depth early on, improving tree growth vis hand prepared soil which is never able to achieve the depth.

[1] Mechanical site preparation will require an approved Soil and Water Conservation Plan

6.4. Windbreaks

Objective: Protect young seedlings and saplings from occasional high winds, improve stem architecture and shelter native forest stands from storms.

Practice: Windbreak/Shelterbelt Establishment: NRCS Practice 380

The combined factors of regional lack of tree cover, 3,000' elevation, and persistent and occasionally gusty trade winds from the east create challenging conditions for minimizing wind stress on young seedlings and saplings. As a fast growing, vertical species, koa is particularly susceptible to deformation and leader damage due to strong winds.

The operational plan is based on installing early koa plantings in those areas already orographically protected from wind (see Fencing units map sequence). Most of the site after fence unit 4 (year 5 on)is, quite exposed to wind. The traditional name for these legendary winds with driving rain is "kipu'u pu'u, the name King Kamehameha gave his first-in-battle assault soldiers who trained in these harsh conditions.

Minimizing wind stress on young trees can protect plants from wind-related damage and alter the microenvironment to enhance plant growth. Wind protection can be accomplished by planting fast-growing wind breaks on strategic high points and ridge crests. Luckily, the topography of the land seems to run perpendicular to prevailing wind conditions, thus providing a suitable setting for installation of windbreak plantings.

The intention of this plan is to install all windbreak plantings within the first year to develop evolving protection for future plantings as rapidly as possible, certainly by year 5. In addition, as protected koa plantings become established, they will provide some additional protection for subsequent plantings. They will be planted in 3 rows, with one species per row. Rows will be 10 ft apart and trees will be 20 ft apart along the row. Trees will be arranged so as to alternate with each other.

Windbreak/shelterbelt species by row, from shortest to tallest, from east to west row

1. Podocarpus (*Podocarpus gracilior*) – WRA 0 low windbreak, medium growth rate
2. Tallow-wood (*Eucalyptus microcorys*) – WRA 1
   or blood-leaf gum (*Eucalyptus torelliana*) – WRA 4 medium windbreak, fast growth
3. Norfolk Island Pine (*Araucaria heterophylla*) – WRA -5 tall windbreak, medium growth rate
   or Chinese fir (*Cunninghamii lanceolata*) – no WRA available

Rule of thumb calculations for windbreaks indicate a wind protection distance of 10x the height of mature trees. As shown on 10-year forestry plan map, ridge crest planting locations will, over time, provide shelter for the entire site, assuming the araucaria and gum plantings reach a height of 100+' after the first 20 years of establishment.

6.5. Fencing

Objective: Exclude domesticated, feral and non-native mammals from the growing restored native forest

Fence - NRCS Practice 382

6.5.1. Cattle

The property has been a cattle ranch since the mid nineteenth-century. The property is perimeter fenced with 5-strand barbed wire. Some sections of fence are adequate; some in need of repair. An agreed upon condition of purchase earlier this year (2018) was that Parker Ranch can continue to graze cattle on those sections of the property not yet scheduled for afforestation. On the three sides of the property not fronting the Māmalahoa Highway, DHHL pastoral lessees run cattle and horses in various conditions of husbandry. Exclusion of cattle is a fundamental requirement for successful koa forest re-generation.

Table 5. Summary of fencing units

Year	Fence ft	Acres
1	5,947	53
2	6,173	71
3	5,451	64
4	4,376	60
5	4,890	59
6	3,802	77
7	3,957	70
8	4,408	46
9	5,211	63
Total	44,215	564

Investment in a koa forest at this scale will require the highest level of protection from cattle or sheep. A small herd of black feral pigs were observed. To protect the investment in select growing stock and especially sensitive native understory species, pigs must also be excluded from the planting.

A perimeter 5-foot hogwire fence with smooth wire for stability on the top and barbed wire at ground level (outside) to deter pig grubbing will be installed in each fence unit (see Fence map). This fence will also serve to exclude neighboring cattle. Every year fences will be inspected and maintained if needed. A formal maintenance entry is planned starting in year 5 (four years after installation), including tightening wires, fixing loose sections and re-staking sections that have come loose.

Cattle are an essential management tool to execute this reforestation stewardship plan. They will keep pasture grasses and invasive woody species, especially topical ash (*Fraxinus uhdei*), sourbush (*Pluchea carolinensis*) and guava (*Psidium guajava*) under control until a unit is scheduled for site preparation and planting. An essential and critical protection aspect for this significant investment is a system of cross fencing to create paddocks that securely contains cattle from temptation grazing on adjacent koa saplings.

As each subsequent pasture unit is converted to koa forest, cattle will be replaced by native vegetation. At the end of this ten (10)-year plan, all cattle will be eliminated from the property and a permanent fencing system will be in place to localize, contain, and minimize any potential cattle trespass that might occur from adjacent pastoral leasehold herds.

6.5.2. Other mammals

Signs of several deleterious mammals have been noted during site visits, particularly around and near the open stock watering ponds. These include rats (*Rattus rattus* and possibly *Rattus norvegicus*), feral pigs (*Sus scrofa*), mongoose (*Herpestes javanicus*), and cats (*Felis catus*) it is likely that loose or feral dogs (*Canis lupus*) also visit the ponds.

Most of these species do not represent, at this time, a threat to the forest restoration objective of this project, aside from pigs which uproot tender seedlings, and rats which occasionally chew bark on koa trees.

The long-term objective of a restored koa-ʻōhiʻa forest means that, over time, there will be an increase in native bird habitat which may, in the future, be affected by the presence of rats and cats. Rats eat tree fruits and seeds as well as eggs and nestlings. Cats eat birds at various life stages. As native forest areas are restored and enriched during the course of this project, invasive animal control protocols may be necessary.

Recent experience in New Zealand and in Hawaiʻi with “Good Nature” traps have shown great success in controlling rodent and cat damage using humane means. These traps use a CO_2 cylinder to power a strike bolt that instantly kills animals attracted to the bait. The design allows for upwards of 12 kills/trap before requiring re-arming. As native and migratory birds begin to frequent the property, vector control will be used to reduce the population of these mammals to promote a safe haven for nesting and foraging. In addition it may be prudent to incorporate this control feature on the high-value, select “elite” seedlings planting sites to avoid bark damage by rats.

Due to the low cost, location specificity and iterative nature of vector control, this is included under the monitoring and not separated as a budget item in this management plan. Most of the cost, as with other monitoring activities, is in the technician time needed to get the work done.

6.6. Tree/Shrub Establishment

Objective: Re-establish a koa-dominant forest with ʻōhiʻa and associated native understory on land historically managed as cattle pasture.

Practice- Tree/Shrub Establishment: NRCS practice 612

Hand planting will be carried out using a tree spade or dibble as appropriate for the available nursery stock. Soil surface should be perforated to a depth slightly greater than the length of the seedling stock and the seedling should be placed into this hole. The root collar should be marginally lower than the level of the soil (between 1/8-1/4" with the root mass oriented vertically so the tip of the root does not bend outward ("J - rooting"). Soil is then compacted lightly around the root system. Subsequent silvicultural activities will include fertilizer application, competition control, timber stand improvement (pruning), and native species enhancement.

Koa and mixed forest plantings will be planted at the same time, the only difference being their spatial arrangement and seedling count. Mixed forest stands, as their name implies should be a mix of species across the area, not a patchwork of monotypic stands.

Table 6. Summary of stocking by stand type and relative area occupied by each stand type

Type	Description	Seedlings/acre Koa	Seedlings/acre Other	Acres
1	Timber	350	50	385
2	Restoration	125	75	148
3	Timber (ash)	650	50	15

6.6.1. Seedlings & seed sourcing

Seeds need to be collected in advance to allow adequate time for growth in the nursery setting. There are very limited supplies of ʻōhiʻa on the property, and no koa. Therefore, seedlings will be grown from collected seed supplies with first preference for the Waimea area followed by upper elevations in Hāmākua and then Kaʻu. Paniolo Forestry currently has a working relationship with Native Nursery on Maui, who will supply most of the seedlings. Additionally, in a meeting with the local charter school, Kanu o ka ʻĀina, they have expressed interest in growing and planting enrichment seedlings using students.

Koa seed procurement strategy is to keep sources as local (Island of Hawaii) as possible. There are several reasons for this: increased project flexibility by having a stable source of seedlings, safeguarding against outside pathogen spread (especially Rapid ʻōhiʻa Death [ROD]), promoting genetically conserved adaptations to local conditions, and introducing volunteers to this aspect of forestry. However, the laudable objective of using locally sourced seedlings must not come at the expense of achieving overall forest management goals. Because the overall project goal is to produce the highest quality koa wood with desirable characteristics, seed sources from other islands may also be included into yearly plantings to ensure as robust a genetic base as possible.

In addition, working relationships with Haleakala Ranch and Kamehameha Schools have generated propagation material from selected "elite" lines of koa which show desired and valuable characteristics such as figure, color, and vertical form. The Haleakala stock was originally propagated from Island of Hawaii seedstock 32 years ago. These selected lines of improved planting stock will be planted in identified highest-quality growing areas for propagation purposes. One or several seed orchards are contemplated as part of this project to capture and track the progress of these elite genetic sources.

Seedling size will necessarily depend on the species in question: Pioneer species such as koa will be 25-30 cm in height with a small dibble pot size of 65-100 cc, which is sufficient for a more aggressive species. Enrichment and enclosure species will be in 20-40 cm in height in a small to medium pot of 200 to 500 cc, with the objective of providing an older, more robust seedling for these more sensitive species. At least nine months should be allowed for māmane and ʻōhiʻa seedlings; six months for maile, ʻolapa and pilo seedlings; and three to four months for koa seedlings.

6.6.2. Koa Plantings

Koa and aʻaliʻi seedlings will be planted three to six months after weed control and site preparation. The planting sequence will begin with spot cultivation of planting sites for individual seedlings. Approximately 10' x 11' (3.3 m x 3.5 m) spacing will yield the target 400 spots per acre, of which 350 are for koa and 50 are for aʻaliʻi, mixed. However, natural variations in site will result in densities that are slightly higher or lower than the target.

Each koa or aʻaliʻi seedling will then be manually planted along the line or in the prepared hole. Hand planting crews will use a tree spade or dibble as appropriate for the nursery stock. Mechanical site preparation facilitates planting, and it is expected that rates will exceed 800 trees planted per day on flatter ground (<20% slope). Production will drop to 500 trees per day on sloping soil, and 200 in areas where machine site preparation is not possible and hand preparation will be needed.

Standard planting techniques will be followed, with planting holes dug to the depth of the seedling root stock, root collars buried marginally lower than the level of the soil, and all seedlings oriented vertically. After seedlings are placed in the ground, loose soil will be firmly packed around the roots to bring the root collar level with the soil surface.

6.6.3. Mixed forest plantings (kīpuka enrichment planting)

At this time, the only significant native vegetation on the property are scattered ʻōhiʻa, found mostly on cliff faces and steep, rocky areas. Given the history of Parker Ranch pasture management and grazing for over 150 years, it is assumed that seed sources for native understory plants will be non-existent, thereby requiring use of seedlings for enrichment species.

The goal for enrichment species establishment is a net average of 75 trees per acre on those units with slope >20%. Koa will be used as a pioneer species to carry the stand and provide initial cover, planted at a density of 125 trees/acre.

The focus is to initiate a trajectory of recovery to re-create the native forest that once stood on this land, thereby providing habitat for native species and improving the overall environmental quality of the property, including aquifer recharge, and erosion control. These ridge units will effectively serve as "kīpukas", islands of native vegetation, which, slowly, over time, will provide seed sources and spread throughout the site.

The following list of proposed enrichment species is representative, in order of planned abundance, other species will also be utilized as appropriate for the site and as available.

- ʻŌhiʻa (*Metrosideros polymorpha)*
- Aʻaliʻi (*Dodonaea viscosa*)
- Māmaki (*Pipturus albidus*)
- ʻŌlapa (*Cheirodendron triginum*)
- Kōlea (*Myrsine lessertiana*)
- ʻiʻo nui (*Dryopteris wallichiana*)
- ʻŌhelo (*Vaccinium calycinum*)
- Hōʻawa (*Pittosporum glabrum*)
- Pilo (*Coprosma montana*)
- Ulei (*Osteomeles anthyllidifolia*)
- Maile (*Alyxia stellate*)
- ʻIeʻie (*Freycinetia arborea*)
- Hāpuʻu pulu (C*ibotium glaucum*)
- Hāpuʻu iʻi (*Cibotium menziesii*)
- Iliahi (*Santalum paniculatum*)

6.7. Nutrient Management

Objective: Provide koa and other seedlings with nutrient inputs to ensure health and productivity while minimizing non-point pollution of surface and groundwater

Practice- Nutrient Management: NRCS practice 590

Long-term grazing has reduced soil fertility in this area and post-planting fertilizer application reduces the future weed control burden by helping seedlings to grow more quickly to heights at which weed competition is less intense. Application using controlled release fertilizer (CRF) will minimize movement of nutrients and other potential contaminants to surface and/or groundwater.

At planting, a crown fertilizer treatment assists with early seedling growth and development, and will consist of a 4-ounce (120 gram) dose of high phosphate (11-52-00 or similar) CRF distributed evenly within a 12" diameter area centered on the seedling stem, or, on slopes, a half-moon shape on the uphill side of the seedling. The property is located in a high-rainfall area (70" or more per year), so nutrient leaching is a concern, which is partially mitigated by the use of CRF fertilizers.

If an unlikely second application is needed, the crown application will be 6 ounces (180 grams) per seedling of 11-52-0 with micronutrients or other high-phosphate, low potash mix with micronutrients at 6 ounces per seedling CRF.

6.8. Weed Control

Objective: Control herbaceous weed competition until canopy closure and establishment of trees and shrubs

Practice- Herbaceous Weed Control: NRCS Practice 315;

Creating a "new" koa forest on previously pastured and grazed land will require significant inputs of weed control agents to ensure the successful survival and health of the newly-planted seedlings. Site preparation activities will temporarily diminish competitive herbaceous weed pressure through chemical and mechanical means. However, in the months following planting, there will be inevitable recurrence of resident grasses that will need attention.

For timber stands, a single weed control (aside from that applied during site preparation) application will be used. For mixed species restoration stands, which feature lower stocking and slower growing species, two entries will be used in the first year. All stands will receive two further entries during the Integrated Pest Management (IPM) applications, which also include control of psyllids, anticipated for the second and third years.

Figure 8. Ground control works very well if the terrain is less than 20% slope, the limit for rubber tire equipment.

Selective or broad-spectrum herbicides, depending on actual weed pressure will be used as needed for post-planting competition control until trees are two years old or until the canopy has closed. Grasses will be the main targets for this operation; annual herbaceous species such as bull thistle and fireweed in moderate numbers are not as damaging to young seedlings. A manual spot treatment is an option for outbreaks of broadleaf weeds in early development stage (less than 10 ft height).

Because of the history of pasture management, the dominant weed species on site are grasses. Herbicides with grass-specific modes of action may, therefore, be applied over the entire planting area. These compounds do not affect broadleaf biochemistry and are thus safe to use without chemical barriers around seedlings. Examples of these grass-specific herbicides are fluazipop (Fusilade DX) and quizalofop (Assure II).

Monitoring will reveal which particular weed species have emerged and will be used to determine the precise formula to control weeds. Depending on the weed species composition, other herbicides in the toolbox may include Streamline (aminocyclopyrachlor), Polaris AC (imazapyr), Element 4 (triclopyr), Roundup PowerMax (glyphosate), and Escort (metsulfuron methyl). All label regulations will be observed for broadcast or spot treatments as appropriate.

6.9. Integrated Pest Management

Integrated Pest Management

Objective: Protect growing koa trees with timely and effective treatment of insects and pathogens.

Practice- Forest stand improvement: NRCS Practice 666

Maintaining healthy trees is the first and best defense against pests and pathogens, but some level of disease or pest infestation may be unavoidable even in healthy plantings. This is best accomplished in the context of an integrated pest management (IPM) approach to dealing with pests and pathogens. The IPM framework involves three sequential assessments, (1) monitoring potential pest agents, (2) identifying threshold densities or populations at which pests cause unacceptable economic damage, and (3) identifying and applying the most effective control agent.

Figure 9. Rotary wing aircraft are a cost-effective option for later stage weed control combined with pest control. Psyllids are of particular concern for this project. Note the row site preparation working around native forest patches.

To control insect pests using IPM, the first step is to identify potential pest species. This requires a monitoring program that can take on varying degrees of sophistication. When damaging levels of the pest are discovered, the first option for control methods is typically a pheromone-based trapping system or adhesive traps. Chemical insecticides are used if control is impossible with more benign methods.

Likely insect pests on A. koa include the acacia psyllid (*Acizzia uncotoides*), a non-native sap-sucking insect, the koa moth (*Scotorythra paludicola*), a native defoliating insect, and the koa borer (*Xylosandrus compactus*). Psyllid infestations may threaten performance of entire stands by feeding on growing tips and causing extreme branching in the following growth phase. Koa is attacked by psyllids in the second year after planting. This causes stunting and loss of apical dominance, with concomitant branchiness. Koa moth is usually constrained to a few individuals in a given stand. The forest health practice here is to use IPM techniques to reduce the psyllid population during the critical spring time of year 2 and year 3.

Chemical options for controlling the psyllid include dinotefuran (Safari 20 SG) or spirotetramat (Movento), both of which have labeling appropriate or adaptable to use in koa plantings on Hawaii Island. The koa moth may also respond to these treatments, although such a use is not explicitly defined for Movento.

A combined treatment, utilizing one of the agents above plus a grass-control herbicide will be applied in the spring of the 2nd and 3rd year using helicopter as an application method. This is an extremely cost-effective way to reduce pest presence and reduce pressure from grasses in the understory. The application will be used in both koa and mixed forest stands.

6.10. Pruning and Singling

Objective: Improve the stem form, quality, and value of planted koa stems through judicious and timely stem correction.

Figure 10. Pruning is the only cost-effective way to effectively improve koa stem form in a planted forest setting. The need for it is obvious (right). Battery pruners reduce fatigue and cost and improve quality of pruning practice (left).

Practice- Tree/shrub pruning: NRCS Practice 660

Koa has poor apical dominance which results in heavy branching, control of which will require several entries for both singling in year 1 (removal of competing leaders to favor only a single growing tip) pruning (removal of lateral branches up to a height of 6 to 8 feet.

Acacia koa shows a strong tendency to branch and fork even when grown at relatively high stem densities. At the planting geometries prescribed herein, pruning and singling treatments will be necessary to enhance form and growth rates. The *singling operation* (pruning to a dominant leader) should occur when trees first begin to show evidence of competing leaders. The most vigorous leader should be promoted by cutting the inferior leader tips back by 1/3 their length. This operation usually occurs between 10 and 15 months of age.

At a point between 14 and 20 months, depending on growth performance, the first pruning treatment will likely be required. Lower branches should be pruned up to a height of approximately 50% to 65% of the crown depth, with the smaller percentage crown depth removed from unhealthy / shorter trees, and the larger percentage from healthy / taller trees. Branches must be pruned when their basal diameter is less than 1/2". Depending on growth rates, a second pruning entry may be required after 24 months of age.

A third pruning, after 24 months of age is not included in the budget tables for this management plan due to the uncertainty of its need. This treatment should be used only if additional clear wood height is needed and comes at a relatively nominal cost per entry.

The final objective should be to yield an expanse of tree trunk free of branches for at least 8 to 10' above the ground. Subsequent entries scheduled as necessary according to tree growth rates. Pruning should result in koa trees with no lower branches to interfere with clear wood growth.

6.11. Ash stand replacement (year 8)

Objective: Replace existing tropical ash stand and regenerate a new koa forest

Practice- Site preparation: NRCS Practice 460; Brush management: NRCS practice 314

The ash stand is approximately 80 years old (estimated planting date 1930's CCC) and apparently has never been thinned or managed in any active way. The impressive height of these existing trees is evidence of the site's productivity for timber production and one of the reasons for the acquisition of this property. Tropical ash is a known invasive species. Evidence of prolific volunteer re-generation is evident on the forest floor, kept in check by constant cattle presence.

As these cattle transition off the property in coordination with koa plantings on successive units, herbicide applications will be necessary to control the spread of volunteer starts. The location of this stand provides an advantageous existing windbreak for that portion of the property directly to the west.

The ash stand is also a significant amenity on the property, providing shade and shelter from wind and rain for visitors and a windbreak for young saplings in years 1 and 2. Until other maturing forest components are established on site, retaining a portion of this grove is desirable. However, in the grove will become a nuisance as cattle are removed and seedlings begin to germinate inside the koa and mixed forest planted stands. Therefore, it must be removed.

Plans for the property call for a small saw mill (permit applications in process) that will be able to mill materials from this initial harvest and will be capable of milling the final harvest of the residual stand. Final harvest of these trees and subsequent conversion to a koa stand will occur in year 8. It is estimated that by this time there will be more comfort in the land management to tackle this stand and the sawmill use will have reduced the stocking to ameliorate costs.

The conversion of an ash stand to koa is no small feat, thus the following measures are to be used, based on experience of converting such stands in Hōnaunau Forest in 2005-2010:

1. Site preparation (ash only): remove all remaining standing trees and treat (with imazapyr) or remove stumps. Preferably keep stumps in place to avoid soil disturbance.
    a. Clear brush into windrows no less than 200' apart in neat stacks such that they block the wind

2. Brush management: Treat seedlings and sprouting root fragments with imazapyr or Garlon 3A/4
3. Plant stands at a high 700 seedlings/acre to promote rapid site occupation and shading
4. Control weeds (ash seedlings) a second time in year 1 using imazapyr at low rates with glyphosate

Controlling ash is a necessary step for the long-term integrity of the forest and surrounding properties.

Ash is very susceptible to imazapyr, koa is less susceptible. This single factor, combined with high stocking will assist the conversion of this stand from the aggressive ash seedlings to koa. Ash seeds only last 2-3 years in the ground, the weed pressure will be short-term.

Figure 11. Treating an ash stump with imazapyr mix. Ash is very susceptible to imazapyr, both as cut stump and foliar.

6.12. Monitoring

Objective: Actively monitor and adaptively manage silvicultural activities and their results and incorporate this information into future management decisions. Monitor and control vectors if these are predating on forest birds.

Practice- Access Control: NRCS Practice 472; and Upland Wildlife Habitat Management: NRCS Practice 643

A critical element of forest management is an active and effective monitoring program. Monitoring will take place in three areas every year, using the following practices:

1. Monitor integrity of fences and gates, fix as necessary to maintain pig and cattle exclusion
2. Growth and yield of production koa plantings – establish 2 permanent sample plots of 8-10 trees each for annual measurements, ideally these are circular, using variable area or a fixed area approach. In the first 2 years, tree height and survival would be the two data categories. Once trees reach sufficient size to have a measurable diameter at 1.4 m above the ground, diameter would also be recorded. Data analysis would follow standard statistical methods to quantify koa growth rates and projected timber yields, as well as evolving species composition of the restored forest.
3. Record sign of deleterious mammals near water bodies, consider deployment of control measures if these are affecting native or migratory birds and a safe harbor agreement is in place.

7. Budget & practices summary

7.1. Budget summary

Period	Applicant	FSP	Combined
Year 1	$88,723	$88,723	$ 177,445.43
Year 2	$113,263	$113,263	$ 226,526.58
Year 3	$119,919	$119,919	$ 239,837.18
Year 4	$113,963	$113,963	$ 227,926.29
Year 5	$116,861	$116,861	$ 233,722.57
Year 6	$126,272	$126,272	$ 252,543.56
Year 7	$125,385	$125,385	$ 250,769.19
Year 8	$238,835	$238,835	$ 477,669.89
Year 2	$118,354	$118,354	$ 236,707.53
Year 10	$31,354	$31,354	$ 62,707.48
Total:	**$1,192,928**	**$1,192,928**	**$2,385,856**
		avg per year	**$238,586**
		avg per acre	**$4,357.24**

7.2. **FSP and NRCS practice codes used in this management plan & relevant rates for Siglo property**

FMP Simplified Name	NRCS Practice Name	NRCS Code	Unit	Cost per unit
Tree Pruning	Tree/Shrub Pruning	660	acre	$ 91.00
Seedlings: Koa (350) & a'alii (50)	Tree Establishment	612	seedling	$ 3.00
Seedlings: Native	Tree Establishment	612	seedling	$ 5.50
Monitoring	Access control	472	acre	$ 110.00
Fence construction	Fence	382	foot	$ 9.00
Fence maintenance	Fence	382	foot	$ 0.32
Brush management (chem)	Brush Management	314	acre	$ 340.00
Competition control	Herbaceous Weed Control	315	acre	$ 220.00
Competition control 2	Herbaceous Weed Control	315	acre	$ 110.00
Fertilizer & application	Nutrient management	590	acre	$ 189.00
Forest stand improvement	Forest stand improvement	666	acre	$ 245.00
Site preparation (ash only)	Tree/Shrub Site Preparation	460	acre	$ 650.00
Site preparation: Grass control	Tree/Shrub Site Preparation	490	acre	$ 250.00
Site preparation: Mechanical	Tree/Shrub Site Preparation	490	acre	$ 396.00
Windbreak/Shelterbelt	Windbreak/Shelterbelt	380	acre	$ 3.10

8. Practice implementation schedule & annual budgets

8.1. Year 1 implementation schedule

Activity	NRCS code	Start month	FMU			
			1	111	211	212
Year 1 (2019)						
Windbreak/Shelterbelt	380	3	1			
Fence construction	382	8	1			
Fence maintenance	382	8				
Site preparation: grass control	490	2		1	1	1
Site preparation: mechanical	490	7		1	1	1
Seedlings & planting: koa & a'alii	612	10		400	125	125
Seedlings & planting: mixed	612	10			75	75
Fertilizer & application	590	10		1	1	1
Competition control	315	11		1	1	1
Competition control 2	315	12			1	1
Forest stand improvement	666	3				
Tree Pruning	660	7		1	1	1

8.1.1. Year 1 budget

Activity	NRCS code	Cost per unit	Units	FMU Area	1 5,947	111 22.0	211 4.1	212 7.3
Year 1 (2019)				Month			Year 1	
Windbreak/Shelterbelt	380	$3.10	15,810	3	$ 49,011			
Fence construction	382	$9.00	5,947	8	$ 53,523			
Fence maintenance	382	$0.32	---	8				
Site preparation: grass control	490	$250	---	2		$ 5,500	$ 1,015	$ 1,836
Site preparation: mechanical	490	$396	---	7		$ 8,712	$ 1,607	$ 2,908
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$ 26,400	$ 1,522	$ 2,754
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ 1,674	$ 3,029
Fertilizer & application	590	$189	---	10		$ 4,158	$ 767	$ 1,388
Competition control	315	$220	---	11		$ 4,840	$ 893	$ 1,616
Competition control 2	315	$110	---	12		$ -	$ 446	$ 808
Forest stand improvement	666	$245	---	3		$ -	$ -	$ -
Tree Pruning	660	$91.00	---	7		$ 2,002	$ 369	$ 668
Year subtotal:	---	---		---	$102,534	$ 51,612	$ 8,293	$15,006
Share %	---	---		---	50%	50%	50%	50%
Applicant share:	---	---		---	$ 51,267	$ 25,806	$ 4,147	$ 7,503
FSP Share:	---	---		---	$ 51,267	$ 25,806	$ 4,147	$ 7,503
Year 1 Applicant Sum:	**$88,723**	**Year 1 FS**	**$88,723**		**Total:**	**$177,445**	**$/ac:**	**$5,312**

8.2. Year 2 Implementation schedule

Activity	NRCS code	Start month	FMU						
			2	121	221	222	111	211	212
Year 2 (2020)									
Fence construction	382	8	1						
Fence maintenance	382	8							
Site preparation: grass control	490	2		1	1	1			
Site preparation: mechanical	490	7		1	1	1			
Seedlings & planting: koa & a'alii	612	10		400	125	125			
Seedlings & planting: mixed	612	10			75	75			
Fertilizer & application	590	10		1	1	1			
Competition control	315	11		1	1	1	1	1	1
Competition control 2	315	12			1	1			
Forest stand improvement	666	3					1	1	1
Tree Pruning	660	7					1	1	1
Monitoring	643	7	5						

8.2.1. Year 2 Budget

Activity	NRCS code	Cost unit[1]	Units	FMU Area	2	121	221	222	111	211	212
					6,173	47.3	12.8	10.6	22.0	4.1	7.3
Year 2 (2020)				**Month**		**Year 1**			**Year 2**		
Fence construction	382	$9.00	6,173	8	$ 55,557						
Fence maintenance	382	$0.32	---	8							
Site preparation: grass control	490	$250	---	2		$ 11,826	$ 3,210	$ 2,645	$ -	$ -	$ -
Site preparation: mechanical	490	$396	---	7		$ 18,733	$ 5,085	$ 4,189	$ -	$ -	$ -
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$ 56,766	$ 4,815	$ 3,967	$ -	$ -	$ -
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ 5,297	$ 4,364	$ -	$ -	$ -
Fertilizer & application	590	$189	---	10		$ 8,941	$ 2,427	$ 1,999	$ -	$ -	$ -
Competition control	315	$220	---	11		$ 10,407	$ 2,825	$ 2,327	$ 4,840	$ 893	$ 1,616
Competition control 2	315	$110	---	12		$ -	$ 1,412	$ 1,164	$ -	$ -	$ -
Forest stand improvement	666	$245	---	3		$ -	$ -	$ -	$ 5,390	$ 994	$ 1,799
Tree Pruning	660	$91.00	---	7		$ -	$ -	$ -	$ 2,002	$ 369	$ 668
Monitoring	643	$110	---	7	$ 550						
Year subtotal:	---	---		---	$ 55,557	$106,673	$25,071	$20,654	$12,232	$ 2,256	$ 4,083
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$27,779	$53,337	$12,535	$10,327	$6,116	$1,128	$2,041
FSP Share:	---	---		---	$27,779	$53,337	$12,535	$10,327	$6,116	$1,128	$2,041
Year 2 Applicant Sum:	**$113,263**		**Year 2 FSP Sum:**			**$113,263**		**Total:**	**$226,527**	**$/ac:**	**$3,203**

8.3. Year 3 implementation schedule

Activity	NRCS code	Start month	FMU 3	131	132	133	231	232	121	221	222	111	211	212
Year 3 (2021)														
Fence construction	382	8	1											
Fence maintenance	382	8												
Site preparation: grass control	490	2		1	1	1	1	1						
Site preparation: mechanical	490	7		1	1	1	1	1						
Seedlings & planting: koa & a'alii	612	10		400	400	400	125	125						
Seedlings & planting: mixed	612	10					75	75						
Fertilizer & application	590	10		1	1	1	1	1						
Competition control	315	11		1	1	1	1	1	1	1	1			
Competition control 2	315	12			1	1	1	1						
Forest stand improvement	666	3							1	1	1	1	1	1
Tree Pruning	660	7							1	1	1	1	1	1
Monitoring	643	7	10											

8.3.1. Year 3 budget

Activity	NRCS	Cost unit	Units	FMU	3	131	132	133	231	232	121	221	222	111	211	212
				Area	5,451	14.7	16.1	8.5	19.0	6.0	47.3	12.8	10.6	22.0	4.1	7.3
Year 3 (2021)				**Month**		**Year1**					**Year 2**			**Year 3**		
Fence construction	382	$9.00	5,451	8	$ 49,059											
Fence maintenance	382	$0.32	---	8												
Site preparation: grass control	490	$250.00	---	2		$ 3,672	$ 4,034	$ 2,119	$ 4,751	$ 1,509	$ -	$ -	$ -	$ -	$ -	$ -
Site preparation: mechanical	490	$396.00	---	7		$ 5,817	$ 6,390	$ 3,357	$ 7,526	$ 2,391	$ -	$ -	$ -	$ -	$ -	$ -
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$ 17,627	$19,364	$10,173	$ 7,127	$ 2,264	$ -	$ -	$ -	$ -	$ -	$ -
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ -	$ -	$ 7,840	$ 2,490	$ -	$ -	$ -	$ -	$ -	$ -
Fertilizer & application	590	$189.00	---	10		$ 2,776	$ 3,050	$ 1,602	$ 3,592	$ 1,141	$ -	$ -	$ -	$ -	$ -	$ -
Competition control	315	$220.00	---	11		$ 3,232	$ 3,550	$ 1,865	$ 4,181	$ 1,328	$10,407	$ 2,825	$ 2,327	$ -	$ -	$ -
Competition control 2	315	$110.00	---	12		$ -	$ 1,775	$ 933	$ 2,091	$ 664	$ -	$ -	$ -	$ -	$ -	$ -
Forest stand improvement	666	$245.00	---	3		$ -	$ -	$ -	$ -	$ -	$11,590	$ 3,146	$ 2,592	$ 5,390	$ 994	$1,799
Tree Pruning	660	$91.00	---	7		$ -	$ -	$ -	$ -	$ -	$ 4,305	$ 1,168	$ 963	$ 2,002	$ 369	$ 668
Monitoring	643	$110	---	7	$ 1,100											
Year subtotal:	---	---		---	$ 49,059	$ 33,125	$38,162	$20,050	$37,109	$11,787	$26,302	$ 7,139	$ 5,882	$ 7,392	$1,364	$2,467
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$ 24,530	$ 16,562	$19,081	$10,025	$18,554	$ 5,894	$13,151	$ 3,570	$ 2,941	$ 3,696	$ 682	$1,234
FSP Share:	---	---		---	$ 24,530	$ 16,562	$19,081	$10,025	$18,554	$ 5,894	$13,151	$ 3,570	$ 2,941	$ 3,696	$ 682	$1,234
Year 3 Applicant Sum:	**$119,919**		**Year 3 FSP Sum:**			**119,919**		**Total:**	**$239,837**	**$/ac:**	**$3,727**					

8.4. Year 4 implementation schedule

Activity	NRCS code	Start month	FMU											
			4	141	241	242	131	132	133	231	232	121	221	222
Year 4 (2022)														
Fence construction	382	8	1											
Fence maintenance	382	8												
Site preparation: grass control	490	2		1	1	1								
Site preparation: mechanical	490	7		1	1	1								
Seedlings & planting: koa & a'alii	612	10		400	125	125								
Seedlings & planting: mixed	612	10			75	75								
Fertilizer & application	590	10		1	1	1								
Competition control	315	11		1	1	1	1	1	1	1	1			
Competition control 2	315	12			1	1								
Forest stand improvement	666	3					1	1	1	1	1	1	1	1
Tree Pruning	660	7					1	1	1	1	1	1	1	1
Monitoring	643	7	20											

8.4.1. Year 4 budget

Activity	NRCS code	Cost unit [1]	Units	FMU	4	141	241	242	131	132	133	231	232	121	221	222
				Area	4,376	40.8	17.1	1.9	14.7	16.1	8.5	19.0	6.0	47.3	12.8	10.6
Year 4 (2022)				**Month**		**Year 1**			**Year 2**					**Year 3**		
Fence construction	382	$9.00	4,376	8	$ 39,384											
Fence maintenance	382	$0.32	6,173	8												
Site preparation: grass control	490	$250.00	---	2		$ 10,199	$ 4,273	$ 465	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Site preparation: mechanical	490	$396.00	---	7		$ 16,155	$ 6,769	$ 737	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$ 48,956	$ 6,410	$ 698	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ 7,051	$ 767	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fertilizer & application	590	$189.00	---	10		$ 7,711	$ 3,231	$ 352	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Competition control	315	$220.00	---	11		$ 8,975	$ 3,760	$ 409	$ 3,232	$ 3,550	$ 1,865	$ 4,181	$ 1,328	$ -	$ -	$ -
Competition control 2	315	$110.00	---	12		$ -	$ 1,880	$ 205	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Forest stand improvement	666	$245.00	---	3		$ -	$ -	$ -	$ 3,599	$ 3,953	$ 2,077	$ 4,656	$ 1,479	$11,590	$3,146	$2,592
Tree Pruning	660	$91.00	---	7		$ -	$ -	$ -	$ 1,337	$ 1,468	$ 771	$ 1,730	$ 549	$ 4,305	$1,168	$ 963
Monitoring	643	$110	---	7	$ 2,200											
Year subtotal:	---	---		---	$ 39,384	$ 91,996	$33,374	$ 3,632	$ 8,167	$ 8,972	$ 4,714	$10,567	$ 3,357	$15,895	$4,314	$3,554
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$ 19,692	$ 45,998	$16,687	$ 1,816	$ 4,084	$ 4,486	$ 2,357	$ 5,284	$ 1,678	$ 7,947	$2,157	$1,777
FSP Share:	---	---		---	$ 19,692	$ 45,998	$16,687	$ 1,816	$ 4,084	$ 4,486	$ 2,357	$ 5,284	$ 1,678	$ 7,947	$2,157	$1,777
Year 4 Applicant Sum:	**$113,963**		**Year 4 FSP Sum:**			**$113,963**		**Total:**	**$227,926**	**$/ac:**	**$3,815**					

8.5. Year 5 implementation schedule

Activity	NRCS code	Start month	FMU 5	151	141	241	242	131	132	133	231	232
Year 5 (2023)												
Fence construction	382	8	1									
Fence maintenance	382	8	1									
Site preparation: grass control	490	2		1								
Site preparation: mechanical	490	7		1								
Seedlings & planting: koa & a'alii	612	10		400								
Seedlings & planting: mixed	612	10										
Fertilizer & application	590	10		1								
Competition control	315	11		1	1	1	1					
Competition control 2	315	12										
Forest stand improvement	666	3			1	1	1	1	1	1	1	1
Tree Pruning	660	7			1	1	1	1	1	1	1	1
Monitoring	643	7	30									

8.5.1. Year 5 budget

Activity	NRCS code	Cost unit [1]	Units	FMU / Area	5	151	141	241	242	131	132	133	231	232
					4,890	59.0	40.8	17.1	1.9	14.7	16.1	8.5	19.0	6.0
Year 5 (2023)				**Month**		**Year 1**	**Year 2**			**Year 3**				
Fence construction	382	$9.00	4,890	8	$ 44,010									
Fence maintenance	382	$0.32	5,947	8	$ 1,903									
Site preparation: grass control	490	$250.00	---	2		$ 14,741	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Site preparation: mechanical	490	$396.00	---	7		$ 23,351	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$ 70,759	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fertilizer & application	590	$189.00	---	10		$ 11,145	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Competition control	315	$220.00	---	11		$ 12,973	$ 8,975	$ 3,760	$ 409	$ -	$ -	$ -	$ -	$ -
Competition control 2	315	$110.00	---	12		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Forest stand improvement	666	$245.00	---	3		$ -	$ 9,995	$ 4,188	$ 456	$ 3,599	$ 3,953	$ 2,077	$ 4,656	$ 1,479
Tree Pruning	660	$91.00	---	7		$ -	$ 3,712	$ 1,555	$ 169	$ 1,337	$ 1,468	$ 771	$ 1,730	$ 549
Monitoring	643	$110	---	7	$ 3,300									
Year subtotal:	---	---		---	$ 45,913	$132,968	$22,683	$ 9,504	$ 1,034	$ 4,936	$ 5,422	$ 2,848	$ 6,386	$ 2,028
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$ 22,957	$ 66,484	$11,341	$ 4,752	$ 517	$ 2,468	$ 2,711	$ 1,424	$ 3,193	$ 1,014
FSP Share:	---	---		---	$ 22,957	$ 66,484	$11,341	$ 4,752	$ 517	$ 2,468	$ 2,711	$ 1,424	$ 3,193	$ 1,014
Year 5 Applicant Sum:	**$116,861**		**Year 5 FSP Sum:**			**$116,861**		**Total:**	**$233,723**	**$/ac:**	**$3,964**			

8.6. Year 6 implementation schedule

Activity	NRCS code	Start month	FMU 6	FMU 161	FMU 151	FMU 141	FMU 241	FMU 242
Year 6 (2024)								
Fence construction	382	8	1					
Fence maintenance	382	8	1					
Site preparation: grass control	490	2		1				
Site preparation: mechanical	490	7		1				
Seedlings & planting: koa & a'alii	612	10		400				
Seedlings & planting: mixed	612	10						
Fertilizer & application	590	10		1				
Competition control	315	11		1	1			
Competition control 2	315	12						
Forest stand improvement	666	3			1	1	1	1
Tree Pruning	660	7			1	1	1	1
Monitoring	643	7	40					

8.6.1. Year 6 budget

Activity	NRCS code	Cost unit [1]	Units	FMU Area	6 3,802	161 77.3	151 59.0	141 40.8	241 17.1	242 1.9
Year 6 (2024)				**Month**		**Year 1**	**Year 2**	**Year 3**		
Fence construction	382	$9.00	3,802	8	$ 34,218					
Fence maintenance	382	$0.32	6,173	8	$ 1,975					
Site preparation: grass control	490	$250.00	---	2		$ 19,323	$ -	$ -	$ -	$ -
Site preparation: mechanical	490	$396.00	---	7		$ 30,607	$ -	$ -	$ -	$ -
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$ 92,750	$ -	$ -	$ -	$ -
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ -	$ -	$ -	$ -
Fertilizer & application	590	$189.00	---	10		$ 14,608	$ -	$ -	$ -	$ -
Competition control	315	$220.00	---	11		$ 17,004	$12,973	$ -	$ -	$ -
Competition control 2	315	$110.00	---	12		$ -	$ -	$ -	$ -	$ -
Forest stand improvement	666	$245.00	---	3		$ -	$14,447	$ 9,995	$ 4,188	$ 456
Tree Pruning	660	$91.00	---	7		$ -	$ 5,366	$ 3,712	$ 1,555	$ 169
Monitoring	643	$110	---	7	$ 4,400					
Year subtotal:	---	---		---	$ 36,193	$174,292	$27,419	$ 9,995	$ 4,188	$ 456
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$ 18,097	$ 87,146	$13,710	$ 4,998	$ 2,094	$ 228
FSP Share:	---	---		---	$ 18,097	$ 87,146	$13,710	$ 4,998	$ 2,094	$ 228
Year 6 Applicant Sum:	**$126,272**		**Year 6 FSP Sum:**		**$126,272**		**Total:**	**$252,544**	**$/ac:**	**$3,267**

8.7. Year 7 implementation schedule

Activity	NRCS code	Start month	FMU 7	FMU 171	FMU 172	FMU 271	FMU 161	FMU 151
Year 7 (2025)								
Fence construction	382	8	1					
Fence maintenance	382	8	1					
Site preparation: grass control	490	2		1	1	1		
Site preparation: mechanical	490	7		1	1	1		
Seedlings & planting: koa & a'alii	612	10		400	400	125		
Seedlings & planting: mixed	612	10				75		
Fertilizer & application	590	10		1	1	1		
Competition control	315	11		1	1	1	1	
Competition control 2	315	12				1		
Forest stand improvement	666	3					1	1
Tree Pruning	660	7					1	1
Monitoring	643	7	50					

8.7.1. Year 7 budget

Activity	NRCS code	Cost unit[1]	Units	FMU	7	171	172	271	161	151
				Area	3,957	8.0	37.2	25.0	77.3	59.0
Year 7 (2025)				**Month**		**Year 1**			**Year 2**	**Year 3**
Fence construction	382	$9.00	3,957	8	$ 35,613					
Fence maintenance	382	$0.32	5,451	8	$ 1,744					
Site preparation: grass control	490	$250.00	---	2		$ 1,992	$ 9,305	$ 6,239	$ -	$ -
Site preparation: mechanical	490	$396.00	---	7		$ 3,155	$14,740	$ 9,883	$ -	$ -
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$ 9,560	$44,665	$ 9,359	$ -	$ -
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ -	$10,295	$ -	$ -
Fertilizer & application	590	$189.00	---	10		$ 1,506	$ 7,035	$ 4,717	$ -	$ -
Competition control	315	$220.00	---	11		$ 1,753	$ 8,189	$ 5,490	$17,004	$ -
Competition control 2	315	$110.00	---	12		$ -	$ -	$ 2,745	$ -	$ -
Forest stand improvement	666	$245.00	---	3		$ -	$ -	$ -	$18,936	$14,447
Tree Pruning	660	$91.00	---	7		$ -	$ -	$ -	$ 7,034	$ 5,366
Monitoring	643	$110	---	7	$ 5,500					
Year subtotal:	---	---		---	$ 37,357	$ 17,965	$83,933	$48,727	$42,974	$19,813
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$ 18,679	$ 8,982	$41,967	$24,364	$21,487	$ 9,906
FSP Share:	---	---		---	$ 18,679	$ 8,982	$41,967	$24,364	$21,487	$ 9,906
Year 7 Applicant Sum:	**$125,385**		**Year 7 FSP Sum:**		**$125,385**		**Total:**	**$250,769**	**$/ac:**	**$3,575**

8.8. Year 8 implementation schedule

Activity	NRCS code	Start month	FMU									
			8	311	181	182	281	282	171	172	271	161
Year 8 (2026)												
Fence construction	382	8	1									
Fence maintenance	382	8	1									
Site prepartion: ash stand	490	2		1								
Brush management (chem)	314	7		1								
Site preparation: grass control	490	10			1	1	1	1				
Site preparation: mechanical	490	10		1	1	1	1	1				
Seedlings & planting: koa & a'alii	612	10		700	400	400	125	125				
Seedlings & planting: mixed	612	10					75	75				
Fertilizer & application	590	12		1	1	1	1	1				
Competition control	315	3		1	1	1	1	1	1	1	1	
Competition control 2	315	7		1	1	1	1	1				
Forest stand improvement	666	7						1	1	1	1	1
Tree Pruning	660	7						1	1	1	1	1
Monitoring	643	7	60									

8.8.1. Year 8 budget

Activity	NRCS code	Cost unit [1]	Units	FMU / Area	8 / 4,408	311 / 14.8	181 / 23.6	182 / 4.4	281 / 13.2	282 / 4.8	171 / 8.0	172 / 37.2	271 / 25.0	161 / 77.3
Year 8 (2026)				**Month**		**Year 1**					**Year 2**			**Year 3**
Fence construction	382	$9.00	4,408	8	$ 39,672									
Fence maintenance	382	$0.32	4,376	8	$ 1,400									
Site prepartion: ash stand	490	$650.00	---	2		$ 38,328	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Brush management (chem)	314	$340.00	---	7		$ 20,048	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Site preparation: grass control	490	$250.00	---	10		$ -	$10,199	$ 4,273	$ 465	$ 3,672	$ -	$ -	$ -	$ -
Site preparation: mechanical	490	$396.00	---	10		$ 23,351	$16,155	$ 6,769	$ 737	$ 5,817	$ -	$ -	$ -	$ -
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$123,829	$48,956	$20,511	$ 698	$ 5,509	$ -	$ -	$ -	$ -
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ -	$ -	$ 767	$ 6,059	$ -	$ -	$ -	$ -
Fertilizer & application	590	$189.00	---	12		$ 11,145	$ 7,711	$ 3,231	$ 352	$ 2,776	$ -	$ -	$ -	$ -
Competition control	315	$220.00	---	3		$ 12,973	$ 8,975	$ 3,760	$ 409	$ 3,232	$ 3,550	$ 1,865	$ 4,181	$ -
Competition control 2	315	$110.00	---	7		$ 6,486	$ 4,488	$ 1,880	$ 205	$ 1,616	$ -	$ -	$ -	$ -
Forest stand improvement	666	$245.00	---	7		$ -	$ -	$ -	$ -	$ 3,599	$ 3,953	$ 2,077	$ 4,656	$ 1,479
Tree Pruning	660	$91.00	---	7		$ -	$ -	$ -	$ -	$ 1,337	$ 1,468	$ 771	$ 1,730	$ 549
Monitoring	643	$110	---	7	$ 6,600									
Year subtotal:	---	---		---	$ 41,072	$236,159	$96,484	$40,425	$ 3,632	$33,617	$ 8,972	$ 4,714	$10,567	$ 2,028
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$ 20,536	$118,079	$48,242	$20,212	$ 1,816	$16,808	$ 4,486	$ 2,357	$ 5,284	$ 1,014
FSP Share:	---	---		---	$ 20,536	$118,079	$48,242	$20,212	$ 1,816	$16,808	$ 4,486	$ 2,357	$ 5,284	$ 1,014
Year 8 Applicant Sum:	**$238,835**		**Year 1 FSP Sum:**			**$238,835**		**Total:**	**$477,670**		**$/ac:**	**$7,862**		

8.9. Year 9 implementation schedule

Activity	NRCS code	Start month	FMU											
			9	191	291	292	311	181	182	281	282	171	172	272
Year 9 (2027)														
Fence construction	382	8	1											
Fence maintenance	382	8	1											
Site preparation: grass control	490	2		1	1	1								
Site preparation: mechanical	490	7		1	1	1								
Seedlings & planting: koa & a'alii	612	10		400	125	125								
Seedlings & planting: mixed	612	10			75	75								
Fertilizer & application	590	10		1	1	1								
Competition control	315	11		1	1	1	1	1	1	1	1			
Competition control 2	315	12			1	1								
Forest stand improvement	666	3					1	1	1	1	1	1	1	1
Tree Pruning	660	7					1	1	1	1	1	1	1	1
Monitoring	643	7	60											

8.9.1. Year 9 budget

Activity	NRCS code	Cost unit[1]	Units	FMU Area	9	191	291	292	311	181	182	281	282	171	172	272
					5,211	26.1	19.3	6.8	23.6	4.4	13.2	4.8	8.0	37.2	25.0	25.0
Year 9 (2027)				**Month**		**Year 1**			**Year 2**					**Year 3**		
Fence construction	382	$9.00	5,211	8	$ 46,899											
Fence maintenance	382	$0.32	3,957	8	$ 1,266											
Site preparation: grass control	490	$250.00	---	2		$ 10,199	$ 4,273	$ 465	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Site preparation: mechanical	490	$396.00	---	7		$ 16,155	$ 6,769	$ 737	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Seedlings & planting: koa & a'alii	612	$3.00	350 / 125	10		$ 48,956	$ 6,410	$ 698	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Seedlings & planting: mixed	612	$5.50	75	10		$ -	$ 7,051	$ 767	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fertilizer & application	590	$189.00	---	10		$ 7,711	$ 3,231	$ 352	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Competition control	315	$220.00	---	11		$ 8,975	$ 3,760	$ 409	$ 3,232	$ 3,550	$ 1,865	$ 4,181	$ 1,328	$ -	$ -	$ -
Competition control 2	315	$110.00	---	12		$ -	$ 1,880	$ 205	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Forest stand improvement	666	$245.00	---	3		$ -	$ -	$ -	$ 3,599	$ 3,953	$ 2,077	$ 4,656	$ 1,479	$11,590	$3,146	$2,592
Tree Pruning	660	$91.00	---	7		$ -	$ -	$ -	$ 1,337	$ 1,468	$ 771	$ 1,730	$ 549	$ 4,305	$1,168	$ 963
Monitoring	643	$110	---	7	$ 6,600											
Year subtotal:	---	---		---	$ 48,165	$ 91,996	$33,374	$ 3,632	$ 8,167	$ 8,972	$ 4,714	$10,567	$ 3,357	$15,895	$4,314	$3,554
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$ 24,083	$ 45,998	$16,687	$ 1,816	$ 4,084	$ 4,486	$ 2,357	$ 5,284	$ 1,678	$ 7,947	$2,157	$1,777
FSP Share:	---	---		---	$ 24,083	$ 45,998	$16,687	$ 1,816	$ 4,084	$ 4,486	$ 2,357	$ 5,284	$ 1,678	$ 7,947	$2,157	$1,777
Year 2 Applicant Sum:	**$118,354**			**Year 2 FSP Sum:**		**$118,354**		**Total:**	**$236,708**	**$/ac:**	**$4,536**					

8.10. Year 10 implementation Schedule

Activity	NRCS code	Start month	FMU								
			9	191	291	292	311	181	182	281	282
Year 10 (2028)											
Fence maintenance	382	8	1								
Competition control	315	11	1	1	1	1					
Forest stand improvement	666	3		1	1	1	1	1	1	1	1
Tree Pruning	660	7		1	1	1	1	1	1	1	1
Monitoring	643	7	60								

8.10.1. Year 10 budget

Activity	NRCS code	Cost unit [1]	Units	FMU	9	191	291	292	311	181	182	281	282
				Area	5,211	26.1	19.3	6.8	23.6	4.4	13.2	4.8	8.0
Year 10 (2028)				**Month**		**Year 2**			**Year 3**				
Fence maintenance	382	$0.32	3,957	8	$ 1,266								
Competition control	315	$220.00	---	11		$ 8,975	$ 3,760	$ 409	$ -	$ -	$ -	$ -	$ -
Forest stand improvement	666	$245.00	---	3		$ 9,995	$ 4,188	$ 456	$ 3,599	$ 3,953	$ 2,077	$ 4,656	$ 1,479
Tree Pruning	660	$91.00	---	7		$ 3,712	$ 1,555	$ 169	$ 1,337	$ 1,468	$ 771	$ 1,730	$ 549
Monitoring	643	$110.00	---	7	$ 6,600								
Year subtotal:	---	---		---	$ 7,866	$ 22,683	$ 9,504	$ 1,034	$ 4,936	$ 5,422	$ 2,848	$ 6,386	$ 2,028
NRCS%	---	---		---	50%	50%	50%	50%	50%	50%	50%	50%	50%
Applicant share:	---	---		---	$ 3,933	$ 11,341	$ 4,752	$ 517	$ 2,468	$ 2,711	$ 1,424	$ 3,193	$ 1,014
FSP Share:	---	---		---	$ 3,933	$ 11,341	$ 4,752	$ 517	$ 2,468	$ 2,711	$ 1,424	$ 3,193	$ 1,014
Year 10 Applicant Sum:	**$31,354**		**Year 9 FSP Sum:**			**$31,354**	**Total:**		**$62,707**	**$/ac:**	---		

9. Economic Analysis

9.1. Methods and assumptions

For the purposes of this management plan, the current budget costs were fed into a discounted cash flow (DCF) model that simplifies operations into a single “standard” acre. The “standard” acre costs were equalized so as to more or less add up to the total budget figure of 2.3 million dollars in aggregate.

Per acre koa establishment costs, spot cultivation and manual spraying and fertilizer			
Description	Cost ($ / ac) by year with GE tax		
	Year 1	Year 2	Year 3
Fence installation & maintenance	($730)	$0	$0
Site preparation: grass control	($250)	$0	$0
Site preparation: mechanical	($396)	$0	$0
Seedlings: Koa & a'ali'i	($800)	$0	$0
Seedlings: Natives	($450)	$0	$0
Planting	($153)	$0	$0
Fertilizer and application	($189)	$0	$0
Competition control	($220)	($220)	$0
Competition control 2	($73)	$0	$0
Integrated pest management		($230)	($230)
Tree pruning		($35)	($35)
Monitoring			($91)
Other activities: ash stand mgmt			($105)
Totals	($3,261)	$ (485.00)	$ (461.00)
		Cumulative	$ (4,207)

Koa establishment costs, mechanical preparation, ex pasture, 550 acres unsubsidized			
Operation	Cost ($) by activity by entry for entire project		
	1	2	3
Fence installation & maintenance	($401,500)	$0	$0
Site preparation: grass control	($137,500)	$0	$0
Site preparation: mechanical	($217,800)	$0	$0
Seedlings: Koa & a'ali'i	($440,000)	$0	$0
Seedlings: Natives	($247,500)	$0	$0
Planting	($84,150)	$0	$0
Fertilizer and application	($103,950)	$0	$0
Competition control	($121,000)	($121,000)	$0
Competition control 2	($40,150)	$0	$0
Integrated pest management	$0	($126,500)	($126,500)
Tree pruning	$0	($19,250)	($19,250)
Monitoring	$0	$0	($50,050)
Other activities: ash stand mgmt	$0	$0	($57,750)
Totals	($1,793,550)	$ (266,750.00)	$ (253,550.00)
		Cumulative	$ (2,313,850)

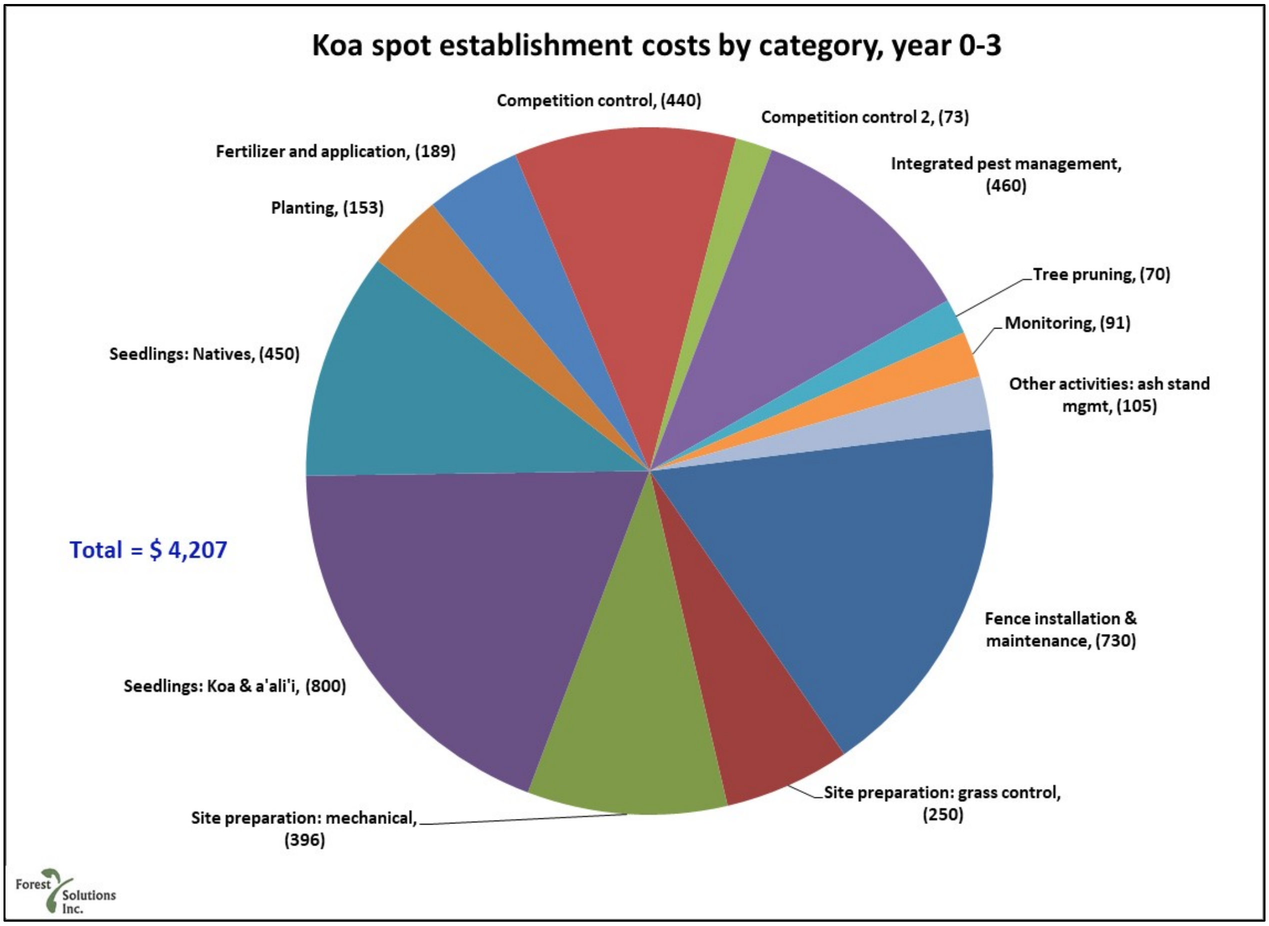


Figure 12. Koa establishment costs for Kapoaula property. These costs include fencing and mixed species planting

These costs are all discounted to year 0 at a 7% annual yield, including 3 planned harvest entries: one at 30 years, a second at 45 years and a final harvest (of the first cohort) at 60 years. For each successive harvest, resulting volume was calculated and apportioned according to predicted quality into small sawtimber, large

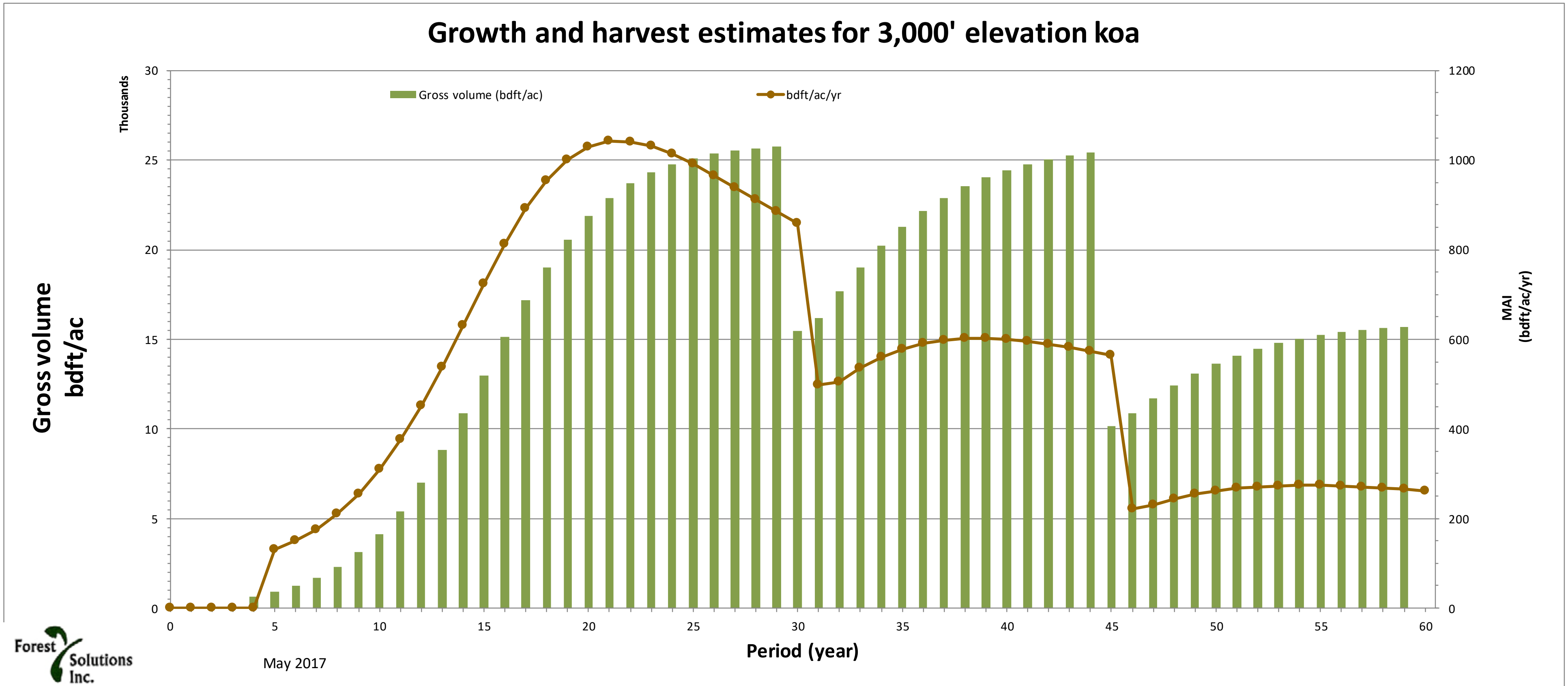
Table 8. Relative allocation of volume by harvest age

Operation	Year	Percent			
		Biomass	Small Saw	Large Saw	Veneer
Harvest 1	30	60%	30%	10%	0%
Harvest 2	45	30%	30%	30%	10%
Final vol	60	20%	20%	40%	20%

Table 7. Relative value of koa wood by type and age

Operation	Year	Value, US$/bdft stumpage			
		Biomass	Small Saw	Large Saw	Veneer
Harvest 1	30	-	$ 4.00	$ 8.00	$ 14.00
Harvest 2	45	-	$ 5.00	$ 10.00	$ 16.00
Final vol	60	-	$ 6.00	$ 12.00	$ 18.00

sawtimber and veneer. Each harvest age and quality type has a different price point:



Growth information from other properties under management and DOFAW permanent sample plots were used to fit a koa growth function and estimate overall yield in three harvests, graphically represented above, where the Y axis represents the standing volume and the x axis represents the successive years. The green bars represent total standing volume, the brown line is the annual grown rate (mean annual increment – MAI).

Each harvest entry is evident by the downward step in total volume. Standing volume will recover faster younger trees and under higher stocking; this is accounted for with the reduction in response rate after each harvest entry.

Table 9. Predicted harvest volumes by type and age

Operation	Year	Volume, bdft			
		Biomass	Small Saw	Large Saw	Veneer
Harvest 1	30	6,186	3,093	1,031	-
Harvest 2	45	4,572	4,572	4,572	1,524
Final vol	60	3,142.00	3,142	6,284	3,142

The foregoing volume and relative value computation is fed back into the DCF model to calculate present value (PV) during the stand development. This is presented in graphical form on the next page, where the left axis is PV and the Y axis is the stand age.

9.2. Results of the analysis

The result of this analysis is that the unsubsidized PV for this project is approximately $5,100 per acre including land carrying and forest management costs. For the planted forest as a whole, the 550 acres represent an NPV of $2.8 million. The internal rate of return (IRR) for the project is 9% or 2% over the discount rate employed.

9.3. Challenges to this analysis

There are two salient challenges to this analysis. The first is that the growth of koa is still not well understood, particularly after 30 years. The second is that the prices for harvested volume are, at best, conjecture as there time spans involved are large. In both cases, the analysis opts for the conservative approach, discussed below.

9.3.1. Unknown growth

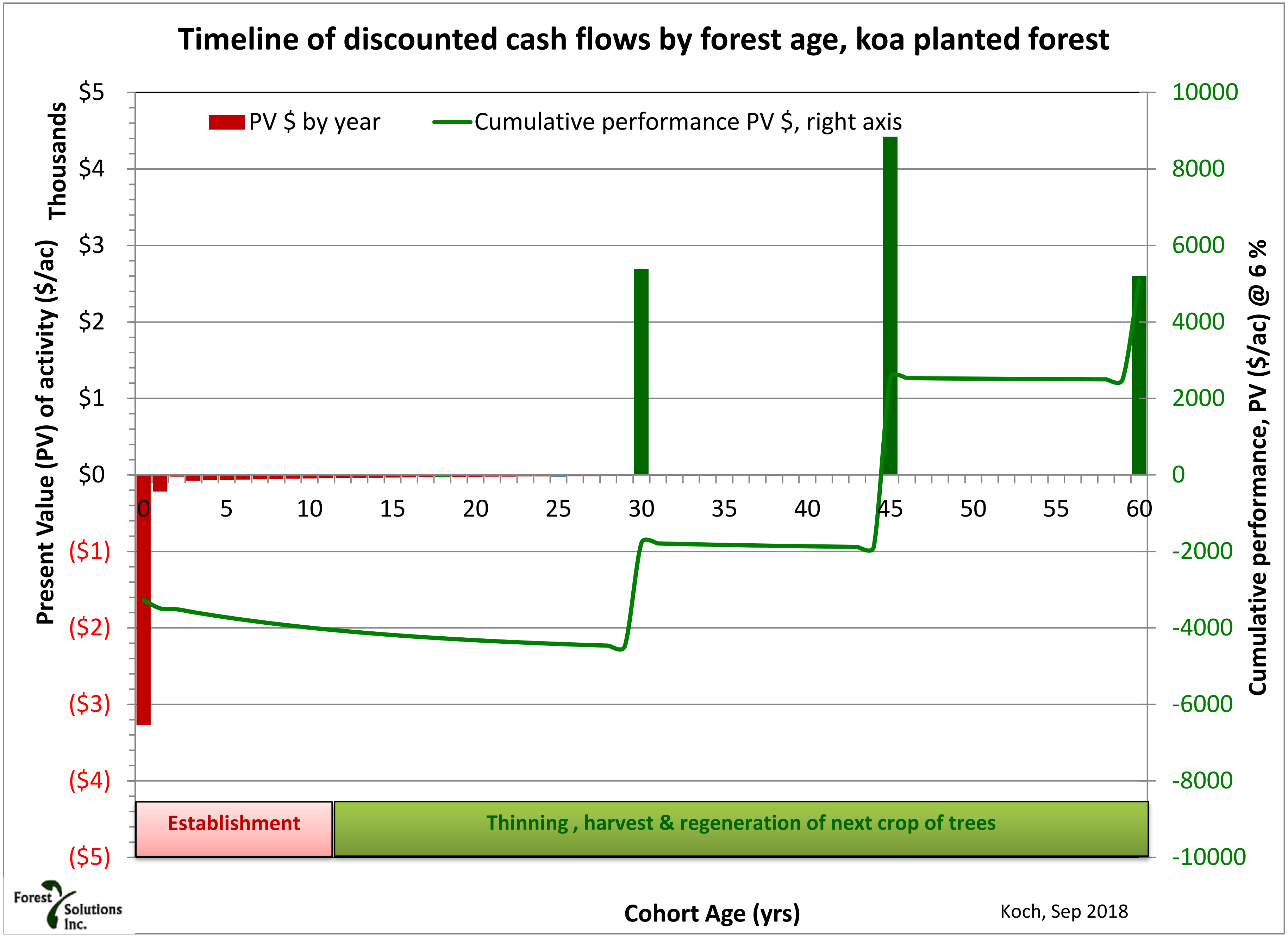
While the growth of koa is unknown, the current model employs a conservative 50% of observed growth from 15 plots at a higher elevation elsewhere on Hawaiʻi Island. This still does not solve the potential for lower yield, yet provides some assurance that the modeled growth rates are indeed conservative.

9.3.2. Prices for koa volume will vary in the long term

It is impossible to predict long term prices for any commodity, much less those for koa, the price of which has doubled in the last 10 years. However, we use a consistent (uninflated) price across the analysis period with the assumption that any price appreciation will also be reflected in the wider economy. There may (or may not) be a real (i.e. after inflation) price increase in koa wood. The conservative solution is to not include any such real price appreciation.

9.3.3. Diseases and/or climate change

Hardwood trees are a long-term investment. The longer time span introduces risks not normally associated with investments, such as disease and climate change. A percentage of the planted koa will be of wilt-resistant stock, however, it is unlikely that there will be enough seed from this stock to fully plant the project. As a result, there may be wilt affecting trees on the property, especially at the lower reaches. This will be exacerbated by climate change effects and the natural disease adaptation to cooler climes.



Timeline of discounted cash flows by forest age, koa planted forest
PV $ by year
Cumulative performance PV $, right axis
Present Value (PV) of activity ($/ac) Thousands
$5
$4
$3
$2
$1
$0
($1)
($2)
($3)
($4)
($5)
10000
8000
6000
4000
2000
0
-2000
-4000
-6000
-8000
-10000
Cumulative performance, PV ($/ac) @ 6 %
0
5
10
15
20
25
30
35
40
45
50
55
60
Establishment
Thinning , harvest & regeneration of next crop of trees
Forest Solutions Inc.
Cohort Age (yrs)
Koch, Sep 2018

APPENDIX B
BIOLOGICAL SURVEY

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Biological Survey
Kapoaula Koa Forest
TMK (3rd.) 4-7-007-011
Kapoaula, Hāmākua, Island of Hawai‘i

By Ron Terry, Ph.D., Patrick Hart, Ph.D., and Layne Yoshida, B.S.
Prepared for Paniolo Forestry LLC and the Department of Land and Natural Resources
April 2019

Introduction

Siglo Forest, LLC acquired the 564-acre Kapoaula property from Parker Ranch to obtain long-term access for the purposes of planting koa trees (Figure 1a and 1b). Siglo has partnered with other resource firms and public agencies in a project to convert pastureland back to a semblance of the native koa-‘ōhi‘a forest (*Acacia koa-Metrosideros polymorpha*) that once stood in this area and to provide controlled future uses of the forest for commercial products. This goal has been advanced through preparation of a site-specific forestry management plan (FMP) prepared by Forestry Solutions, Inc.[1] Through implementation of the FMP measures, in approximately 50 years the property will consist of a mixed-species native forest with the steep-sloped areas primarily used for native species conservation and less steeply sloped, less erodible areas primarily used for timber production. The resulting koa forest will provide a sustainable, long-term, predictable source of instrument grade wood for Taylor Guitars, one of the venture partners, produce high-quality wood for other uses, and provide habitat for native species, inspiring others to plant trees on their land for similar purposes. The ten-year objectives are as follows:

- Reforest the entire property with koa and a complement of associated native forest plants.
- Improve the quality of wood to be harvested in the future by:
  - planting seed from known, high-quality sources; and
  - utilizing cuttings propagated from trees with superior color, figure and form.
- Intensive management of koa for saw timber on those areas of the property with slopes less than 20%--accounting for 70% of the property or 390 acres.
- Reforest the remaining upland areas with a multi-species native forest, utilizing koa as a pioneer species—accounting for 30% of the area or 163 acres.
- Protect planted forest from wind by planting fast-growing, cattle resistant windbreaks.

This biological survey was prepared to provide an assessment of the overall biological environment and potential impacts of the project and to inform implementation of the project in case there is a need for avoidance or other mitigation.

The survey involved a full assessment of flora and vegetation of the property based on walking the main access road and the perimeter fence line; inspection of existing groves of trees; wandering transects focused on areas with the highest potential for native species; inspection of a number of wetlands; and periodic excursions into random areas not selected for examination for other reasons.

[1] The FMP is a separate appendix to the Environmental Assessment to which this report is an appendix.

Teams of between one and four biologists (Ron Terry, Patrick Hart, Layne Yoshida, and Cory Edging) walked the area on two separate days in February and March 2019. The objectives of the botanical survey were to: 1) describe the vegetation; 2) list all species encountered; and 3) identify threatened or endangered plant species. Plant species were identified in the field and later in the laboratory. Special attention was given to the possible presence of any federally (USFWS 2019) listed threatened or endangered plant species.

The survey also included a limited faunal survey restricted to providing a list of birds and introduced mammals, reptiles, or amphibians observed during the botanical survey. Also considered in this report is the general value of the habitat for native birds and the Hawaiian hoary bat. Not included are evaluation of impacts to invertebrates, although members of the Solanaceae plant family, many of which are known to be host plants for the endangered Blackburn’s sphinx moth (*Manduca blackburnii*), were specifically searched for.

Included in this report are discussions of threatened and endangered species. Federal and State of Hawai‘i endangered species laws require government agencies to ensure that their actions are not likely to jeopardize the continued existence of federal or State listed threatened endangered species (16 U.S.C. §1536(a)(2) and (4); Chapter 195D, HRS). The U.S. Endangered Species Act defines Critical Habitat as areas that may or may not be occupied by a threatened or endangered species but are essential to the conservation of the species. These areas may require special management considerations or protection (16 U.S.C. §1532 (5)).

Ecological Context and Biological Literature

Physical Factors Influencing Vegetation and Animal Habitat

There are several factors that influence the flora, vegetation and faunal habitat of the Kapoaula property. The geologic substrate on the property consists of different-aged lava flows from Mauna Kea ranging from as young as 4,000 years to as old as 250,000 years (Wolfe and Morris 1996). Winds in the area are dominantly northeast trades, replaced periodically by winds with a southerly component that can bring with them volcanic haze, or vog, when Kilauea Volcano is active (UH Hilo 1998). Kapoaula receives abundant rainfall. The average annual rainfall is 83 inches on the makai end of the property at an elevation of 2,740 feet and 56 inches at the mauka end at 3,180 feet. Monthly averages vary from about 4 inches in the comparatively dry summer months to more than 12 inches in the relatively wetter months of November through March (Giambelluca et al. 2013). The area is at very low risk of drought. Soils on the property are classified by the U.S. Natural Resources Conservation Service (NRCS) as Honoka‘a silty clay loam in the lower elevations and Maile silt loam in the upper elevations. Both soil types are listed as “highly erodible.” These soils have an 8-10% organic material content. Locally boggy conditions develop readily when the soil is compressed by cultivation, vehicles or animals. Both natural and human-created small depressions are present in this landscape and form temporary or even sometimes semi-permanent ponds. A number of minor gullies and ephemeral streams are typical of this landscape, which has not eroded sufficiently to have deep gulches and permanent streams, which would offer very distinct habitats.

Vegetation

It is difficult to speculate on the precise pre-human vegetation of the area, since the area has been completely transformed by removal of tree cover and introduction and promotion of pasture grasses maintained by heavy cattle grazing. In the *Manual of the Flowering Plants of the Hawaiian Islands,* Gagne and Cuddihy (1990) described the natural vegetation in fairly undisturbed areas with similar geology and climate in this part of Hāmākua as sub-montane rain forest dominated by **ʻ**ōhiʻa, koa and hapuʻu (*Cibotium* spp.) (Gagne and Cuddihy 1990). Historical records indicate that this entire flank of Mauna Kea was once a dense koa-ʻōhiʻa forest, but the in 1850s the forest was evidently nearly eliminated and replaced by grazing land. An 1856 account from the *Sandwich Island Monthly Magazine* reported:

> "…it is in the memory of many foreigners now living here, when the whole of these plains were covered in a thick wood…where hardly a tree stands for miles…….Thousands of old dead trees both standing upright and prostrate, from the present boundaries of these woods, exhibit a mode in which the destruction is effected; for whilst the old trees die of age, no young ones are seen taking their place, as during the last thirty or forty years, the cattle have eaten or trodden them down.…..."In former times when I was a boy (said Ha'alelea), Waimea was a thickly wooded region all about there…. but of late years round about where I lived, it is as cleared of trees as the Esplanade is."….. He explained that white settlers had felled the trees for fuel and fences for cattle pens and that "a good many of the young trees were destroyed by the cattle" (Fischer 2015: 62).
>
> "From the nature of the country to the windward of our private lands [Waimea] (a dense forest and almost impenetrable undergrowth covering nearly the whole of it) as the herds increased it became an impossibility to prevent cattle from getting beyond the reach of our control, and gradually they have filled this land with their offspring" (Fischer 2015: 188).

John Parker's original homestead at Mana was located about a mile mauka of the property boundary. An early account of the ranch reported on the koa milling activity in the area:

> "…it was below the koa forest of Hanaipoi that the saw pits were dug in the land known as Makahalau where the purebred bulls and cows are now penned up. This became the great center for koa work, cutting down trees, selecting the best to be sawn up into lumber through the saw pits, the piling up of koa lumber on hilly ground so that the air could get between the boards and season the wood. There was so much lumber piled up in this section that the natives called the place Palihooukapapa [Hill of piled lumber]" (Brennan 2006: 82).

Over the last century, however, there have only been small areas of remnant forest patches of ʻōhiʻa that reflect the original vegetation. No threatened or endangered plant species are known from this general area, and no plant critical habitat is present on or near the property (https://ecos.fws.gov/ecp/report/table/critical-habitat.html). The closest plant critical habitat is at about three miles south on a pair of hills that provide specialized habitat for a group of cinder cone species.

General Faunal Habitat

The quality of habitat for native animals is primarily determined by vegetation and the degree of disturbance. At the Kapoaula property, as in similar locations along the Hāmākua Coast, both the bird and invertebrate fauna would be expected to be dominated by non-native species that are adapted to open grassland habitats. A few widespread native species will tend to be present and forest patches may attract native birds. Unlike the situation with plants, a number of widespread endangered species may fly over, and, in some cases, nest, roost, forage, or otherwise utilize some features of the habitat on the property. However, no animal critical habitat is present on the property or within four miles of the property (https://ecos.fws.gov/ecp/report/table/critical-habitat.html). The closest animal critical habitat is eight miles away on Mauna Kea and on the Hakalau Forest National Wildlife Refuge, which are critical habitat units for various endangered birds.

Birds

A number of native forest birds occur along the Hilo-Hāmākua coast within the elevational range of the Kapoaula property. These include honeycreepers such as the ʻapapane (*Himatione sanguinea*) and ʻamakihi (*Chlorodrepanis virens*), the ʻelepaio (*Chasiempis sandwicensis* – a monarch flycatcher), the ʻōmaʻo thrush (*Myadestes obscurus*), and the Hawaiian hawk (*Buteo solitarius*). All of these species generally require ʻōhiʻa forest, but the hawk is known to breed successfully in both native and non-native forests. Additional native forest bird species are found in the montane forests along the Hāmākua Coast above the mosquito belt (generally above 4,000 feet in elevation), where native plant resources are still present and *Culex* mosquitos are absent or scarce. A particularly important location is the 32,733-acre Hakalau Forest National Wildlife Refuge, located about 20 miles from the Kapoaula property. Birds for which the continuing health of the Refuge may be a critical factor include the threatened ʻiʻiwi (*Drepanis coccinea*), as well as the endangered ʻakiapōlāʻau (*Hemignathus munroi*), Hawaiʻi creeper (*Loxops mana*) and Hawaiʻi ʻakepa (*Loxops coccineus*). Bird survey work in Puna on the eastern end of the Island of Hawaiʻi documented in Spiegel et al. (2006) indicate that in many lowland forests, ʻamakihi are the most common and widespread native birds and are significantly associated with ʻōhiʻa. These lowland ʻōhiʻa forests can also support endangered Hawaiian hawks which forage in forests nearby agricultural tracts and nest in tall trees. At low elevations there has been widespread recovery of this species and a changing composition of the forest bird community; nevertheless, lowlands dominated by non-native vegetation and bird species continue to have few forest birds, with a few exceptions.

By contrast, some native waterbirds are common in both upland and lowland environments. In the Hāmākua Coast in general, waterbirds may be found in streams, estuaries, natural and artificial ponds, and wetlands. The most common native waterbird at lower elevations is the indigenous black-crowned night heron, or ʻaukuʻu (*Nycticorax nycticorax hoactli*), a wetland bird. It is also not unusual to spot the endangered Hawaiian goose or nēnē (*Branta sandwicensis*), a wide-ranging and friendly bird, in a variety of environments and elevations throughout the island. Conceivably present in isolated ponds in the uplands are three endangered waterbirds: Hawaiian ducks or koloa maoli (*Anas wyvilliana*), Hawaiian stilt or aeʻo (*Himantopus mexicanus knudseni*), and the Hawaiian coot or ʻalae ke'oke'o (*Fulica alai)*. Of these three birds, only the koloa maoli is likely in the project area, as Hawaiian stilts are generally found only below 600 feet in elevation, and Hawaiian coots below 1,320 feet (Hawaiʻi DLNR 2015).

A very common native resident migratory bird, the Pacific golden-plover or kolea (*Pluvialis fulva*), is often seen in grassy areas far from the coast throughout the region during its winter residency in Hawaiʻi.

While seabirds are not generally observed directly in the region, they may actually be transiting it at night. The Hawaiian petrel (*Pterodroma sandwichensis*), the Hawaiian sub-species of Newell's shearwater (*Puffinus newelli*), and the band-rumped storm-petrel (*Oceanodroma castro*) have been recorded over-flying various areas on the Island of Hawaiʻi between mid-March and December each year. The Hawaiian petrel and band-rumped storm-petrel are listed as endangered, and Newell's shearwater as threatened, under both federal and State of Hawaiʻi endangered species statutes. The petrels and shearwaters hunt over the ocean during the day and fly to higher elevations at night to nest. The Hawaiian petrel and the band-rumped storm petrel generally nest well above 5,000 feet on the Big Island, but some nests have recently been found at lower elevations on Kohala volcano. Both the Newell's shearwater and Hawaiian petrel are known to burrow under ferns on forested mountain slopes. These burrows are used year after year and usually by the same pair of birds. Although capable of climbing shrubs and trees before taking flight, they need an open downhill flight path through which they can become airborne. Although once abundant on all the main Hawaiian islands, most Newell's shearwater colonies today are found in the steep terrain between 500 to 2,300 feet on Kauaʻi, while Hawaiian petrel colonies are found on Kauaʻi, Maui, Lanaʻi, and Hawaiʻi islands (https://www.fws.gov/pacificislands/fauna/newellsshearwater.html). The primary cause of mortality in these species in Hawaiʻi is thought to be predation by alien mammalian species at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with manmade structures and, if not killed outright, become easy targets of predatory mammals.

Mammals

Hawaiʻi's only native land mammal is the endangered Hawaiian hoary bat or ōpeʻapeʻa (*Lasiurus cinereus semotus*). These solitary, nocturnal bats roost in tall shrubs and trees and rarely in lava tubes, cracks in rocks, or man-made structures. They are found at all elevations on Kauaʻi, Maui, Hawaiʻi and Oʻahu. They roost in native and non-native vegetation alike, utilizing ʻōhiʻa, hala, coconut palms, kukui, kiawe, avocado, shower trees, and even fern clumps, as well as possibly eucalyptus and sugi pine. Prime foraging areas include forest and pasture interfaces, forest road corridors, streams, bays, and inlets. They use echolocation to find and capture native and non-native night-flying insects such as moths, beetles, crickets, mosquitoes, and termites. Hawaiian hoary bats have adapted to urban and agricultural land uses fairly successfully, probably because of high levels of insect prey found there. Research indicates that bats reproduce in the lowlands but move to higher elevations during the winter, possibly in order to utilize the cooler temperatures to achieve a lower metabolic rate while roosting. Maps produced by DLNR (2015) indicate that they have been sighted throughout the Hāmākua Coast, and indeed, the island.

Bats are vulnerable to habitat loss, pesticides, predation, snagging in barbed wire, and roost disturbance. During clearing, grubbing or tree trimming/cutting, the removal of tall, woody vegetation can temporarily displace bats using the vegetation for roosting. As bats use multiple roosts within their home territories, this disturbance from the removal of vegetation is likely to be minimal. However, during the pupping season, from about June 1 to September 15 each year, female bats carrying pups may be less able to rapidly vacate a roost site when the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage, and very small pups may be unable to flee a tree that is being felled. (DLNR- 2005; Bonaccorso 2010; https://www.pacificrimconservation.org/wp-content/.../Hawaiian%20Hoary%20Bat.pdf;

Reptiles and Amphibians

There are no native terrestrial reptiles or amphibians in Hawaiʻi. Several species of gecko, anole and skink, as well as a cryptic, wormlike blind snake, are common throughout the island. Bufo toads (*Bufo marinus*), bullfrogs (*Rana catesbeiana*) and the highly invasive coqui frog (*Eleutherodactylus coqui*) are found in all of the rainier lowlands of the island of Hawaiʻi, including the Hāmākua Coast.

Invertebrates

Twenty-three species of invertebrate are currently listed as threatened or endangered in the State of Hawaiʻi (U.S. Fish and Wildlife Service 2019). These include a spider, an amphipod, a moth, snails, picturewing flies, yellow-faced bees and damselflies. Very few if any of these species have a high potential to be present at the Kapoaula property. Most of the listed species are restricted to other islands or found at substantially higher elevations with intact native forest, often with specific host plant species that are lacking on the properties.

Native insects are highly associated with native vegetation. Invertebrate fauna in active agricultural areas are almost exclusively non-native species, because of the lack of native plants and the periodic application of insecticides. Few of the endangered insects listed above are common in the pastures of the region. However, there is one endangered insect, the orangeblack Hawaiian damselfly (*Megalagrion xanthomelas*), that lives in streams and wetlands at locations around the coastline on the Island of Hawaiʻi, primarily in estuaries and ponds at sea level. On other islands, it has been sighted as high as 3,280 feet above sea level. According to conservationists, its limited habitat and small scattered populations may affect long-term stability. The species is susceptible to the effects of habitat loss and introduced species (https://xerces.org/orangeblack-hawaiian-damselfly/; https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=I063; DLNR-DOFAW 2013; Polhemus 1993 and 1995; Polhemus and Asquith 1996).

Current Vegetation and Flora at Kapoaula

Our team of biologists spent portions of two days at Kapoaula conducting biological surveys. All portions of the property were investigated.

The current vegetation on the property is about 90 percent managed pasture, consisting of various non-native species of grass, with kikuyu grass (*Cenchrus clandestinus*) and Pangola grass (*Digitaria eriantha*) most common. There are also a large variety of primarily non-native herbs, although the pasture is well-managed and noxious weeds are relatively low in cover and biomass. Gulch slopes and rock faces support some ferns and low shrubs as well.

There is a single 14.8-acre grove of forestry trees likely planted during the Civilian Conservation Corps era, in the 1930s (see Figures 1a and 2e). It is composed mainly of tropical ash (*Fraxinus uhdei*), with two rows of tsugi pine (*Cryptomeria japonica*), two rows of swamp mahogany (*Eucalyptus robusta*) in poor condition, and scattered turpentine tree (*Syncarpia glomulifera*). The windward edge of the stand, composed of tsugi pine and swamp mahogany, has been stunted by wind, and the rest of the ash stand is beginning to show signs of mechanical deterioration, owing to the mature condition of the trees.

No permanent streams are present and all watercourses are highly ephemeral. True, distinct riparian vegetation is not present, but the high slopes and presence of trees near the deeper gulches creates a shady environment that promotes different assemblages of plants than the open pastures. More ferns and herbs and fewer grasses are present there. Several semi-permanent ponds or wetlands are also present, most of them apparently created by artificially blocked drainage, sometimes for cattle watering.

Flora

A full list of flora found on the property is contained in Table 1. Only a small proportion of the plant species found are native, and they make up generally a very small part of the vegetative cover and biomass. The most numerous native plants are ohi‘a, the fern pala‘a (*Sphenomeris chinensis*) and the sedge *Cyperus polystachyos.* Also present are the herb popolo (*Solanum americanum*), the fern ally moa (*Psilotum nudum*), and several ferns: uluhe (*Dicranopteris linearis*), *Microlepia speluncae*, *Christella cyatheoides* and sword fern (*Nephrolepis exaltata*). Non-native plants of some concern include the widespread fireweed (*Senecio madagascariensis*), which sickens cattle, and strawberry guava (*Psidium cattleianum*).

Threatened and Endangered Plant Species

No listed or proposed threatened or endangered plant species were found. Given the current context, in an area almost completely devoted to regularly grazed pasture and groves of non-native forestry trees, it is unlikely that one would be found. It should also be noted that very few individuals within Solanaceae family were found, and none that could potentially serve as hosts for the endangered Blackburn’s sphinx moth.

Fauna and Native Animal Species Habitat at Kapoaula

Introduced Mammals, Reptiles, and Amphibians

The only live mammals seen during the survey were domestic cattle (*Bos taurus*). It is likely that small Indian mongooses (*Herpestes a. auropunctatus*), mice (*Mus* spp.), rats (*Rattus* spp.), feral cats (*Felis catus*), feral pigs (*Sus scrofa*) and domestic dogs, (*Canis f. familiaris*) are occasionally present on the property. None of these wild alien mammals have conservation value and all are deleterious to native flora and fauna. There are no native terrestrial reptiles or amphibians in Hawai‘i. No reptiles and amphibians were detected during the survey.

Invertebrates

No systematic invertebrate survey was conducted for the property, given the low probability of the presence of T&E or rare species, and the low likelihood that reforestation activities would adversely affect them. Several damselflies, likely one of the common native species, as well as an indigenous dragonfly, the common green darner (*Anax junius*) were observed in several of the ponds that occupy the property.

Hawaiian Hoary Bat

The endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*) is ubiquitous throughout the Island of Hawaiʻi, and they are thus presumed to be present on the property. The bats are known to favor eucalyptus groves, which are present on the property and in the general region. Bats may forage for flying insects near the large grove of tropical ash and eucalyptus and the small groves of ʻōhiʻa on a seasonal basis. They may roost in some of the trees and shrubs on the property. In addition to unaided visual detection in the dawn and dusk hours, Hawaiian hoary bats can be detected by night vision binoculars and goggles using available light; thermal infrared scopes and cameras; sound detectors using high-frequency ultrasonic microphones with a range above 20 kilohertz; and modified marine surveillance radar. Our visual-only surveys took place in daylight, and none of these techniques were employed on the property, because the bats are presumed to be present and no information valuable in a biological reconnaissance would be obtained by employing the technologies.

Birds

Only a few species of birds were detected during the surveys, most of them non-native and typical of those found in similar pasture habitats: skylark (*Alauda arvensis*), Japanese white-eye (*Zosterops japonicus*), Kalij pheasant (*Lophura leucomelanos*), domestic chickens (*Gallus gallus domesticus*), wild turkeys (*Meleagris gallopavo*) and scaly-breasted munia (*Lonchura punctulata*). It is likely that repeated or extended observations at different times of the day and year would generate a much larger list of non-native birds. One would expect ring-necked pheasant (*Phasianus colchicus*), Erckel's francolin (*Francolinus erckelii*), mourning dove (*Zenaida macroura*) and a variety of other birds.

Several native birds were also present. The most frequently seen native bird was the Pacific golden-plover or kolea (*Pluvialis fulva*), which was abundant in the pastures. The Pacific golden-plover is a protected migratory bird. A pair of pueo (*Asio flammeus sandwichensis*), the Hawaiian endemic sub-species of the short-eared owl, was seen in the lower elevations near the adjacent quarry. This diurnal bird of prey is regularly seen within the grasslands of South Kohala into Hāmākua. This species is currently widespread in South Kohala and does not have special protected status under either the State or federal endangered species statutes. Two endangered bird species were also present. We observed a pair of endangered Hawaiian hawks (*Buteo solitarius*), which appear to have been a parent and a juvenile from the previous year. The birds were seen from a distance in a small grove of ʻōhiʻa, but when we got to the edge of the grove of tropical ash, the birds flew into a low position on a tree on the edge of a grove directly above us and observed us for about ten minutes (see Figure 2i for a photo). It is somewhat likely given the size of the grove and its relationship to adjacent habitat that Hawaiian hawks utilize the grove for nesting. On two occasions we observed a pair of what were either Hawaiian ducks (koloa maoli -*Anas wyvilliana*) or Hawaiian duck hybrids, in two separate small ponds in the lower part of the property.

As stated previously, the elevation of the land at 2,740 to 3,180 feet above sea level is within the range of many native forest birds, including the Hawaiʻi ʻamakihi (*Hemignathus virens*) (which is sometimes found down to sea level in Puna), ʻelepaio (*Chasiempis sandwichensis*), ʻiʻiwi (*Vestiaria coccinea*), ʻapapane (*Himatione sanguinea*), and ʻōmaʼo (*Myadestes obscurus*). However, the lack of native forest cover means that such birds are unlikely to be found, and several bird observations at different times of the day did not detect them.

The seabirds discussed in the previous section may be present in this part of Hāmākua and may overfly, roost, nest, or utilize resources here, including the endangered Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus auricularis newelli*). No advanced seabird detection technologies (e.g., radar) were employed, and it is difficult to speculate on whether these birds pass over the property.

Findings and Recommendations

Both the vegetation and flora of the Kapoaula property are typical of former native forests that were cleared for pasture many decades ago. A stable assemblage of pasture grasses and some herbs have come to dominate the biomass and cover, except in the limited forestry plantings. Very few natives are present besides a few scattered groves of ʻōhiʻa. All rare, threatened or endangered plants and any traces of intact native ecosystems are long gone and unlikely to return without intensive human intervention. Habitat for native animals is very limited and in general, only the most widespread endangered animals – Hawaiian hoary bats and Hawaiian hawks – are present. Interestingly, the pair of Hawaiian ducks seen in one of the property's small ponds signals that there is potential for nesting habitat for this species, although the areas around such ponds would need to be managed with rat, mongoose and cat predator control to allow breeding. Other less manageable threats exist as well, including avian diseases and predation by ʻaukuʻu, cattle egrets (*Bubulcus ibis*) and barn owls (*Tyto alba*), each of them present in the area.

The reforestation of virtually the entire property with koa and a complement of associated native forest plants will significantly improve the vegetation, watershed qualities and faunal habitat of the property. The majority of the property will be intensively managed to grow koa for saw timber, but where high slopes are present – about 30 percent of the property – the vegetation will be managed for a multi-species native forest where koa is not planned for harvest. Even in the saw timber areas, the encouragement of a native species understory rather than a plantation-style arrangement, coupled with the planting and harvesting rotation of stands of varying ages, will maintain a healthy native forest over most of the property at any given time. In addition to diversifying the native flora, this restoration will reduce soil compaction and provide cover and food for native wildlife.

There will be minor impacts to some native faunal species, all of which are either insignificant or can be mitigated to insignificant levels through simple project management measures.

- The Pacific golden-plover is unlikely to be disturbed by the forestry operations but because of the growth of trees may become less abundant on the property in the future. It will

continue to find abundant habitat in the thousands of acres of pasture and other grasslands in the area, as well as agricultural and urban areas throughout the island.
- Forestry operations in the short-term and the eventual growth of tree cover will displace short-eared owls, but there is abundant additional suitable pasture habitat within the area for any displaced owls to move into, and no adverse impacts would be expected.

In order to avoid impacts to endangered but widespread native birds and the Hawaiian hoary bat:

- To minimize impacts to the endangered Hawaiian hoary bat, we recommend that trees taller than 15 feet not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15). Barbed wire should not be used on fences with the exception of the bottom strand, which is required for excluding feral pigs.
- To minimize impacts to Hawaiian hawks, we recommend avoiding earthmoving or tree cutting during the breeding season for Hawaiian hawks (March through September). If this time period cannot be avoided, arrange for a hawk nest search to be conducted by a qualified biologist. If hawk nests are present in or near the project site, all land clearing activity should cease until the expiration of the breeding season.
- If any activities incorporate outdoor lighting, they may attract endangered seabirds, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of these seabirds through interaction with outdoor lighting, we recommend no construction lighting or unshielded equipment maintenance lighting after dark between the months of April and October. All permanent lighting should be shielded in strict conformance with the Hawai‘i County Outdoor Lighting Ordinance (Hawai‘i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

The Forest Management Plan for the project contains in Chapter 6, “Detailed practices and objectives”, a variety of specific and detailed best practices for forest management that include measures to protect the biological environment. These recommendations are incorporated by reference here.

There is a significant potential for the project to accomplish some or all of the following conservation benefits:

- Reduced habitat fragmentation;
- Maintenance, restoration, or enhancement of existing habitats;
- Increases in habitat connectivity;
- Stabilized or increased numbers or distribution; and
- Opportunities to test and develop new habitat management techniques.

As the project proceeds, it is expected that a baseline survey will be conducted to establish the levels of listed species currently on the property, and an SHA will be developed.

Limitations

No biological survey of a large area can claim to have detected every species present. Some plant species are cryptic in juvenile or even mature stages of their life cycle. Thick brush can obscure even large, healthy specimens. Birds utilize different patches of habitat during different times of the day and seasons, and only long-term study can determine the exact species composition. The findings of this survey must therefore be interpreted with proper caution; in particular, there is no warranty as to the absence of any particular species.

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https://dlnr.hawaii.gov/wildlife/files/2019/03/SWAP-2015-Hawaiian-duck-Final.pdf
Damselflies and Dragonflies Order Odonata.
https://dlnr.hawaii.gov/wildlife/files/2019/02/SWAP-2015-Odonata-Final.pdf
‘Alae ke‘oke‘o or Hawaiian coot. Fulica alai.
https://dlnr.hawaii.gov/wildlife/files/2019/03/SWAP-2015-Hawaiian-coot-Final.pdf;

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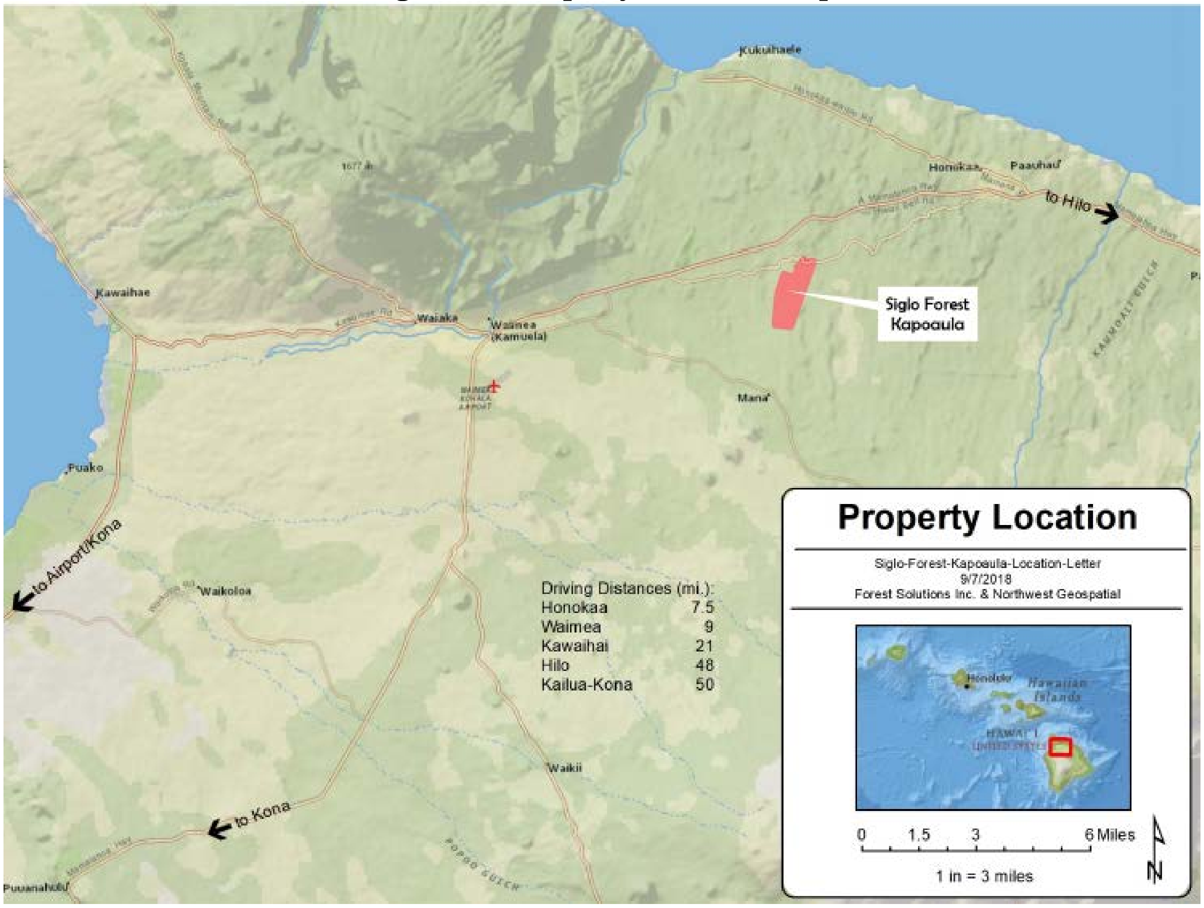
Figure 1a Property Location Map



Source: Forestry Solutions Inc.

Figure 1b. Aerial Image of Property

Source: Google Earth ©.

Figure 2 Project Site Photos

2a. USDA Airphoto from January 1965 (Tropical ash stand on property visible in upper right quadrant) ▲

Figure 2 Project Site Photos

2b. Majority of property is pasture with no trees ▲
▼ 2c. Isolated groves are present on a few ridges

Figure 2 Project Site Photos

2e. Tropical ash grove on left, ʻōhiʻa patch in foreground, Monterey pines on ridge in center ▲

▼ 2f. Low light levels prevail in interior rows of tropical ash grove

Figure 2 Project Site Photos

2g. Shallow, ephemeral gulches lack distinct riparian vegetation ▲ ▼ 2h. Pair of hawks in tree

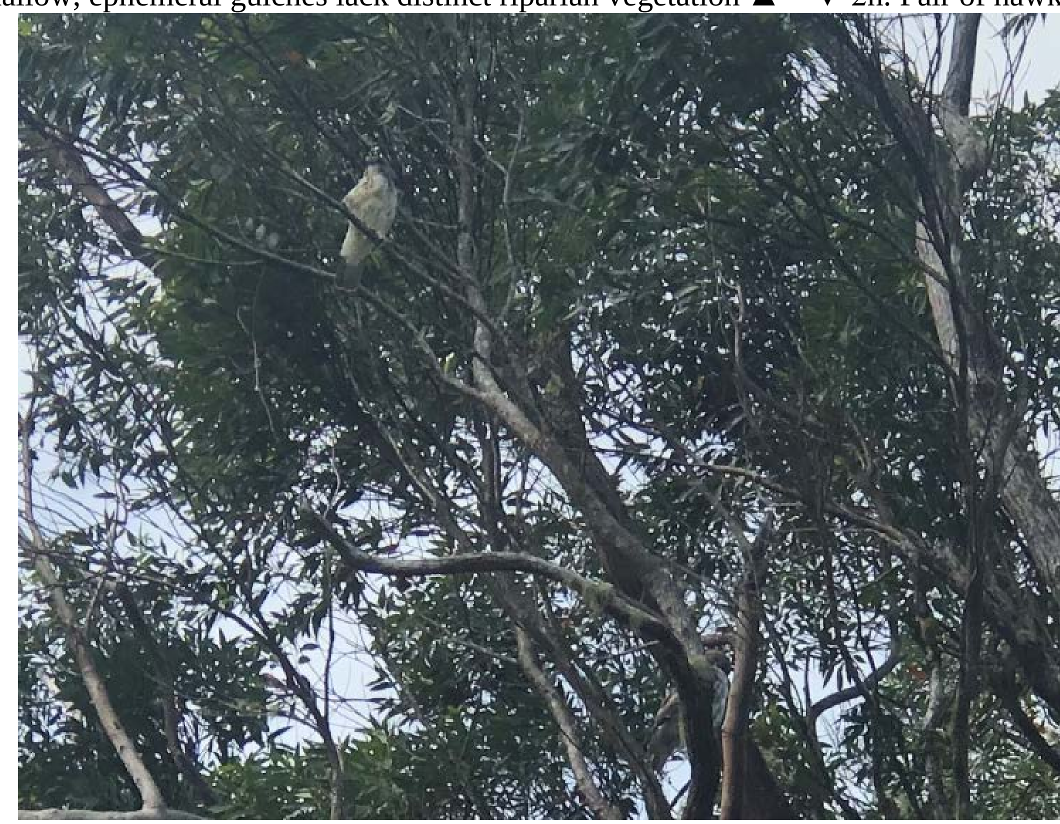


Figure 2 Project Site Photos

2i. Isolated ponds with wetlands and waterbird habitat ▲

▼ 2j. Eucalyptus fringe tropical ash grove

Table 1
Plants Observed on Kapoaula Property

Scientific Name	Family	Common Name	Life Form	Status*
Adiantum hispidulum	Pteridaceae	Rough maidenhair fern	Fern	A
Ageratina adenophera	Asteraceae	Maui pamakani	Herb	A
Agrostis stolonifera	Poaceae	Creeping bentgrass	Herb	A
Andropogon virginicus	Poaceae	Broomsedge	Grass	A
Anthoxanthum odoratum	Poaceae	Sweet vernal grass	Herb	A
Axonopus fissifolius	Poaceae	Narrow leaved carpet grass	Grass	A
Blechnum occidentalum	Blechnaceae	Blechnum	Fern	A
Cenchrus clandestinus	Poaceae	Kikuyu grass	Grass	A
Centella asiatica	Apiaceae	Asiatic Pennywort	Herb	A
Cibotium glaucum	Cibotiaceae	Hapu‘u pulu	Fern	E
Christella cyatheoides	Thelypteridaceae	Cyclosorus	Fern	E
Christella dentata	Thelypteridaceae	Christella	Fern	A
Cirsium vulgare	Asteraceae	Bull thistle	Herb	A
Commelina diffusa	Commelinaceae	Honohono grass	Herb	A
Conyza bonariensis	Asteraceae	Hairy horseweed	Herb	A
Cryptomeria japonica	Taxodiaceae	Tsugi	Tree	A
Cuphea carthagenensis	Lythraceae	Tarweed	Shrub	A
Cupressus sp.	Cupressaceae	Cypress	Tree	A
Cymbopogon refractus	Poaceae	Barbwire grass	Herb	A
Cynodon dactylon	Poaceae	Bermuda grass	Grass	A
Cyperus halpan	Cyperaceae	Nut grass	Sedge	A
Cyperus polystachyos	Cyperaceae	Pycreus	Sedge	I
Desmodium uncinatum	Fabaceae	Desmodium	Herb	A
Dicranopteris linearis	Gleicheniaceae	Uluhe	Fern	I
Digitaria eriantha	Poaceae	Pangola grass	Herb	A
Digitaria violascens	Poaceae	Violet crabgrass	Herb	A
Eragrostis brownei	Poaceae	Sheepgrass	Herb	A
Erechtites hieracifolia	Asteraceae	Fireweed	Herb	A
Eucalyptus robusta	Myrtaceae	Swamp mahogany	Tree	A
Fraxinus uhdei	Oleacea	Tropical ash	Tree	A
Geranium homeanum	Geraniaceae	Cranesbill	Herb	A
Gnaphalium purpureum	Asteraceae	Purple cudweed	Herb	A
Hedychium sp.	Zingiberaceae	Ginger	Herb	A
Hydrocotyle verticillata	Araliaeae	Marsh pennywort	Herb	A
Hypericum mutilum	Clusiaceae	Dwarf St. John’s wort	Herb	A
Hypochoeris radicata	Asteraceae	Hairy cat’s ear	Herb	A
Juncus acuminatus	Juncaceae	Sharp-fruited rush	Herb	A
Kyllinga breviifolia	Cyperaceae	Kili‘o‘opu	Sedge	A
Medicago rugosa	Fabaceae	Clover	Herb	A
Megathyrsus maximus	Poaceae	Guinea grass	Grass	A
Melaleuca leucodendrum	Myrtaceae	Paperbark tree	Tree	A
Melinus minutiflora	Poaceae	Molasses grass	Grass	A
Metrosideros polymorpha	Myrtaceae	‘Ōhi‘a	Tree	E
Microlepia speluncae	Dennstaedtiaceae	Microlepia	Fern	I

Nephrolepis exaltata	Nephrolepidaceae	Sword Fern	Fern	I
Nephrolepis multiflora	Nephrolepidaceae	Sword fern	Fern	A
Oxalis corymbosa	Oxalidaceae	Pink wood sorrel	Herb	A
Panicum repens	Poaceae	Torpedo grass	Herb	A
Paspalum conjugatum	Poaceae	Hilo grass	Grass	A
Paspalum urvillei	Poaceae	Vasey grass	Grass	A
Persicaria punctata	Water smartweed	Polygonaceae	Herb	A
Pinus radiata	Pinaceae	Monterey pine	Tree	A
Phytolacca octandra	Phytolaccaceae	Southern pokeweed	Herb	A
Plantago lanceolata	Plantaginaceae	Narrow-leaved plantain	Herb	A
Plantago major	Plantaginaceae	Common plantain	Herb	A
Pluchea carolinensis	Asteraceae	Sourbush	Shrub	A
Polygala paniculata	Polygonaceae	Milkwort	Herb	A
Psidium cattleianum	Myrtaceae	Strawberry guava	Tree	A
Psilotum nudum	Psilotaceae	Moa	Fern Ally	I
Rhynchospora caduca	Cyperaceae	Beak rush	Herb	A
Rubus rosifolius	Rosaceae	Thimble berry	Herb	A
Sacciolepis indica	Poaceae	Glenwood grass	Herb	A
Senecio madagascariensis	Asteraceae	Fireweed	Herb	A
Schinus terebinthifolius	Anacardiaceae	Christmas berry	Shrub	A
Schizachyrium condensatum	Poaceae	Tufted beardgrass	Grass	A
Sida rhombifolia	Malvaceae	Cuba jute	Herb	A
Solanum americanum	Solanaceae	Popolo	Shrub	I
Sphenomeris chinensis	Lindsaeaceae	Pala‘a	Fern	I
Sporobolus africanus	Poaceae	Smutgrass	Grass	A
Syncarpia glomulifera	Myrtaceae	Turpentine tree	Tree	A
Trifolium repens	Fabaceae	White clover	Herb	A
Urochloa mutica	Poaceae	California grass	Grass	A
Verbena litoralis	Verbenaceae	Oiwi	Shrub	A
Vulpia myuros	Poaceae	Rat tail fescue	Herb	A

APPENDIX C

ARCHAEOLOGICAL AND CULTURAL INVENTORY REPORTS

C1 DRAFT ARCHAEOLOGICAL ASSESSMENT

C2 CULTURAL IMPACT ASSESSMENT

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An Archaeological Assessment of the Paniolo Tonewoods Kapoaula Koa Forest Management Plan

TMK: (3) 4-7-007:011

Kapoaula Ahupuaʻa
Hāmākua District
Island of Hawaiʻi

DRAFT VERSION

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ASM Project Number 31870.00

An Archaeological Assessment of the Paniolo Tonewoods Kapoaula Koa Forest Management Plan

TMK: (3) 4-7-007:011

Kapoaula Ahupuaʻa
Hāmākua District
Island of Hawaiʻi

ASM affiliates

EXECUTIVE SUMMARY

At the request of Ron Terry of Geometrician Associates, LLC, on behalf of Cardno GS, Inc. (CGS), ASM Affiliates conducted an Archaeological Inventory Survey (AIS) of a roughly 564-acre study area located on Tax Map Key (TMK): (3) 4-7-007:011 in Kapoaula Ahupua‘a, Hāmākua District, Island of Hawai‘i. The AIS was conducted to accompany a Hawai‘i Revised Statutes Chapter 343 Environmental Assessment prepared for the Kapoaula Koa Forest Management Plan Project that has been proposed by the landowner’s (Siglo Forest, Inc.) lessee, Paniolo Forestry, LLC, in conjunction with Paniolo Tonewoods. The objective of the project is to develop a long-term supply of quality *koa* (*Acacia koa*) wood and associated native forest plants by reforesting the study area with *koa* and other native trees, replacing the existing pasture that has been used for cattle grazing since the mid- to late nineteenth century. The current study was conducted in accordance with Hawai‘i Administrative Rules (HAR) 13§13–284 and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawai‘i Administrative Rules 13§13–276. Because no archaeological sites were found during the AIS, this report has been prepared as an Archaeological Assessment in accordance with HAR 13§13-284-5(b)(5)(A).

Traditional accounts, boundary commission testimonies and historical maps indicate that the study area was forested until the second half of the nineteenth century. Traditional uses of the forests on the slopes of Mauna Kea are understood to have included the harvesting of upland resources such as timber, plants products, and bird feathers, as well as for travel, ceremonial or ritual purposes, and associated temporary habitation. After the introduction of cattle to the area in the early to mid-nineteenth century, the current study area became deforested and converted to pasture. The land was acquired by Parker Ranch in 1874, and it has been used for cattle grazing since that time.

Fieldwork for the current study consisted of an initial reconnaissance of the study area conducted by Benjamin Barna, Ph.D. (Principal Investigator) on January 29, 2019, followed by an intensive (100% coverage) pedestrian survey conducted between March 26 and 28, 2019. The field crew for the intensive survey consisted of Genevieve L. Glennon, B.A., Lauren M. U. Kepa‘a, Johnny Dudoit, B.A., and Lyle Auld, B.A., under the direction of Benjamin Barna, Ph.D. In the large open pasture portions of the study area, field crew members walked in systematic transects paralleling the survey area boundaries, spaced no more than 40 meters apart. The low, recently-grazed grass covering most of the study area resulted in excellent visibility. In addition to walking transects, a thorough inspection was made of vegetated areas and bedrock overhangs with potential for concealing archaeological features and lava tubes, as well as prominent and anomalous landforms. Exposed soil cuts created by roads and cattle were inspected to ascertain the soil stratigraphy throughout the study area. Given the erosional environment of the study area, no subsurface testing was conducted.

As a result of the current fieldwork, no archaeological sites or other historic properties of any kind were identified within the study area. All of the ranching related infrastructure encountered during the survey appeared modern. An effort was made to identify the physical routes two trails depicted on historic maps, but the routes have been obscured by cattle trampling, erosion, and the incursion of pasture grasses since the mid-nineteenth century. Given the history of erosion and other ground disturbance related to livestock ranching, it is unlikely that any buried cultural deposits exist within the current study area.

Given the negative findings of the current study with respect to archaeological resources, it is concluded that the proposed project will not impact any known historic properties. The determination of effect for the proposed project is “no historic properties affected.” With respect to the historic preservation review process of the Department of Land and Natural Resources–State Historic Preservation Division, our recommendation is that no further work needs to be conducted within the current study area prior to or during project implementation. In the unlikely event that significant archaeological resources are discovered during the proposed ground disturbing activity, work should cease in the area of the discovery and DLNR-SHPD contacted pursuant to HAR 13§13-280-3.

CHAPTERS

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1. INTRODUCTION

At the request of Ron Terry of Geometrician Associates, LLC, on behalf of Cardno GS, Inc. (CGS), ASM Affiliates conducted an Archaeological Inventory Survey (AIS) of a roughly 564-acre study area located in Kapoaula Ahupuaʻa, Hāmākua District, Island of Hawaiʻi (Figure 1). The study area comprises a single parcel, Tax Map Key (TMK): (3) 4-7-007:011 (Figure 2), which is owned by Siglo Forest, Inc. The AIS was conducted to accompany a Hawaiʻi Revised Statutes Chapter 343 Environmental Assessment prepared for the Kapoaula Koa Forest Management Plan Project that has been proposed by Siglo Forest, Inc.'s lessee, Paniolo Forestry, LLC, in conjunction with Paniolo Tonewoods. The objective of the project is to develop a long-term supply of quality *koa* (*Acacia koa*) wood and associated native forest plants on the subject parcel for use in the manufacture of musical instruments and for other uses. To do so, Paniolo Forestry, LLC will plant *koa* and other native trees on the subject parcel, which will replace the existing pasture that has been used for cattle grazing since the mid- to late nineteenth century.

The current study was conducted in accordance with Hawaiʻi Administrative Rules (HAR) 13§13–284 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. 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. According to HAR 13§13-284-5(b)(5)(A), when no archaeological sites are found during an AIS, the results of the AIS shall be reported through an Archaeological Assessment. This report contains background information outlining the study area's physical and cultural contexts, a presentation of previous archaeological work in the vicinity of the project area, and current survey expectations based on that previous work. Also presented are an explanation of the project's methods and a description of the findings, followed by recommendations and a determination of effect for the proposed project.

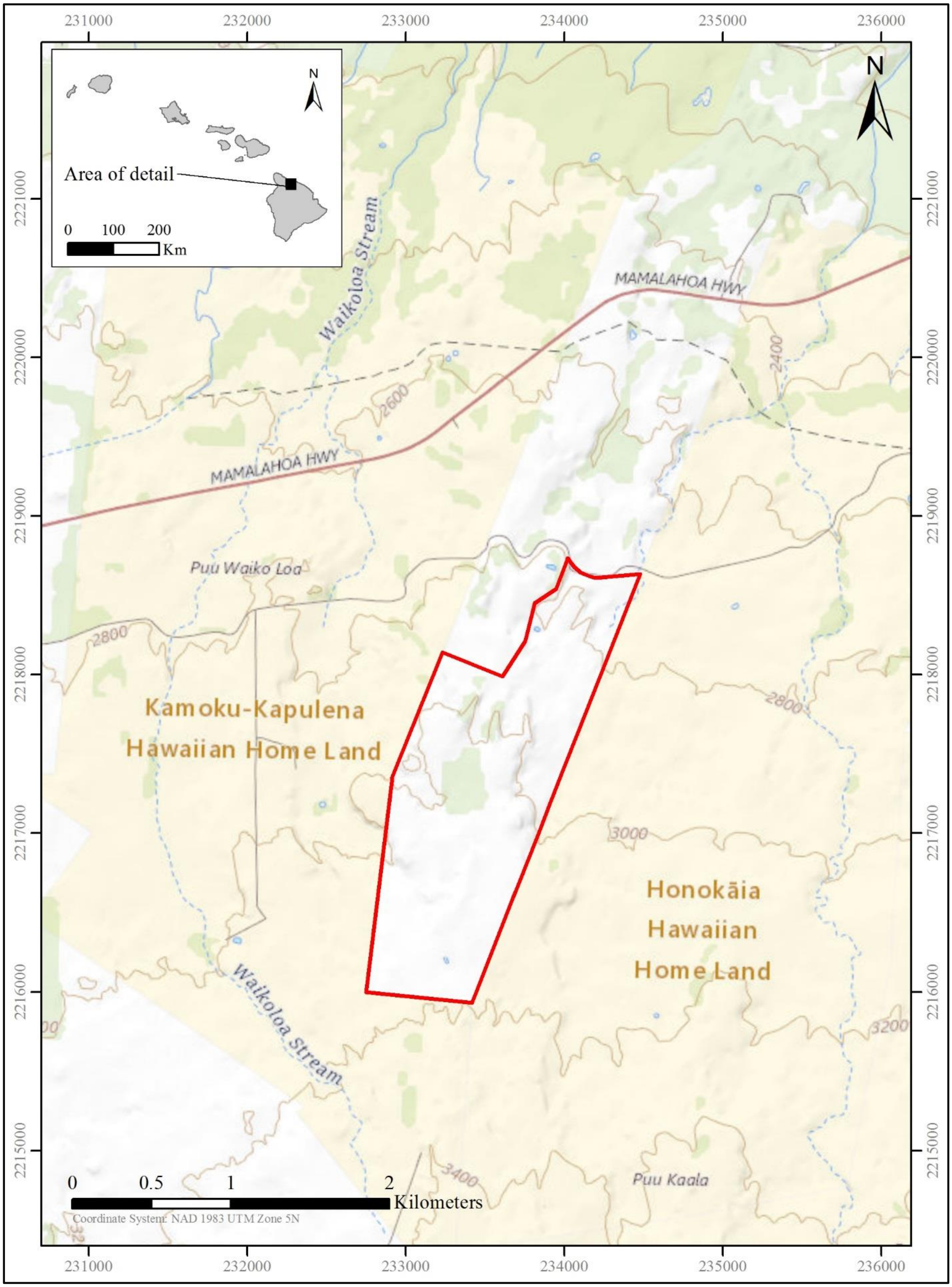


Figure 1. Study area location.

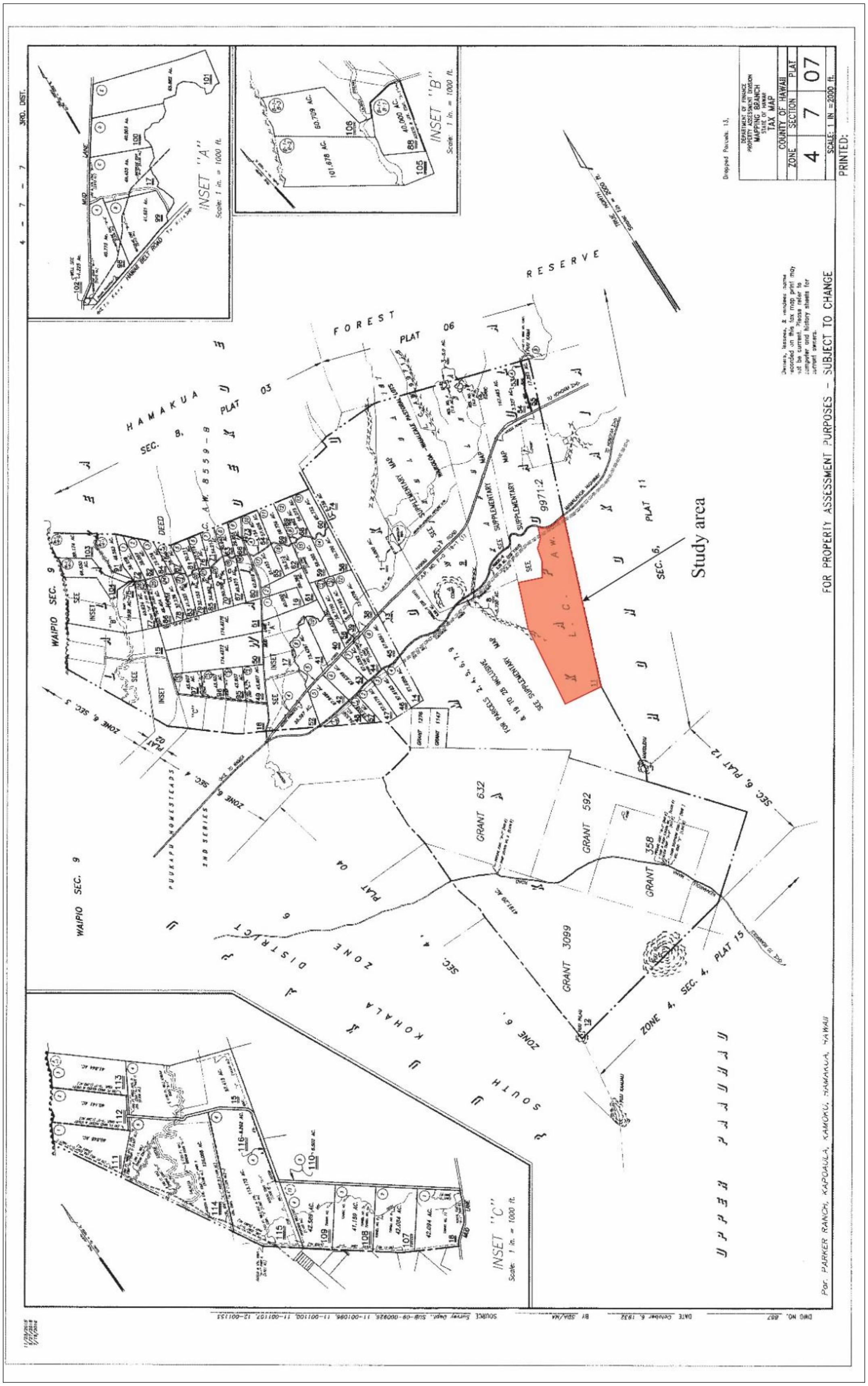


Figure 2. Tax Map Key (3) 4-7-007 showing location of current study parcel (011).

STUDY AREA DESCRIPTION

The current study area encompasses roughly 564 acres of pastureland (Figure 3) and is situated on the southernmost boundary of Kapoaula Ahupuaʻa, Hāmākua District, Island of Hawaiʻi (see Figures 1 and 2). The study area extends along the *mauka* (southern) edge of the Old Māmalahoa Highway, and is accessed by a gated, unimproved access road that enters into the parcel from the north. The study area is bounded to the west by Kamoku and Kapulena *ahupuaʻa* and to the east by Honokaia Ahupuaʻa. Its northern boundary is coterminous with the *ahupuaʻa* boundary with Kamoku along the Old Māmalahoa Highway (Figure 4), and it is adjacent to the Edwin DeLuz gravel quarry to the northwest. It is situated on the northern flank of Mauna Kea Volcano at elevations ranging from 2,740 to 3,180 feet (835 to 969 meters) above sea level, roughly 7 kilometers from the coast (see Figure 1). The undulating terrain (Figures 5 and 6) is characterized by gentle to moderately north-sloping hills punctuated with outcroppings and occasional steep and rocky ridgelines, particularly in the *makai* half of the parcel. A single permanent stream crosses into the study area near the northwestern corner of the property (Figure 7). Several non-perennial surface streams (none of which were flowing at the time of the current study) have incised shallow to moderate intermittent drainage channels (Figures 8 and 9) through the study area.

Soils within the study area (Figure 10) are classified as Maile-Waiākea-Rock outcrop complex on 6 to 35 percent slopes (Soil Survey Staff 2019). These soils consist of two distinct, well-drained loams, namely Maile and Honokaa, that range from ashy, sandy loam to hydrous silt loam, and highly organic silty clay that formed in a series of volcanic ash layers overlying basalt that originated from Mauna Kea Volcano during the Pleistocene epoch. The geology underlying the current study area is composed predominately of 11,000 to 64,000-year-old Laupāhoehoe Volcanics (labeled as “Qlb” in Figure 11). The northeast section of the parcel contains small portions of Hāmākua Volcanics that have been dated to 64,000 to 300,000 years old (labeled as “Qhm” in Figure 11). Mean annual rainfall within the study area averages approximately of 2,038 millimeters (80.24 inches), with the majority of rainfall occurring between the months of November and April and the least occurring in June and September (Giambelluca et al. 2013). The study area is characterized by a cool, semi-tropical climate with a mean annual temperature ranging from 32 to 78 degrees Fahrenheit (Giambelluca et al. 2013).

As a result of nearly two centuries of cattle grazing, vegetation within the study area consists almost exclusively of a pasture grasses (see Figure 5), dominated by introduced perennial forage grasses and sedges including but not limited to *kikuyu* (*Pennisetum clandestinum*), *Honohono* (*Haplostachys haplostachya*), natal redtop (*Melinus rupens*), and Hilo (*Paspalum conjungatum*) grasses occasionally interspersed with common dandelion (*Taraxacum officinale*), *palapalai* (lace fern; *Microlepia strigosa*), and fireweed (*Chamerion angustifolium)*. Within actively grazed paddocks, cattle aid in keeping the vegetation cover down. The study area’s pastoral vegetation pattern is further characterized by a lone Christmas berry (*Schinus terebinthifolius*) and cherry blossom tree (*Prunus* sp.), a few free-standing patches of *ʻōhiʻa lehua* (*Metrosideros polymorpha*) along hill slopes (Figure 12), and a 14-acre stand of introduced tropical ash trees (*Fraxinus uhdei*; Figure 13) located in the central portion of the study area. This introduced vegetation regime is much different than what would have been found prior to the widespread impacts of cattle ranching during the Historic Period, when the study area would have occupied a zone of dense *ʻōhiʻa* rainforest (Clark and Kirch 1983).

The interior of the study area is accessed via an unimproved ranch road (Figure 14) that ascends from Old Māmalahoa Highway. The road generally traverses prominent ridges and high ground past the stand of tropical ash, then continues to a cattle watering hole located about 550 meters from the he *mauka* parcel boundary. Grazing has also resulted in a several artificial modifications to the landscape that include barbed wire and electric fence lines, remnant water lines (Figure 15), a water pump (Figure 16), and several concrete- and porcelain cattle water troughs (Figure 17). Permanent barbed wire boundary fencing, with the occasional welded pipe gate, surrounds the entire perimeter of the study area (Figures 18 and 19). A small segment of the fence on the study area’s western boundary includes several square concrete fence posts, one of which is inscribed near the top with the letters “07” and marked with an unidentifiable ranch brand below (Figure 20). Electric cross-fencing partitions the study area into eight grazing paddocks. The impacts of livestock grazing on the study area is also visible. Many of the grazed, moderately to steeply sloping hills in the study area are crossed by networks of meandering livestock trails and are contoured with a series of descending terracettes (Figure 21), undoubtedly intensified by livestock trampling. Furthermore, numerous semicircular cattle resting areas are eroded into the bases of low-lying hillsides (Figure 22) and occasionally at the bases of bedrock outcroppings (Figure 23).

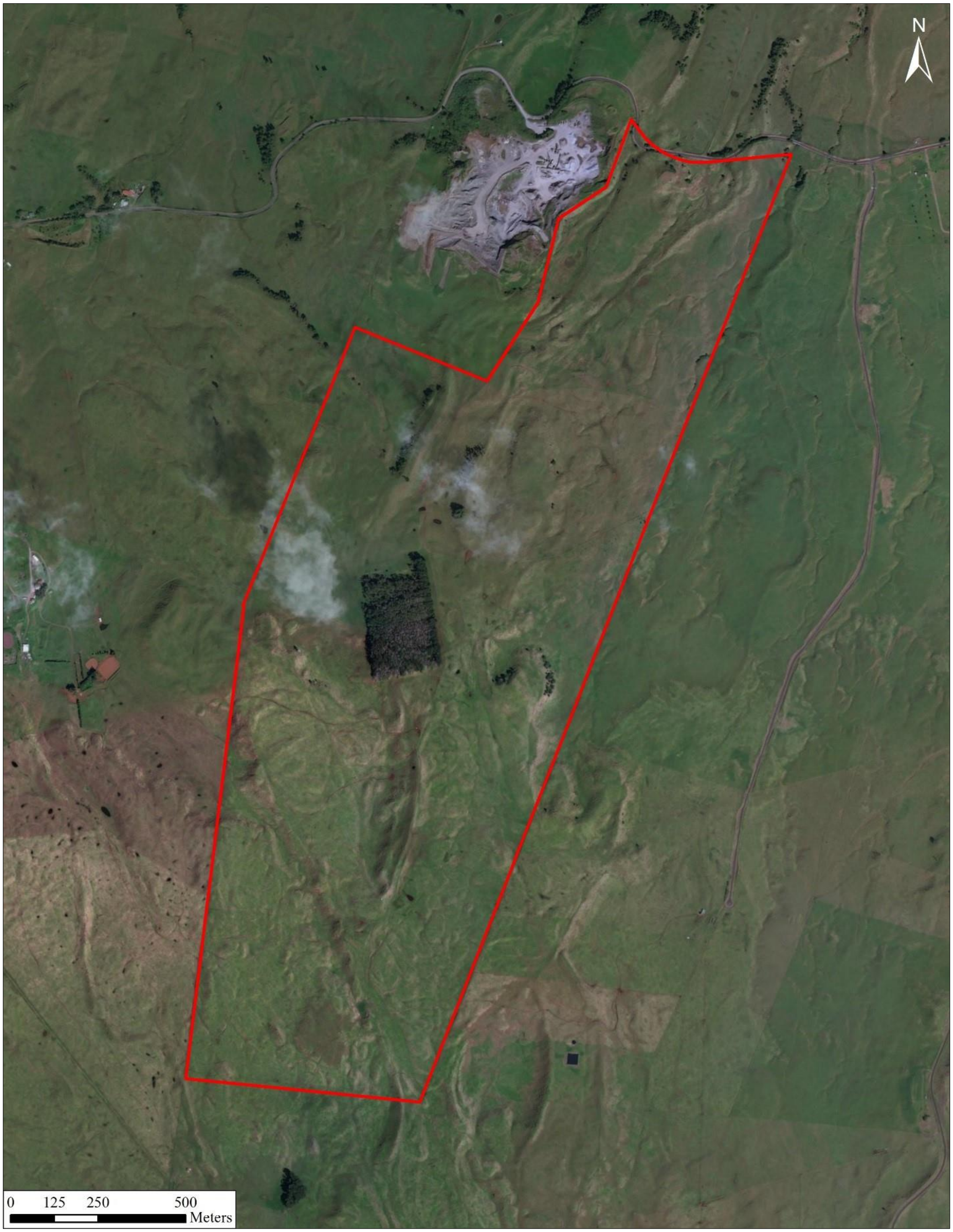


Figure 3. Google Earth™ satellite image showing study area location (outlined in red).

Figure 4. Northern study area boundary adjacent to Old Māmalahoa Highway, view to the northwest.

Figure 5. Typical undulating terrain in study area, view to the southwest.

Figure 6. Typical study area terrain, view to the southeast.

Figure 7. Eastern, fenced study area boundary crossing a small perennial stream, view to the northeast.

Figure 8. Shallow drainage paralleling western study area boundary, view to the north.

Figure 9. Wide drainage near western boundary of study area, view to the northeast.

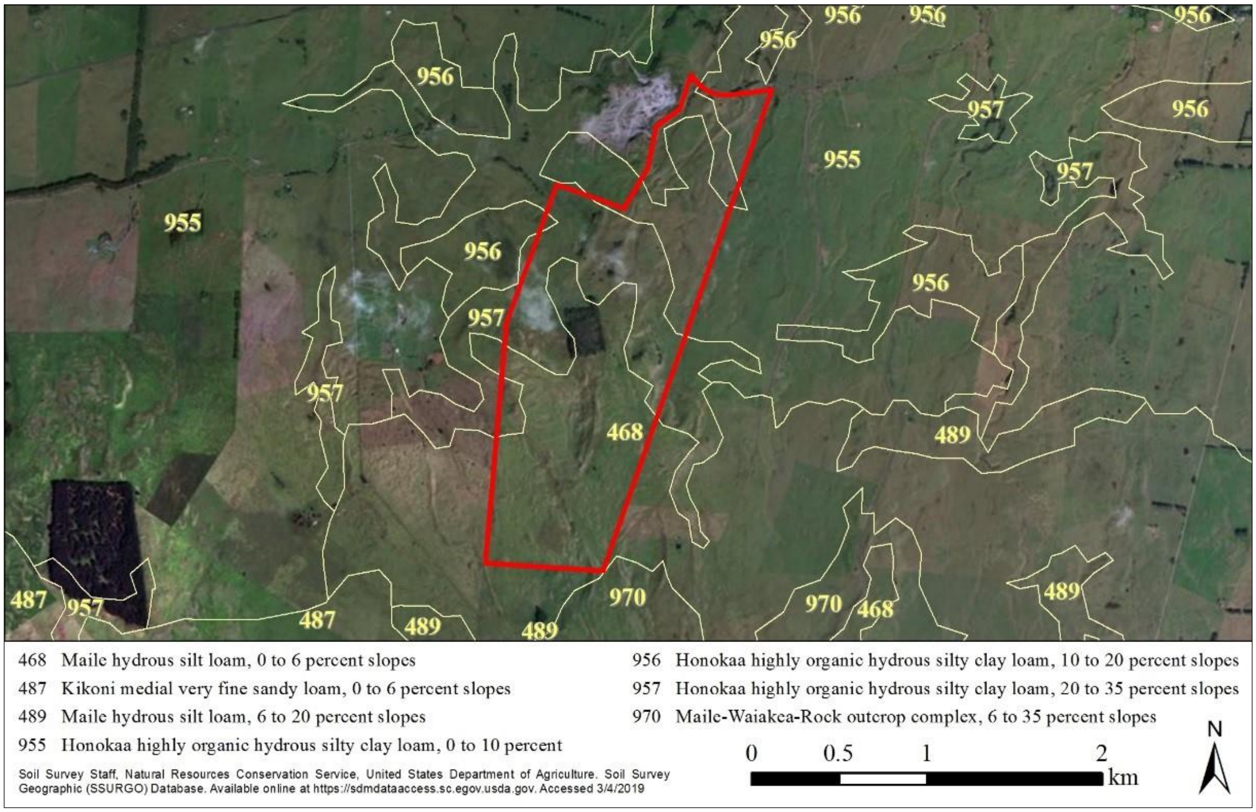


Figure 10. Soil within the study area (Soil Survey Staff 2019).

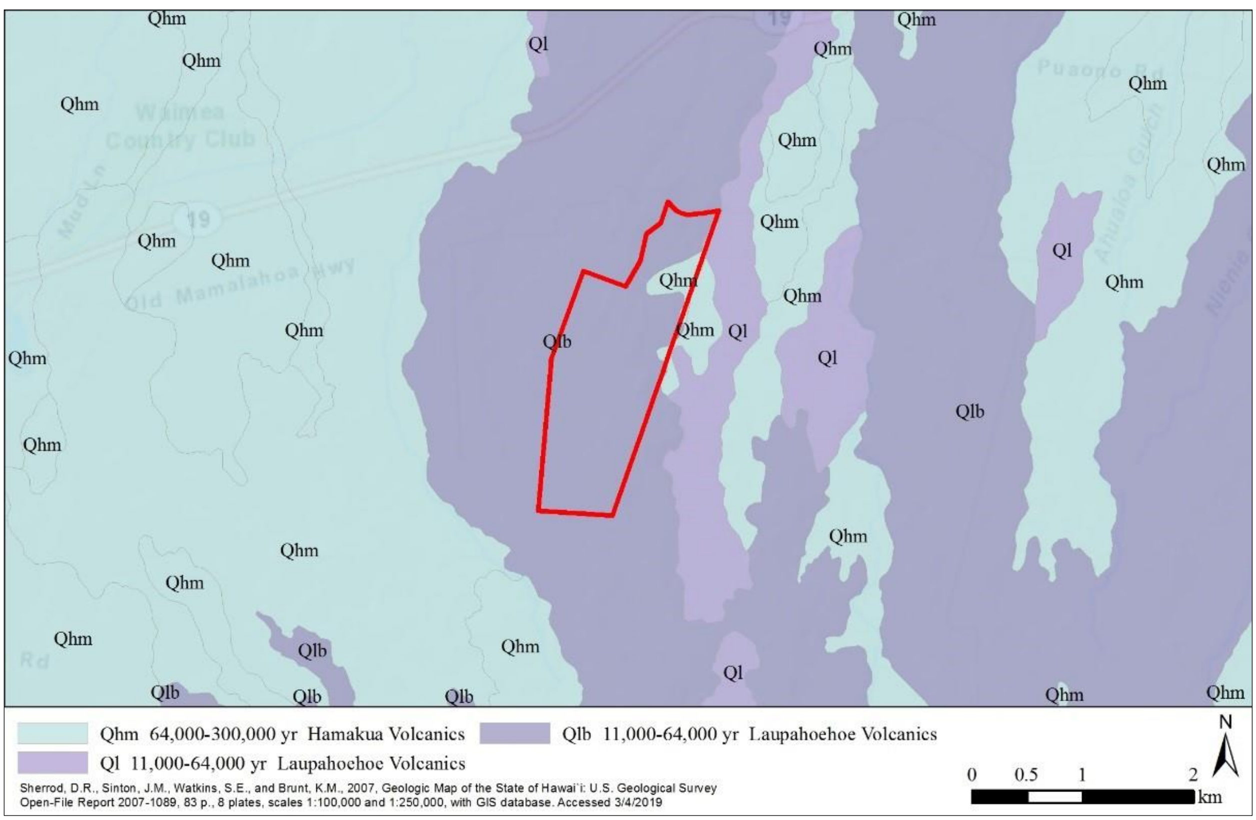


Figure 11. Geological units in the current study area (Sherrod et al. 2007).

Figure 12. Pair of *‘ōhi‘a* trees on slope of elevated landform, view to the southwest.

Figure 13. Stand of ash trees (at right), view to the northwest.

Figure 14. Unimproved access road leading *mauka* from Old Māmalahoa Highway, view to the southwest.

Figure 15. Remnant 1-inch galvanized steel waterline, overview.

Figure 16. Water pump on hilltop, view to the east.

Figure 17. Porcelain water trough in depression, view to the east.

Figure 18. Barbed wire fence line on the eastern boundary of the study area, view to the northeast.

Figure 19. Barbed wire fence and pipe gate on the *mauka* boundary of the study area, view to the south.

Figure 20. Concrete fence post with embedded PVC pipe and inscription reading “07” and unidentifiable brand, view to the north.

Figure 21. Hillside exhibiting a network of terracettes, view to the southeast.

Figure 22. Cattle resting area, view to the northeast.

Figure 23. Cattle resting area situated at base of bedrock outcrop, view to the northwest.

THE PROPOSED PROJECT

Siglo Forest, LLC acquired the 564-acre Kapoaula property from Parker Ranch to obtain long-term access for the purposes of planting koa trees. In an effort to convert pastureland back to a semblance of the native *koa-ʻōhiʻa* forest that once stood in this area and to provide controlled future uses of the forest for commercial products, Forest Solutions Inc. was hired by Siglo Forest, LLC to author a site-specific forestry management plan for the area. Figure 24 depicts the twenty-five forest units, fencing, and roadways that will be used to implement the plan. The project will plant, over a ten (10) year period, 553 acres of suitable land with *koa* and a range of associated native plants (11.3 additional acres are reserved for a saw mill site and access road). The project will combine the production of timber in a plantation format with mixed native forest plantings in less accessible areas. Over time–decades or a century–colonization of the plantation area with the enrichment species from the mixed forests, from bird droppings and natural plant colonization is anticipated. Through implementation of the site-specific forestry management plan, in approximately 50 years, pasture in current study area will be replaced with a mixed-species native forest. Steep-sloped areas will primarily be used for native species conservation, and less steeply-sloped, less erodible areas will be primarily used for timber production. The resulting *koa* forest will provide a sustainable, long-term, predictable source of musical-instrument grade wood, produce high-quality wood for other uses, and provide habitat for native species. The ten-year objectives are as follows:

- Reforest the entire property with koa and a complement of associated native forest plants.
- Improve the quality of wood to be harvested in the future by:
- planting seed from known, high-quality sources; and
- utilizing cuttings propagated from trees identified as having superior color, figure, and form.
- Intensive management of koa for saw timber on those areas of the property with slopes less than 20%--accounting for 70% of the property or 390 acres.
- Reforest the remaining upland areas with a multi-species native forest, utilizing koa as a pioneer species—accounting for 30% of the area or 163 acres.
- Protect planted forest from wind by planting fast-growing, cattle resistant windbreaks

The proposed project will include activities identified as Natural Resource Conservation Service (NRCS) conservation practices with potential to affect historic properties as identified in the 2016 *Prototype Programmatic Agreement Between the US Department of Agriculture, Pacific Islands Area Natural Resources Conservation Service State Office, and the Hawaii State Historic Preservation Officer, Regarding Conservation Assistance* (the PPA). Conservation practices with potential to affect historic properties that will be implemented by the proposed project are listed in Table 1. These practices include Tree and Shrub Site Preparation (Practice 490), Windbreak/Shelterbelt Establishment (Practice 380), Fencing (Practice 382), and Tree/Shrub Pruning (Practice 660). Fencing will be installed over a nine-year period as cattle are gradually removed from the parcel (see Figure 24). Other improvements will include a dwelling unit and a sawmill.

Table 1. NRCS Conservation Practices with potential to effect historic properties.

NRCS Practice	*Practice Name*	*Description*
490	Tree and Shrub Site Preparation	Ripping and bedding or deep spot cultivation 24 to 36 inches (60 to 90 cm)
380	Windbreak/Shelterbelt Establishment	Ripping and bedding or deep spot cultivation 24 to 36 inches (60 to 90 cm)
382	Fencing	Standard 5-foot hog-wire fences with a smooth top wire and barbed ground wire
660	Tree/Shrub Pruning	Singling and one, possibly two, pruning treatments per tree

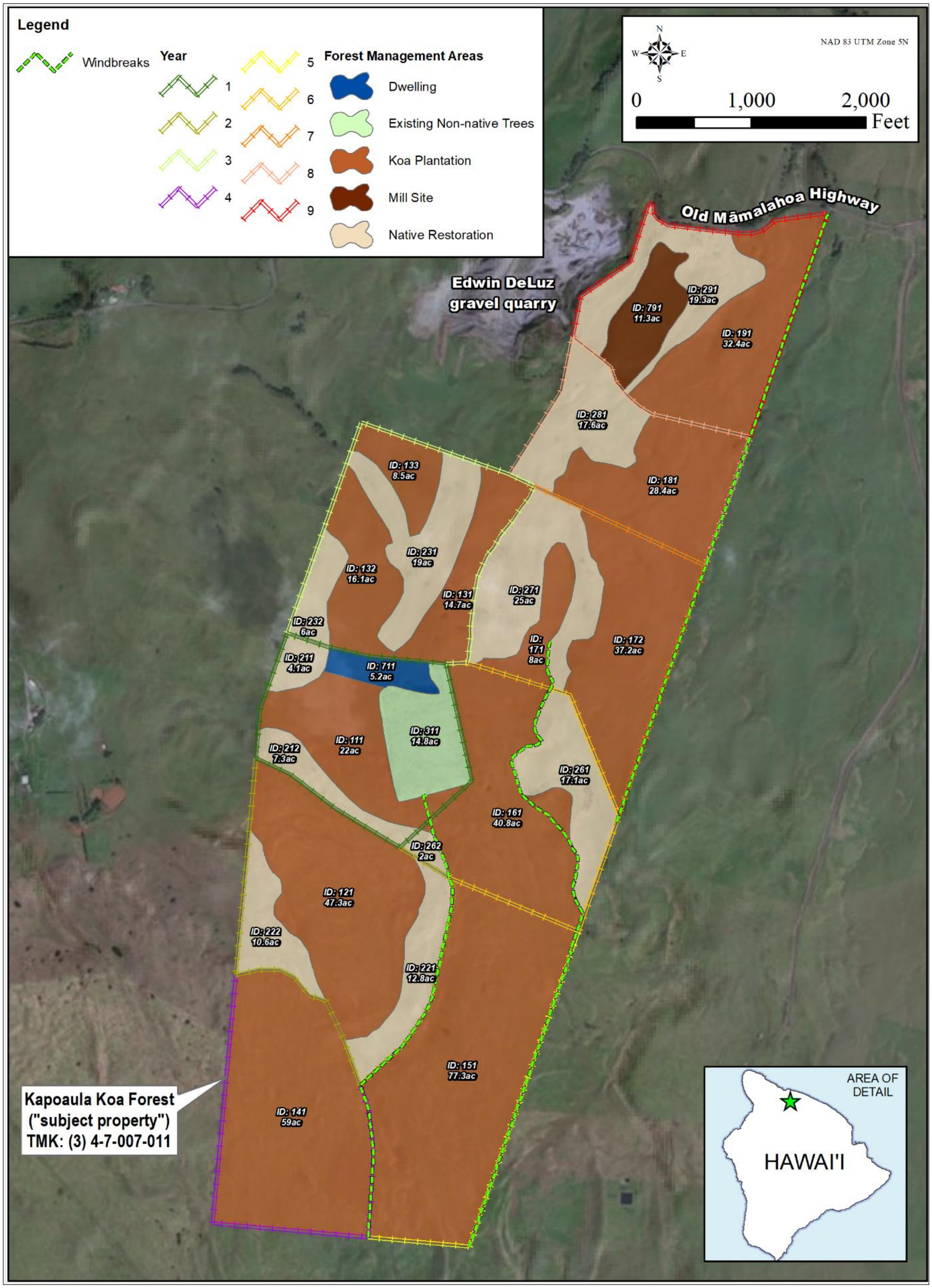


Figure 24. Proposed forest management units.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the study area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical background for the region is presented, and the results of previous archaeological studies conducted in the vicinity of the study area are summarized.

CULTURE-HISTORICAL CONTEXT

The study area is situated in Kapoaula Ahupuaʻa on the windward slopes of Mauna Kea within the traditional *moku* (district) of Hāmākua, one of six *moku* of Hawaiʻi Island (Figure 25). The name of the *ahupuaʻa* is currently spelled “Kapoaula,” but early documents produced during the *Māhele* of 1848 consistently spell the name “Kapaaula.” Neither of these place names appear in Pukui et al.’s (1974) compendium of place names. This modern spelling appears to originate in the Land Commission Award documentation for the *ahupuaʻa* (see discussion below).

Although the boundaries of the Hāmākua District are strictly political, the lands encompassed by it possess a unique environment that played a large role in determining the boundaries and shaping its history from the time of Polynesian settlement to the modern day. Understanding this environment is important for understanding the history of the current study area:

> Hāmākua district is a windward district in the truest sense. It has ca. 29 miles of shoreline, primarily focused on Mauna Kea’s eastern slopes with exposed cliffs rough seas, and narrow reef formations. Above the sea cliffs, the gentle slopes have a thick soil cover and abundant rainfall, and lush vegetation, with the upper slopes from 1,000-6,000 feet in an ʻōhiʻa-koa rain forest. The slopes are cut by deep (up to 300-foot), narrow stream gulches cloaked with kukui and pandanus. Yet Hāmākua is more than these slope and gulch lands. It also includes the extremely large, deep valleys of Waipiʻo and Waimanu which have cut over a millennia into the older Kohala Mountain, valleys which . . . dominated the history of the district and the island. Hāmākua also extended inland, encompassing the high elevation māmane-naio forests of Mauna Kea and the subalpine, oft snow-covered, summit itself. The district continued across the foggy and cold upland plateau or Saddle with its terrain a mixture of bare lava and soils, and with its vegetation a mixture of ʻōhiʻa and māmane-naio forests. This plateau had important nesting grounds of ʻuʻau and nēnē. And, Hāmākua virtually spanned the island-reaching to and looking down into the upper edges of Kona. (Cordy 2000:21)

It was to this general environmental setting that the first Polynesians in Hawaiʻi arrived. Over generations they shaped and utilized the natural environment to provide all they needed for sustenance and survival. In the process they created a uniquely Hawaiian culture that was wholly adapted to the environment. The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes the presentation of a generalized model of Hawaiian Prehistory and a discussion of the general settlement patterns for Hāmākua. The discussion of Prehistory is followed by a summary of Historical events in the district that begins with the arrival of foreigners in the islands and then continues with the history of land use in Hāmākua after contact. The summary includes a discussion of the changing lifeways and population decline of the early Historic Period, a review of land tenure in the study *ahupuaʻa* during the *Māhele ʻĀina* of 1848, and documentation of the transition to the ranching industry from the last quarter of the nineteenth century to the present day. A synthesis of the Precontact settlement patterns and the Historically documented land use, combined with a review of the findings of previously conducted archeological studies, provides a means for predicting the types of archaeological features that may be encountered within the study area, and forms a basis for assessing the function, age, and significance of any encountered archaeological sites.

A Generalized Model of Hawaiian Prehistory

Within the last decade, refined chronometric data and analyses strongly support a “short chronology” of the timing of the initial colonization of the Hawaiian Islands. In this chronology, the settlement of the archipelago begins around A.D. 1000. It has been generally reported that the sources of the early Hawaiian population—the Hawaiian Kahiki—were the Marquesas and Society Islands (Emory in Tatar 1982). Athens et al. (2014), using archaeological and paleoenvironmental data, propose that the initial settlement of the Hawaiian Islands occurred between A.D. 940 and 1130, and most probably between A.D. 1000 and 1100. Other recently developed models date this event to ca. A.D. 1120-1260 (Duarte 2012; Rieth et al. 2011; Wilmshurst et al. 2011), while Kirch’s (2011) position is that colonization was unlikely to have occurred before A.D. 1000, but definitely by A.D. 1200. As with previous models (which held that the first inhabitants of Hawaiʻi Island arrived by A.D. 300), early colonization is still thought to have involved habitation and subsistence activity on the windward side of the island (Burtchard 1995; Hommon 1986; Kirch 1985). The implications of a more recent colonization on the currently accepted chronology alters the timing of Kirch's (1985) 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 Settlement Period was a time 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, 2010). According to Fornander (1969), Hawaiians brought from their homeland certain universal Polynesian customs: the major gods Kāne, Kū, Kanaloa, and Lono; the *kapu* system of law and order; cities of refuge; the *ʻaumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. Conventional wisdom suggests that the first inhabitants of Hawaiʻi Island focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Hommon 1986; Kirch 1985). 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.

As time passed a uniquely Hawaiian culture developed. The portable artifacts found in archaeological sites of the Development Period of the Hawaiian prehistory reflect not only an evolution of the traditional tools, but some distinctly Hawaiian inventions. The adze (*koʻi*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are ʻ*ulu maika* stones and *lei niho palaoa*. The later were status items worn by individuals of high rank, which indicates recognition of status differentiation (Kirch 1985). As population expanded in the Hawaiian Islands so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Once most of the ecologically favorable zones of the windward and coastal regions of the major islands were settled, the more marginal leeward areas were developed. Migrations to Hawaiʻi from the Marquesas and Society Islands may have continued throughout the early Settlement and Development Periods (Kirch 1985, 2012). 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 Hawaiʻi were controlled by a few powerful chiefs.

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. Subsistence patterns intensified as crop farming evolved into large irrigated field systems and expanded into the marginal dry land areas. The greatest population growth occurred during the Expansion Period, and it was during this time that a second major migration settled in Hawaiʻi, this time from Tahiti in the Society Islands. According to Kamakau (1976), the *kahuna* Pāʻao settled in the islands during the 13th century. Pāʻao was the keeper of the god Kūʻkāʻilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pāʻao was expelled from his homeland in Tahiti by Lonopele. He prepared for a long voyage and set out across the ocean in search of a new land. On board Pāʻao's canoes were thirty-eight men (*kānaka*), two stewards (*kānaka ʻāʻīpuʻupuʻu*), the chief Pilikaʻaiea (Pili) and his wife Hinaʻaukekele, Nāmauʻu o Malaia, the sister of Pāʻao, and the prophet Makuakaʻūmana. Kamakau (1991:100–102) told the following story of their arrival in Hawaiʻi:

> Puna on Hawaiʻi Island was the first land reached by Pāʻao, and here in Puna he built his first heiau for his god Ahaʻula and named it Ahaʻula [Wahaʻula]. It was a luakini. From Puna, Pāʻao went on to land in Kohala, at Puʻuepa. He built a heiau there called Moʻokini, a luakini.
>
> It is thought that Pāʻao came to Hawaiʻi in the time of the aliʻi Laʻau because Pili ruled as moʻi after Laʻau. You will see Pili there in the line of succession, the moʻo kūʻauhau, of Hanalaʻanui. It was said that Hawaiʻi Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawaiʻi Island had been without a chief for a long time, and the chiefs of Hawaiʻi were aliʻi makaʻāinana or just commoners, makaʻāinana, during this time.
>
> …There were seventeen generations during which Hawaiʻi Island was without chiefs—some eight hundred years…The lack of a high chief was the reason for seeking a chief in Kahiki, and that is perhaps how Pili became the chief of Hawaiʻi. He was a chief from Kahiki and became the ancestor of chiefs and people of Hawaiʻi Island.

The Pili line's initial ruling center was likely in Kohala, but Cartwright (1933) suggests that Pili resided in and ruled from Waipi'o Valley in the Hāmākua District. Ethnohistorical traditions (Fornander 1880) indicate that Waipi'o was associated with at least nine successive Pili line rulers of Hawai'i Island, from Kaha'imoele'a to Umi (between roughly A.D. 1460 and 1620). Prior to the establishment of these Pili rulers, Waipi'o was the residential base for powerful local rulers dating back to at least the A.D. 1200s (Cartwright 1933).

Heiau construction flourished during the Expansion Period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206). This pattern continued to intensify from A.D. 1500 to Contact (A.D. 1778), and evidence suggests that substantial changes were made to the political system as well. Within Kohala, for example, the Great Wall complex at Koai'e is organized with certain platforms in the complex physically separated from contemporaneous features. Griffin et al. (1971) interpret these separate spaces as symbolizing class stratification.

The period from A.D. 1300–1500 was characterized by population growth as well as expanded efforts to intensify upland agriculture. Rosendahl (1972) has proposed that settlement in leeward Kohala at this time was related to seasonal, recurrent occupation, and that coastal sites were occupied in the summer to exploit marine resources, while upland sites were being occupied during the winter months with a primary 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.

According to Kirch's (1985) model, the concept of the *ahupua'a* was established sometime during the A.D. 1400s, adding another component to an already well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua'a* were ruled by *ali'i 'ai ahupua'a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua'a* generally speaking, are wedge-shaped subdivisions of land that radiate out from the center of the island, typically extending from the mountain into the sea. Their boundaries are often defined by the topography of the land and its geological features. In these land units 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 (*maka'āinana*), who lived in a given *ahupua'a* 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 *ali'i* (see Kamakau 1992; Malo 1951).

Entire *ahupua'a*, or smaller portions of the land called *'ili* were generally under the jurisdiction of appointed *konohiki* or lesser chief-landlords, who answered to an *ali'i-'ai-ahupua'a* (chief who controlled the *ahupua'a* resources). The *ali'i-'ai-ahupua'a* in turn answered to an *ali'i 'ai moku* (chief who claimed the abundance of the entire district). Thus, *ahupua'a* resources supported not only the *maka'āinana* and *'ohana* 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 resource management planning. In this system, the land provided fruits and vegetables and some meat for the diet, and the ocean provided a wealth of protein resources (Rechtman and Maly 2003). The *ahupua'a* were further divided into smaller sections such as the *'ili 'āina, mo'o 'āina, paukū 'āina, kīhāpai, kō'ele, hakuone*, and *kuakua* (Hommon 1986; Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mō'ī* (king). By the seventeenth century, large areas of Hawai'i Island (*moku āina* – districts) were controlled by a few powerful *ali'i 'ai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawai'i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). 'Umi a Līloa, a renowned *ali'i* of the Pili line who ruled from Waipi'o Valley, is often credited with uniting the island of Hawai'i under one rule (Cordy 1994). 'Umi's reign lasted until around A.D. 1620, and was followed by the rule of his son, Keawenui a 'Umi, and then his grandson, Lonoikamakahiki (Cordy 1994).

Kirch (1985) places the beginning of the Proto-Historic Period during the rule of Lonoikamakahiki. This was a time marked by both political intensification and stress and continual conquest by the reigning *ali'i*. Wars occurred regularly between intra-island and inter-island polities during this period. By the 1700s, rule of Hawai'i Island was divided among the chiefs of Kona and Hilo (Kamakau 1992). Keawe, a Pili line ruler and the son of Kanaloakapulehu, was the chief of Kohala, Kona, and Ka'ū. When Keawe died, he split the rule of his lands between two of his sons, further dividing the island's chiefdoms; Kalaninui'iamamao became the ruling chief of Ka'ū, and Ke'eaumoku became the ruling chief of Kona and Kohala (Kamakau 1992). Wars between the *ali‘i* continued unabated through this transition. Alapa‘inui, the son of former Kona war chief Kauauanui a Mahi, desired to take control of Hawai‘i Island (Kamakau 1992), and successfully waged war against the chiefs of Kona and Kohala, and eventually took control of Ka‘ū and Hilo as well. Alapa‘inui ruled for many years, and appointed his son Keawe‘ōpala ruler of the island upon his death in 1754 (Kamakau 1992). It was during this time of warfare that Kamehameha was born in the North Kohala District in the *ahupua‘a* of Kokoiki, near the *heiau* of Mo‘okini (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (1992:66–68) places the birth event sometime between A.D. 1736 and 1758, most likely nearer to the later date. This period was one of continual conquest by the reigning *ali‘i*. In A.D. 1775 Kalani‘ōpu‘u and his forces, who had already conquered Hāna in eastern Maui, raided and destroyed the neighboring Kaupō District, then launched several more raids on Moloka‘i, Lāna‘i, Kaho‘olawe, and parts of West Maui. It was at the battle of Kalaeoka‘ilio that Kamehameha, a favorite of Kalani‘ōpu‘u, was first recognized as a great warrior and given the name of Pai‘ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalani‘ōpu‘u and Kahekili (1777–1779), Ka‘ahumanu and her parents left Maui to live on the island of Hawai‘i (Kamakau 1992). Kalani‘ōpu‘u was fighting on Maui when the British explorer Captain James Cook first arrived in the islands.

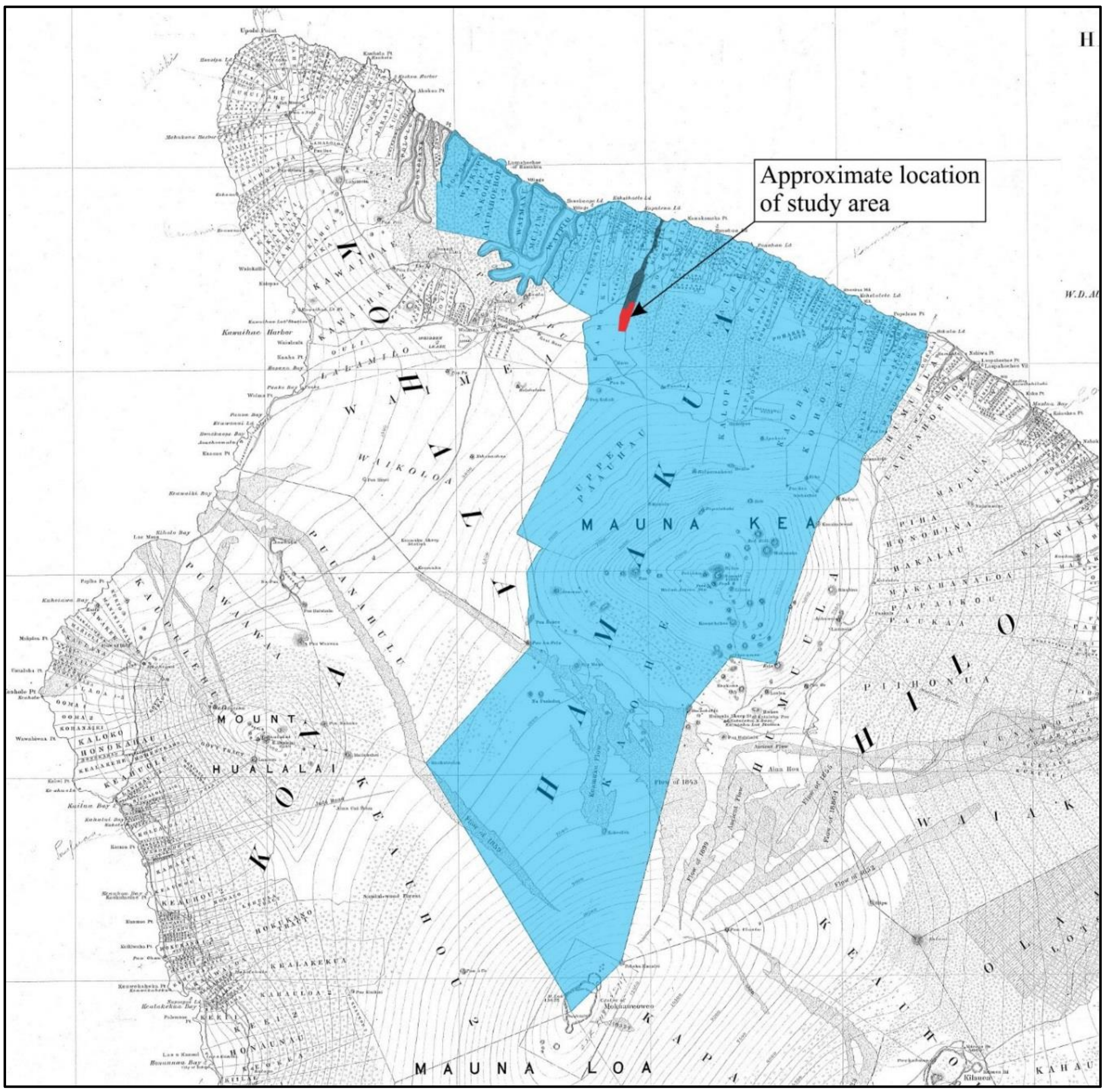


Figure 25. Portion of Hawai‘i Registered Map No. 2060 showing location of the study area within Hāmākua and Kapoaula (after Donn 1901).

History After Contact

The arrival of foreigners in Hawaiʻi marks the beginning of the Historic Period. Demographic trends during the later Proto-Historic Period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. There was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kent 1983; Kirch 1985). Foreigners very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered Oʻahu, Maui and Molokaʻi, in 1795, Hawaiʻi saw the beginnings of a market system economy (Kent 1983). This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

The Arrival of Captain James Cook and the End of Kalaniʻōpuʻu's Reign (1778-1782)

British explorer Captain James Cook, in command of the ships *H.M.S. Resolution* and *H.M.S. Discovery*, landed in the Hawaiian Islands on January 18, 1778. The following January 17th [1779], on a return trip to Hawaiian waters, Cook anchored near Kaʻawaloa along the north shore of Kealakekua Bay in the South Kona District to resupply his ships. This return trip occurred at the time of the annual *Makahiki* festival, and many of chiefs and commoners were gathered around the bay celebrating. It has been suggested that Captain Cook was understood to be the god Lono himself returned, as men would not normally be allowed to paddle out during the *Makahiki* without breaking the *kapu* and forfeiting all of their possessions (Kamakau 1992). Kalaniʻōpuʻu, the reigning chief of Hawaiʻi Island, left a battle with Kahekili on Maui, and after arriving at Kealakekua Bay, visited Cook on board the *H.M.S. Resolution*, where they exchanged gifts. Kamehameha, the future ruler of all of Hawaiʻi, was present at this meeting (Jarves 1847). On February 4th, Cook set sail, but a storm off the Kohala coast damaged the mast of the *H.M.S. Resolution*, and both ships were forced to return to Kealakekua Bay to make repairs. With Cook's return many of the inhabitants of Kealakekua began to doubt that he actually was the physical manifestation of Lono (Kamakau 1992). Ten days later, a dispute over stolen nails escalated and after one of Cook's boats was stolen, the captain set ashore at Kaʻawaloa with six marines to ask Kalaniʻōpuʻu for its return. When Kalaniʻōpuʻu denied any knowledge of the theft, Cook tried to take him captive (Kamakau 1992). A fight ensued, and Cook was killed along with four of his men and several natives. Kalaniʻōpuʻu and his retinue retreated inland. After offering the body of Cook as a sacrifice to the *akua*, some of his bones were returned to the British aboard *Resolution* (Kamakau 1992), who shortly thereafter returned to sea.

After the death of Captain Cook and the departure of *H.M.S. Resolution* and *Discovery*, Kalaniʻōpuʻu moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1992). While he was living in Kona, famine struck the district. Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized, and then he set out on a circuit of the island. While in Kohala, Kalaniʻōpuʻu proclaimed that his son Kiwalaʻō would be his successor, and he gave the guardianship of the war god Kūkaʻilimoku to Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalaʻō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moaʻula was erected in Waipiʻo at this time (ca. A.D. 1781), and after its dedication Kalaniʻōpuʻu set out for Hilo to quell a rebellion by a Puna chief named Imakakoloʻa.

Imakakoloʻa was defeated in Puna by Kalaniʻōpuʻu's superior forces, but he managed to avoid capture and hide from detection for the better part of a year. While the rebel chief was sought, Kalaniʻōpuʻu went to Kaʻū and erected a *heiau* called Pākini (Kamakau 1992). Imakakoloʻa was eventually captured and brought to the *heiau*, where Kiwalaʻō was to sacrifice him. "The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief" (Fornander 1996:202). However, before Kiwalaʻō could finish the first offerings, Kamehameha, "grasped the body of Imakakoloʻa and offered it up to the god, and the freeing of the tabu for the *heiau* was completed" (Kamakau 1992:109). Upon observing this single act of insubordination, many of the chiefs believed that Kamehameha would eventually rule over all of Hawaiʻi. After usurping Kiwalao's authority with a sacrificial ritual in Kaʻū, Kamehameha retreated to his home district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). Kalaniʻōpuʻu died in April of 1782 and was succeeded by his son Kiwalaʻō.

The Rule of Kamehameha I (1782-1819)

After Kalaniʻōpuʻu died, several chiefs were unhappy with Kiwalaʻō's division of the island's lands, and civil war broke out. Kiwalaʻō, Kalaniʻōpuʻu's son and appointed heir, was killed at the battle of Mokuʻōhai, South Kona in July of 1782. Supporters of Kiwalaʻō, including his half-brother Keōua and his uncle Keawemauhili, escaped the and laid claim to the Hilo, Puna, and Kaʻū Districts. According to ʻIʻi (1963), nearly ten years of almost continuous warfare followed, as Kamehameha endeavored to unite the island of Hawaiʻi under his rule and conquer the islands of Maui and O‘ahu. Keōua became Kamehameha’s main rival on the island of Hawai‘i, and he proved difficult to defeat (Kamakau 1992). Around 1790, in an effort to secure his rule, Kamehameha began building the *heiau* of Pu‘ukoholā at Kawaihae, which was to be dedicated to the war god Kūka‘ilimoku (Fornander 1996). When Pu‘ukoholā Heiau was completed in the summer of 1791, Kamehameha sent his two counselors, Keaweaheulu and Kamanawa, to Keōua to offer peace. Keōua was enticed to the dedication of the Pu‘ukoholā Heiau by this ruse and when he arrived at Kawaihae he and his party were sacrificed to complete the dedication (Kamakau 1992). The assassination of Keōua gave Kamehameha undisputed control of Hawai‘i Island (Greene 1993). Between 1792 and 1796, after the dedication of Pu‘ukoholā, Kamehameha mostly resided at Kawaihae and worked the lands of the Waikōloa-Waimea region (Maly and Maly 2002). By 1796, Kamehameha had conquered all the island kingdoms except for Kaua‘i. It wasn’t until 1810, when Kaumuali‘i of Kaua‘i gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976). Kamehameha would go on to rule the islands for another nine years. He and his high chiefs participated in foreign trade, but continued to enforce the rigid *kapu* system.

In the twelve years following the death of Captain Cook, sixteen foreign ships (all British and American) called in Hawaiian waters (Restarick 1928). In 1790, two sister ships, the *Eleanora* and the *Fair American*, were trading in Hawaiian waters when a skiff was stolen from the *Eleanora* and one of its sailors was murdered. The crew of the *Eleanora* proceeded to slaughter more than 100 natives at Olowalu [Maui]. After leaving Maui, the *Eleanora* sailed to Hawai‘i Island, where one of its crew, John Young, went ashore and was detained by Kamehameha’s men. The other vessel, the *Fair American*, was captured by the forces of Kamehameha off the coast of North Kona, and in an act of retribution for the Olowalu massacre, they slaughtered all but one crew member, Isaac Davis. Guns and a cannon (later named “Lopaka”) were recovered from the Fair American and were kept by Kamehameha as part of his fleet (Kamakau 1992). Kamehameha made John Young and Isaac Davis his advisors.

During the first part of the nineteenth century, Hawai‘i’s culture and economy continued to change drastically as capitalism and industry established a firm foothold in the islands. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha, who resided on the Island of O‘ahu at this time, did manage to maintain some control over the trade on Hawai‘i Island (Kent 1983; Kuykendall and Day 1976).

Upon returning to Kailua in 1812, Kamehameha resided at Kamakahonu, from whence he continued to rule the islands for another nine years. While in Kailua, He and his high chiefs participated in foreign trade, but also continued to enforce the rigid *kapu* system. He ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *kapa* material, food and fish (Kamakau 1992). This new burden added to the breakdown of the traditional subsistence system. Farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamakau indicates that, “this rush of labor to the mountains brought about a scarcity of cultivated food . . . The people were forced to eat herbs and tree ferns, thus the famine [was] called Hi-laulele, Haha-pilau, Laulele, Pualele, ‘Ama‘u, or Hapu‘u, from the wild plants resorted to” (Kamakau 1992:204). Once Kamehemeha realized that his people were suffering, he “declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land” (Kamakau 1992:204).

The Death of Kamehameha I and the Abolition of the Kapu System (1819-1820)

Kamehameha I died on May 8, 1819 at Kamakahonu, and the changes that had been affecting the Hawaiian culture since the arrival of Captain Cook in the Islands began to accelerate. Following the death of a prominent chief, it was customary to eliminate all of the regular *kapu* that maintained social order and the separation of men and women, elite and commoner. Thus, following Kamehameha’s death, a period of *‘ai noa* (free eating) was observed along with the relaxation of other traditional *kapu*. It was the responsibility of the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs were altered (Kamakau 1992).

> The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief’s decision to introduce free eating (*‘ainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been

> greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-aliʻi, and in most of the histories of ancient rulers. Free eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992:222)

Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After purification ceremonies Liholiho returned to Kamakahonu. Instead of re-instating the traditional *kapu*, Liholiho ate the dog meat *kapu* to the women *aliʻi*, entered the women's *lauhala* house, and did whatever he desired. While he may have done so during a time when he had not yet reinstituted the eating *kapu*, other chiefs present appear to have thought otherwise, and word spread that the *kapu* had been abandoned. Kekuaokalani, caretaker of the war god *Kūkaʻilimoku*, was dismayed by his cousin's (Liholiho) actions and revolted against him, but was defeated.

With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawaiʻi to Kauaʻi, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. By December of 1819, Kamehameha II had sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the ʻ*aumakua* worship, to continue (Kamakau 1992; Oliver 1961).

With the end of the *kapu* system, changes in the social and economic patterns began to affect the lives of the common people. Liholiho moved his court to Oʻahu, lessening the burden of resource procurement for the chiefly class on the residents of Hawaiʻi Island. 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 included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845).

Hāmākua 1820-1848: A Land in Transition

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawaiʻi. They arrived in Kailua-Kona on March 30, 1820 to a society with a religious void to fill. Many of the *aliʻi*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopted their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the sandalwood trade wrought havoc on the lives of the commoners, as they weakened from the heavy production, exposure, and famine just to fill the coffers of the *aliʻi*, who were no longer under any traditional constraints (Kuykendall and Day 1976; Oliver 1961). The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawaiʻi went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry.

Some of the earliest written descriptions of Hāmākua come from the accounts of the first Protestant Missionaries to visit the island. Early Historic visitors to Hāmākua noted the beauty and fertility of this part of the island. 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 for the growing Calvinist mission. Ellis recorded observations made during this tour in a journal. Traveling through the Hāmākua District heading west from Hilo, Ellis described the environs of Hāmākua, particularly between the stretch of Koloaha to the east of the study area to Kapulena to the west, thusly:

> We arose at day-light on the 16th, and shortly after left Tumoarii. We had not travelled more than four or five miles when we reached Kaahua. After breakfast, we proceeded on our journey over a country equal in fertility to any we had passed since leaving Waiakea. The houses were in general large, containing usually three or four families each. Mr. Goodrich was indisposed through the day, which obliged us to travel but slowly. near noon we stopped at Koloaha, and while he reclined beneath the shade of an adjoining grove of trees, I addressed the assembled natives on the subject of religion. After remaining about two hours, we walked to another village, where Mr. Thurston spoke to the people, who gave good attention. We then kept on our way till we reached Malanahae, where a congregation of people assembled, with whom we conversed some short time, then bade

> them farewell, and about three P.M. reached Kapulena, where we preached to upwards of 100 of the people. (Ellis 2004:356)

At Kapulena (northwest of the current study area) Ellis' party split into two groups; Ellis and Thurston continued northwest following the coast to Waipiʻo Valley, and Bishop and Goodrich proceed inland to Waimea, passing nearby the study area:

> On Monday morning Messers. Bishop and Goodrich commenced their journey to Waimea. Having procured a man to carry their baggage, they left Kapulena, and taking an inland direction, passed over a pleasant country, gently undulated with hill and dale. The soil was fertile, the vegetation flourishing, and there was considerable cultivation, though but few inhabitants. (Ellis 2004:357)

Lyons arrived at Kawaihae on July 16, 1832 and replaced Reverend Dwight Baldwin as the minister in Waimea (Maly 1999). Lyons' missionary territory, although centered in Waimea, included the districts of Kohala and Hāmākua. He served as the preeminent missionary of the area of the area until his death in 1886 (Puakō Historical Society 2000), becoming one of the most beloved of the Hawaiian missionaries, known to his parishioners as *Ka Makua Laiana*, *haku mele o ka aina* Mauna (Father Lyons, lyric poet of the mountain country). In 1834, Lyons relocated to Hāmākua following his two-year missionary service in Waimea. He described the journey to Hāmākua thusly:

> . . . If we take the route to Hamakua, there is, in wet weather, a marsh to pass through—not much unlike Bunyan's Slough of Despond—either in going or returning, or both. It is perhaps four miles long—a most dismal place; yet the woods are sometimes vocal with the music of birds, which furnishes a little relief to the tediousness of the way. . . On one route to Hamakua, part of the road is a mere foot-path lying thro' a dense wood of Koa and Ohia. (Doyle 1953:111)

He further elaborated:

> We have no roads such as you have in America, but we got to Hamakua after a fashion. Mrs. L was drawn part of the way in a rocking chair attached to the fore wheels of a wagon; a part of the way she was carried in the same chair by natives; and part of the way she walked. The little one was carried by a native. You would have smiled to see how we lived. (Doyle 1953:75)

The Legacy of the *Māhele ʻĀina* of 1848

By the mid-nineteenth century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840 the first Hawaiian constitution had been drafted and the Hawaiian Kingdom transformed from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, the King (Kamehameha III) and his high-ranking chiefs decided to separate and define the ownership of all lands in the Kingdom (King n.d.). This change was further promoted by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be taken from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the King, the chiefs and *konohiki*, and their tenants (the *makaʻāinana* or common people). In 1845 the legislature created the "Board of Commissioners to Quiet Land Titles" (more commonly known as the Land Commission. All land claims, whether by chiefs for entire *ahupuaʻa* or by tenants for their house lots and gardens, had to be filed with the Land Commission within two years of the February 14, 1846, but the deadline was extended several times for chiefs and *konohiki* (Soehren 2005).

The King and some 245 chiefs (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). Once the King and his chiefs accepted the principles of the Privy Council, the *Māhele ʻĀina* (Land Division) was completed in just forty days (on March 7, 1848), and the names of all of the *ahupuaʻa* and *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*, that paid tribute to the ruling chief and not to the chief of the *ahupuaʻa*) of the Hawaiian Islands and the chiefs who claimed them, were recorded in the *Māhele* Book (Soehren 2005). As this process unfolded King Kamehameha III, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. Accordingly, the day after the division with the last chief was recorded in the *Buke Māhele* (*Māhele* Book), King Kamehameha III commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike the King, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their awards (LCAw.). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land," while the lands retained by Kamehameha III became known as "Crown Land," and the lands received by the chiefs became known as "*Konohiki* Land" (Chinen 1958:vii, 1961:13). All lands awarded during the *Māhele* 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.

During the *Māhele*, native tenants of the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to, *kuleana* parcels that they actively lived on or farmed. 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 than the two-year term, and the deadline was extended several times for the Land Commission to finish its work (Maly 2002). In the meantime, 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 "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and the process by which they could apply for fee-simple interest in their *kuleana*. The work of the Land Commission was completed on March 31, 1855. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which 9,337 were awarded (Maly 2002).

The disposition of the lands of Kapoaula is a complicated matter, and it is important to note that there are inconsistencies in the *Māhele*-era recordkeeping for Leleiōhoku's land award. As a result of the *Māhele*, the entire 1,697 ¼-acre *ahupuaʻa* of Kapoaula (comprising five smaller lands of the same name) was slated to be returned to Kamehameha III by the *Aliʻi Nui* William Pitt Leleiōhoku, the first husband of Harriet Keōpūolani Nāhiʻenaʻena and second husband to Ruth (Luka) Keʻelikōlani (Buke Mahele 1848:23). Combining smaller *ahupuaʻa* in this was not uncommon, as Gonschor and Beamer (2014:80) note, "If a group of numbered ahupuaʻa with the same name ended up having the same konohiki, or all becoming Government or Crown land, they were frequently consolidated into one." As Leleiōhoku's lands were to be awarded to him in "Freehold less than Allodial," it appears that Kapoaula was intended to be one of the lands commutated to the Government in exchange for patenting his other lands. The chain of events following this initial decision is somewhat murky, however, as Leleiōhoku died in 1848 shortly after the *Māhele* was completed, and Kapoaula was not commutated. The lands awarded to him as a result of the *Māhele* were allocated to his widow and to their son and heir, John William Pitt Kīnaʻu:

> By action of the Privy Council on May 27, 1850, a Resolution was approved for the division of the lands of William Pitt Leleiohoku to be surrendered in Lieu of Commutation as set forth in Vol. 3 of Privy Council Records on page 327 as follows:
>
> > "Resolved that the division of lands between the Government and the widow and heirs of William Pitt Leleiohoku, deceased, this day submitted to the King and Privy Council be, and is hereby approved: and that the Minister of the Interior be, and is hereby authorized to grant a Royal Patent or Patents to Luka Keelikolani, the widow of the said Leleiohoku for such lands as may apportioned to her as her dower in the estate of the said Leleiohoku, and also to grant a Royal Patent or Patents to John Pitt Kinau, the son and heir of the said Leleiohoku for such lands as may be assigned to him as his portion of said estate: Provided however, that nothing in this resolution shall be construed as interfering with the rights of the Land Commission to settle all disputes that may exist as to the title or bounds of any of said lands; and further provided, that nothing therein contained shall be construed as interfering with the rights of native tenants in said lands." (Commisioner of Public Lands 1929:75–76)

Of the thirteen Hāmākua *ahupuaʻa* awarded to Leleiōhoku, nine were relinquished to the *Mōʻī*, and four were retained by him (Kameʻeleihiwa 1992). Kameʻeleihiwa (1992:25) relates that Leleiōhoku

> held 93 *ʻĀina* before the *Māhele*, principally on Hawaiʻi island (73). He gave up 61 percent of his *ʻĀina* to the *Mōʻī*, receiving 36: 25 on Hawaiʻi, 7 on Māui, 2 on Oʻahu, and 1 on Molokaʻi… When Leleiōhoku died soon after the signing of the *Buke Mahele* in 1848, his heirs (his wife Keʻelikōlani and son John Pitt Kīnaʻu) were required to cede 12 or more *ʻĀina*, or another 13 percent, in

government commutation. These included 8 *ʻĀina* on Hawaiʻi and 4 on Māui. By 1849, Leleiōhoku's estate had shrunk to 25 percent of its pre-*Māhele* size.

Commutation of the nine Hāmākua *ahupuaʻa* occurred on August 27, 1850, two years after his death. Kapoaula was not included among these lands. Leleiōhoku was succeeded by his only heir, and "the substantial *ʻĀina* of Leleiōhoku [including Kapoaula] were left to his son, W.P. Kīnaʻu, with his widow Ruta Keʻelikōlani as guardian" but "Kīnaʻu died as a youth in 1859 and so Leleiōhoku's *ʻĀina* were really inherited by Keʻelikōlani" (Kameʻeleihiwa 1992:307). Before Keʻelikōlani passed away in 1883, she "became one of the largest owners of *ʻĀina* by the time of her death…because she became heir to various *Aliʻi Nui* who died before her" (Kameʻeleihiwa 1992:246).

Leleiōhoku's lands were awarded posthumously as Land Commission Award (LCAw.) 9971. The award itself adds to the confusion over Kapoaula, as it appears that the *ahupuaʻa* was included twice in the award (Soehren 2005). *ʻĀpana* 2 of the award (Figures 26 and 27) is for the *ahupuaʻa* of "Kapoaula" in Hāmāku on Hawaiʻi Island. The award includes a description of the boundary and a map that clearly identifies the land as the *ahupuaʻa* containing the current study area. *ʻĀpana* 18 of the award is for "Kapaaula" in Hamakaua on Hawaiʻi Island. The land is not described in the same detail as *ʻĀpana* 2, only named. The award was finalized on May 2, 1853, five years after Leleiōhoku's death, and a map (Figure 28) were made from C. J. Lyons's survey of the awarded land. A description of the *ahupuaʻa* boundary, as surveyed by Lyons, was included in the LCAw. documentation (the portion including the current study area is bolded; Hawaiian words are italicized):

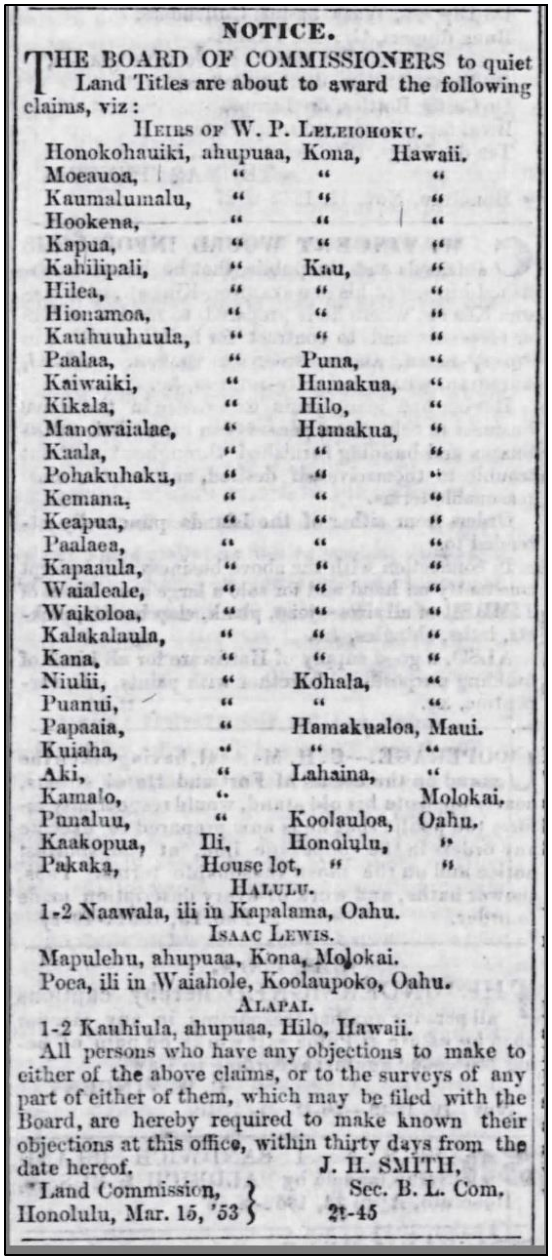
> Starting at the east corner on the *makai* (seaward) side adjoining with Malanahae just below the stream, and running to the *ili kai maloo* (low tide, as when much of the reef is exposed) for 435 feet, then ascending up the cliff to the large stone at the boundary of this [land] and Manai, then ascending on the boundary of Manai Hema 16˚ west 1,346 feet until the *pā* (enclosure) of Popoloa, then from the enclosure south 31˚ west 330 feet, then south 35˚ west 515 feet, then at Manai south 9˚ 45 feet west 5,555 feet until it reaches the *mauka* most *kuleana* boundary, then at Mooiki, south 11˚ 30 feet west 1,666 feet to the top of the hill, then south 25˚ 15 feet west 3,080 feet cutting the western corner of Wainaku, until it reaches the puu "Naunuakini" then at Haukoi, south 15˚ west 3,300 feet until it reaches the embankment on the western side of the stream, then at Keahakea, south 43˚ 30 feet west 2,400 feet until it reaches the *ahupohaku* (stone mound) at Waiakaalae, then on the boundary of Kapulena south 11˚ 45 feet west 12,800 feet until it reaches the marker at the *awawa* (gulch, valley) *makai* of Kamakaukuapuu, **then south 2˚ east 4,450 feet at Kapulena until it reaches the *mauka* most boundary of this land, just below Alalakeiki**, **then at Kamoku north 87˚ 30 feet east 2,250 feet until it reaches the "Alanui pii o Honokaia," north 11˚ 30 feet east 17,700 feet until it reaches puu Ka-manu**, then at the boundary of Malanahae north 22˚ west 690 feet until it reaches puu Keokeo, then north 5˚ west 1,350 feet until it reaches the *ʻōhiʻa* tree marking Kapaaula at the start of the stream at a placed called Kapohoiholena, then descending down the stream on the boundary of Malanahae until the point of commencement.
>
> 1,697 ¼ acres

The land was not patented for another eighty years, when Alfred Wellington (A.W.) Carter, manager of Parker Ranch (which owned the land by that time) was issued Land Patent Grant 8451 on January 8, 1934.

Another version of Lyons' map (Figure 29) includes additional details about the study area. Most importantly, the map indicates that the study area was still forested in 1853. The forests on Mauna Kea traditionally provided Hawaiians with forest resources, especially feathers, plant materials, and wood, and places for ritual activities (Tomonari-Tuggle 1996). Bird-catching was a specialized form of hunting that provided highly-valued feathers to craft specialists, who transformed them into high status goods that included *lei*, *kāhili* (royal insignial plumes), *ʻahu ʻula* (cloaks), *mahiole* (helmets), and *ʻakua hulu manu* (feathered images of gods) (Brigham 1899, 1903, 1918; Buck 1944, 1957; Emerson 1894). The *aliʻi* controlled the collection of feathers through specific requests (Kamakau 1992), as tribute during the *Makahiki*, and through a "standing order" (*palala*) for this item of *hoʻokupu* (Malo 1951). Boundary Commission records examined by Cordy (Cordy 2003), support the idea that bird-catchers were *makaʻāinana* who hunted birds within their own *ahupuaʻa* on a part-time basis (*contra* Emerson 1894; see also Lass 1998; Linnekin 1988). This suggests only temporary habitation in this part of the forest, which would likely lead to relatively ephemeral evidence of the presence of the bird-catchers. Boundary commission records (see discussion below) indicate that the forests continued to support some bird-catching into the mid-19th century, but the upper forests were significantly altered by livestock, which trampled and grazed them into grasslands. Lyons' map captures this landscape in transition by noting a "Pahua Bipi" [*pāhuʻa,* a clear areas in pastures where it is easy to rope cattle; *bipi*, beef/cattle] located *makai* of the current study area. (Pukui and Elbert 1986:301)

The map also shows two trails, which are highlighted in yellow on Figure 29. The old trail/road referred to as “Honokaia” by Makaenaena is depicted in Figure 30, where it is labeled “Alanui o Honokaia.” The trail extends slightly into the southeastern corner of the current study area. From there, the trail follows the parcel’s eastern boundary for a short distance before linking with a *mauka*/*makai* trail/road called “Alanui pii uka i ka mauna” which translates literally as “large path going inland to the mountain.” This second trail roughly bisects the study area and extends from this junction *makai* towards the *kuleana* lots in the northern portion of Kapoaula. Above the junction at the Honokaia boundary, the Alanui pii uka i ka mauna and the Alanui o Honokaia continue southwards into the Government land of Kamoku (see Figures 30 and 29).

No *kuleana* awards were made within the current study area. In the *makai* portion of Kapoaula, nine claims for *kuleana* parcels were made by eight claimants, all of which were awarded. The awarded lands totaled 116.5 acres and ranged between 9.3 and 16.5 acres.



NOTICE.

THE BOARD OF COMMISSIONERS to quiet Land Titles are about to award the following claims, viz:

HEIRS OF W. P. LELEIOHOKU.

Honokohauiki,	ahupuaa,	Kona,	Hawaii.
Moeauoa,	"	"	"
Kaumalumalu,	"	"	"
Hookena,	"	"	"
Kapua,	"	"	"
Kahilipali,	"	Kau,	"
Hilea,	"	"	"
Hionamoa,	"	"	"
Kauhuuhuula,	"	"	"
Paalaa,	"	Puna,	"
Kaiwaiki,	"	Hamakua,	"
Kikala,	"	Hilo,	"
Manowaialae,	"	Hamakua,	"
Kaala,	"	"	"
Pohakuhaku,	"	"	"
Kemana,	"	"	"
Keapua,	"	"	"
Paalaea,	"	"	"
Kapaaula,	"	"	"
Waialeale,	"	"	"
Waikoloa,	"	"	"
Kalakalaula,	"	"	"
Kana,	"	"	"
Niulii,	"	Kohala,	"
Puanui,	"	"	"
Papaaia,	"	Hamakualoa,	Maui.
Kuiaha,	"	"	"
Aki,	"	Lahaina,	"
Kamalo,	"		Molokai.
Punaluu,	"	Koolauloa,	Oahu.
Kaakopua,	Ili,	Honolulu,	"
Pakaka,	House lot,	"	"

HALULU.

1-2 Naawala, ili in Kapalama, Oahu.

ISAAC LEWIS.

Mapulehu, ahupuaa, Kona, Molokai.
Poea, ili in Waiahole, Koolaupoko, Oahu.

ALAPAI.

1-2 Kauhiula, ahupuaa, Hilo, Hawaii.

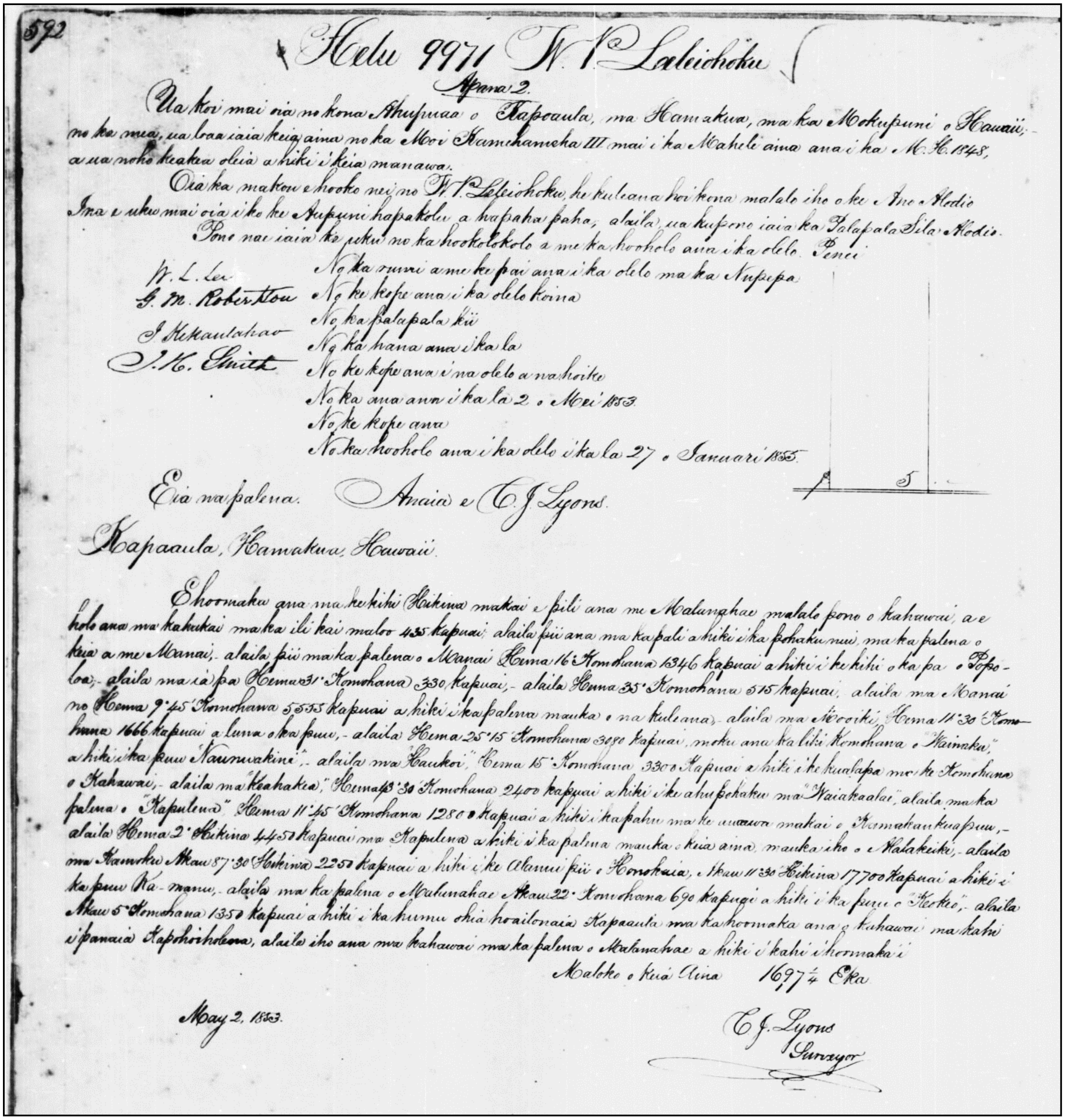
All persons who have any objections to make to either of the above claims, or to the surveys of any part of either of them, which may be filed with the Board, are hereby required to make known their objections at this office, within thirty days from the date hereof.

J. H. SMITH,
Sec. B. L. Com.

Land Commission,
Honolulu, Mar. 15, '53

2t-45

Figure 26. Newspaper notice from March 15, 1853 listing Kapoaula (listed as Kapaaula) and other lands to be awarded to Leleiohoku during the *Māhele* (The Polynesian 1853).



592

Helu 9971 W. P. Leleiohoku

Apana 2.

Ua koi mai oia no kona Ahupuaa o Kapoaula, ma Hamakua, ma ka Mokupuni o Hawaii, no ka mea, ua loaa iaia keia aina no ka Moi Kamehameha III mai i ka Mahele aina ana i ka M. H. 1848, a ua noho kaakaa oleia a hiki i keia manawa.

Oia ka makou e hooko nei no W. P. Leleiohoku, he kuleana hoi kona malalo iho o ke Ano Alodio Ina e uku mai oia i ko ke Aupuni hapakolu a hapaha paha, alaila, ua kupono iaia ka Palapala Sila Alodio.

Pono nae iaia ke uku no ka hookolokolo a me ka hooholo ana i ka olelo. Penei

W. L. Lee — No ka hoomaopopo a me ke pai ana i ka olelo ma ka Nupepa
G. M. Robertson — No ke kope ana i ka olelo koina
J. Kekaulahao — No ka palapala kii
J. H. Smith — No ka hana ana i ka la
No ke kope ana i na olelo a na hoike
No ka ana ana i ka la 2 o Mei 1853.
No ke kope ana
No ka hooholo ana i ka olelo i ka la 27 o Januari 1855.

Eia na palena. Anaia e C. J. Lyons.

Kapaaula, Hamakua, Hawaii.

E hoomaka ana ma ke kihi Hikina makai e pili ana me Malunahae malalo pono o kahawai, a e holo ana ma kahakai ma ka ili kai maloo 435 kapuai; alaila pii ana ma ka pali a hiki i ka pohaku nui, ma ka palena o keia a me Manai; alaila pii ma ka palena o Manai Hema 16° Komohana 1346 kapuai a hiki i ke kihi o ka pa o Popoloa; alaila ma ia pa Hema 31° Komohana 330 kapuai; alaila Hema 35° Komohana 515 kapuai, alaila ma Manai no Hema 9° 45' Komohana 5555 kapuai a hiki i ka palena mauka o na kuleana; alaila ma Nooiki, Hema 11° 30' Komohana 1666 kapuai a luna o ka puu; alaila Hema 25° 15' Komohana 3080 kapuai, moku ana ka liki Komohana o "Wainaku," a hiki i ka puu "Naunuakini"; alaila ma "Haukoi," Hema 15° Komohana 3300 kapuai a hiki i ke kualapa me ke Komohana o Kahawai; alaila ma "Keahakea," Hema 13° 30' Komohana 2400 kapuai a hiki i ke ahu pohaku ma "Waiakaalai," alaila ma ka palena o "Kapulena," Hema 11° 45' Komohana 12800 kapuai a hiki i ka pahu ma ke auwaa makai o Kamakaukuapuu; alaila Hema 2° Hikina 4450 kapuai ma Kapulena a hiki i ka palena mauka o keia aina, mauka iho o Malakeike; alaila ma Kaumoku Akau 87° 30' Hikina 2250 kapuai a hiki i ke Alanui pii o Honokaia, Akau 11° 30' Hikina 17700 kapuai a hiki i ka puu Ka-manu; alaila ma ka palena o Malunahae Akau 22° Komohana 690 kapuai a hiki i ka puu o "Keokeo"; alaila Akau 5° Komohana 1350 kapuai a hiki i ka kumu ohia hoailonaia Kapaaula ma ka hoomaka ana o kahawai ma kahi i panaia Kapohoiholena, alaila iho ana ma kahawai ma ka palena o Malunahae a hiki i kahi i hoomaka ai.

Maloko o keia Aina 1697¼ Eka

May 2, 1853.

C. J. Lyons
Surveyor

Figure 27. LCAw. 9971 *'apana* 2 to William Leleiohoku (www.kipukadatabase.com).

Figure 28. Survey map of LCAw. 9971:2 by C.J. Lyons, study area shaded red.

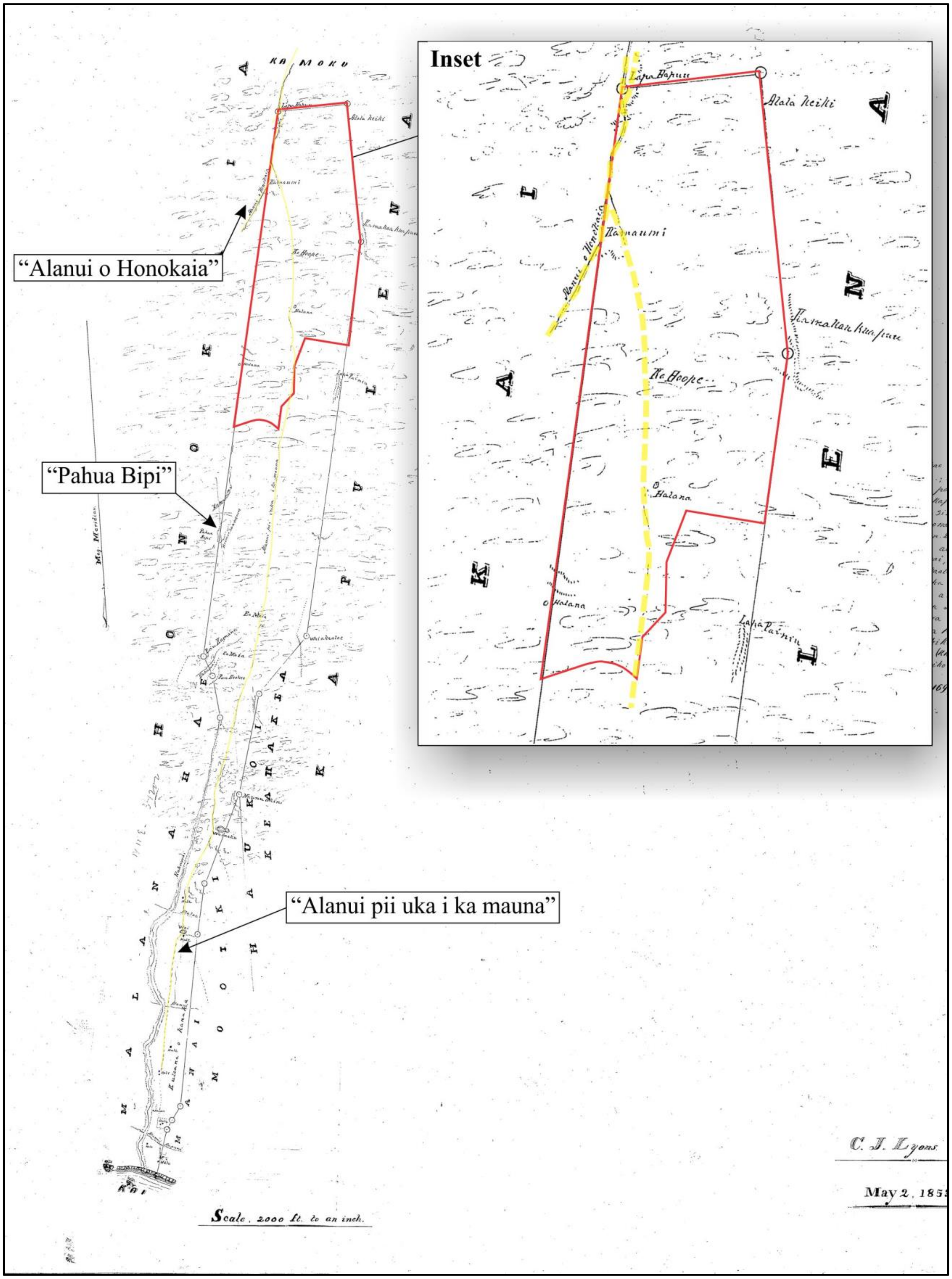


Figure 29. Portion of Registered Map No. 46 with the current study area outlined red (after Lyons 1853).

Boundary Commission Testimony (1862-1873)

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai‘i to legally set the boundaries of all the *ahupua‘a* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and transcribed in English. Although hearings for most *ahupua‘a* boundaries were brought before the Boundary Commission and later surveyed by Government employed surveyors, in some instances, the boundaries were established through a combination of other methods. In some cases, *ahupua‘a* boundaries were established by conducting surveys on adjacent *ahupua‘a*. In cases where the entire *ahupua‘a* was divided and awarded as Land Claim Awards and or Government issued Land Grants (both which required formal surveys), the Boundary Commission relied on those surveys to establish the boundaries for that *ahupua‘a*. Although these surveys aided in establishing the boundaries, they lack the detailed knowledge of the land that is found in the Boundary Commission hearings.

While the boundaries for Kapoaula do not appear to have ever been brought before the Boundary Commission, testimony for the adjacent *ahupua‘a* of Honokaia was provided to the Boundary by Makaenaena on April 18, 1873. Makaenaena may have been about fifty years old at the time of his testimony. In his description, Makaenaena not only names several places in the immediate vicinity of the current project area, but provides insights regarding Precontact land use, such as bird-catching, within the general area. Makaenaena described the boundaries of Honokaia as follows (place names bolded, Hawaiian words italicized, and underlined emphasis added for sections relevant to Kapoaula):

> I was born at **Kawela Hamakua**, Island of **Hawaii**, before the time of collecting sandalwood on the mountains. Have always lived on **Kawela** and **Honokaia**. I am a *kamaaina* of these lands. My father Moopua (now dead) showed me these boundaries when I went with him to catch birds. If we caught birds on other lands, the *Luna* of those lands, would take the birds away from us, and so he pointed out the boundaries to me. **Honokaia** is bounded on the *makai* side by the Sea; on the South East side by **Kawela** and **Au 1st**, *mauka* by **Kamoko** [**Kamoku**], North West side by **Kamoko**, **Kapoaula** and **Malanahae**. There were always in old times fisheries belonging to **Honokaia** extending out to sea a short distance. The boundary at the shore between **Honokaia** and **Kawela** is a large rock in the Sea called **Pohakulelehu**: From this point the boundary between these two lands runs *mauka* to a grove of *Puhala* trees called **Paihala**, thence *mauka* to place at old road called **Kuaiwahia**: Thence *mauka* to grove of *Puhala* trees called **Puanapouli**: Thence to small hill called **Kulanahae**: Thence across Government road to hill called **Puuainako**: Thence to a small mound **Wiliwilihalou**: Thence to a grove of small *ohia* trees on the side of a *pali* at place called **Kauluawaa**: Thence to waterhole called **Kauluawaa**: Thence to grove of *ohia* trees **Kuhewa**: The place called **Ohiakiihelele** is on the land **Honokaia** a short distance from the boundary: From **Kuhewa** the boundary runs *mauka* to **Kawelaloa**: Thence to **Kawahine**: The boundary from the shore follows up the *iwi aina*: From **Kawahine** to to [sic] **Inoino** gulch, and *mauka* to a *pali* called **Palinui**: The brow of *pali* is boundary, level land is on **Honokaia**, and *pali* on **Kawela**: Thence along brow of *pali* and on to **Pakeke**: Thence to **Pohokai**: Thence up a ridge to **Pohopuumaia**, at this point cross the **Inoino** gulch: Thence to place called **Puuloa** at the old **Kawela** road: Thence follow up the old road to **Nahaleopaa** a *puu pahoehoe* in **Inoino** *kahawai:* the *mauka* corner of **Kawela** where it is cut off by **Au 1st**: The place where the boundary of **Honokaia** enters the woods is at the water hole **Kaohiawaa** *mauka* of the grove of *ohia* trees of the same name.
>
> From **Nahaleopaa** the boundary between **Honokaia** and **Au 1st** follows up the old road **Honokaia** one side of road and **Au 1st** on other, to place called **Puuokane hekili** (a small hill or mound): Thence along road to a hill **Puupohaku**: Thence to old *mamake* [*māmaki*] ground called **Waiakekukai**: Thence to **Kalapahaaha**: Thence to small hill **Puulepo**: Thence to **Waiakahoi** a *Kahawai* with a cave it where the bird catchers used to live: Thence **Honokaia** ends and **Au** is cut off by **Kamoko**: Thence boundary of **Honokaia** runs along **Kamoko** to old *Mamake* ground called **Kumaweo**: Thence to *Mamake* grounds called **Nakikapio**: Thence to a ridge called **Makaleha**: Thence *makai* to a hill **Kalapaaki**: Thence to **Kalapa Hapu [Lapa Hapuu]** the *mauka* corner of land of **Kapoaula** The corner of **Kamoku** on boundary of **Honokaia**.
>
> I went with Wiltse when he surveyed the boundary between **Honokaia** and **Kawela**, marked trees and pointed out boundaries. **Kaikauna** went with us. I was born before the collecting of sandalwood by Boki. . . . (Boundary Commission, Hawaii, Vol. A, No. 1, pgs. 238-240)

Makaenaena's testimony indicates that Kapoaula borders Honokaia to the northwest, and that Kalapa/Lapa Hapuu was the southeastern corner boundary between the two *ahupua'a.* Makaenaena's testimony also contains references to cultural, natural, and geographic places of significance in the general vicinity of the study area, including a grove of *pūhala* trees (Puanapouli), a place with a water hole where *'ōhi'a* grew (Kauluawaa), another water hole (Kaohiawaa), two groves of *'ōhi'a* trees (Kaohiawaa, Kuhewa), a gulch (Inoino), a *pali* (Palinui), a *pu'u pāhoehoe* (Nahaleopaa), three *māmaki*-growing areas (Kumaweo, Nakikapio, Waiakekukai), an upland stream with cave where bird-catchers dwelled (Waiakahoi), a ridge (Makaleha), numerous hills (Kalapaaki, Kulanahae, Puuainako, Puuokane hekili, Puupohaku), and four old roads (Honokaia, Government road, Kawela, Kuaiwahia). Makaenaena also reveals that the lands of Honokaia were hunting grounds for birds. Honokaia also had ancient fishing rights extending out to the sea, and Kapoaula undoubtedly did, too. While traditional land use is not explicitly discussed for Kapoaula in the testimony, Makaenaena's description of the forest land and bird-catching boundaries suggest that bird-catching likely took place in the current study area.

Another historic map prepared in 1853 (Figure 30) depicts five *inoa 'āina* (Hawaiian place names) within the study area, supplementing the few mentioned in the LCAw. boundary description. These places are Alala Keiki, Lapa Hapuu, Kamauami, Kamakaukuapuu, and Ka Hoope. Most importantly for the current study, the two trails shown in Figure 29 are also depicted. The locations of the named places described above are plotted on a current satellite image of the study area in Figure 31. Superimposing these named places onto the present-day landscape

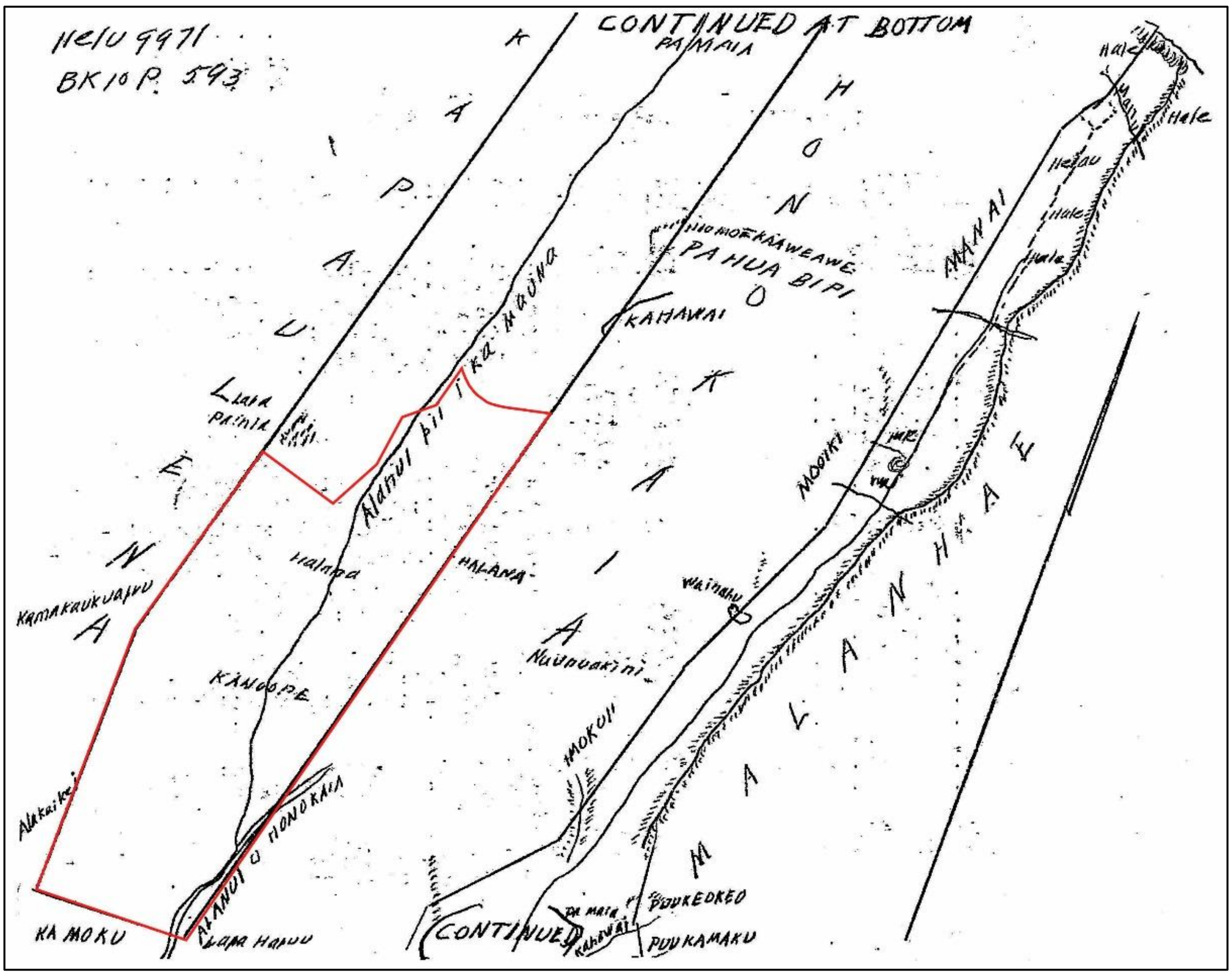


Figure 30. Tracing of C.J. Lyons' survey map of LCAw. 9971:2 with the current study area outlined in red (Office of Hawaiian Affairs 2018).

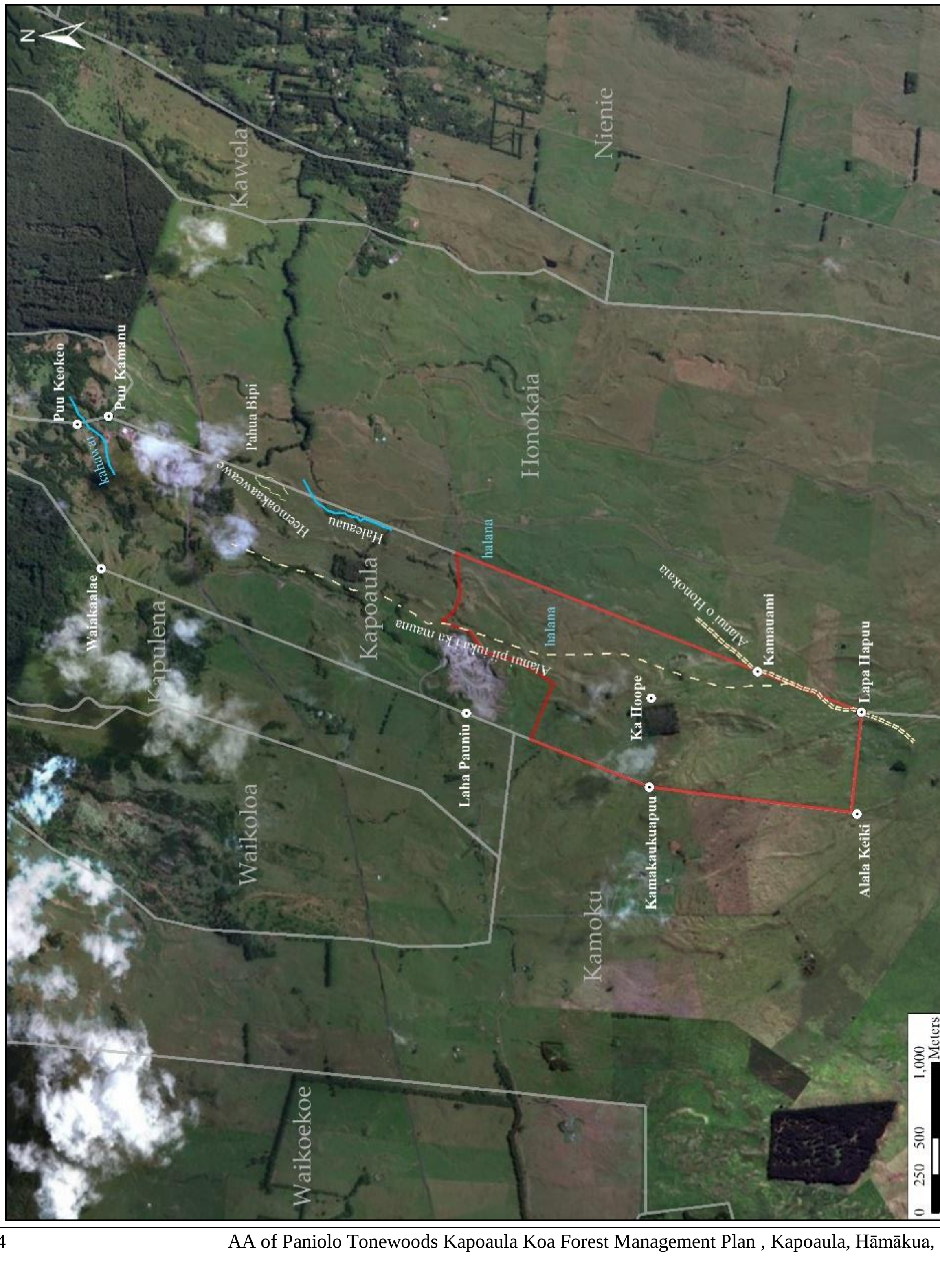


Figure 31. Locations of place names in study area compiled from historic maps.

The Ranching and Sugar Industries in Hāmākua During the Mid to Late Nineteenth Century

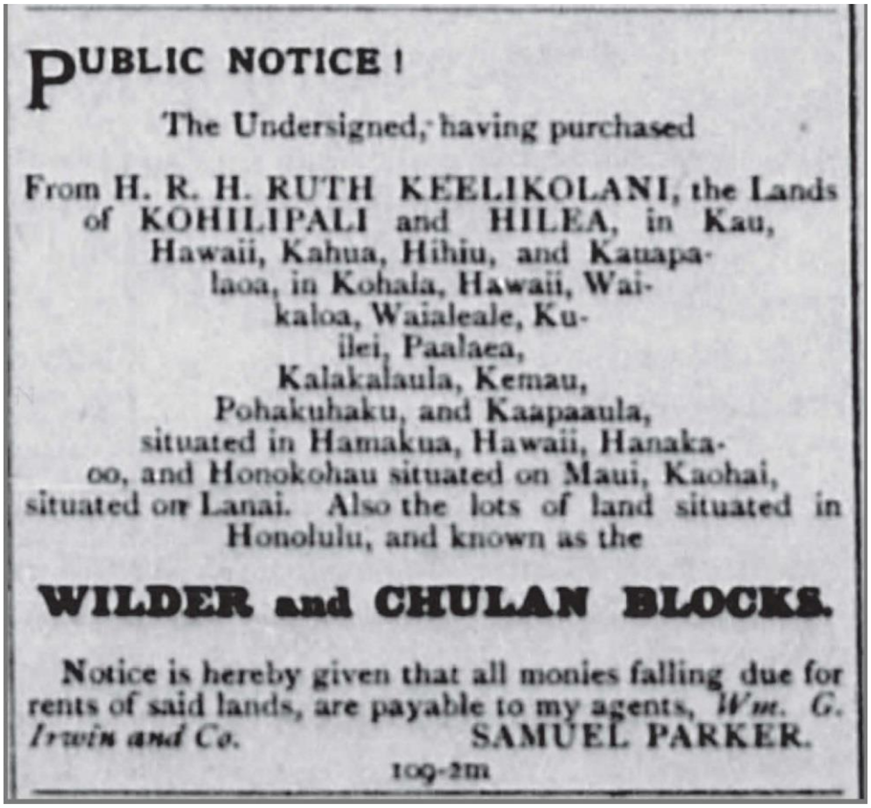
The written history of the late nineteenth to the early twentieth century largely reflects news of new settlers, religious endeavors, and commercial pursuits in the region. The introduction of European livestock had a profound effect on upland Hāmākua and neighboring lands in Kohala. McEldowney (1983) discusses changes in land use and land ownership before and after the *Māhele* that culminated in the eventual displacement of the Hawaiian community in Kohala, and similar events impacted Hāmākua's residents as well. After 1848, when land became a commodity, Hawaiians were often forced off their house lots (and livelihoods) simply because they lacked the cash with which to make the purchase (of land) or pay the property tax. The creation of private property also resulted in a shift away from the traditional *mauka*-to-*makai* management of whole *ahupuaʻa*, as certain industries moved into large swaths of land, such as livestock ranching into dwindling upper forests of Hāmākua. As a result, Hawaiian culture was well on its way towards Western assimilation as industry in Hawaiʻi transitioned from the boom-and-bust sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar and cattle industries.

Free-roaming livestock, such as cattle, sheep, and goats were brought to Hawaiʻi in the ships of Western explorers during the late eighteenth century. Upon presenting the first cattle to Kamehameha I in 1789, Captain George Vancouver advised the *Mōʻī* to place a protective ten-year *kapu* on the animals to allow them to multiply and roam freely all throughout Hawaiʻi Island (Vancouver 1984). By the mid-nineteenth century, the unregulated population of livestock became a nuisance to the native farmers and evidence of the impact on the greater environment was cause for concern. During the 1830s, under the administration of Kauikeaouli (Kamehameha III), *vaqueros* (cowboys of Mexican, Indian, and Spanish descent) were brought to Hawaiʻi to train Hawaiians in the handling of both horses and wild cattle. Although Hawaiians quickly adopted the newly introduced animal handling skills, organized ranching operations would not prosper in Hāmākua until the mid-nineteenth century.

By the time the *Māhele* began in 1848, John Palmer Parker had struck out on his own, having received two acres of land at Mānā where he built a family house and first ranch buildings (Bergin 2004). He rapidly expanded his landholdings, purchasing 640 acres surrounding Mānā in 1850, and in 1852 he purchased another 1,000 acres. Some of the leased lands would eventually be deeded to the ranch by outright purchase (Bergin 2004). In a few years, John Parker had turned most of the day-to-day operations of Parker Ranch over to his son, John Palmer Parker II. The growth of Parker Ranch and its rivals inevitably led to legal clashes over land and cattle throughout the 1860s.

An early rival of Parker Ranch, the Waimea Grazing and Agricultural Company (WGAC), was founded by Robert C. Janion and William H. Green in 1861 and joined by F. Spencer and Company soon thereafter. The WGAC acquired considerable strategic assets around Waimea in an attempt to monopolize the livestock industry in the region (Bergin 2004). From the outset, Spencer, Janion, and Green maintained an adversarial relationship with Parker Ranch. Land disputes and allegations cattle rustling were common occurrences between these two competing entities. During the early 1860s, for example, Parker successfully thwarted Janion's men from harvesting unbranded cattle on his lands. Frank Spencer, meanwhile, contested Parker's claim to more than 17,800 acres in other parts of the island. These disputes were still ongoing when John Palmer Parker, the founder of Parker Ranch, died on August 20, 1868 (Bergin 2004). At the time Parker Ranch controlled about 47,000 acres of land in the region. The ranch lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr. In the next decade, the ranch would outbid the WGAC on important grazing leases and purchase additional lands, dooming its early rival to bankruptcy (Maly and Maly 2005; Wellmon 1969). Among those land purchases were several *ahupuaʻa* in Hāmākua and Kohala belonging to H.R.H. Ruth Keʻelikōlani. Parker Ranch purchased Kapoaula from Keʻelikōlani on August 5, 1874, for a sum of two hundred dollars (Bureau of Conveyances Liber 39:496). A list of lands bought from Keʻelikōlani appears in an advertisement (Figure 32) taken out by Samuel Parker in 1882 in an attempt to collect outstanding rents.

An 1877 *Report of the Royal Commissioners on Development of Resources* documented the effects of cattle ranching on the environment of the Kohala, Waimea, and Hāmākua regions, and the resultant outmigration of the native population during this period. Forests on the Kohala mountains were dying back, and water sources were polluted by cattle (Maly and Maly 2002). By the late-1870s, largely due to persistent drought conditions within its grazing lands, the Waimea Grazing and Agricultural Company went out of business, and its herd was purchased by Parker Ranch. Parker Ranch continued to expand their operations in the Hāmākua area throughout the 1870s and 1880s, and in 1882, existing Parker Ranch landholdings were further amplified by the purchase of Kapoaula from Keʻelikōlani by Samuel Parker (Figure 32).



PUBLIC NOTICE !

The Undersigned, having purchased

From H. R. H. RUTH KEELIKOLANI, the Lands of KOHILIPALI and HILEA, in Kau, Hawaii, Kahua, Hihiu, and Kauapalaoa, in Kohala, Hawaii, Waikaloa, Waialeale, Kuilei, Paalaea, Kalakalaula, Kemau, Pohakuhaku, and Kaapaaula, situated in Hamakua, Hawaii, Hanakaoo, and Honokohau situated on Maui, Kaohai, situated on Lanai. Also the lots of land situated in Honolulu, and known as the

WILDER and CHULAN BLOCKS.

Notice is hereby given that all monies falling due for rents of said lands, are payable to my agents, *Wm. G. Irwin and Co.* SAMUEL PARKER.

109-2m

Figure 32. Public notice regarding purchase of Kapoaula (listed as “Kaapaaula”) on October 28, 1882 (Daily Honolulu Press 1882).

Another industry that emerged in Hāmākua during the mid- to late nineteenth century was commercial sugar cultivation. Sugarcane was grown on all islands, and when Cook arrived he wrote of seeing sugarcane plantations. Sugarcane was a Polynesian introduction and served a variety of uses. The *kō kea* or white cane was the most common, usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy and Handy 1972). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children’s teeth by chewing on it (Handy and Handy 1972). It was used to thatch houses when *pili* grass or *lau hala* were not abundant (Malo 1903). The Chinese on Lāna‘i are credited with producing sugar first, as early as 1802. However, it was not until 1835 that sugar became established commercially, replacing the waning sandalwood industry (Kuykendall and Day 1976; Oliver 1961).

Following the signing of a reciprocity treaty between the Kingdom of Hawai‘i and the United States of America in 1876, sugar plantations developed rapidly throughout the islands (Fong et al. 2005). Between 1876 and 1888, twenty sugar plantations sprang up along the Hāmākua coast (Dorrance and Morgan 2000). In 1878, the first sugar mill was established in the Hāmākua District, and due to its rich soil and plentiful water supply the district soon became the premiere location for growing sugar on the Island of Hawai‘i (Hazlett et al. 2007). The seaward portions of Kapoaula (up to 1,400 feet elevation) were included in the lands of the Honoka‘a Sugar Company. Lands cultivated in sugarcane extended from Kahaupu Gulch between the *ahupua‘a* of Pā‘auhau and Kaao northeast of the study area, all the way to the edge of Waipi‘o Valley. The fields were originally unirrigated, and for twenty-five years ratoon crops were grown in many areas because reaching the fields to replant was difficult. Eventually harvesting was accomplished using a combination of hand labor, flumes, and railroad (Dorrance and Morgan 2000).

While the *makai* portion of Kapoaula was included in the lands of the Honoka‘a Sugar Company, the *mauka* portion of the *ahupua‘a* remained under ownership of Parker Ranch and continued to be used for grazing purposes. A map of the northwestern portion of Hāmākua prepared in 1909 by A.J. Williamson (Hawai‘i Registered Map No. 2640) shows the relationship between Parker Ranch lands and Kapoaula (Figure 33). One important detail shown on the map is the upper extent of the forest (symbolized with bushy “tree-top” symbols, cf. Figure 29) located below the current study area at elevations less than 2,250 feet. Also, the trails depicted in 1853 do not appear on this map. A “new” road to Waimea (built ca. 1907) passes along the *makai* boundary of the current study area.

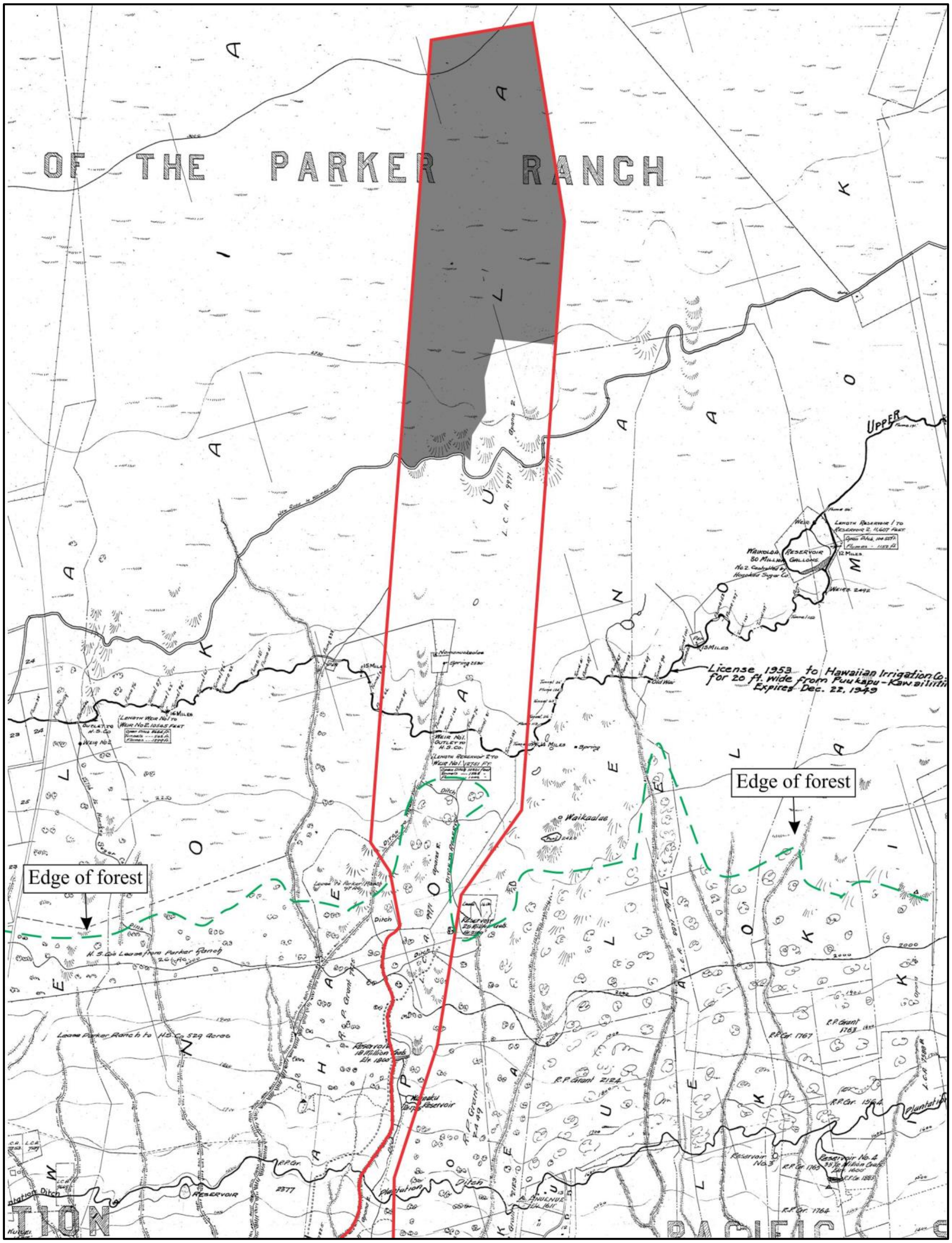


Figure 33. Portion of Hawai'i Registered Map No. 2640 showing Kapoaula (outlined in red) and the study area (shaded gray) within the lands of Parker Ranch (after Williamson 1909).

For the remainder of the twentieth century, the current study area was used almost exclusively as pasture. One exception to this was an experimental planting of tropical ash (*Fraxinus* sp.) trees in the central portion of the study area. More than 1,500 acres of tropical ash were planted throughout Hawai‘i beginning in 1924 (Whitesell et al. 1971). Information concerning the planting of this stand could not be located, but it is possible that the stand was planted in ca. 1930s by the Civilian Conservation Corps (CCC). Based on aerial photographs taken in 1954 (Figure 34), the stand of trees was well established by mid-century.

The stand of trees is also depicted on a 1951 Plat Map (Figure 35) of the parcel. This map also shows in detail the ranching infrastructure in the study area and the survey markers used to produce the survey. Survey markers shown include three concrete posts at parcel boundary corners and the “Kamakaukuapuu” triangulation station near the parcel’s western boundary *makai* of the ash stand. Ranching infrastructure includes a waterhole in the upper and lower portions of the study area and a network of cattle trails connecting these waterholes with others outside the current study area. This cattle trail network contrasts with the distinctly linear routes of the Alanui pii uka i ka mauna and the Alanui o Honokaia depicted on maps from a century before (see Figures 29 and 30). Although it is possible to follow the cattle trails in a *mauka-makai* direction, they do not appear to follow either of the older trails very closely. The tropical ash stand in also depicted, as is a gravel pit straddling the Old Māmalahoa Highway at the northern boundary of the study area. These two features are also visible on the 1957 USGS quadrangle map (Figure 36). The study area remained in pasture since throughout the twentieth century (Figure 37), and into the present day.

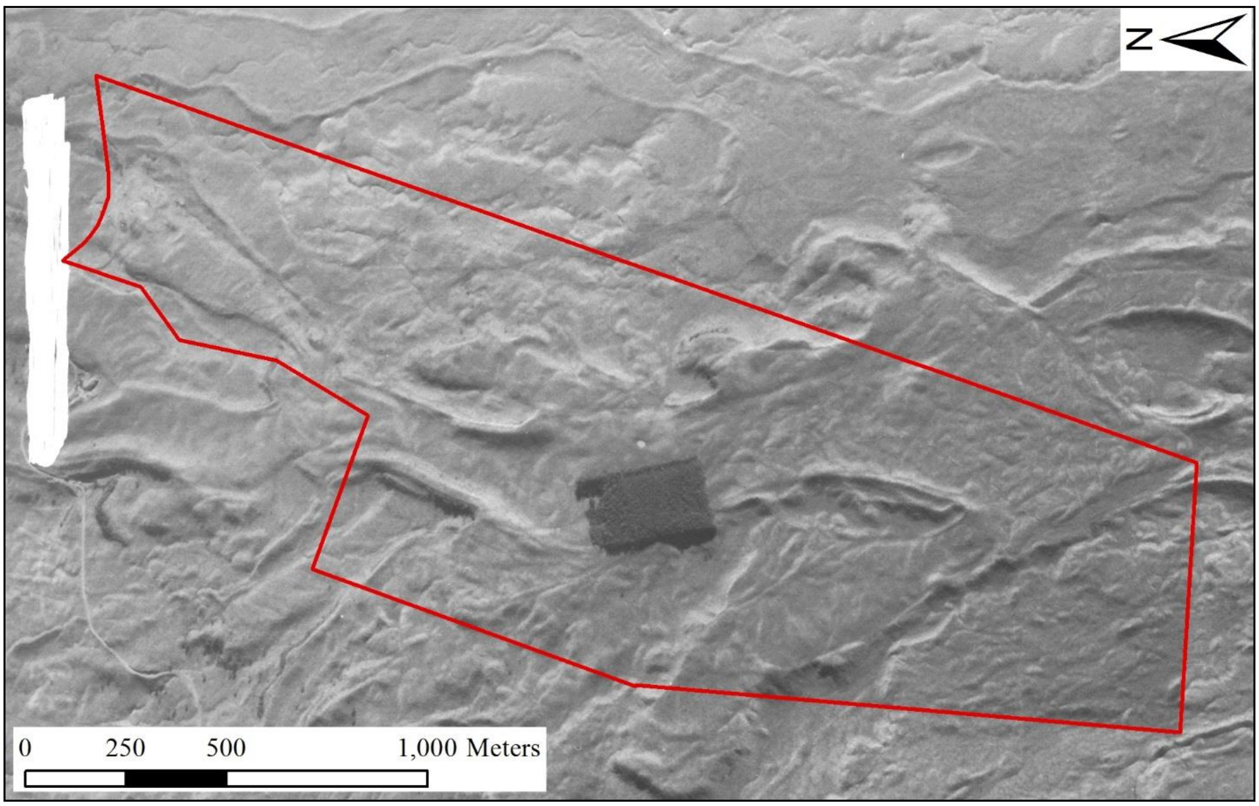


Figure 34. Aerial photograph taken in 1954 with the study area outlined in red (USGS 1954).

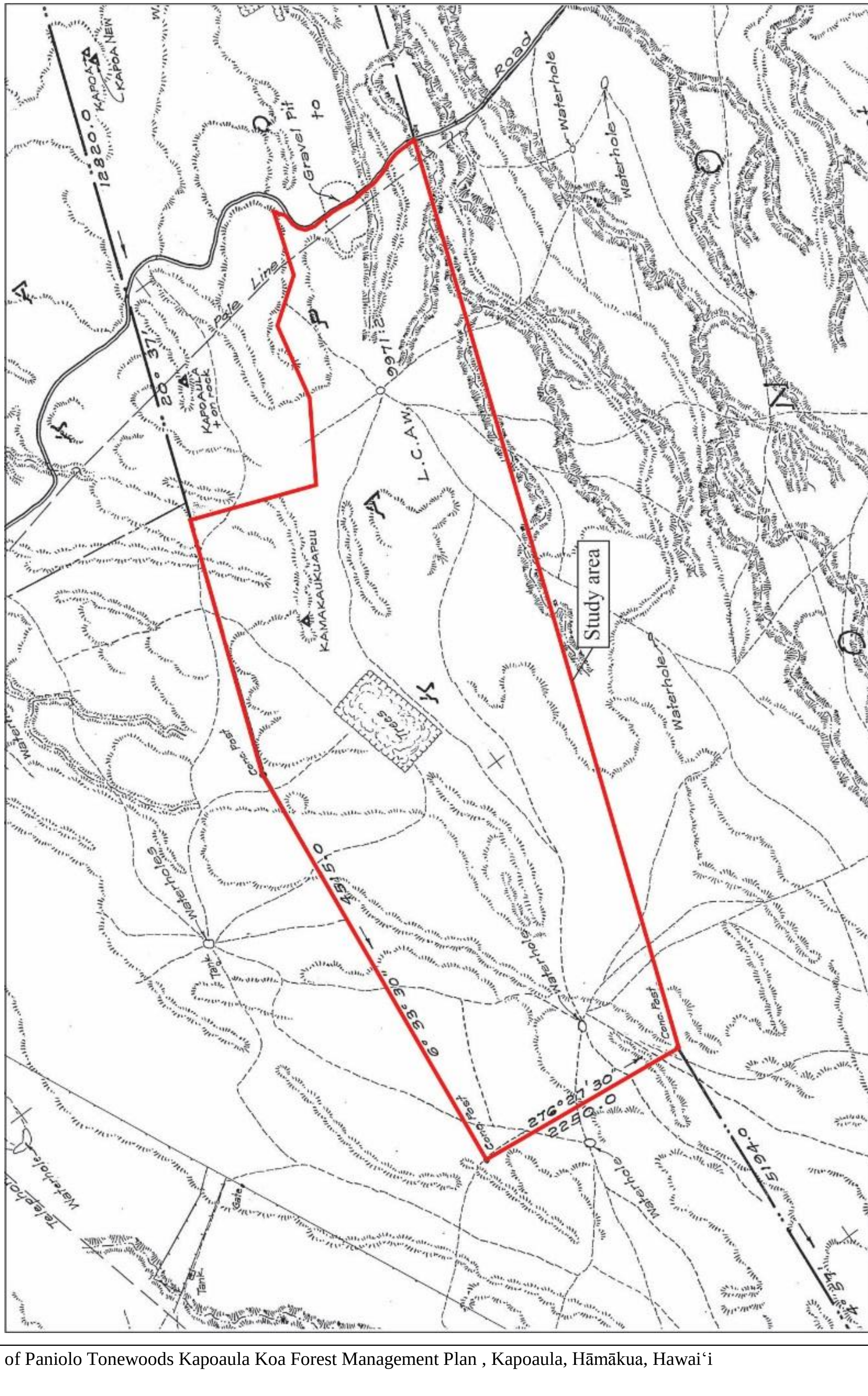


Figure 35. Portion of Plat Map 6.2 H.H. with current study area outlined in red (Aki and Lane 1951).

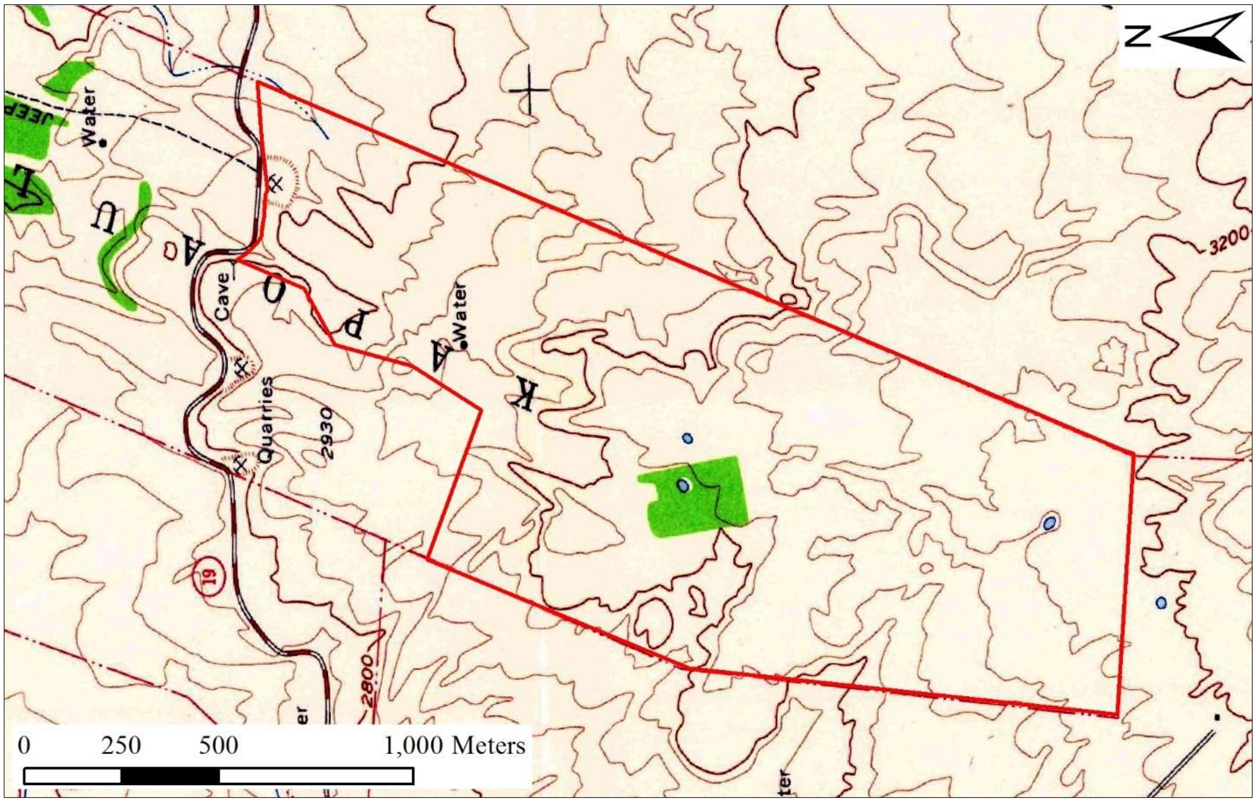


Figure 36. Portion of 1957 Kukuihaele quadrangle map, current study area outlined in red (USGS 1957).

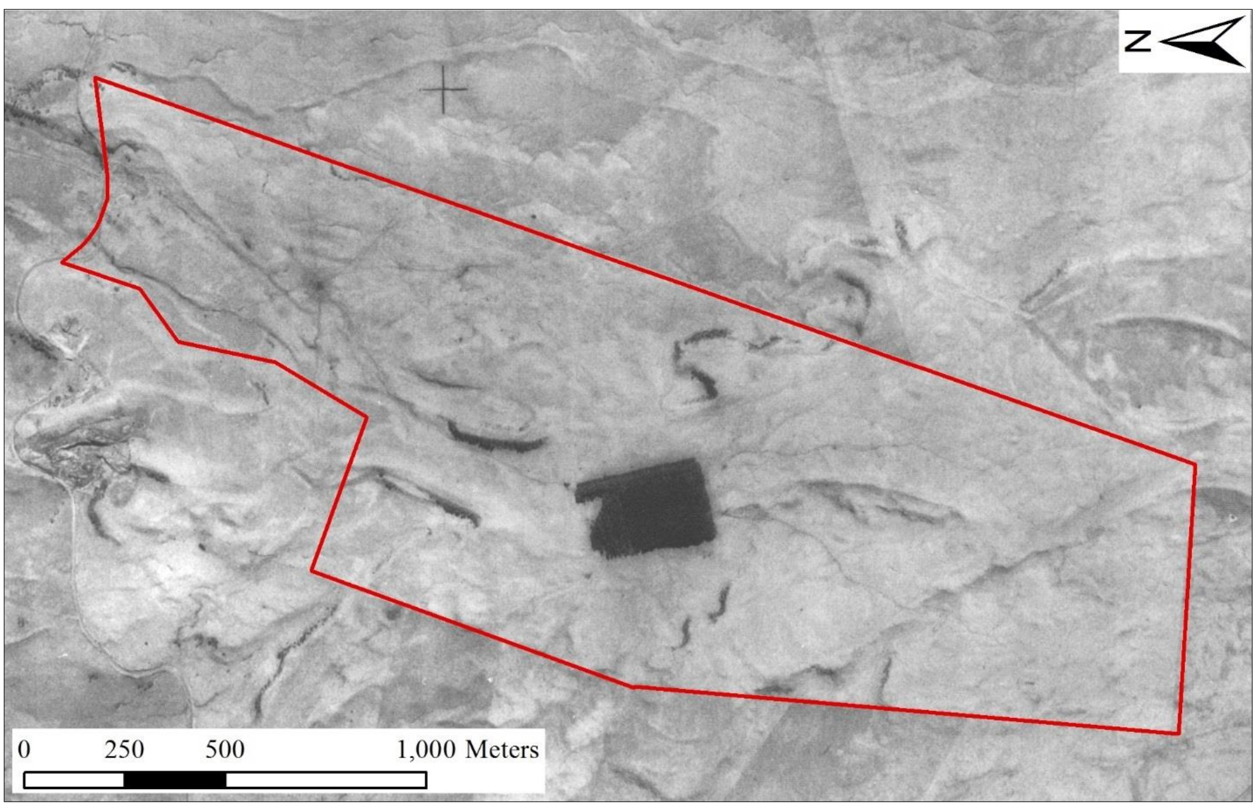


Figure 37. Aerial photograph taken in 1977 with the study area outlined in red (Hawaii Statewide GIS Program 2017).

PREVIOUS ARCHAEOLOGICAL STUDIES

Very few formal archaeological studies have been conducted in the immediate vicinity of the current study area (Table 1). Cordy's (1994) regional synthesis of previous studies in Hāmākua summarizes the general Precontact and early Historic land use patterns of the region (including the lands of the study area) in an effort to provide a predictive archaeological model for the district. Immediately adjacent to the current study area, Fong et al. (2005) conducted a literature review, field check, and cultural impact evaluation for Honokaia Pasture Lots Subdivision. Slightly *makai* (northeast) of the current study area, Cleghorn (1999) conducted an Archaeological Inventory Survey (AIS) at Inoino bridge located along the Old Māmalahoa Highway, and Rechtman et al. (2009) prepared *An Archaeological and Limited Cultural Assessment of a Planned Access Road Route across TMKs: 3-4-6-11:004, 006, and 044*. The locations of the Fong et al. (2005), Cleghorn (1999), and Rechtman et al. (2009) studies relative to the current study area are shown in Figure 38, and the findings of each of the studies listed above are summarized below.

In *A Regional Synthesis of the Hāmākua District, Island of Hawai'i*, Dr. Ross Cordy (1994) summarizes the general Precontact and early Historic land use patterns for the subregion of East Hāmākua, which includes Kapoaula Ahupua'a (Cordy 1994). The summary is based on a review of *Māhele* records and a detailed examination of archival historical information. Cordy (1994) defines four general envirionmental zones within East Hāmākua: (1) the Sea-shore, (2) the Seaward Upland Slopes, (3) the 'Ōhi'a-Koa Forest Zone, and (4) The Gulches. The current project area is located just above the Seaward Upland Slopes within the 'Ōhi'a-Koa Forest Zone. The Seaward Upland Slopes was the primary farming and residential zone of East Hāmākua. House sites in this zone were common between the sea cliffs and the cross-island trail (near the present-day Highway 19). Garden plots (*māla*, *kīhāpai*, and *kula*), which were generally non-irrigated, tended to be located in close proximity to the house lots. In the *mauka* regions of this zone, some scattered fields were present that were not associated with permanent residences. Dryland taro was the dominant crop of The Seaward Upland Slopes, but sweet potatoes and bananas were also commonly grown (Cordy 1994).

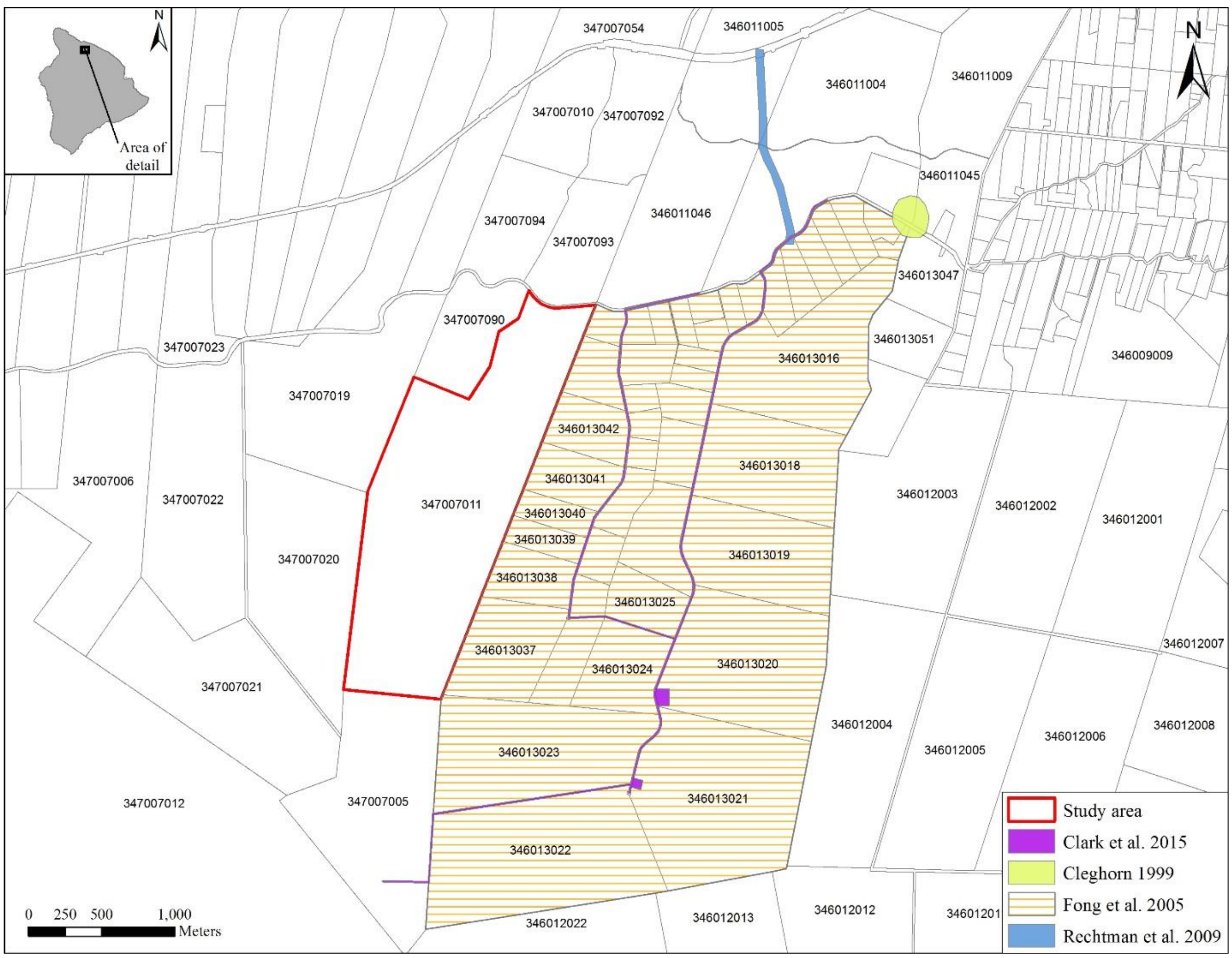


Figure 38. Previous archaeological studies conducted in the vicinity of the current study area.

In the ʻŌhiʻa-Koa Forest Zone, the Precontact and early Historic peoples of East Hāmākua utilized the natural resources of the forest. Activities in this zone included gathering bark to make fishing nets, collecting *māmaki* to make *kapa*, and catching birds for their feathers. At lower elevations within the ʻŌhiʻa-Koa Forest Zone small plantings of supplemental crops such as bananas and taro were also present. Habitation in this zone occurred at caves and campsites that were occupied for short durations of time (Cordy 1994).

Cleghorn (1999) conducted an archaeological inventory survey at Inoino Bridge located along the Old Māmalahoa Highway to the northeast of the current study area (see Figure 38). He identified four small caves (Caves 1, 2, 3, and 4) in the ʻŌhiʻa-Koa Forest Zone during an archaeological inventory survey at Inoino Bridge along the Old Māmalahoa Highway (TMKs: (3) 4-6-011:037 and 038). The caves, which were all recorded under the State Inventory of Historic Places (SIHP) designation Site 21405, are located in Kawela Ahupuaʻa along its boundary with Honokaia Ahupuaʻa. Each of caves contained stone constructions including platforms, walls, and alignments. Cleghorn (1999) suggests that the platforms within three of the caves, based on their formal attributes, could be Precontact burial monuments. However, no excavations or structural dismantling was performed during the survey to determine if human remains were indeed present within the stone structures. Cleghorn (1999) also recorded the Historic Inoino Bridge across Inoino Gulch, which was replaced by a new Inoino Bridge subsequent to the completion of the study.

In 2005, Fong et al. (2005) conducted a literature review, field check and cultural impact evaluation for approximately 2,500 acres of Department of Hawaiian Home Lands (DHHL) Lands in Honokaia Ahupuaʻa (TMKs: (3) 4-6-011: 003, 011, 012, and 013), to the east/southeast of the current study area (see Figure 38). The literature review included a study of archival sources, historic maps, Land Commission Awards (LCAw.), and previous archaeological studies relative to Honokaia. These resources were used to construct a history of land use within the *ahupuaʻa*. The field inspection, which included limited pedestrian survey and aerial survey, was conducted by two archaeologists over a span of three days. The inspection was intended to identify any surface archaeological features present within the 2,500 acres and to assess the potential impacts to any such features so that sensitive areas that might require further investigation or mitigation prior to any development could be dealt with. As a result of the field check a single archaeological site – a Historic wall, possibly a dam or gulch crossing – was recorded, but was not considered significant and was not assigned an SIHP site number. Two other structures, a corral and a quarry, were noted within the survey area, but were determined to lack archaeological or historical significance, as both were less than fifty years old. Fong et al. (2005) did not provide a map showing the location of any of the potential archaeological features identified. During community consultation, seven individuals were contacted of which only one individual, Halealoha Ayau, responded with interest to participate. In his interview, he recommended that cultural monitors be on site during excavations, "to assure that applicable burial treatment laws are adhered to."

Site 21405, previously recorded by Cleghorn (1999) within Inoino Gulch, was also relocated and inspected by Fong et al. (2005), and a fifth cave (Cave 5) containing two crude, mounded walls was identified at the site. As a result of the inspection, it was determined that all five of the caves were located just beyond the boundaries of the study area. Given the absence of significant sites within the Fong et al. (2005) study area, it was concluded that the development of the area would have no effect on historic resources. As part of the study of the DHHL Honokaia Lands Fong et al. (2005) made an attempt to contact several individuals, organizations, and agencies by e-mail regarding traditional cultural properties in Honokaia. Only one organization, *Hui Mālama O Nā Kūpuna O Hawaiʻi Nei* headed by Mr. Halealoha Ayau, responded to the e-mail. Mr. Ayau indicated that the members of the organization primarily wanted to make sure that cultural monitors were present during excavations to assure that applicable burial treatment laws would be adhered to (see Fong et al. 2005:36). Fong et al. (2005) reviewed several areas of possible cultural concerns for properties that could by impacted by the proposed development of the DHHL lands including archaeological sites, burials, gathering rights, hunting rights, trails, and storied places, but no traditional cultural properties were identified within the area, so no impacts were expected.

In 2009, Rechtman Consulting, LLC (Rechtman et al. 2009) conducted an archaeological survey and limited cultural assessment for a roughly 1.3 kilometer-long access road across three parcels northeast of the current study area (see Figure 38). The study involved a visual inspection of the access road corridor along the eastern boundary of Honokaia Ahupuaʻa from Highway 19 to the Old Māmalahoa Highway and phone interviews with five individuals from the Honokaia ʻOhana group. No archaeological resources of any kind were observed during the pedestrian survey, and no resources (landforms, vegetation, etc.) of a traditional cultural nature were present. The individuals interviewed for the study had no information regarding significant cultural places or practices that may have occurred within the project area. The only recollection of the area was that it was used for ranching. Given the negative findings of the study, Rechtman et al. (2009) concluded that development of the proposed access road route would not significantly impact any known historic properties or any cultural resources and practices of a traditional and customary nature. They therefore recommended that no further historic preservation work or mitigation was needed.

In 2015, ASM Affiliates (Clark et al. 2015) conducted an AIS a portion of a portion of TMK: (3) 4-6-013:001-046 in Honokaia Ahupuaʻa to the east/southeast of the current study area for the proposed installation of a gravity-fed non-potable water system and appurtenances in the Honokaia Pastoral Lots Subdivision (see Figure 38). As a result of the study, a single archaeological site (Temporary Site 1), consisting of a short alignment of stacked boulders and cobbles on the northeastern slope of an intermittent drainage channel, was identified near the northern boundary of the study area. The site was fully documented during the study, however it was concluded by Clark et al. (2015) that much like a similar alignment previously identified by Fong et al. (2005), the site retained no integrity and was therefore not considered to be significant. As such, it was not assigned an SIHP Site number.

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

Year	*Author(s)*	*Type of Study*	*Ahupuaʻa*
1999	Cleghorn	Inventory Survey	Kawela
2005	Fong et al.	Literature Review, Field Check, Cultural Impact Evaluation	Honokaia
2009	Rechtman et al.	Inventory Survey and Limited Cultural Assessment	Honokaia
2015	Clark et al.	Inventory Survey	Honokaia

3. STUDY AREA EXPECTATIONS

The culture-historical context presented above for the *ahupuaʻa* of Kapoaula and the Hāmākua District, combined with the summary of previous archaeological research conducted in the vicinity of the study area, provides a basis for predicting the type and location of archaeological resources that may still be present within the current study area. Based this information, the archaeological expectations for the current study are limited. Traditional accounts, boundary commission testimonies and historical maps indicate that the study area was forested until the second half of the nineteenth century. Prior to that time, the forests on the slopes of Mauna Kea are known to have been used primarily for obtaining upland resources such as timber, plants products, and bird feathers, as well as for travel and for ceremonial or ritual purposes. Travel into the forests occurred on *mauka-makai* trails, two of which are known to have crossed the current study area. Those traveling into the forests likely only stayed temporarily while conducting their business there, and so evidence of these activities in the form of habitation sites or activity areas are likely to have been relatively ephemeral.

Deforestation of the current study area likely began shortly after the introduction of European livestock. The effects of grazing, but also timbering, led to the degradation of the native forest. As historical descriptions from other parts of the island attest, the loss of tree cover on the mountain side resulted in a dramatic increase in erosion. The loss of topsoil would have also resulted in damage to or the destruction of shallow or surface archaeological sites. While the amount of soil lost due to the effects of deforestation are unknown, it strongly suggests that the entire study area is an erosional environment, and that the prospects of buried sites is minimal. Over the course of the nineteenth century, the forest was replaced by pasture. The combined effects of trampling by cattle and the spread of introduced grasses such as *kikuyu* would have also had a deleterious effect on remnants of any sites created while the area was forested. Modern use of four-wheel-drive vehicles appears to have followed a similar route to that of the *mauka-makai* trail (the "Alanui pii uka i ka mauna"), further reducing the potential that evidence of the trail has survived.

While the expectations for encountering intact archaeological sites are very low, it is remotely possible that Precontact sites, including trails, temporary habitations, caves, or resource procurement areas could be encountered in areas protected by old-growth vegetation or difficult to reach terrain. Additionally, historic ranching related features such as corrals, walls, roads, fences, dams, or enclosures may also be present.

4. FIELDWORK

Fieldwork for the current study consisted of an initial reconnaissance of the study area conducted by Benjamin Barna, Ph.D. (Principal Investigator) on January 29, 2019, followed by an intensive (100% coverage) pedestrian survey conducted between March 26 and 28, 2019. The field crew for the intensive survey consisted of Genevieve L. Glennon, B.A., Lauren M. U. Kepaʻa, Johnny Dudoit, B.A., and Lyle Auld, B.A., under the direction of Benjamin Barna, Ph.D. In the large open pasture portions of the study area, field crew members walked in systematic transects paralleling the survey area boundaries with spacing between crew members no more than 40 meters. Ground surface visibility was excellent in the pasture. No archaeological features were observed on the ground surface, nor were any grass-covered terrain anomalies suspected of being archaeological features. In addition to walking transects, a thorough inspection was made of vegetated areas and bedrock overhangs with potential for concealing archaeological features and lava tubes, as well as prominent and anomalous landforms. Exposed soil cuts created by roads and cattle (Figure 39) were inspected to ascertain the soil stratigraphy throughout the study area. Soils observed in these cuts consisted of 7.5 4/4 Brown compact organic silty clay loam extending at least 1.5 meters below the ground surface, with subrounded basalt cobble and boulder inclusions. Given the erosional environment (which was probably exacerbated between the 1850s and the establishment of pasture later that century), no subsurface testing was conducted.

Figure 39. Exposed soil profile in cattle resting area.

FINDINGS

As a result of the current study, no archaeological sites or other historic properties of any kind were identified within the study area. All of the ranching related infrastructure (e.g., fencing, water troughs) encountered during the survey appeared modern. The concrete fenceposts (see Figure 20) observed during the current study did not correspond to the "concrete posts" depicted in the 1951 plat map (see Figure 35). An effort was made to identify evidence of the two trails ("Alanui pii uka i ka mauna" and the "Alanui o Honokaia") depicted on historic maps (see Figures 29 and 30). Portions of the unpaved ranch road *makai* of the tropical ash stand likely follow the alignment of the "Alanui pii uka i ka mauna", but currently there are only extensive wheel ruts from motor vehicle traffic. Where the projected trail alignment deviates from the jeep road, there are no surface indications of the trail. The physical route of the trail appears to have been obscured by cattle trampling, erosion, and the incursion of pasture grasses since the mid-nineteenth century. Given the history of erosion and other ground disturbance related to livestock ranching, it is unlikely that any buried cultural deposits exist within the current study area.

5. DETERMINATION OF EFFECT AND RECOMMENDATIONS

Given the negative findings of the current study with respect to archaeological resources, it is concluded that the Paniolo Tonewoods Kapoaula Koa Forest Management Plan will not impact any known historic properties. The determination of effect for the proposed project is “no historic properties affected.” With respect to the historic preservation review process of the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD), our recommendation is that no further work needs to be conducted within the Paniolo Tonewoods Kapoaula Koa Forest Management Plan study area prior to or during project implementation. In the unlikely event that significant archaeological resources are discovered during the proposed ground disturbing activity, work should cease in the area of the discovery and DLNR-SHPD contacted pursuant to HAR 13§13-280-3.

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A Cultural Impact Assessment for the Paniolo Tonewoods Kapoaula Koa Forest Management Project

(3) 4-7-007:011

Kapoaula Ahupuaʻa
Hāmākua District
Island of Hawaiʻi

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ASM Project Number 31870.00

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1. INTRODUCTION

At the request of Ron Terry of Geometrician Associates, LLC on behalf of Cardno GS, Inc. (CGS), ASM Affiliates has prepared this Cultural Impact Assessment (CIA) to accompany a Hawai‘i Revised Statues (HRS) Chapter 343 Environmental Assessment (EA) for the proposed Kapoaula Koa Forest Management Plan (KKFMP) located on a roughly 564-acre portion of land in Kapoaula Ahupua‘a, Hāmākua District, Island of Hawai‘i on TMK: (3) 4-7-007:011 (Figures 1, 2, and 3). The project has been proposed by Siglo Forest, Inc.’s lessee, Paniolo Forestry, LLC, in conjunction with Paniolo Tonewoods. The objective of the project is to develop a long-term supply of quality *koa* (*Acacia koa*) wood and associated native forest plants on the subject parcel for use in the manufacture of musical instruments and for other uses. To do so, Paniolo Forestry, LLC will plant *koa* and other native trees on the subject parcel, which will replace the existing pasture that has been used for cattle grazing since the mid- to late nineteenth century.

The current study is an accompanying document to an Environmental Assessment (EA) conducted in compliance with Hawai‘i Revised Statutes (HRS) Chapter 343; pursuant to Act 50 and in adherence with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawai‘i, on November 19, 1997. As stated in Act 50, which was proposed and passed as Hawai‘i State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, “environmental assessments . . . should identify and address effects on Hawaii’s culture, and traditional and customary rights . . . native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the ‘aloha spirit’ in Hawai‘i. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.”

This report is divided into four main sections, beginning with an introduction and a general description of the study area, followed by a detailed cultural-historical background and a presentation of prior studies; all of which combine to provide a physical and cultural context for the current project area. The results of the consultation process are then presented, along with a discussion of potential impacts as well as appropriate actions and strategies to mitigate any such impacts.

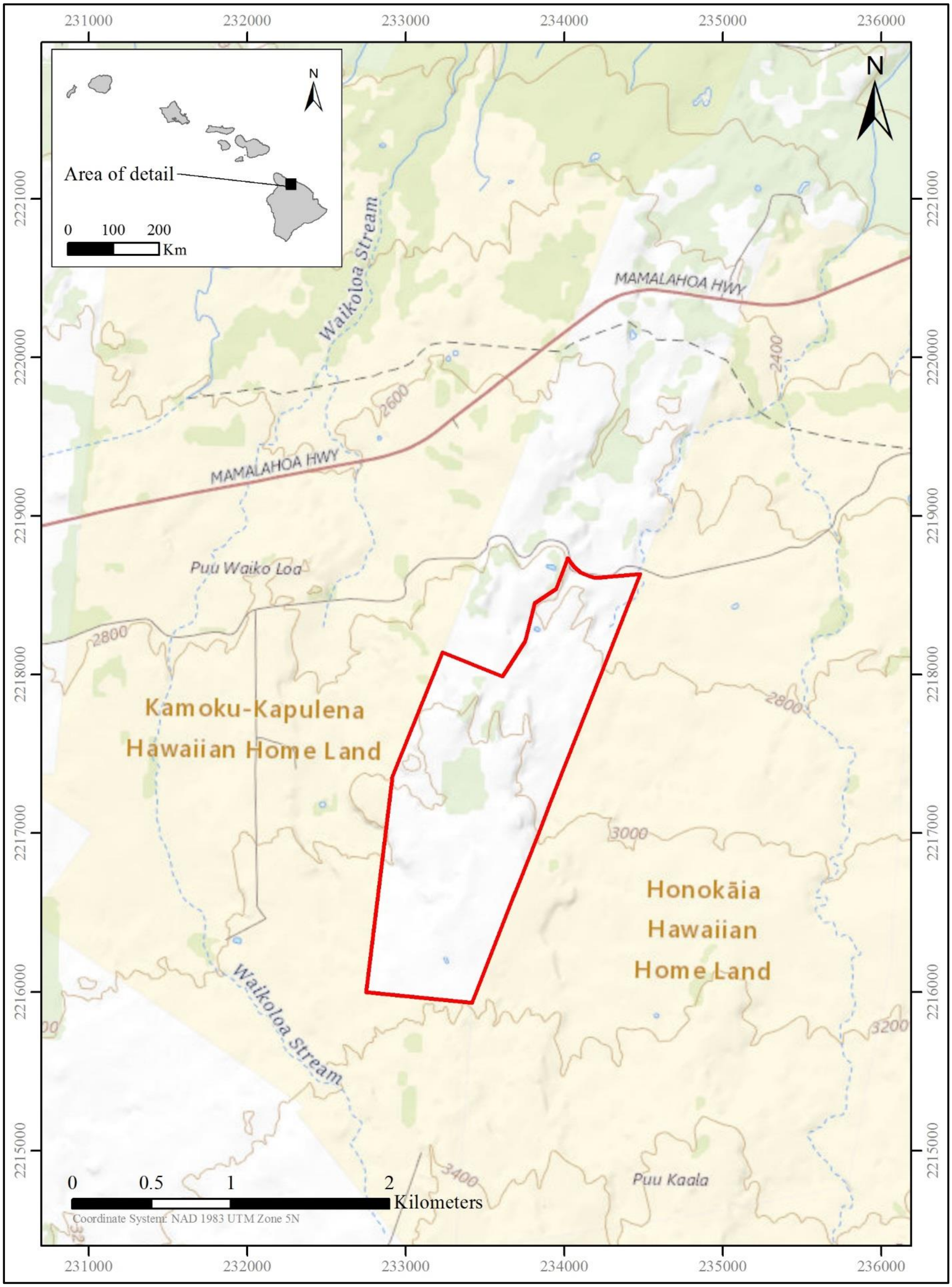


Figure 1. Study area location.

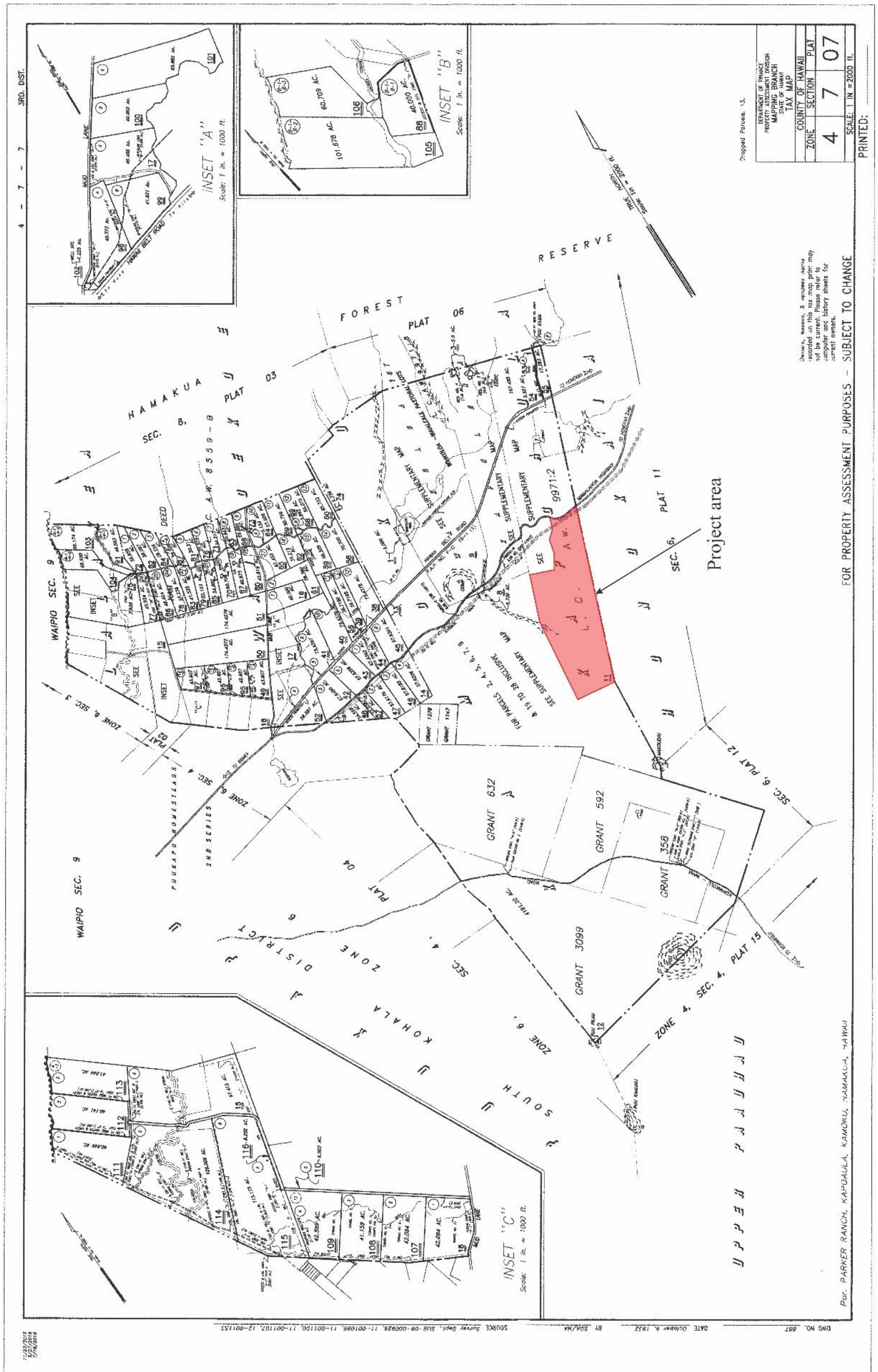


Figure 2. Tax Map Key (3) 4-7-007:011 showing the current study parcel (shaded in red).

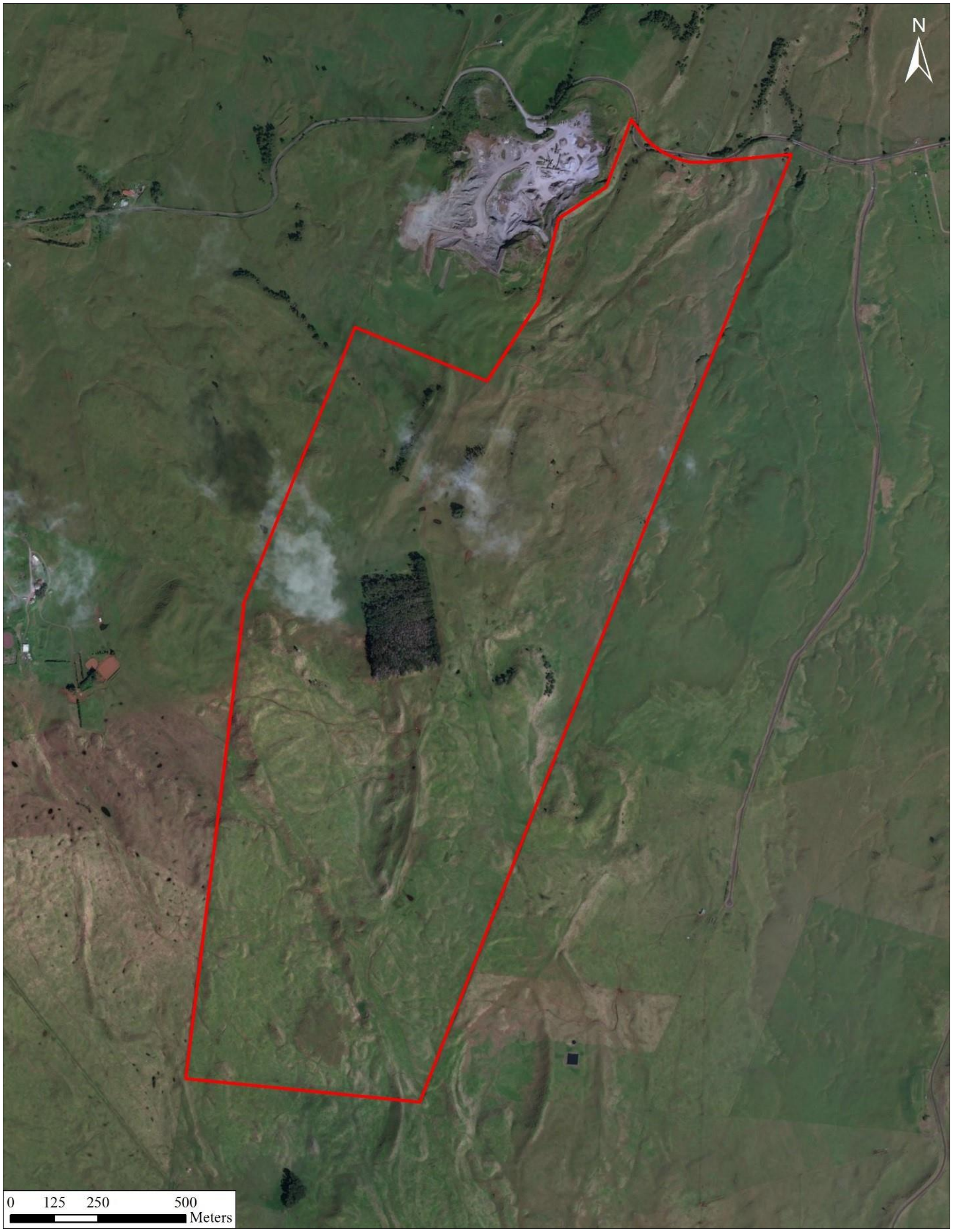


Figure 3. Google Earth™ satellite image showing study area location (outlined in red).

STUDY AREA DESCRIPTION

The current study area encompasses roughly 564 acres of pastureland and is situated on the southernmost boundary of Kapoaula Ahupuaʻa, Hāmākua District, Island of Hawaiʻi (see Figure 3). The study area extends along the *mauka* (southern) edge of the Old Māmalahoa Highway, and is accessed by a gated, unimproved access road that enters into the parcel from the north. The study area is bounded to the west by Kamoku and Kapulena *ahupuaʻa* and to the east by Honokaia Ahupuaʻa. Its northern boundary is coterminous with the *ahupuaʻa* boundary with Kamoku along the Old Māmalahoa Highway and it is adjacent to the Edwin DeLuz gravel quarry to the northwest. It is situated on the northern flank of Mauna Kea Volcano at elevations ranging from 2,740 to 3,180 feet (835 to 969 meters) above sea level, roughly 7 kilometers from the coast. The undulating terrain is characterized by gentle to moderately north-sloping hills punctuated with outcroppings and occasional steep and rocky ridgelines, particularly in the *makai* half of the parcel. A single permanent stream crosses into the study area near the northwestern corner of the property. Several non-perennial surface streams (none of which were flowing at the time of the current study) have incised shallow to moderate intermittent drainage channels through the study area.

Soils within the study area (Figure 4) are classified as Maile-Waiākea-Rock outcrop complex on 6 to 35 percent slopes (Soil Survey Staff 2019). These soils consist of two distinct, well-drained loams, namely Maile and Honokaa, that range from ashy, sandy loam to hydrous silt loam, and highly organic silty clay that formed in a series of volcanic ash layers overlying basalt that originated from Mauna Kea Volcano during the Pleistocene epoch. The geology underlying the current study area is composed predominately of 11,000 to 64,000-year-old Laupāhoehoe Volcanics (labeled as “Qlb” in Figure 4). The northeast section of the parcel contains small portions of Hāmākua Volcanics that have been dated to 64,000 to 300,000 years old (labeled as “Qhm” in Figure 5). Mean annual rainfall within the study area averages approximately of 2,038 millimeters (80.24 inches), with the majority of rainfall occurring between the months of November and April and the least occurring in June and September (Giambelluca et al. 2013). The study area is characterized by a cool, semi-tropical climate with a mean annual temperature ranging from 32 to 78 degrees Fahrenheit (Giambelluca et al. 2013).

As a result of nearly two centuries of cattle grazing, vegetation within the study area consists almost exclusively of a pasture grasses dominated by introduced perennial forage grasses and sedges including but not limited to *kikuyu* (*Pennisetum clandestinum*), *Honohono* (*Haplostachys haplostachya*), natal redtop (*Melinus rupens*), and Hilo (*Paspalum conjungatum*) grasses occasionally interspersed with common dandelion (*Taraxacum officinale*), *palapalai* (lace fern; *Microlepia strigosa*), and fireweed (*Chamerion angustifolium)*. Within actively grazed paddocks, cattle aid in keeping the vegetation cover down. The study area’s pastoral vegetation pattern is further characterized by a lone Christmas berry (*Schinus terebinthifolius*) and cherry blossom tree (*Prunus* sp.), a few free-standing patches of *ʻōhiʻa lehua* (*Metrosideros polymorpha*) along hill slopes and a 14-acre stand of introduced tropical ash trees (*Fraxinus uhdei*) in the central portion of the study area. This introduced vegetation regime is much different than what would have been found prior to the widespread impacts of cattle ranching during the Historic Period, when the study area would have occupied a zone of dense *ʻōhiʻa* rainforest (Clark and Kirch 1983).

Grazing has also resulted in a several artificial modifications to the landscape that include barbed wire and electric fence lines, unimproved ranch roads, remnant water lines, a water pump, and several concrete- and porcelain cattle water troughs, a modern survey marker was identified in the northern central portion of the study area. Permanent barbed wire boundary fencing, with the occasional welded pipe gate, surrounds the entire perimeter of the study area. A small segment of the fence on the study area’s western boundary includes several square concrete fence posts, one of which is inscribed near the top with the letters “07” and marked with an unidentifiable ranch brand below. Electric cross-fencing partitions the study area into eight grazing paddocks. The impacts of livestock grazing on the study area is also visible. Many of the grazed, moderately to steeply sloping hills in the study area are crossed by networks of meandering livestock trails and are contoured with a series of descending terracettes intensified by livestock trampling. Furthermore, numerous semicircular cattle resting areas are eroded into the bases of low-lying hillsides and occasionally at the bases of bedrock outcroppings.

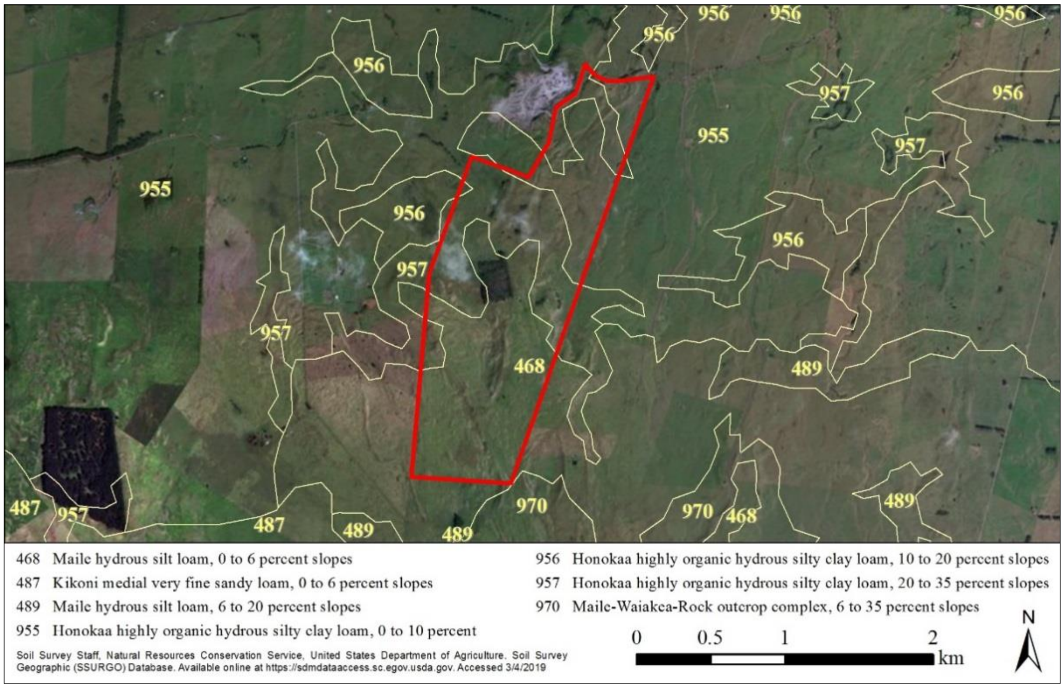


Figure 4.Map showing soil deposits within the current study area (outlined in red).

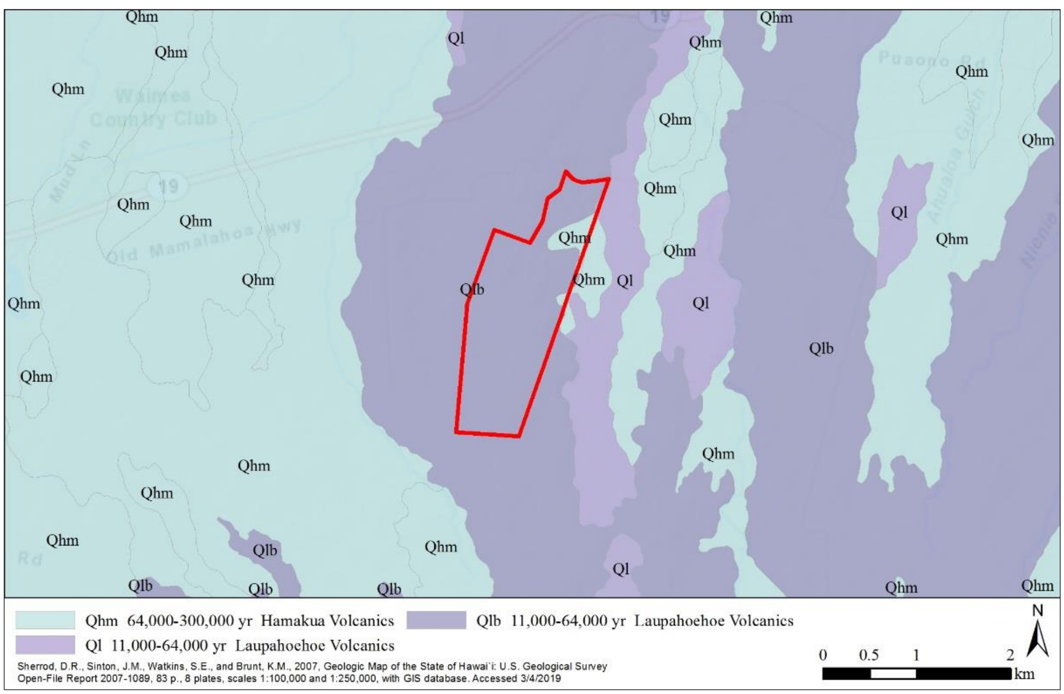


Figure 5.Map showing geological deposits within the current study area (outlined in red).

PROPOSED KAPOAULA KOA FOREST MANAGEMENT PLAN

Siglo Forest, LLC acquired the 564-acre Kapoaula property from Parker Ranch to obtain long-term access for the purposes of planting *koa* (*Acacia koa*) trees. In an effort to convert pastureland back to a semblance of the native *koa-ʻōhiʻa* forest that once stood in this area and to provide controlled future uses of the forest for commercial products, Forest Solutions Inc. was hired by Siglo Forest, LLC to author a site-specific forestry management plan for the area. Figure 6 depicts the twenty-five forest units, fencing, and roadways that will be used to implement the plan. The project will plant, over a ten (10) year period, 553 acres of suitable land with *koa* and a range of associated native plants (11.3 additional acres are reserved for a saw mill site and access road). The project will combine the production of timber in a plantation format with mixed native forest plantings in less accessible areas. Over time–decades or a century–colonization of the plantation area with the enrichment species from the mixed forests, from bird droppings and natural plant colonization is anticipated. Through implementation of the site-specific forestry management plan, in approximately 50 years, pasture in current study area will be replaced with a mixed-species native forest. Steep-sloped areas will primarily be used for native species conservation, and less steeply-sloped, less erodible areas will be primarily used for timber production. The resulting *koa* forest will provide a sustainable, long-term, predictable source of musical-instrument grade wood, produce high-quality wood for other uses, and provide habitat for native species. The ten-year objectives are as follows:

- Reforest the entire property with *koa* and a complement of associated native forest plants.
- Improve the quality of wood to be harvested in the future by: planting seed from known, high-quality sources; and utilizing cuttings propagated from trees identified as having superior color, figure, and form.
- Intensive management of *koa* for saw timber on those areas of the property with slopes less than 20%--accounting for 70% of the property or 390 acres.
- Reforest the remaining upland areas with a multi-species native forest, utilizing *koa* as a pioneer species—accounting for 30% of the area or 163 acres.
- Protect planted forest from wind by planting fast-growing, cattle resistant windbreaks.

The proposed project will include activities identified as Natural Resource Conservation Service (NRCS) conservation practices with potential to affect historic properties as identified in the 2016 *Prototype Programmatic Agreement Between the US Department of Agriculture, Pacific Islands Area Natural Resources Conservation Service State Office, and the Hawaii State Historic Preservation Officer, Regarding Conservation Assistance* (the PPA). Conservation practices with potential to affect historic properties that will be implemented by the proposed project are listed in Table 1. These practices include Tree and Shrub Site Preparation (Practice 490), Windbreak/Shelterbelt Establishment (Practice 380), Fencing (Practice 382), and Tree/Shrub Pruning (Practice 660). Fencing will be installed over a nine-year period as cattle are gradually removed from the parcel (see Figure 6). Other improvements will include a dwelling unit and a sawmill.

Table 1. NRCS Conservation Practices with potential to effect historic properties.

NRCS Practice	*Practice Name*	*Description*
490	Tree and Shrub Site Preparation	Ripping and bedding or deep spot cultivation 24 to 36 inches (60 to 90 cm)
380	Windbreak/Shelterbelt Establishment	Ripping and bedding or deep spot cultivation 24 to 36 inches (60 to 90 cm)
382	Fencing	Standard 5-foot hog-wire fences with a smooth top wire and barbed ground wire
660	Tree/Shrub Pruning	Singling and one, possibly two, pruning treatments per tree

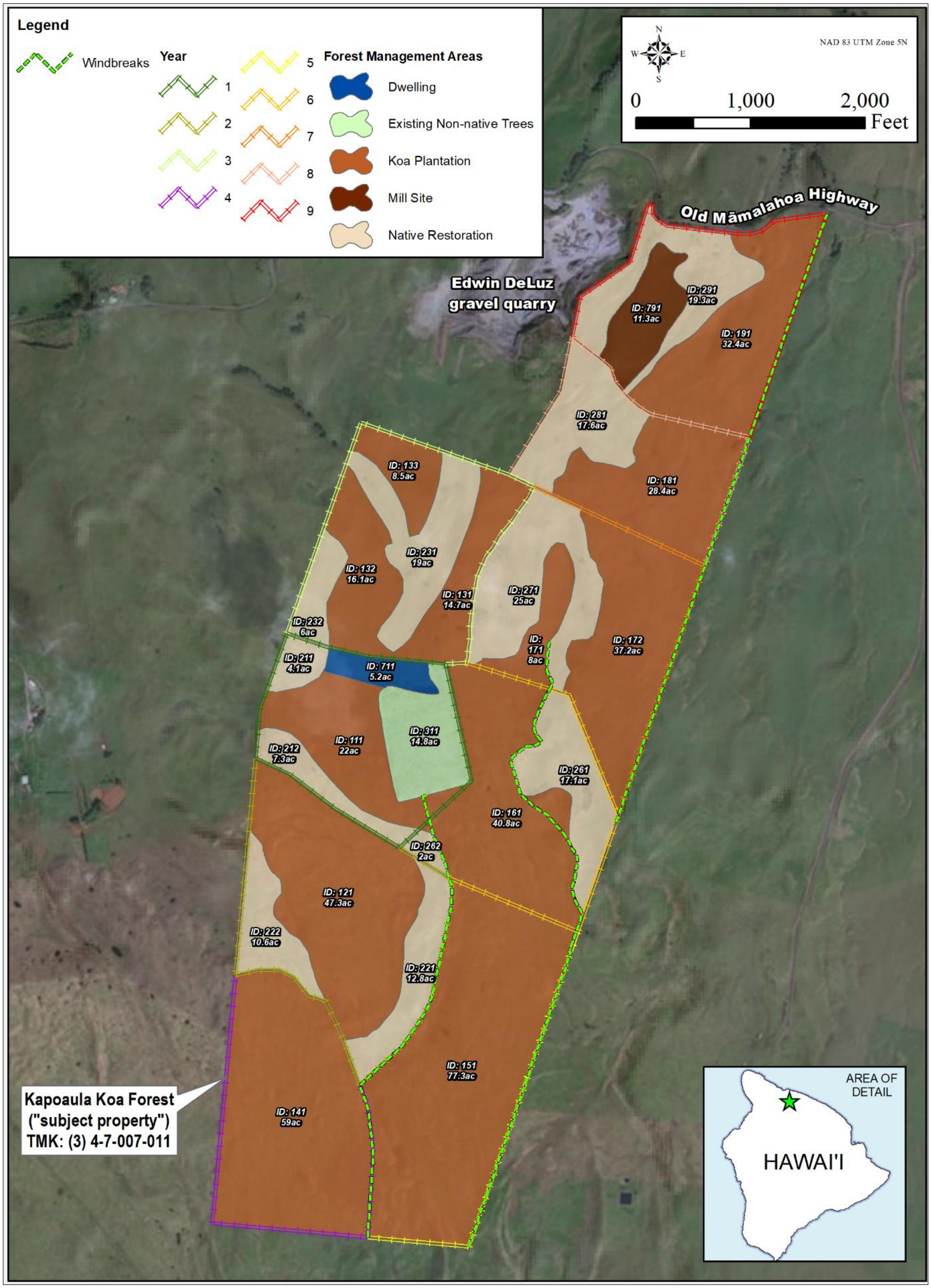


Figure 6. Proposed forest management units.

2. BACKGROUND

This section of the report includes a discussion of the cultural-historical background for the study area and a synthesis of relevant prior research. This information is presented to provide a comprehensive understanding of the cultural significance of the study area and general vicinity and to establish an analytical basis for the assessment of any potential cultural impacts. The ability to assess the cultural significance of the current study area parcel is contingent upon developing (at a minimum), a comprehensive understanding of the *ahupuaʻa* in which the study area is located. As will be demonstrated in the ensuing section, a consideration of the broader region and island landscape is also required.

CULTURE-HISTORICAL CONTEXT

The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes a presentation of a generalized model of Hawaiian Prehistory containing specific legendary references to places within and near to Kapoaula and a discussion of the general settlement patterns for the greater Hāmākua District. The discussion of Prehistory is followed by a summary of historical events in the district that begins with the arrival of foreigners in the islands and then continues with the history of land use in Hāmākua after contact. The summary includes a discussion of the changing lifeways and population decline of the early Historic Period, a review of land tenure in the study *ahupuaʻa* during the *Māhele ʻĀina* of 1848, and the subsequent transition into the ranching and commercial agricultural industries beginning in the last quarter of the nineteenth century.

A Generalized Model of Hawaiian Prehistory

While the question of the timing of the first settlement of Hawaiʻi by Polynesians remains unanswered, several theories have been offered that derive from various sources of information (i.e., genealogical, oral-historical, mythological, radiometric). However, none of these theories is today universally accepted (Kirch 2011). What is more widely accepted is the answer to the question of where Hawaiian populations came from and the transformations they went through on their way to establish a uniquely Hawaiian culture. For many years, researchers have proposed that early Polynesian settlement voyages between Kahiki (the ancestral homeland of the Hawaiian gods and people) and Hawaiʻi were underway by A.D. 300, with long distance voyages occurring fairly regularly through at least the 13th century. While historical accounts often describes Kahiki as any land outside of Hawaiʻi, some researchers point to the Marquesas and the Society Islands as the ancestral homeland of Hawaiʻi's early settlers (Emory in Tatar 1982). More recent research indicates a later settlement date of about A.D. 1000.

During these early times, Hawaiʻi's inhabitants were primarily engaged in subsistence level agriculture and fishing (Handy and Handy 1991). 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 both environmental and social order; which was further assured by the conical clan principle of genealogical seniority (Kirch 1984). The initial permanent settlements were established at sheltered bays with access to fresh water and marine resources. These communities shared extended familial relations and there was an occupational focus on the collection of marine resources. Over a period of a few 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 populations increased so did societal conflict, which resulted in hostility and war between neighboring groups (Kirch 1985). According to Kamakau (1991), the initial settlements were not governed by a political caste system until the arrival of Pāʻao and chiefs from Kahiki.

> …there were seventeen generations during which Hawaiʻi Island was without chiefs—some eight hundred years… The lack of a high chief was the reason for seeking a chief in Kahiki, and that is perhaps how Pili became the chief of Hawaiʻi. He was a chief from Kahiki and became the ancestor of chiefs and people of Hawaiʻi Island. (Kamakau 1991:101–102)

Additionally, Kamakau (1976) concluded that settlement patterns date the migration of Pāʻao to the islands during the 13th century. Pāʻao, the keeper of the war god Kūkāʻilimoku, fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pāʻao was expelled from his homeland by Lonopele forcing Pāʻao to set out on a long journey across the ocean in search of new land. Thirty-eight *kānaka* (men) accompanied Pāʻao, which included *kānaka ʻāʻīpuʻupuʻu* (stewards), a chief named Pilikaʻaiea (Pili) and his wife Hinaʻaukekele, Nāmauʻu o Malaia, the sister of Pāʻao, and the prophet Makuakaʻūmana (Kamakau 1991). In 1866, Kamakau told the following story of their arrival in Hawaiʻi:

> Puna on Hawaiʻi Island was the first land reached by Pāʻao, and here in Puna he built his first heiau for his god Ahaʻula and named it Ahaʻula [Wahaʻula]. It was a luakini. From Puna, Pāʻao went on to land in Kohala, at Puʻuepa. He built a heiau there called Moʻokini, a luakini.
>
> It is thought that Pāʻao came to Hawaiʻi in the time of the aliʻi Laʻau because Pili ruled as moʻi after Laʻau. You will see Pili there in the line of succession, the moʻo kūʻauhau, of Hanalaʻanui. It was said that Hawaiʻi Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawaiʻi Island had been without a chief for a long time, and the chiefs of Hawaiʻi were aliʻi makaʻāinana or just commoners, makaʻāinana, during this time. (Kamakau 1991:100)

Prior to the establishment of the Pili dynasty, Waipiʻo Valley in the Hāmākua District was the residential base for powerful local rulers dating back to A.D. 1200s (Cartwright 1933). Presumably, during Pili's rule, the center of government shifted from Waipiʻo to Kohala District but then ultimately centered back to Waipiʻo Valley (Cartwright 1933). Ethnohistorical traditions (Fornander 1880) indicate that Waipiʻo Valley was associated with at least nine successive Pili line rulers of Hawaiʻi Island, from Kahaʻimoeleʻa to ʻUmi A Līloa (from roughly AD 1460 to 1620). During this period, the major rise and influence of the Pili family line expanded beyond the Hāmākua region, and thereby constituted Hāmākua as the epicenter for a complex political caste system formed by firm religious and economic beliefs. As described by Fornander (1880), these universal Polynesian customs and beliefs included: the major gods Kāne, Kū, and Lono; the *kapu* system of law and order; *puʻuhonua* or cities of refuge; the worship of *ʻaumakua* or personal family deities; and the concept of *mana*.

As time passed, a uniquely Hawaiian culture developed. The portable artifacts found in archaeological sites of this next period reflect an evolution of the traditional tools and distinctly Hawaiian inventions. The adze (*koʻi*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are ʻ*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). As the population continued to expand so did social stratification, which was accompanied by 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. During this expansion period, additional migrations to Hawaiʻi occurred from Tahiti in the Society Islands. 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. Hommon (1976) argues, kinship links between coastal settlements disintegrated as those links within the *mauka*-*makai* settlements expanded to accommodate the exchange of agricultural products for marine resources. This shift is believed to have resulted in the formalization of the land division system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society. 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.

The formalization of Hawaiʻi Island's land division system is a major hallmark of this era, which has been attributed to *ahupuaʻa* became the equivalent of a local community, with its own social, economic, and political significance, which added another component to a then well-stratified society. *Ahupuaʻa* were ruled by *aliʻi ʻai ahupuaʻa* or chiefs who controlled the *ahupuaʻa* resources; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land. *Ahupuaʻa* lands were in turn, managed by an appointed *konohiki* or lesser chief-landlord. 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* (commoners) and *ʻohana* (families) who lived on the land but also contributed to the support of the royal community of regional and/or island kingdoms. Additionally, *ahupuaʻa* (such as Kapoaula) are land divisions that typically incorporated all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). Although the *ahupuaʻa* land division typically incorporated all the eco-zones, their size and shape varied greatly. This form of district subdividing was integral to Hawaiian life and was the product of resource management planning that was strictly adhered to. In this system, the land provided fruits and vegetables and some meat for the diet, and the ocean provided a wealth of protein resources (Rechtman and Maly 2003). In communities with long-term royal residents, divisions of labor (with specialists in various occupations on land and in the procurement of marine resources) were also strictly enforced.

By the 17th century, large areas of Hawaiʻi Island were controlled by a few powerful *aliʻi ʻai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawaiʻi, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). ʻUmi a Līloa, a renowned *aliʻi* of the Pili family line, is often credited with uniting the Island of Hawaiʻi under one rule during the Precontact Period (Cordy 1994). ʻUmi-a-Līloa is also credited with formalizing the land division system on Hawaiʻi Island and separating the various classes of chiefs, priests, and laborers (Beamer 2014; Cordy 2000; Kamakau 1992). Upon the death of ʻUmi-a-Līloa, Hawaiʻi Island came under the control of his eldest son Keliʻiokāloa-A-ʻUmi (Cordy 2000), whose reign is marked by his mistreatment of the lesser chiefs and commoners. His reign was short lived and by the early eighteenth century Hawaiʻi Island fell under the control of Alapaʻinui, who assembled a robust army and assigned his closest potential usurpers (his nephews Keawemaʻuhili, Kalaniʻōpuʻu, and Keōua) as generals in his militia. The prodigious ʻĪ clan, spread across the districts of Kaʻū, Puna, Hilo, and portion of Hāmākua was also a powerful force and threat to Alapaʻi campaign (Cordy 2000). As Alapaʻi gathered his forces to strike back at Kekaulike, the *aliʻi nui* of Maui, the high ranking *aliʻi wahine* (chiefess) Kekuʻiapoiwa made her way to Kokoiki, Kohala to give birth to Paiʻea, the birth name of Kamehameha (ibid.).

Kamehameha was reared in the traditions and customs of the ancient chiefs and trained under some of the most skilled warriors of that time including Kekūhaupiʻo. Upon Alapaʻi's death, his eldest son Keaweʻōpala was named heir to the kingdom. By the mid eighteenth century, the young and determined Kamehameha directed his efforts toward consolidating Hawaiʻi Island under his rule. To accomplish this monumental task, Kamehameha continued his training under his more experienced kin namely Kalaniʻōpuʻu, who was the *aliʻi nui* of Hawaiʻi Island (ʻĪʻī 1959). During Kalaniʻōpuʻu's reign, the first foreign vessels arrived in Hawaiian waters captained by British explorer, James Cook. Cook first landed at Waimea, Kauaʻi in 1778 and in 1779, he anchored just off the shores of Kealakekua Bay, Kona. Aboard these ships were innovative technologies and diseases unknown to the inhabitants of these islands. Items such as metal, nails, guns, canons, and the large foreign vessels themselves stirred the interest of the *aliʻi* and *makaʻāinana* alike. Acquisition of these technological advancements came through barter. This resulted in the *aliʻi* gaining possession of such items that ultimately set traditional Hawaiian warfare in new trajectory; one that would be forged by none other than Kamehameha. Wars occurred regularly between intra-island and inter-island polities during this period. It was during this time of warfare that Kamehameha, who would eventually rise to power and unite all the Hawaiian Islands under one rule (Kamakau 1992).

A Brief History of Hawaiʻi After Western Contact

The arrival of Western explorers in Hawaiʻi signified the end of the Precontact Period and the beginning of the Historic Period. With the influx of foreigners, Hawaiʻi's culture and economy underwent drastic changes. Demographic trends during the early Historic Period 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, the establishment of upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kent 1983; Kirch 1985). Foreigners very quickly introduced the concept of trade for profit, and by the time Kamehameha had conquered Oʻahu, Maui, and Molokaʻi, in 1795, Hawaiʻi saw the beginnings of a market system economy (Kent 1983). Some of the work of the *makaʻāinana* shifted from subsistence agriculture to the production of foods and goods that they could trade with early 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). In 1819, Kamehameha died and the *kapu* system that governed all aspects of traditional Hawaiian society was symbolically abolished when Liholiho (son of Kamehameha) ate in the presence of his mothers, Keōpūolani and Kaʻahumanu. Shortly after 1820, 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.

KAPOAULA AHUPUAʻA AND THE GREATER HĀMĀKUA DISTRICT

The current study area is situated within the land of Kapoaula, an *ahupuaʻa* located along the northeast facing shores of the *moku* (district) of Hāmākua, which is one of six traditional districts on Hawaiʻi Island (Figure 7). Kapoaula Ahupuaʻa is bounded on the Hilo side by Malanahae and Honokaia Ahupuaʻa, on the Kohala side by Kapulena and Haukoʻi Ahupuaʻa, and terminates at Kamoku Ahupuaʻa at its *mauka* extent (Figure 8). The lands contained within the Hāmākua District possess a unique precipitous environment that played a large role in determining its boundaries and shaping its history from the time of Polynesian settlement. The sheer size of this district coupled with its access to a variety of environments and resources set the foundation for a thriving population. Stories recounting the episodic life stories and feats of its chiefs and common people illustrate Hāmākua as a thriving political district supported by its fertile and extensively cultivated valleys. Collectively, these accounts paint a picture of the area's rich cultural landscape, most of which has been radically transformed during the Historic era. To begin developing an understanding of this district's cultural history, it is essential to understand the physical environment of this district.

> Hāmākua district is a windward district in the truest sense. It has ca. 29 miles of shoreline, primarily focused on Mauna Kea's eastern slopes with exposed cliffs rough seas, and narrow reef formations. Above the sea cliffs, the gentle slopes have a thick soil cover and abundant rainfall, and lush vegetation, with the upper slopes from 1,000-6,000 feet in an ʻōhiʻa-koa rain forest. The slopes are cut by deep (up to 300-foot), narrow stream gulches cloaked with kukui and pandanus. Yet Hāmākua is more than these slope and gulch lands. It also includes the extremely large, deep valleys of Waipiʻo and Waimanu which have cut over a millennia into the older Kohala Mountain, valleys which, as will be seen, dominated the history of the district and the island. Hāmākua also extended inland, encompassing the high elevation māmane-naio forests of Mauna Kea and the subalpine, oft snow-covered, summit itself. The district continued across the foggy and cold upland plateau or Saddle with its terrain a mixture of bare lava and soils, and with its vegetation a mixture of ʻōhiʻa and māmane-naio forests. This plateau had important nesting grounds of ʻuʻau and nēnē. And, Hāmākua virtually spanned the island-reaching to and looking down into the upper edges of Kona. (Cordy 2000:21)

The Hāmākua District is unlike any other found on Hawaiʻi Island, sharing its boundaries with five of the six district on the island (excluding the Puna District) and encompassing the summit of Mauna Kea and a portion of the summit of Mauna Loa (see Figure 7). The *ʻōlelo noʻeau* or Hawaiian proverb, "Hāmākua kihi loa" literally translated as "Hāmākua of the long corner" commemorates the extent of this district's boundaries (Pukui 1983:53). While the interior portion of this district, known as the *ʻāina mauna* or mountainous lands (Maly and Maly 2005), encompasses the highest reaches found in the Hawaiian archipelago, its coastal section is cut by numerous valleys and gulches with Kaʻula Gulch forming its southern most boundary and Honopuʻe Valley marking its northernmost boundary (see Figure 7). The *ʻōlelo noʻeau* "Hāmākua i ka wakawaka" or "irregular and rough Hāmākua" celebrates this district's uniquely steep and rugged terrain (Pukui 1983:53). Another distinguishing feature of this region is its massive cliff faces that stretches along the coastline. "Hāmākua ʻāina pali loa" or "Hāmākua, land of tall cliffs" praises this natural feature that dominates much of this region (ibid.).

Traveling on foot via the ancient *alaloa* and *ala hele* trails of Hāmākua was done with much difficulty. The old saying "Hāmākua i ke ala ʻulili" or "Hāmākua of the steep trails" recognizes this region as "a land of precipices and gulches where the old trails were often steep and difficult to travel on" (Pukui 1983:53). These trails required the ancient travelers to, at times, descend cliff faces with ropes and ladders woven together from natural fibers. This treacherous method of travel is recorded in a portion of an ancient chant titled *Kū E Hoʻopio Ka Lā or Kūhaupio*, which is often chanted in performance with the art of *hei* or string figures. This chant "recites in turn the divisions of the island of Hawaii, alluding to some well-known feature of each division, relating through metaphor a love tale" (Dickey 1928:14). Both the chant and the accompanying string figure repertoire have been recorded by Lyle Dickey (ibid.) sometime between 1915 and 1917 from informants living on the islands of Oʻahu, Kauaʻi, and Niʻihau. In summarizing this chant Dickey (ibid.:14) opines "Up rose the sun" (*ku e hoopio ka la)* is the most famous of Hawaiian string figures." Dickey goes on to explain that "[t]he accompanying chant is regarded has having a higher literary quality than that of any other figures." (ibid.). That portion of the chant describing Hāmākua reads thusly:

O Hamakua ia, lawe i ka pali Koolau	This is Hamakua with Koolau cliffs
Ke kuukuu ala i ke kaula, ke aki ala ka niho i ka ipu i ka pali o Kohola-lele, o Waipio, a o Waimanu	Lowering rope ladders, holding fishing gourds in the teeth on the cliffs of Koholalele, Waipio and Waimanu. (Dickey 1928:17)

Dickey also gathered another version of this chant that reads:

O Hamakua ia, o ka iʻa iniiniki i ka lima	This is Hamakua where the eels are pinched in the hand
Ke hoʻokuʻukuʻu la ka nalu la ke kaula i ka niho la	Where the ladder is let down while the teeth hold the string. (ibid:18)

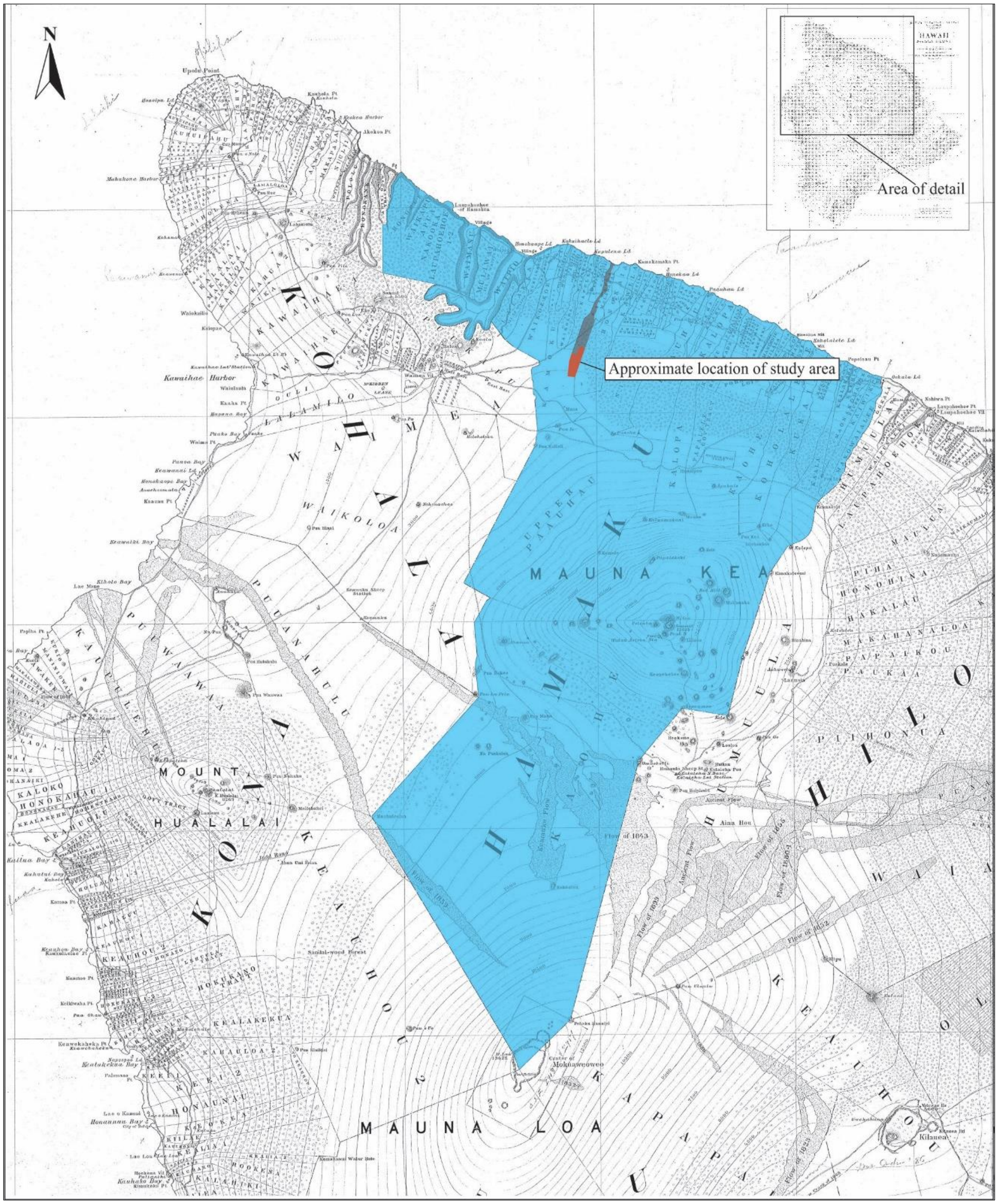


Figure 7. Portion of Hawai‘i Registered Map No. 2060 (Donn 1901) showing the current study area location (shaded red) within Kapoaula (shaded gray) in the *moku* of Hāmākua.

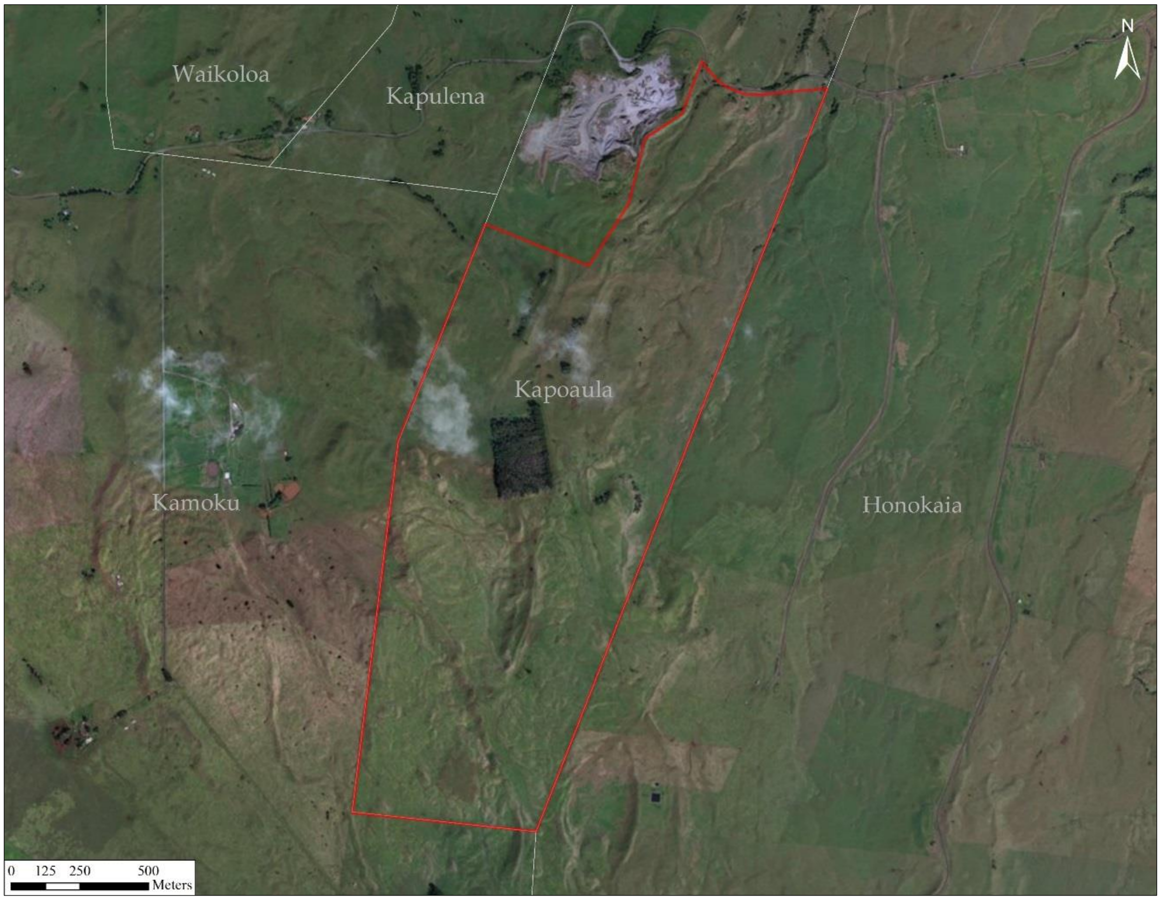


Figure 8. Google Earth™ satellite image showing study area location (outlined in red).

Its northeastward orientation coupled with its densely vegetated interior mountainous slopes created an ideal environment that attracted the rain clouds carried on the ever-blowing trade winds. Several rain names have been recorded for the Hāmākua District, including the *Kīnehelehua*, which is said to have produced the *lehua* clusters and the misty *Lilinoe* rain that appears near the cliff face (Akana and Gonzalez 2015). The slow-moving *Pupūhale* rain is said to have kept the district residence close to their home (Akana and Gonzalez 2015; Pukui and Elbert 1986). An account concerning the mysterious rain described as the *Kūnihi* appeared in the October 15, 1872 edition of the Hawaiian language newspaper, *Ka Nūpepa Kū'ōko'a*. The author, S. K. Kaaiai described a time when a great drought came upon the lands of Hāmākua, which he described as being cultivated by a great number of people. By the end of the drought, all that remained in the middle of the cultivated fields was a single banana belonging to a farmer named Kanoa. In gazing out to the horizon, Kanoa saw an "ao nui elele" or a large dark cloud hovering over the ocean (Kaaiai 1872:1). The farmer, then *kalokalo or* summoned (through conversational prayer) the large cloud, asking it to water his little field (Kaaiai 1872:1; Pukui and Elbert 1986:123). At the closing of his prayer, the cloud moved straight to his field and sent a much-needed downpour that lasted until the following day. The farmer's crops once again flourished but strangely, the rain did not fall upon any other fields, just that of Kanoa (Kaaiai 1872).

The northeast trade winds that blow continuously over this land is duly named *A'eloa*, also referred to as the *Moa'e* winds (Pukui and Elbert 1986). The *A'eloa* wind is also known at times to have a destructive force, tearing down everything in its path. A newspaper article published in the November 30, 1867 edition of *Ka Nūpepa Kū'ōko'a* described the A'eloa wind breaking the old landing located in Koholālele Ahupua'a (Keomakani 1867). *Koholālele*, literally translated as leaping whale, describes the winds of Hāmākua that blows from east to west (Pukui and Elbert 1986). The Koholālele wind is also mentioned in the legendary account of La'amaomao (Fornander 1918–1919). Within the renowned and extensively cultivated valley of Waipi'o, is the Holopo'opo'o winds that blows through hollows of the land (ibid.).

As with many of the large districts of Hawai'i Island, Hāmākua was further divided into two major areas; *Hāmākua Komohana* or West Hāmākua consisting of all the valley lands situated between the Waipi'o and Honopu'e

Ahupuaʻa and Hāmākua Hikina or East Hāmākua inclusive of all the lands between Waipiʻo and Manowaialeʻe Ahupuaʻa. There are roughly 95 *ahupuaʻa* within all of Hāmākua, seven of which are in Hāmākua Komohana, while all the remaining 87 *ahupuaʻa* are within Hāmākua Hikina (Cordy 1994). In his study conducted for the State of Hawaiʻi Historic Preservation Division, titled *A Regional Synthesis of Hāmākua District, Island of Hawaiʻi*, Cordy (1994) drew upon these divisions and provided an in-depth overview of the general Precontact and early Historic land use and settlement patterns for the district. The current study area *ahupuaʻa* of Kapoaula is situated in Hāmākua Hikina.

In his attempt to better understand the settlement patters of Hāmākua Hikina, Cordy further divided east Hāmākua into three subregions: 1) The Lower Windward Slopes of Mauna Kea; 2) the Upper Slopes of Mauna Kea and; 3) the Interior Plateau containing the lands of Pōhakuloa and the slopes of Mauna Loa (Figure 9). Based on Cordy's (1994:3) designation, Kapoaula Ahupuaʻa lies within the subregion, which he dubbed the "Lower Windward Slopes of Mauna Kea". In summarizing the distinguishing features of this subregion, Cordy (1994:3) explains, "[t]he Lower Windward Slopes subregion extends inland up through the ʻōhiʻa forest on Mauna Kea — from sea level to the 5,000-6,000 foot elevation. This is a rolling upland which is cut by a number of fairly deep, narrow gulches."

Unlike the *ahupuaʻa* found in the westward section of Hāmākua, those *ahupuaʻa* in Hāmākua Hikina were relatively narrow at the coast ranging anywhere between 0.1-0.4 miles wide and extending between 2.5-4.0 miles inland (Cordy 1994). These *ahupuaʻa* are characterized by their sloping *kula* lands with their boundaries following the natural contours or ridgelines of the gulches. A few *ahupuaʻa* extended further inland, essentially cutting off the lower *ahupuaʻa* at their *mauka* most end. There are, however, two very large *ahupuaʻa* in east Hāmākua, both of which are very narrow at the coast but increase significantly in acreage as they extend further inland. The smaller of the two is Pāʻauhau, which encompasses the western limit of Hāmākua Hikina and is situated further inland of Kapoaula. The significantly larger Kaʻohe Ahupuaʻa borders the Hilo District and includes a portion of the summit of Mauna Loa and the entire summit region of Mauna Kea, where the sacred spring of Waiau is found and where dense basalt stone was quarried and shaped into the highly prized *koʻi* (adzes). The subject *ahupuaʻa* of Kapoaula falls within the first type of *ahupuaʻa* described by Cordy as it extends inland at an elevation of about 3,200 feet above sea level before being cut off at the *mauka* most extant by Kamoku Ahupuaʻa (see Figures 1 and 8).

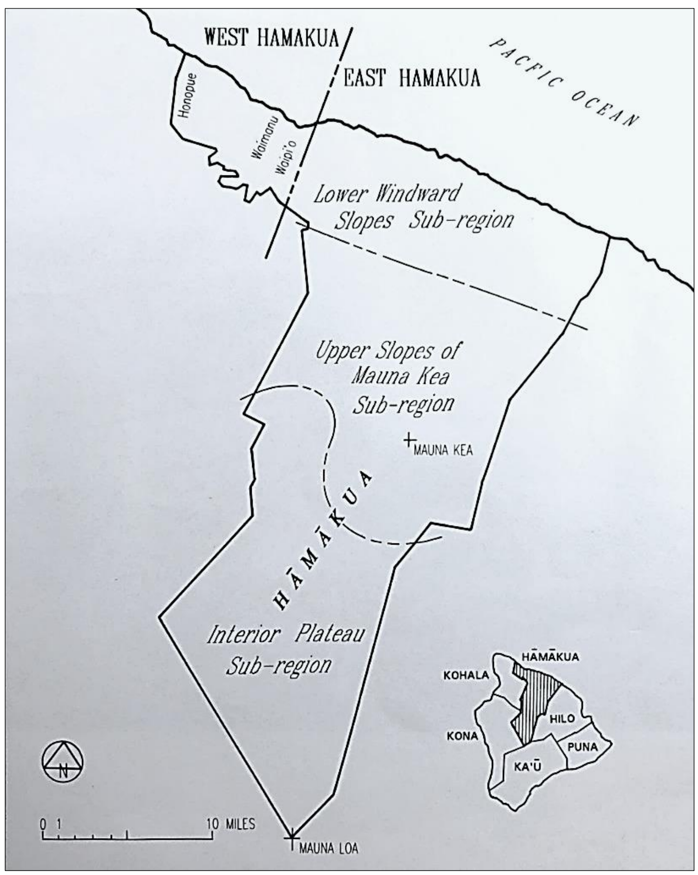


Figure 9. The Regions of Hāmākua District (Cordy 1994:3)

Traditional Agricultural and Gathering Practices of Hāmākua Hikina

In the forested zones of Hāmākua Hikina, various resources were collected that supported the traditional subsistence lifestyle of the people. Such gathering practices included the collection of bark from *māmaki* (*Pipturus* sp.), *ʻakolea* fern (*Athyrium* sp.), and *wauke* (*Broussonetia papyrifera*), whose fibers were prepared and used to make items such as fish nets and *kapa* cloth; the catching of birds, whose feathers were assembled and fashioned into *ahuʻula* (feathered cloaks), *lei hulu* (feathered *lei*), and *mahiʻole* helmets that used exclusively by those of royal bloodline; and the chopping of timbers, from which canoes, houses, and *kiʻi* (wooden images) were carefully carved. While the forested areas provided an array of natural resources, the grassy *kula* lands were transformed into cultivatable fields where small plantings of both staple and supplemental crops such as *maiʻa* (banana), *kalo* (taro), *ʻuala* (sweet potato), which were grown openly in fields and plantations. The "habitually underestimated" *uhi* (yam), a food crop that was often cultivated in the forests to sustain the people during dry seasons and droughts was also part of the repertoire of staple crops favored by the Hawaiians of Hāmākua (Handy and Handy 1991:182). Within Kapoaula specifically, crops such as *kalo*, *ʻuala*, and *wauke* were traditionally cultivated in *kuleana* plots. In the book, *Native Planters In Old Hawaiʻi, Their Life, Lore and Environment*, Handy and Handy (1991) described a traditional agricultural technique called *waele*, (which mirrors that of swidden agriculture), occurring on the *kula* lands, where fire was used to prepare the land for planting:

> On slopes covered with grass, like those of Hāmākua on Maui and Hawaii, and Kohala on Hawaii, the grass was formerly burned off and the ground cleared (*waele*) of brush and stubble...The field then had to be dug over *(ʻohiki*) and the stubble thrown out. The open soil was left for a few weeks, or until the small rubbish had decayed. On the windy slopes of Kohala the whole field was covered with cut grass to keep the moisture in. In planting, small holes were made in the soft earth several feet apart and a cutting dropped into each. The old procedure, termed *ʻokupe*, was to thrust the digging stick into the soft earth with the right hand, lift the soil to one side, and drop the cutting into the hole with the left. The cuttings were left uncovered until the rootlets showed vigorous growth; then each cutting was straightened and soil pressed down around it. (Handy and Handy 1991:109)

Prior to the massive land clearing efforts of the early sugar plantations, Handy and Handy (ibid.:231) described the "board slopes of the wet windward coast [Hāmākua] of Hawaii" as being "completely covered by *kukui* forests." *Kukui*, commonly known as candlenut (*Alleurites moluccanus*), also served a number of purposes. The oily nut found within the hard black shell was used as a lamp and at times the nut was slow roasted then crushed with *paʻakai* (salt) to make the relish/seasoning known as *inamona* (Abbott 1992). The oily properties of this nut were also used medicinally as a laxative to helped expel waste from in the body (ibid.). Hawaiian plant expert, Isabella Abbott further notes that "[a]ll parts of the tree—flowers, fruits (nuts), bark, and leaves—can be used for these purposes" (ibid.:100). Fresh *kukui* leaves were prepared into a poultice and used to treat swelling, deep bruises, and other injuries. Red pigment was also extracted from the bark of old *kukui* trees and from this pigment a reddish color was produced that was used to dye *kapa* and fishnets (ibid.). The hard-black shells were also strung together into *lei*. It is within and along the edges of the old *kukui* forests that another agricultural method termed *pā kukui* or *pā kuikui* was practiced. Handy and Handy write:

> In localities where planting was done along the edges and within the borders of old *kukui* forests, notably on the lower slopes of the Hamakua coast of Hawaii before the forest were cleared for sugar-cane plantations, taro was planted in clearings termed *pa kukui* or *pa-kuikui*. The trees were felled and allowed to decompose. The *kukui* rots very quickly when wet, and wood, bark, and foliage make rich humus. Large holes were then dug in the soil and filled with *kukui* leaves, and when these were decomposed the taro was planted. The plants are said to have grown luxuriantly in such localities, to a height of 7 feet and with corms weighing 20 pounds. (1991:109–110)

These extensive groves of *kukui* found within this district carried with it important spiritual significance and was seen as an domain of the pig-deity Kanepuaʻa or Kamapuaʻa, who was understood to be an embodiment of the deity Lono (Handy and Handy 1991). While Kamapuaʻa held his domain over the lush northeast parts of Hawaiʻi Island, namely Hāmākua and Kohala where "southerly winds sweep around the eastern flank of Mauna Kea" and where the "storm clouds pile up in rolling masses like giant swine rutting in the uplands," his lover and rival Pelehonuamea reigned over the southern and leeward districts of Hilo, Puna, Kaʻū, and Kona (ibid.:341). It is likely observance of these natural phenomena supported the belief that Kanepuaʻa symbolized growth, vigor, and volcanic dormancy, while Pele, with her molten fire, symbolized transformation and rebirth through her volcanic activity. A traditional legendary account describes Kamapuaʻa arrival to Hāmākua and how in a battle with other gods, shaped the precipitous land of Hāmākua. Handy and Handy (1991:619) elucidates:

> Kamapua‘a (=Lono) comes to Hawaii from Kahiki—that is, from the south—as do the *kona* or southerly cyclonic storms which bring winter rains, on which planters in leeward areas depend for their sweet-potato planting. On his way to challenge Pele, Kamapua‘a (as rain clouds) met and vanquished “Lono-with-the-eight-foreheads” (not the same as Lono-the-lord-of-rain). The “eight foreheads” we take to mean eight forelands, or cliffs between gulches along the rainy windward Hamakua coast of Hawaii. This Lono-ka-eho “lowered his foreheads” until they case their shadow upon Kamapua‘a, who was traveling in one of his many forms in the sea. Kamapua‘a pushed aside the forelands (eroded the valleys between them), and then called upon his plant forms of the forests, the *kukui* trees…the *‘ama‘uma‘u* ferns…and the *hala* (pandanus trees are all along the coast and in the gulches), to grow onto “the foreheads” (headlands). The roots crept forth and the forelands (*eho* means to heap of stones) were held fast.

The *kula* region of east Hāmākua served as ideal environment for various subsistence crops. To ensure success in planting in the wind swept *kula* lands, Handy and Handy, detailed specific mulching techniques used to ensure the crops survival:

> Mulched taro was planted on the open *kula* lands up to the border of the old forest zone and is said to have flourished under a mulch of grass, *ti* leaves, and other rubbish heaped around it in the red soil. Small patches so growing today seem to flourish. We are told that taro was planted in *kukui* forests which used to cover the slopes of much of the land that is now planted to sugar cane; for this planting the *kukui* trees were not felled. Presumably such planting was successful only in relatively open glades. A method of upland planting peculiar to this section was that of felling *kukui* trees, allowing them to rot, and then planting taros, which are said to have grown to great size, in the decayed refuse. Another method consisted of digging sizable holes in the ground, filling them with *kukui* leaves, and allowing these to decay completely, after which taros that had been started from cuttings planted in plain soil were introduced and grew to great size. (Handy and Handy 1991:537)

The diversity of climates and the verdant landscapes of east Hāmākua, coupled with the abundance of freshwater and access to both coastal fisheries and the island’s summit region provided the district’s early inhabitants with access to nearly all of the necessities that were vital to their physical and spiritual wellbeing.

Wauke, or what is known as the paper mulberry (*Broussonetia papyrifera*), is also known to have been historically cultivated within Kapoaula Ahupua‘a. According to Handy (1940), there are two types of *wauke*: *wauke* and *wauke mālolo*. Both are utilized for therapeutic purposes, though the former is also useful for *kapa* (tapa) making. Like *kō*, *wauke* was typically grown around *lo‘i kalo* and residences, and Handy (1940) relates that it was prevalent in more moist environments including mauka kula lands and sloped valley sides. Kamakau (1976:40) indicates that *wauke* could also be cultivated in sheltered areas “along streams, in woods, in rocky patches (*kipohopoho makaili*), in rutted ground (*malualua*), in dried-up taro patches, on lands where water flows, and on bottom lands (*‘aina palawai*).” Like wauke, *olonā* was heavily cultivated in the upland reaches of Hāmākua, and was traditionally grown nearby *māmaki* and *wauke* in *kīhāpai* by transplanting tight-knit cuttings in a patch (Handy 1940:201):

> Olona was much the best fiber for fishlines and fishnets. When used for cord (aho olona) the strands of the cleaned fiber were simply spun on the thigh and twisted (nino or milo). Olona cord has a tensile strength greater than that of hemp, but its great value for fishlines and nets lies in the facts that it does not kink and that it lasts longer than any other material. The cord was also used for making nets (koko) to carry cntainers and as a base for ti-leaf raincoats and feather capes. The fresh bark and leaf buds were thought to have medicinal value.

The Polynesian-introduced *kō* (sugarcane; *Saccharum officinarum*) stands as perhaps the most widely developed and extensively cultivated crop in Precontact Hawai‘i. *Kō* was the primary commercial export of the district beginning in the mid-1800s, facilitating Hāmākua’s economic transition during the Historic Period. Cultivation of sugar for commerce purposes has had the unfortunate effect of diluting the distinguishing characteristics of Hawaiian cane varieties due to the hybridization of traditional and introduced species. Prior to its exploitation for profit, *kō* served as a fixed element in Hawaiian horticulture that served a variety of important uses.

Kō was traditionally planted in the lowland plains, and in the *makai* portion of Kapoaula. Neal (1965) relates that there were approximately forty named varieties cultivated by the Hawaiians. Included in these is the most common *kō kea* (white cane) which was typically planted near old homesteads. In general, *kō* is purported to grow well in almost all locales, and was “planted at *kīhāpai* of sweet potato, dry taro and *wauke*, and on the banks of *lo‘i* taro patches; and fields of cultivated plants were beautified by plantings of cane along their banks and borders” (Kamakau 1976:39).

Of great curative value, *kō* is considered especially therapeutic and was included as an essential component of medicinal tonics and compounds (Handy 1940). Aside from its role as an active ingredient in medicines, Abbott (1992) opined that it was sometimes used not as a primary constituent, but rather as a flavoring agent to sweeten distasteful bitter herbs in curative compounds. Alternatively, its sweet juice could also be used in a more insidious manner to conceal and accelerate the effects of various poisons (Lincoln In Press). The juice of the *kō* was considered as a very effective remedy for healing deep cuts and wounds, fractured limbs, and severed body parts, healing the skin leaving no evidence of scar tissue (Kaaiakamanu and Akina 1922; Krauss 1993).

According to Handy and Handy (1991), *kō* served chiefly as sustenance and was eaten as a snack, condiment, and a famine food. The juice of the cane was also toasted over the fire and fed to nursing babies, and was used to strengthen children's teeth by chewing (Handy and Handy 1991). From a more utilitarian aspect, *kō* could be used to thatch the interior of houses when *pili* grass or *lauhala* (pandanus) were not abundant (Handy 1940; Malo 1951). Tassel stems of the *kō* were crafted into roughly two-foot-long arrow darts to be used in the game of *keʻa pua* (also referred to as *ka pua* and *pa pua*) which was enjoyed by men, women, and children particularly during the *Makahiki* (ancient festival that began in October) when the *pua kō* (sugarcane blossom) was in bloom (Lucas 1982; Malo 1951). In ancient Hawaiʻi, the *pua kō* were also strewn about *hōlua* (sled) courses on grassy slopes to make it more slippery (Abbott 1992; Pukui 1983).

Other Historic sources mention the gathering of *māmaki* (*Pipturus* spp.) from the *wao lāʻau* (upland forests) of neighboring Honokaia Ahupuaʻa, a practice that undoubtedly happened within Kapoaula as well, and Handy (1940) relates that *māmaki* was especially prevalent in the higher reaches of Hāmākua. While *wauke* was commonly used for *kapa* production, *kapa* was also made from the bark of the wild *māmaki* (primarly on Hawaiʻi Island) and was known for being quite exceptional, though considered second best in comparison (Brigham 1911; Kamakau 1976). *Kapa wauke* paled in comparison to *kapa māmaki* which was exceedingly both soft and strong and used to make items such as *malo* (loincloth), *pāʻū* (skirt), *kīhei* (shawl covering), and *kapa moe* (sleeping *kapa*) (Handy and Pukui 1998; Kamakau 1976; Neal 1965). However, unlike the former, *kapa māmaki* could not withstand getting wet, making it a poor choice for items that would need to be washed. According to Kaaiakamanu and Akina (1922), the strength of *māmaki* wood also made it a prime choice for *kapa* beater implements.

In addition to being used to make *kapa*, the *māmaki* was also an essential ingredient in traditional medicinal preparations and its fruit, seeds, and leaves were used to treat various ailments in adults, children including weakness and general debility, thrush, digestion issues, cuts and sores, and the fruit and seeds were eaten by expectant mothers beginning at five months along in their pregnancies (Gutmanis 2015; Kaaiakamanu and Akina 1922). Additionally, Krauss (1993) relates that fresh *māmaki* leaves were placed in an *ipu* with hot stones and covered with fresh water where they could be steeped until drunk as a cleansing tonic.

Breadfruit (*ʻulu*) was a *kinolau* (physical manifestation) of the goddess Haumea, the "patron of childbirth," and was plentiful in the district of Hāmākua where it was grown "in the sheltered valleys of the Hamakua coast, where there are still a great many. . ." (1940:190). Careful and gentle propagation was required, which entailed the removal and replanting of the root sucker cutting while ensuring it remained within its original, undisturbed soil casing. With respect to *ʻulu* as a sustainable food source.

One of the crops cultivated specifically in Kapoaula was the *ʻuala*. Abbot (1992:30) relates that typically "*ʻuala* were grown in *puʻe* (mounds) that formed a *māla* (patch), usually surrounded by stone walls" and planted during the full moon, or during the six first days of the new moon. The preparation of *ʻuala* for consumption was similar to *kalo*, and entailed either steaming in an *imu* and eaten whole or mashed as *poi ʻuala* (Abbott 1992; Handy 1940). Although the *poi ʻuala* soured quickly, it was "regarded by Hawaiians as dietetically superior to taro poi, but it is less relished" (Handy 1940:149). Additionally, a dish known as *palula* was also made from the green leaves of the *ʻuala* plant after being cooked in an *imu*. Handy (1940:151) also relates than an alcoholic drink comprised of high-sugar content found in *ʻuala* was also prepared in Hāmākua, and describes the preparation of the *ʻuala ʻawaʻawa* as follows:

> . . . The potatoes are cooked, peeled, mashed and mixed with a large quantity of water, then left in the barrel or jar for three days, being stirred each day. On the third and fourth days the fermentation is sufficient to give the beer enough head to be exhilarating. Mohihi was the most popular variety for making uala awaawa; because of its exhilarating effect when fermented, it was nicknamed Kauaheahe (staring fixedly). Uala awaawa had a great vogue during the period of clearing forests in Hamakua, Hawaii, in the early days of sugar planting. A native landowner would plant a large patch of Mohihi, harvest and cook all of it, put it down in barrels to ferment, and then invite his countrymen from far and near to come and help him clear his land, and in return enjoy a wild orgy of talk and festivity in emptying the barrels of prime Mohihi awaawa.

Uhi was cultivated throughout Hāmākua and served to supplement more primary sources of sustenance such as *kalo* and *ʻuala*. Unlike *kalo*, the *uhi* did not make fine *poi*, and as such was steamed in an *imu* and consumed in its whole form rather than being mashed. In addition to being a supplementary form of nourishment, the *uhi* also possessed value medicinally and it was a beneficial treatment of a wide variety of ailments. Within Hāmākua specifically, the *keʻokeʻo* and *ulaula* varieties were cultivated, the former of which was only utilized for food purposes and the latter which was consumed both as food and could be used for its medicinal value (Handy 1940). Handy and Handy (1940:169–170) elaborate on a method of planting *uhi* in Hāmākua:

> The following old Hawaiian method of planting *uhi* in Hamakua and Olaa was described to me by Judge George Tucker of Olaa whose Hawaiian forbears taught him yam culture. On the ground in the forest a great bin of tree-fern trunks (*hapuu*) was built 3 to 4 feet high on the sides, the fern trucks being laid horizontally. The bin was filled with decaying fern leaves and other rubbish. The seedling tubers (*hua uhi*) were then stuck in the rubbish a few inches below the surface. No earth was put in, but as the rubbish in the bin decayed and sank, more rubbish was heaped on top. Fully matured tubers grown by this method are said to have weighed up to 50 pounds. . .
>
> . . . Another interesting practice in planting yams on steep hillsides and the sides of gulches on the Hamakua coast and in North Hilo was to dig a vertical hole in the side of the slope, 2 to 3 feet deep, and place a large flat stone in it. The hole was then filled with earth and decaying leaves, and the seed yam planted near the top of the hole. The rock at the bottom of the hole prevented the tuber, which grew downward, from growing deep into the ground and forced it to spread out. When time for digging, the earth on the side of the hill or gulch was simply dug away and the tubers extracted. (Handy 1940:169–170)

The *hāpuʻu*, mentioned in several of the Boundary Commission testimonies and historic accounts, was also considered a famine food by Handy and Pukui (Handy and Pukui 1998) and Krauss (1993) who indicate that its starchy core could be cooked and eaten in times of deprivation. Also utilized as a famine food is the *pia* (Polynesian arrowroot), which Abbott (1992) relates was commonly grown in close proximity to *loʻi kalo* (wetland taro).

Legendary Accounts of the Greater Hāmākua District

Prior to first contact with Europeans in the late 18th century and the development of a written Hawaiian language, the history of ancient Hawaiʻi was transmitted orally from generation to generation. After the arrival of the first missionaries in 1820, Hawaiian culture underwent major transformations, one of which included the adoption of the written language. Although oral traditions were still maintained, many natives and foreigners began inscribing generations worth of knowledge onto paper. As such, these writings provide us with invaluable insight into Hawaiʻi's past as they describe elements of Hawaiian culture such as historical figures, beliefs, traditions, *wahi pana* (legendary places), *inoa ʻāina* (place names), and *moʻolelo* (legendary accounts, stories, and myths), *mele* and *oli* (songs and chants), and *ʻōlelo noʻeau* (proverbs and sayings); all of which contribute to an in-depth understanding of the people, their culture and place. One of the hallmarks of traditional legendary accounts are their ability to transcend place and time, all while bringing cohesion to landscapes that have been subjected to artificial divisions and boundaries. While traditional *moʻolelo* specifically associated with Kapoaula are limited, numerous exist for the greater Hāmākua region itself, and include references to the *ʻAeloa*, *Koholālele*, and *Holopoʻopoʻo* winds, exalted deities such as Kamapuaʻa, renowned chiefs such as Wanuʻa and Aiohikupua, and famed figures such as Lāʻiekawai.

The Legend of Kuapākaʻa and the Wind-Gourd of Laʻamaomao

The winds of Kohala are enumerated in a traditional *moʻolelo* featuring the famous wind-gourd Laʻamaomao, which was said to contain all the winds of Hawaiʻi. Originally published by Moses Kuaea Nakuina, the legend relates the story of Pākaʻa, son of Laʻamaomao and Kūanuʻuanu and the highly trusted, personal attendant and favorite of the *aliʻi ʻai moku* Keawenui a ʻUmi, grandson of celebrated *aliʻi nui* ʻUmi a Līloa. Pākaʻa succeeded his father as *kahu* (personal attendant) of Keawenui a ʻUmi, and had charge over many belongings, and he dutifully served the *aliʻi* by keeping a close and careful watch over his material possessions. But Pākaʻa's greatest and most cherished responsibility was the keeping of a highly treasured personal possession: a very special and sacred *ipu* (gourd) passed down to him from his mother. Originally, the *ipu*, known as the wind-gourd of Laʻamaomao, belonged to Pākaʻa's grandmother. Nakuina (2005:14–15) explains the gifting of the *ipu* to Pākaʻa and the instructions from his mother:

> Then Laʻamaomao lifted the lid of a large calabash and took out a small, long, highly polished gourd in a woven bag. The gourd was covered securely. She [Laʻamaomao] turned to her keiki and said, "I'm giving you this gourd which belonged to your extraordinary kupunawahine for whom I was named. Her bones are inside the gourd. While she was alive, she controlled all the winds of the

> islands—she had them under a supernatural power. She gathered all the winds and put them into this gourd, where they're still kept. She memorized one by one the names of all the winds of Hawai'i to Ka'ula. On windless days, she could remove the cover and call out the name of a wind, and the wind in this gourd would blow. This gourd, called 'the wind gourd of La'amaomao,' was famous.
>
> Before she died, she entrusted me to put her bones inside this gourd and care for them until I had a child. Then I was to give the gourd to the child to watch over. You're my only child, so now I'm giving the gourd to you. You must look after it according to the wishes of your extraordinary kupunawahine.
>
> You must care for this gourd because it had been handed down from the kupuna. This gourd has great value—you may not think so now, but when you sail with the ali'i and arrive at an area where no wind blows and the canoes are becalmed, say that the winds are at your command; all you have to do is call, and the winds will blow.
>
> "When you're laughed at, remove the lid of the gourd and call for a wind. The wind will blow and bring the canoes to shore. The ali'i will be grateful to you, and you'll be loved and valued by him."
>
> Before Pāka'a sailed off, La'amaomao taught him the names of all the winds, along with the prayers, songs and chants concerning them, and when she was done, Pāka'a had memorized everything. Then he took the wind gourd and tied it with a cord he had made, prepared his other things for the voyage, and left home.

Pāka'a settled into his role as *kahu,* and he became the utmost favorite of Keawenui a 'Umi. However, the favoritism of Pāka'a inspired considerable virulence and collusion against him by two men, Ho-okele-i-Hilo and Ho'okele-i-Puna. The pair conspired to entrap Pāka'a in scandal by spreading untruths about him to Keawenui a 'Umi and slandered his name in an effort to undermine Pāka'a's prestige in the eyes of his *haku* (master). Keawenui a 'Umi was incensed, and relinquished all of Pāka'a's gifted lands and authority, transferring all power to the two antagonistic men who had usurped Pāka'a's power with their cruel deception. Utterly hurt by Keawenui a 'Umi's naivety to the slander that had befallen his name, Pāka'a gathered some of the belongings of his former *haku*, placed them inside his special family heirloom, departed from Waipi'o, and eventually made a life for himself on Moloka'i. While on Moloka'i, Pāka'a fathered a son, Kūapāka'a whom he groomed the way his own father had groomed him, to one day serve the man who would one day become his *haku* and avenge Pāka'a's enemies.

Meanwhile, the true character of the two schemers who deposed Pāka'a of his esteemed position began to surface, and Keawenui a 'Umi grew regretful of his decision to scorn his former *kahu* in their favor. The tale continues with Keawenui a 'Umi's frantic and persistent search for Pāka'a, with whom he had been communicating with in dreams. Pāka'a and Kūapāka'a knew that the *ali'i* would come searching for them, and strategically positioned themselves in their canoe where they fished for *uhu* (parrot fish) in the dark of morning off the shore of Moloka'i. Keawenui a 'Umi's party approached the pair, but unsuspected their true identity, especially because Pāka'a had assumed the guise of a hunched-over deaf fishermen. The six fleets of men and chiefs from each district on Hawai'i Island approached Pāka'a and Kūapāka'a, led by the *ali'i* of Kohala, Wahilani, soon followed by Wanu'a of Hāmākua:

> As Wanu'a's canoe passed by, Kūapāka'a called out loudly: "Wanu'a goes by, our ali'i of Hāmākua, yet he's not an ali'i, but a kaukauali'i who traps the puhi of Hāmākua with his fingers. He lays his fingers on the smooth rock with bait and when the small puhi crawl up in the spaces between his fingers he grabs them and tosses them into a gourd. This is how he catches the fish of his land, and this is how he enjoys the bounty of Hāmākua. It's said he's an ali'i, but he's not an ali'i." (Nakuina 2005:31)

With each passing fleet, Kūapāka'a continued to hurl insults, incensing each district *ali'i,* who continued past the father and son allowing Keawenui a 'Umi's bevy closer and closer to them. Just before dawn, as Keawenui a 'Umi's party approached, Kūapāka'a chanted to his *haku* at the request of his father. His chant was rivaled by a chant from the Kuhina Nui, Kahikuokamoku, who was part of Keawenui a 'Umi's party and unaware of the youth's true identity. Kūapāka'a, in an effort to lure Keawenui a 'Umi's party onshore so he could isolate Ho-okele-i-Hilo and Ho'okele-i-Puna, continued his chants implicating impending stormy weather. However, Kahikuokamoku challeneged his prophecy, arguing the impossibility of poor weather, and refused to come ashore. Furthermore, Kahikuokamoku challenged Kūapāka'a's knowledge of Hawai'i Island's winds, for how could a young native boy from Moloka'i possibly understand and foretell that strong winds would be heading towards them from Hawai'i Island and cause havoc enough that they would be forced upon the shore. In response, Kūapāka'a drew upon his heirloom gourd and his ancestral knowledge, and began chanting his warning of destruction (bolded, italicized, and underlined emphasis added):

Hurry, hurry,
The source of the storms of Hilo,
Is the wind called ua kea,
Shearing off the edges of a hale and breaking it up,
Kēpia is of Hilo of the upright cliffs,
Uluau is of Waiākea,
Ulumano, ʻAwa, Puʻulena,
Moaniʻala are of Puna,
The winds of Kuamoaʻe have gathered,
My Moaʻe, the wind that is swelling,
Apaiahaa is at Kanakaloloa,
Hau is of Kapalilua,
ʻEka is of Kona,
Kipu is of Kahuā,
ʻEʻelekoa is of Uli,
Kīpuʻupuʻu is of Waimea,
ʻŌlauniu is of Kekaha,
Paʻalaʻa is in the ocean,
Nāulu is of Kawaihae,
A wind that comes
And dashes the milo leaves of Makaopau,
Kalāhuipuaʻa, ʻĀpaʻapaʻa is of Kohala's upland cliffs,
The wind that flies about like vapor,
Puʻukolea is of Kapaʻau,
Holopoʻopoʻo is of Waipiʻo,
ʻAeloa is of *Hāmākua*,
Kona is the wind of the sky
Above the ʻAlenuihāhā sea,
You should come ashore,
The spray of the sea flies up,
The spray of the wind, a storm is coming (Nakuina 2005:39–40)

Keawenui a ʻUmi was rapt with attention at the youth's enumeration, so Kūapākaʻa continued chanting, the winds of Hawaiʻi:

At Kaʻū's windy cape is Ka ʻĪlio a Lono,
The paddle is dipped into the sea of Kāilikiʻi,
At Puna's foundation turns the sun, the light,
Go and feel the wind of Kumukahi,
Hilo's wind-blown rain at sea,
The rain is seaward, over the hala of Leleiwi,
The spray of rain is at *Hāmākua*,
***Hāmākua* is the bridge to the cliffs,**
At Kohala-iki is the Moaʻe wind, the Moaʻe blows,
Kona awakens with the Kēhau breeze,
Kona's burden diminishing with the Kēhau breeze,
Keawenuiaʻumi, come ashore, a storm is coming. (ibid.:40)

He continued:

There, there are the winds rising from the earth,
The ʻĀpaʻapaʻa is of Kohala,
The rainy wind called Nāulu is of Kawaihae,
The Kīpuʻupuʻu is of Waimea,
A cold wind that hurts the skin,
A wind that whips the kapa of that land about,
Tossing up dust before it,
Frightening the procession of travelers,
ʻŌlaniu is the wind,

Pili-a is of Kanikū,
A‘e is of Kala‘au,
Pohu and ‘Eka are the winds of Kona,
Ma‘a‘akuulapu is of Kahalu‘u,
Pilihala is of Ka‘awaloa,
Kēhau is of Kapalilua,
Piuohooilo is of Ka‘ū,
Ho‘olapa is of Kamā‘oa,
Kuehulepo is of Nā‘ālehu
Uahipele is of Kīlauea,
‘Awa is of Leleiwi,
Pu‘ulena is of Waiākea,
Uluau is of Hilo-pali-kū,
Koholālele is of *Hāmākua*,
Holopo‘opo‘o is of *Waipi‘o*,
The tip of that wind,
The tip of this wind,
They will twist into a whirlwind,
The bundle of bones at the back of the canoe exhaling,
Breaking off the buoy floating at the front;
Taking the load from the swamped canoe,
The small canoe will be swamped,
Destroyed with the large canoe,
The ali‘i will die, the kahuna will die,
The weak will die, the strong will die,
The dark wisemen, the bright wisemen,
They will search out, they will confer
To locate the stars of the wave,
O Hōkū‘ula, O Hōkūlei,
They will swimp singly, they will swim by twos,
Yesterday was a calm day,
A crowd of fishermen was at sea,
The paddling of the good canoes,
The strength of the hoewa‘a,
The wisdom of the ho‘okele,
Don’t go far out to sea, ē dear ones,
Stop here, those from Hawai‘i,
Come here over the sea surface,
You will be possessed on O‘ahu,
There will be darkness only on calm O‘ahu,
Yesterday was calm, today will be stormy;
Keawenuia‘Umi, come ashore, a storm is coming. (ibid.:41-42)

After Kūapāka‘a’s recital of the winds of Hawai‘i, O‘ahu, Kaua‘i, Maui, and Ka‘ula, Keawenui a ‘Umi became unsettled with suspicion that the boy’s forecast would be realized. Perturbed at the possibility of meeting certain death in the face of violent weather, Keawenui a ‘Umi consulted with his two advisors, and thus the ultimate targets of the trickery, who adamantly insisted that Kūapāka‘a was lying and that they should depart. Kūapāka‘a continued chanting his warning, enumerating upon the winds of Maui and Moloka‘i in an effort to beguile them onshore, but Keawenui a ‘Umi’s party still retained suspicion and were not sure if they were being duped. Kahikuokamoku demanded the youth’s name, but Kūapāka‘a denied him, arguing that he would reveal his name once the men landed, but they did not comply, and instead the canoes sailed off to O‘ahu.

Soon after their departure, and upon the command of his father, Kūapāka‘a chanted:

Ē winds that I’ve called,
Blow here, those of Ka‘ula and Kaua‘i first,
Those of O‘ahu and Hawai‘i from the sides,
Those of Maui and Moloka‘i last,

Blow true, and overtake the canoe fleet
Of Keawenuiaʻumi, the aliʻi. (ibid.:63)

And with this utterance, every wind that had escaped Kūapākaʻa's lips through chant ravaged the atmosphere, wreaking utter havoc upon Keawenui a ʻUmi's fleet. Soon, the survivors and their *aliʻi* made their way back to Molokaʻi to escape the mayhem, and were led safely to shore by Kūapākaʻa and his father, who continued to play the role of the unassuming fisherman. Keawenui a ʻUmi was cold and wet from the escapade, and Kūapākaʻa was concerned for his well-being:

> By evening, all the canoes had landed, but Keawenuiaʻumi remained on the platform of his double-hulled canoe because he had no dry kapa or malo to wear since all his clothing had been lost at sea. Kūapākaʻa saw his haku shivering on the canoe, so he went to speak to his father: "I pity my haku because he's suffering from the cold. He just sits there in a wet malo on the canoe, without any kapa covering."
>
> Pākaʻa took out one of Keawenuiaʻumi's malo which he had cared for when he was the aliʻi's kahu; he gave it to his keiki: "Here's one of your haku's malo. Take it to him. Ask him to remove the wet malo he's wearing and bring it back here. Tell him that this malo you give him is yours."
>
> Kūapākaʻa took the dry malo and offered it to Keawenuiaʻumi saying, "Here's my insignificant malo for you. Please remove your wet one."
>
> Keawenuiaʻumi gave his wet malo to Kūapākaʻa, and the keiki gave the aliʻi the dry one. Keawenuiaʻumi noticed the dry malo looked very much like one of his own. He said to Kūapākaʻa, "Perhaps this is one of my malo—it looks like one of mine."
>
> The keiki said, "The malo is mine. My mother beat the kapa for it and I was saving it until I could wear it in public as an adult. But now it's yours, my haku."
>
> After the aliʻi had taken off his wet malo and put on the dry one, he placed the wet one in the keiki's care.
>
> The keiki returned with it and when he reached the door of Pākaʻa's hale, his father asked him, "Where is your haku's malo?"
>
> "Here it is."
>
> "Hang it at the door of my hale, so that the ʻāʻipuʻupuʻu can no longer come in here."
>
> "I've hung it at the door."
>
> Pākaʻa said, "Now only you can enter here because you've been made sacred for your haku by the handling of his kapa. From now on, you'll distribute the food in here to the ʻāʻipuʻupuʻu who come, because they can longer enter." (ibid.:66-67)

The scenario repeated with Pākaʻa giving Kūapākaʻa a beautifully-scented *kapa* that he had cared for over the years for Keawenui a ʻUmi. Although suspicious, the *aliʻi* presumed the tale told to him by the boy was true, that it was a *kapa* of the same fragrance as his but from Wailau, Molokaʻi and not in fact one of his own. Being that Keawenui a ʻUmi had lost everything in the storm, Kūapākaʻa continued to care for his *haku*, who was still clueless as to the boy's true identity. He dutifully attended to his every need, just as his father Pākaʻa had in previous years. Meanwhile, Pākaʻa continued to craft his revenge plot on Hoʻokele-i-Hilo and Hoʻokele-i-Puna, and in order to facilitate this, his son let loose the winds of his gourd to keep the weather just unstable enough so Keawenui a ʻUmi would not be able to leave the island.

Four months later the weather became agreeable once more, and Keawenui a ʻUmi and his men readied their canoes for sailing. That night, Kūapākaʻa chanted to each of the six district *aliʻi* and their men to ready themselves for sailing:

Get up, get up, it's day, there's light,
The sun has arrived, and there above,
Iao [the planet Jupiter], Maio [a navigation star],
Kamaha, Kahikikuokamoku,
Kani-ʻūʻū, the star at Helani,
Get up, move, Kohala,
The land of Wahilani. (ibid.:73-74)

The men were confused, as the voice urging them to depart belonged to Kūapākaʻa, who instructed them to set sail to Kaʻula and explained to them that Keawenui a ʻUmi would shortly follow. However, Kūapākaʻa did not wake his *haku* immediately, and allowed him to sleep in, while the other fleets departed Molokaʻi. When day broke, Keawenui a ʻUmi and his men (including Hoʻokele-i-Hilo and Hoʻokele-i-Puna) departed to Kaʻula in search of

Pākaʻa. Being that the rest of his party had departed, Keawenui a ʻUmi requested that Kūapākaʻa accompany him to Kaʻula to search for Pākaʻa, which he agreed to do as this was part of his father's plan. As part of Pākaʻa's conspiracy to exact revenge on his enemies, he had instructed his son to load the double-hulled canoe of the *aliʻi* with a hollowed-out tree trunk secretly filled with food, drink, palm fronds, and a large stone to be used as an anchor.

Meanwhile, the rest of Keawenui a ʻUmi's party was en route to Kaʻula, but stalled at Oʻahu to wait for their *aliʻi*, but he never arrived. Exhausted from their journey, the men fell asleep. When they awoke, they unexpectedly found that they had drifted to Hawaiʻi Island, and found themselves on the shores of Kawaihae. Meanwhile, Keawenui a ʻUmi and his party were voyaging to Kaʻula, with Hoʻokele-i-Hilo and Hoʻokele-i-Puna steering the canoe, oblivious to their immenent, discretely planned demise. To carry out the final segment of the grand scheme, Kūapākaʻa allowed the winds out of Laʻamaomao, and the weather became severe. He anchored the canoe with his big rock and encouraged the men to ride out the storm in place, arguing that it would be better than fighting the bad weather. The bitter wind and rain chilled the men to the bone and they began to get hypothermic. Just before they reached the verge of death, Kūapākaʻa then revealed the hidden trove of food. He gave palm fronds for protection and food and drink for strength to everyone on board except his father's enemies, Hoʻokele-i-Hilo and Hoʻokele-i-Puna, who inevitably sucuumbed to the cold and perished.

As the weather cleared and became pleasant, Kūapākaʻa assumed the role of the now-deceased steersmen, and set sail for Kaʻula. However, that night when everyone was sleeping, the boy opened his wind-gourd yet again, and the winds wafted them to Hawaiʻi Island where they landed at Kawaihae. Once there, joy and excitement overcame Keawenui a ʻUmi and his party, and they rushed to lovingly greet their families while Kūapākaʻa was utterly forgotten, abandoned, and alone. Eventually, word of a canoe race that the boy participated in reached the ears of Keawenui a ʻUmi by a messenger, and it was realized that Kūapākaʻa's neglect had been inadvertent, as it was mistakenly presumed that the youth had been taken in and cared for. As part of the wager for the canoe race against Keawenui a ʻUmi's favorite fishermen, it was agreed that should Kūapākaʻa reign victorious, the losers be baked in an *imu* (underground oven). During their conversation, Kūapākaʻa informed his *haku* that he intended to make true on his wager and kill the men. But he was met with opposition from Keawenui a ʻUmi, who did not want to see his men perish. Eventually, a deal was made in which Kūapākaʻa would fetch Pākaʻa from Molokaʻi if Keawenui a ʻUmi agreed that the fishermen be put to death.

Though Pākaʻa longed to serve his *haku* once more, he refused to travel back to Hawaiʻi Island without having his land, position as navigator, and other rights restored. When Keawenui a ʻUmi was informed of this, he immediately consented, eager to reconnect. Only once Keawenui a ʻUmi agreed to restore everything that had been revoked from Pākaʻa, did his beloved *kahu* return to him to serve him faithfully for the rest of his days.

He Moʻolelo No Palila

The following account concerns a brave and powerful warrior from Kauaʻi named Palila, who was known to single handedly defeat a multitude of warriors in any battle. At a young age, Palila was taken by his grandmother Hina to the temple of ʻĀlanapō in Kōloa on Kauaʻi Island. Here, Palila was raised by the gods and where he acquired all his *mana* (power). Palila eventually moved from Kauaʻi to Hawaiʻi Island, where one of his most epic battles took place. Upon his arrival, a battle between the Hilo chief, Kulukuluʻā and Hāmākua chief, Wanuʻa was being fought. Wanuʻa, and his warriors, Moanonuikalehua, Kamuonuiaiake, and Puupuukaamai were about to defeat Kulukuluʻā when Palila, in a surprise attack, swung his club and struck it fiercely to the earth, causing the land to violently shake to its very core. With such force, the club became buried deep into the ground killing all three men. In his pursuit for victory, Palila traversed across the lands of Hāmākua to slaughter as many men as he possibly could, traveling as far as Kūkaʻiau in Hāmākua (Fornander 1918–1919).

Haunaka, the Strong Man of Pāʻauhau Yields to Aiohikupua, the Young Chief of Kauaʻi

The following story concerns Aiohikupua (also spelled Aiwohikupua in some accounts), a young chief from Kauaʻi who set out on a journey to secure his dream lover, Lāʻieikawai residing in seclusion at the mythical land of Paliuli on Hawaiʻi Island. While *en route* from Kauaʻi, Aiohikupua, who is described as a "kanaka ikaika…i ke kui a me ka mokomoku" (a strong man skilled in both boxing and wrestling), landed at Kauhola in Pūʻeke, Kohala where a customary gathering displaying the strength and skills of the district's most famed fighters were on display. While at Kauhola, Aiohikupua went head-to-head with Kohala's most famed fighter, Ihuanu (Fornander 1918–1919:407). After an exchange of taunts, Aiohikupua with a single thrust, drove his fist right through the chest of Ihuanu, killing him almost instantaneously. After raising the body of Ihuanu on his hand, Aiohikupua twirled his hand over his head, sending the body of Ihuanu hurling over the crowd. Startled by the power and strength of the young chief, the crowd quickly dispersed and word of Aiohikupua's strength spread throughout the neighboring lands. After defeating Ihuanu, Aiohikupua boarded a double-hulled canoe and along with his company of men, sailed to Pāʻauhau in Hāmākua.

After landing at the shores of Pāʻauhau, Aiohikupua heard a great roar of voices coming from the uplands. He then inquired with the *kamaʻāina* of Pāʻauhau the source of the shouting, to which the people replied "[t]he people are gathered there to witness the champion wrestler, Haunaka, the strongest man of the district" (ibid.:410). To his excitement, Aiohikupua proceeded towards the crowd and upon his arrival called out Haunaka. While Aiohikupua vocalized his taunts to Haunaka, a man, who had witnessed the events at Kauhola approached Haunaka from the crowd informing him that "…this is the very man who struck Ihuanu, in Kohala, and killed him. This man's blow is sharp like a point of a spear; you people will therefore have no chance against him" (ibid.). Rather than engaging in battle, Haunaka approached Aiohikupua and extended his greetings. At the conclusion of the games, Aiohikupua and his company of men once again, boarded a double hauled canoe and set sailed for Hilo in search of his lover Lāʻieikawai.

Legends Concerning Kamapuaʻa

The Hāmākua coast, was known as the region that belonged to Kanepuaʻa or Kamapuaʻa, one of the embodiments of paramount deity, Lono (Handy and Handy 1972). Recounted by Martha Beckwith (1970) the *moʻolelo* of Pele, the fire goddess and Kamapuaʻa, the pig demi-god, expounds on the distinct district designations for both deity and the characteristics of the landscape that are intrinsically tied to their persona. The escapades of Kamapuaʻa, a *kupua* (demigod), was one of mischief and passion and often involved the epic love-hate affair between his lover and foe, Pele. Their affair began when Kamapuaʻa visited the crater of Halemaʻumaʻu and in his attempt to woo her transformed into a handsome man. Standing at the edge of the crater Kamapuaʻa tried to seduce Pele with his songs and good looks but Pele rejected him uttering insults of his genealogy and is beast-like nature. Her annoyance initiated a heated exchange and in a fiery fury, Pele casted her flames at him and a battle ensued. Kamapuaʻa then threatened to douse the fires of her crater home with a flood of water, but Pele and her family worked to keep her fires burning. Makahanaloa, Kamapuaʻa's sister, came to his aid with a shroud of fog and rain which quickly filled the crater with water. Eventually Pele's fires were extinguished except for her fire sticks. Feeling defeated, Pele eventually yielded to Kamapuaʻa and two divided the districts between themselves. Pele, reigning over lava-laden districts of Puna, Kaʻū and Kona and Kamapuaʻa presiding over wet, fertile districts of Kohala, Hāmākua and Hilo (Beckwith 1970). Handy and Handy, provided a summary of the domain of Kamapuaʻa on Hawaiʻi Island describing the district thusly:

> Where dark clouds at the beginning (November-December) and at the culmination (January-February) of the season of rains pile up against forelands and rocky summits, where thunder rumbles and echoes, there is Kamapuaʻa. On Hawaii his domain was the verdant rainy Hamakua coast, where, when southerly winds sweep around the eastern flank of Mauna Kea, the storm clouds pile up in roiling masses like giant swine rutting in the uplands. After the thunder, the voice of Lono (= Kamapuaʻa), the clouds let down their rain in deluges. The verdant forest reaches to the very brink of the crater of Kilauea. (Handy and Handy 1972:341)

A common and renowned feature of the Hāmākua region is the abundant rainfall and lush landscapes that are essential for an ideal agricultural environment. These natural characteristics are fundamentally connected to Lono, god of agriculture and peace, a prevalent figure within the traditional belief system.

ʻAumakua Manō of Hāmākua

Martha Beckwith (Pukui 1983:141) relates that the worship of *ʻaumakua* (family or personal ancestral gods) was directed towards certain stones, animals, trees, flowers, insects, and natural phenomena who are "half god, half, human, who utter their counsels through the lips of some medium, who becomes for the moment possessed with their spirit":

> The presence of a spirit is indicated by a divine possession in which the person possessed speaks not as he is accustomed but in the character and with the words of spirit whose medium he is. His utterances are not his own but are the means by which, together with dream and vision, the spirit of the *aumakua* counsels his protégé. In order that the *aumakua* may be strong enough to act as his part as helper, he must receive offerings of prayer, and of sacrifice in the shape of food and drink called "feeding the spirit." (ibid.:506)

As previously mentioned, *ʻaumākua* (plural form of *ʻaumakua*) served as intermediaries and played an important role in guiding the soul to the underworld and was capable of leading it either into the desirable and peaceful Wākea region or the miserable depths of Milu. Therefore, it was vital to maintain good relations with the *ʻaumākua*. Emerson

(1892) elaborates on *ʻaumākua* forms, practices of veneration, and consequenses of accidental disrespect by its *kahu* (keeper):

> Every family had its *aumakua*, to whom each individual owed allegiance and worship, and from whom he expected aid and guidance in all the affairs of life. So long as a person devoutly observed the *kapus*, fulfilled his vows, and rendered due worship, the *aumakua* was his best friend and protector. But let him fail in any of these particulars, thereby becoming *hewa* [wrong, or guilty], he incurred its wrath and displeasure, which was visited upon him by pain and sickness. The *kahuna* must then be called in to determine which of the *aumakuas* was offended and for what cause, and to atone for the fault by the proper prayer and offerings. One of the grave faults that a person might commit was "*pepehi aumakua*," that is, injuring or destroying any animal of the class held sacred by his family. This fault [*hewa*] was never done intentionally, and, when commited by an unlucky accident, the offender was bound to make a feast of such articles as *awa*, a pig, fowls, squid, the fishes called *aholehole*, *anae*, *kala*, *kumu*, and *palani*, together with *kalo*, potatoes, bananas and sugar cane as an offering to the offended god. . .(ibid.:22)
>
> As the children inherited the *aumakuas* of both father and mother, the tendency was for every family to have a large number of *aumakuas*. It is claimed, that the primary idea of the word *aumakua* is the spirit of an ancestor, deified and rendered potent for good or evil, by the long continued *hoomanamana* of its posterity. The spirits of those who had become famous for skill or power would very naturally after death receive the worship of those their craft or profession. Many of these *aumakuas* still retain the shadowy form of a human spirit. Others have been transformed into various animal forms, or, as some people prefer to consider it, manifest themselves through those animals. Other have taken up their abode in trees, stones, and other objects. (ibid:23)

Of particular note are shark *ʻaumākua* who are frequently worshipped in coastal areas of Hawaiʻi such as Hāmākua, and considered as both a friend and protector of its *kahu* yet are merely associated as *kauwā* (slaves/servants) because of their obligatory servitude (Beckwith 1917; Emerson 1892). Emerson (1892:8) argues that the "shark was perhaps the most universally worshipped of all the *aumakuas*, and, strange to say, was regarded as peculiarly the friend and protector of all his faithful worshippers." Ancestral deity worship is considered a quintessential spiritual practice of the Native Hawaiians of old, and it stands today as a heritable custom, belief, and connection to the past preserved by rich oral traditions many of which are associated with mythological tales. The following six *ʻaumākua manō* are identified as belonging Hāmākua (Emerson in Beckwith 1917:512–513):

> ***Pehu*** (k) (swollen), listed for *Hamakua*, Hawaii, and said to have eaten some natives there, also listed second among the great sharks of *Maui*.
>
> **Mahiki** (k), **Kawaiiki** (w), **Kaahu** (w), Kai (w), **Uhanui** (k), sharks of *Hamakua*, Hawaii.
>
> **Kupiopio (k)**, seven fathoms long, who lives at *Keamoku*, *Haena*. He is slain by the *Kau* shark-god. According to Emerson's notes "He came from *Kaula* to live at *Hamakua*. On his way he fell in with Makaluahau (k) of *Kalihi*, Oahu, who became his *aikane*, and went with him to *Hamakua*. There their spirits rested and directed the people of *Paauhau* to plant *awa*, which their keeper brought to feed them.

ʻŌlelo Noʻeau of Hāmākua

The oral tradition of Hawaiʻi is perhaps best preserved in *ʻōlelo noʻeau*, which have been passed down throughout the generations. Many *ʻōlelo noʻeau* speak of Hāmākua, and most mention the famed winds of the region The following proverbs illustrate Hāmākua in great detail, and appear below as they were interpreted and published in *ʻŌlelo Noʻeau, Hawaiian Proverbs & Poetical Sayings* by Mary Kawena Pukui (1983):

> *Hele a ʻīlio pīʻalu ka uka o Hāmākua i ka lā.*
> Like a wrinkled dog is the upland of Hāmākua in the sunlight.
> An uncomplimentary remark about an aged, wrinkled person. Line from a chant.
> (80)
>
> *Hāmākua ʻāina pali loa.*
> Hāmākua, land of tall cliffs.
> Praise of Hāmākua, Hawaiʻi.
> (53)
>
> *Hāmākua i ka wakawaka.*

Irregular and rough Hāmākua.
Praise of Hāmākua, a district of gulches and valleys.
(53)

Hāmākua i ke ala ʻulili.
Hāmākua of the steep trails.
Praise of Hāmākua, a land of precipices and gulches where the old trails were often steep and difficult to travel on.
(53)

Hāmākua kihi loa.
Hāmākua with a long corner.
One corner of Hāmākua touches every district of Hawaiʻi except Puna. Also, a play on *kihi loa*. A native of Hāmākua is said to avoid meeting strangers. Because of bashfulness or disinclination to share his possessions, he will turn aside (*kihi*) and go a long way (*loa*).
(53)

Hele a ʻīlio pīʻalu ka uka o Hāmākua i ka lā.
Like a wrinkled dog is the upland of Hāmākua in the sunlight.
An uncomplimentary remark about an aged, wrinkled person. Line from a chant.
(80)

Hilo, mai Mawae a ka pali o Maulua.
Hilo, from Mawae to the cliff of Maulua.
The extent of the Hilo district is from Mawae on the Puna side to Maulua on the Hāmākua side.
(108)

Ka hālau a Ī.
The house of ʻĪ.
The descendants of ʻĪ, who extended through Hāmākua, Hilo, Puna and Kaʻū. One of these was ʻĪmakakoloa, who was condemned to death by Kamehameha. According to the historian Kamakau, ʻĪmakakoloa was put to death in Kamaʻoa. But according to the people of Ka'ū, a junior kinsman of similar appearance was substituted at the execution.
(141)

Ka ua kīhene lehua o Hāmākua.
The rain that produces the *lehua* clusters of Hāmākua.
(169)

Waipiʻo: the Epicenter of Hāmākua's Precontact Political System

Situated roughly three miles to the west of Kapoaula Ahupuaʻa is Waipiʻo, a large, well-watered valley that during Hawaiʻi's Precontact times was an exceptionally significant royal and religious center. Waipiʻo's valley floors were checkered with significant architecture centered around its status as a royal center. These included man-made fishponds, sacred *heiau*, a royal residence and mausoleum, and numerous *loʻi*. Aside from these archaeological sites and features, Waipiʻo was also home to the *kāʻai* – two woven wicker caskets containing the *iwi* (bones) of the *aliʻi* Līloa and allegedly his grandson, Lonoikamakahiiki as well. In addition to this, Waipiʻo also contained a *puʻuhonua* (places of refuge). But perhaps it is most renowned for serving as home base to a long line of powerful Pili rulers. Cordy's (1994) report outlines the reign of Pili from approximately 1300-1800 A.D., accounting for roughly 20 years per reign (Figure 10), establishing the original Pili line ruler (Pili Kaʻaiea) at 1320 A.D. It is suggested by Cartwright in Cordy's (1994) study that it is likely that Pili "resided and ruled out of Waipiʻo," however therein lies an uncertainty as to the determination of whether or not the early Pili rulers controlled the entirety of Hawaiʻi Island, "or whether the island was a loose confederation with Hamakua's ruler as the most powerful ruler." Waipiʻo remained the ruling center of Hawaiʻi Island until approximately 1620 A.D., "when ʻUmi shifted the governmental focus to Kona," however "it remained important to the ruling line up to the time of Kamehameha as one of many royal residences" (Cordy 1994:6).

Fornander's (1969) *An Account of the Polynesian Race* attributed the foundation of the Pili ruler lineage to the high priest Paʻao, who in the wake of the "expulsion or death" of Waipiʻo's prior, sovereign ruler Kapawa, sent for a replacement chief from the lands of Kahiki. The name of this new, territorial sovereign chief was Pili Kaʻaiea. It is from him that "the ruling Hawaiian chiefs down the Kamehameha family, claimed their descent" (Fornander 1969:23).

Pili was seemingly succeeded in rule by his son Koa, his grandson Ole, and his great grandson Kukohou. However, Fornander was unable to say for certain whether or not this is the actual hereditary relationship, as according to other genealogies, Koa and Ole might have in fact been brothers to Pili instead (ibid.: 39).

Perhaps, the most prominent Pili descendant *ali‘i* to rule over Waipi‘o were Līloa and his two sons, Hākau and ‘Umi-a-Līloa. Although the Pili bloodline ran strong through the veins of various *ali‘i* up until the time of Kamehameha I, the story of these three chiefs still echo in the minds and hearts of Hāmākua’s natives. Especially the tale of ‘Umi, the last great *ali‘i* of Waipi‘o. ‘Umi-a-Līloa (‘Umi-son-of-Līloa), born in the fifteenth century, exhibited a special aptitude for humbly taking care of people since the days of his youth. This extraordinary quality would continue to bloom over the course of his life, leading up to chiefdom and his eventual success in ruling the kingdom and uniting all the districts of Hawai’i Island under his rule. ‘Umi’s father was the religious and sacred high chief (*ali‘i nui kapu*) Līloa (son of Kiha), who was responsible for the “building of the places of worship (luakini, waihau, unu, ko‘a) and the erecting of stones of Kane” (Kamakau 1992:2). Līloa was an *ali‘i* who “kept the peace in his kingdom and his people contented and prosperous,” a trait which undoubtedly spilled over to his son ‘Umi (ibid.). Līloa was born of a chiefly ancestry, both paternally and maternally, and fathered two children aside from ‘Umi, who were of chiefly descent: a son, Hākau (Līloa’s initial successor), and a daughter named Kapu-kini, who would later become a wife of ‘Umi. According to Kamakau (1992:2):

> At one time Liloa desired to build several heiaus in Hamakua from Kukuihaele to Kowana‘e and the vicinity about Kealakaha. When a house for the god was completed, Liloa, the kahunas, the favorite god, Ku-ka‘ili-moku, the chiefs, and servants went up from Waipi‘o to the pork-eating feast for the dedication of the chief’s heiau. The procession was made a tabu one, from Kukuihaele to Wai-ko‘eko‘e and on to Kapulena, Kawela, and Pa‘auhau. Games for the strengthening of the body were played, such as dish rolling (*maika*), dart gliding (*pahe‘e*), boxing (*mokomoko*), and spear hurling (*pahukala*). At Koholalele, the tabu for [the heiau of] Maninini was observed. Then they went on the lower side of Kowaluna and Koapapa‘a. They encamped at Koapapa‘a and at Ka‘awikiwiki.

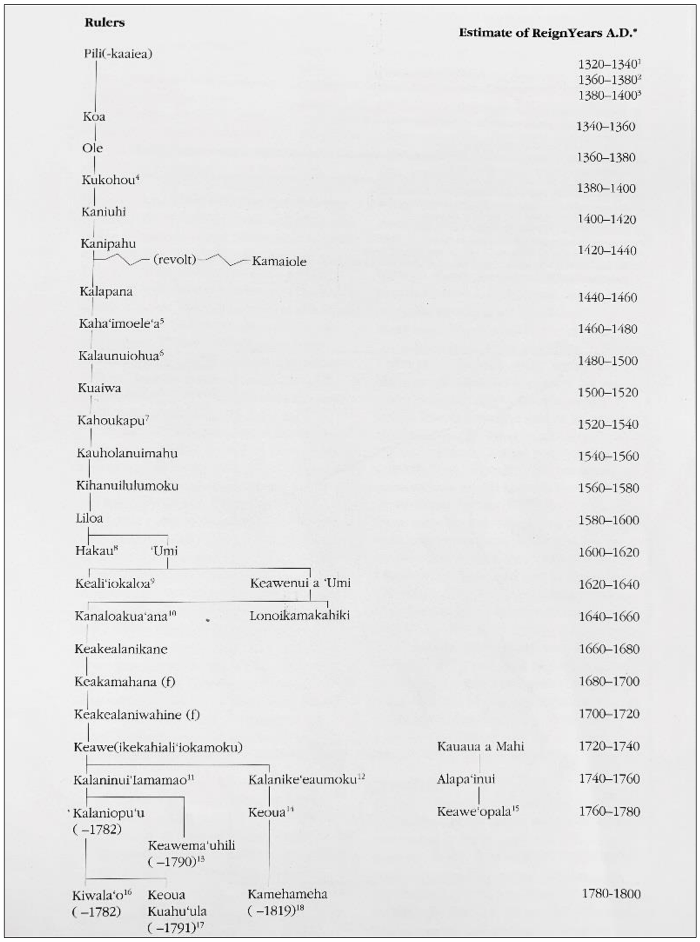


Figure 10. Chronology of the Pili rulers of Hawai‘i Island (Cordy 1994:7).

The mother of ‘Umi was a common woman from Kealakaha named Akahi-a-Kuleana. Although her genealogy did link her to Kanipahu, a descendant of the Pili line, the generations that followed had coupled with those of lower rank, thereby lowering their family’s status to *maka‘āinana* or commoners. Being that her status was not of *ali‘i* rank, her son ‘Umi was considered a “lowly birth (*lepo popolo*)” (Kamakau 1992:1). It was not common for *ali‘i* and commoners to intermingle, much less to conceive a child together, in fact, “she was startled at seeing a man dressed in the attire of a chief and thought that she was about to be put to death” when he approached her bathing in a stream after gazing upon her beauty from the cliff of Kealakaha (ibid:3).

> The chief asked that they do what he was desirous of doing, and the woman consented. After they had fulfilled that desire they knew that a child was conceived. The chief said, ‘This is my command: when our child is born if it be a girl, name her for your side of the family; but if it be a boy, name him for mine. He shall be named ‘Umi. I am Liloa, and these are the tokens for the child when he grows up and seeks me in Waipi‘o: the feather cape, ivory pendant, helmet and kauila spear’ (laau palau). The woman heeded the words and remembered all of the chief’s command. (Kamakau 1992:3)

Indeed, Akahi had conceived a child that day, whom she reared with her sometime abusive husband. She named him ‘Umi, and “in raising him no particular rules were observed, and he grew up into a handsome but mischievous boy. He did not mind his father but minded his mother” (ibid.:5). The boy seemed to have a fondness for providing for other children, continually giving them “all the food, fish, tapa, and loin cloths” from his personal household, often landing him in trouble with Akahi’s husband, who handed out beatings to the boy frequently out of his frustration and anger. On one such occasion, ‘Umi was receiving yet another beating, Akahi exclaimed to her husband:

> That is not your son that you are cruelly beating, but you and I have a share in rearing him. Why talk about your food and fish that are consumed by him? This is why I live with you, to feed his mouth and to give him his needs. “Whose is this child of yours?” [he asked]. His wife answered,

> "My child is not yours; my child is a chief and he is Liloa's." "Where are the tokens that I may recognize your son as the child of Liloa, the chief?" Akahi-a-Kuleana fetched the feather cape, the helmet, the ivory pendant, and loin cloth from their hiding place. (Kamakau 1992:5)

Fearing for his life, Akahi's husband ceased the beating of the child. The young ʻUmi then requested to see his birth father to which his mother obliged. ʻAkahi adorned her son with the royal items and gave him detailed instructions on how to approach his sacred father lest death be handed to him. ʻAkahi explained:

> After leaving this place, you will have far to go until you reach a wide stream. Remember then that the land lying before you is Waipiʻo, a land of plenty. It is a beautiful land to behold from the top of the precipice. You will see numerous fish ponds and taro patches. The long river there is Wailoa, and on both sides of it, at the opening in the valley, and along the sides [of the cliffs] going inland are the cluster of houses. (Kamakau 1992:6)

ʻUmi, who was about the age of ten, rounded up his *hoʻokama* (adopted son), ʻOmaʻokamau and the two boys journeyed to Waipiʻo. Along the way, ʻUmi in his kind-hearted manner took it upon himself to adopt two more sons, Piʻimaiwaʻa and Koʻi. Together, the four young boys walked until they reached the cliff of Koaʻekea, where:

> ʻUmi gazed down on the cluster of houses nestling on a broad stretch of land surrounded by cliffs with an opening on the seaward side. They descended, walked to Lalakea pond, swam across the Wailoa Stream, and faced Ka-hauno-ka-maʻahala, the residence of the chief Liloa. It was surrounded by a wooden fence. Tabu sticks were placed outside of the enclosure to mark the boundary beyond which commoners were not allowed to go. (Kamakau 1992:7)

Watching the guards closely, ʻUmi snuck his way around the royal residence and in a sudden dash, leaped onto the lap of the great chief Līloa.

> The chief looked at the boy sitting on his lap and asked, "Whose child are you?" The boy answered, "Yours! I am ʻUmi-a-Liloa." Liloa noticed the token he had left for his son and kissed and wept over him. (Kamakau 1992:7)

The great chief Līloa, embraced his son and following their reunion, ʻUmi was circumcised and dedicated, as custom dictated. The sacred drum, Halalū, and the smaller *kaʻeke* drums were sounded in the *heiau* of Pakaʻalana. After learning that his son had adopted his three traveling companions, Līloa recognized ʻUmi's kind-hearted nature and in a somewhat prophetic manner Līloa declared:

> This is a kind-hearted boy. Although he is still a child, he has made himself like a father and mother to his people. His descendants cannot fail to become rulers. (Kamakau 1992:8)

As the news of Līloa's new son spread throughout his kingdom, it was met with both innocent ignorance from the people of the countysides and with despite, which came primarily from Līloa's eldest son and heir apparent, Hākau. Seeing his father's love for ʻUmi filled Hākau with feelings of envy and jealousy. Līloa worried for ʻUmi and informed him:

> …after I am dead and you are left with your lord and brother, go elsewhere and live under others if he should mistreat and abuse you. This is the one thing you must do, take care of the god. Whatever you have, remember him. Though you may live in poverty, the god will have compassion on you and reward you. (Kamakau 1992:9)

Following the death of Līloa, Hākau took over his father's kingdom and ruled for a year, observing his father's teachings. However, as Līloa predicted, Hākau grew to be a cruel and merciless chief, having no regard for other chiefs, including ʻUmi and commoners alike. In missionary, William Ellis's transcriptions from the native people of the valley, it was said that Hākau's cruelty was renown, that he had even been known to behead men who had a "fine-looking head" and had once even "ordered a man's arm to be cut off, and brought to him, only because it was tataued [tatooed] in a manner more handsome than his own" (Ellis 1917:274). Fearfully, ʻUmi emancipated himself and his adopted sons to the *moku* of Hilo, where Hākau had no reign. There, he acquired four wives and lived proper, all the while heeding his father's words regarding the god Ku-ka-ʻili-moku. Questions began to arise regarding the disappearance of ʻUmi. One man in particular, Kaleiokū, began seeing certain chiefly omens when he was around ʻUmi, and one day confronted him. His suspicions were confirmed, indeed, this was the chief everyone had been talking about. Although many were fearful once this fact arose in public, Kaleiokū became ʻUmi's attendant, and:

> Built many long houses (*halau*), ten times ten of them, for the purpose of feeding men. When people came from Hilo to Hamakua for salt they were given pork to eat [a mark of great hospitality]. Travellers [sic] from Hamakua, Kohala and Kona who went to Hilo and Puna for birds' feathers

> were received in ʻUmi's eating places. Before a year had gone, many people had been received, and ʻUmi's hospitality gained fame." (Kamakau 1992:12)

It was said that ʻUmi was a "kindly chief who cared for the big men, the little men, the old men, the old women, children, the poor, and the sick. One thing he did was to give food to people" (Kamakau 1992:12). His genuine kindness and compassion served him well. With the help of those he had selflessly served, he forged a surprise attack on "Hakau, his chiefs, and members of the court. . . all the corpses of those slain in battle were offered up in the *heiau* of Honuaʻula in Waipiʻo," and it is said that when:

> ʻUmi-a-Liloa laid the victims on the altar in the heiau-the bodies of the fallen warriors and chif, Hakau-the tongue of god came down from heaven, without the body being seen. The tongue quivered downward to the altar, accompanied by thunder and lightning, and took away all the sacrifices. (Kamakau 1992:14)

In the years following the overthrow of Hākau's court, ʻUmi waged war on and succeeded in taking each *moku* of Hawaiʻi Island. He had many chiefly wifes, one of whom was also his half-sister (Hākau's full blooded sister) Kapu-kini who bore him two sons, Keliʻi-o-kaloa and Ke-awe-nui-a-ʻUmi, both who would become heir to the Kingdom of Hawaiʻi. ʻUmi, being an avid farmer and fisherman, accomplished much, including constructing *kalo* patches in Waipiʻo.

In his old age, ʻUmi-a-Līloa retired to Kona. At his request, a plan was set in motion which would require the help of his sons, daughters, fellow chiefs, and commoners to erect a stone slab tomb to prepare for his death. The tomb failed to be readied by the time of ʻUmi's passing, and instead the slabs were stored in a cave in Kailua. There are two versions of the fate of ʻUmi's corpse: one story says that his adopted son Koʻi (who had been given land from Waimanu to Pololū) asked permission to "conceal his bones completely" (Kamakau 1992:32). He killed a man in Kekaha who bore a strong resemblance to ʻUmi. Late one night, he entered the cave at Makaʻeo, laid this substitute corpse to rest, and accompanied by his brother in law, took ʻUmi's body to a secret cave among the precipitous cliffs at Waimanu. Another account contradicts this story, stating that Koʻi actually took ʻUmi's bones to the island of Maui to a secret, undisclosed location. Until this day, ʻOnly the birds know where Umi son of Līloa lies buried" (Beckwith 1970:391).

The Arrival of Captain James Cook and the End of Kalaniʻōpuʻu's Reign (1778-1782)

British explorer Captain James Cook, in command of the ships *H.M.S. Resolution* and *H.M.S. Discovery*, landed in the Hawaiian Islands on January 18, 1778. The following January 17th [1779], on a return trip to Hawaiian waters, Cook anchored near Kaʻawaloa along the north shore of Kealakekua Bay in the South Kona District to resupply his ships. This return trip occurred at the time of the annual *Makahiki* festival, and many of chiefs and commoners were gathered around the bay celebrating. It has been suggested that Captain Cook was understood to be the god Lono himself returned, as men would not normally be allowed to paddle out during the *Makahiki* without breaking the *kapu* and forfeiting all of their possessions (Kamakau 1992). Kalaniʻōpuʻu, the reigning chief of Hawaiʻi Island, left a battle with Kahekili on Maui, and after arriving at Kealakekua Bay, visited Cook on board the *H.M.S. Resolution*, where they exchanged gifts. Kamehameha, the future ruler of all of Hawaiʻi, was present at this meeting (Jarves 1847). On February 4th, Cook set sail, but a storm off the Kohala coast damaged the mast of the *H.M.S. Resolution*, and both ships were forced to return to Kealakekua Bay to make repairs. With Cook's return many of the inhabitants of Kealakekua began to doubt that he actually was the physical manifestation of Lono (Kamakau 1992). Ten days later, a dispute over stolen nails escalated and after one of Cook's boats was stolen, the captain set ashore at Kaʻawaloa with six marines to ask Kalaniʻōpuʻu for its return. When Kalaniʻōpuʻu denied any knowledge of the theft, Cook tried to take him captive (Kamakau 1992). A fight ensued, and Cook was killed along with four of his men and several natives. Kalaniʻōpuʻu and his retinue retreated inland. After offering the body of Cook as a sacrifice to the *akua*, some of his bones were returned to the British aboard *Resolution* (Kamakau 1992), who shortly thereafter returned to sea.

After the death of Captain Cook and the departure of *H.M.S. Resolution* and *Discovery*, Kalaniʻōpuʻu moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1992). While he was living in Kona, famine struck the district. Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized, and then he set out on a circuit of the island. Around A.D. 1780, while in Kohala, Kalaniʻōpuʻu proclaimed that his son Kīwalaʻō would be his successor, and he gave the guardianship of the war god Kūʻkāʻilimoku to Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kīwalaʻō did not seem to honor (Fornander 1996; Kamakau 1992), and preferred Kamehameha as the next ruler. The *heiau* of Moaʻula was erected in Waipiʻo at this time (ca. A.D. 1781), and after its dedication Kalaniʻōpuʻu set out for Hilo to quell a rebellion by a Puna chief named ʻĪmakakoloa, a descendant of the famed ʻĪ family that ruled over Kaʻū, Puna, Hilo, and Hāmākua. The *ʻōlelo noʻeau* "*Ka hālau a Ī*" literally translated as "the house of ʻĪ" likens the extent of this family's rule to a *hālau* or a long-house (Pukui 1983:141) .

ʻĪmakakoloa was defeated in Puna by Kalaniʻōpuʻu's superior forces, but he managed to avoid capture and hide from detection for the better part of a year. While the rebel chief was sought, Kalaniʻōpuʻu went to Kaʻū and erected a *heiau* called Pākini (Kamakau 1992). ʻĪmakakoloa was eventually captured and brought to the *heiau*, where Kīwalaʻō was to sacrifice him. "The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief" (Fornander 1996:202). However, before Kīwalaʻō could finish the first offerings, Kamehameha, "grasped the body of Imakakoloʻa and offered it up to the god, and the freeing of the tabu for the *heiau* was completed" (Kamakau 1992:109). Upon observing this single act of insubordination, many of the chiefs believed that Kamehameha would eventually rule over all of Hawaiʻi. After usurping Kīwalaʻō's authority with a sacrificial ritual in Kaʻū, Kamehameha retreated to his home district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). Kalaniʻōpuʻu died in April of 1782 and was succeeded by his son Kīwalaʻō.

After Kalaniʻōpuʻu died in A.D. 1782 civil war broke out, Kīwalaʻō was killed, and Kamehameha became the ruler of Hawaiʻi Island. The wars between Maui and Hawaiʻi continued until A.D. 1795 (Handy and Handy 1972; Kuykendall and Day 1976). Several battles were fought in the Hāmākua District during this period, and many of the religious structures in Waipiʻo Valley were destroyed (Hazlett et al. 2007).

The Rule of Kamehameha I (1782-1819)

After Kalaniʻōpuʻu died, several chiefs were unhappy with Kīwalaʻō's division of the island's lands, and civil war broke out. Kīwalaʻō, Kalaniʻōpuʻu's son and appointed heir, was killed at the battle of Mokuʻōhai, South Kona on July 1782. Supporters of Kīwalaʻō, including his half-brother Keōua and his uncle Keawemauhili, escaped and laid claim to the Hilo, Puna, and Kaʻū Districts. According to ʻĪʻī (1963), nearly ten years of almost continuous warfare followed, as Kamehameha endeavored to unite the island of Hawaiʻi under his rule and conquer the islands of Maui and Oʻahu. Keōua became Kamehameha's main rival on the island of Hawaiʻi, and he proved difficult to defeat (Kamakau 1992). Around 1790, in an effort to secure his rule, Kamehameha began building the *heiau* of Puʻukoholā at Kawaihae, which was to be dedicated to the war god Kūkaʻilimoku (Fornander 1996). When Puʻukoholā Heiau was completed in the summer of 1791, Kamehameha sent his two counselors, Keaweaheulu and Kamanawa, to Keōua to offer peace. Keōua was enticed to the dedication of the Puʻukoholā Heiau by this ruse and when he arrived at Kawaihae he and his party were sacrificed to complete the dedication (Kamakau 1992). The assassination of Keōua gave Kamehameha undisputed control of Hawaiʻi Island (Greene 1993). Between 1792 and 1796, after the dedication of Puʻukoholā, Kamehameha mostly resided at Kawaihae and worked the lands of the Waikōloa-Waimea region (Maly and Maly 2002). The wars between Maui and Hawaiʻi continued until A.D. 1795 (Handy and Handy 1972; Kuykendall and Day 1976) where a series of battles were fought in the Hāmākua District and many of the religious structures in Waipiʻo Valley were destroyed (Hazlett et al. 2007).

Waipiʻo, being the high profile epicenter for royal and religious activities in the islands that it was, garnered attention from those wishing to destroy and demolish it and everything it stood for. on two separate occasions, warfare was waged in Waipiʻo, one of which is recognized as being the first naval battle in the islands where both parties utilized "modern gunnery" (Fornander 1969:244). The spark that initiated this naval battle, known as Kepūwahaʻula, was ignited by chief Kaʻeokulani from Kauaʻi. He and Maui chief Kahekili set out with their war canoes to "avenge the defeat of Kalanikupule on Maui, and to deal a crushing blow to the growing power of Kamehameha (Fornander 1969:241). On their voyage down the island chain, the pair intermittently stopped at several locations with their separate war fleets, recruiting crew for the impending battle. The two chiefs split up, with Kahekili hugging the coastline of the Kohala District and Kaʻeokulani heading straight for Waipiʻo. As related by Fornander (Fornander 1969:243), "the acts of spoliation and bararity committed on this occasion were the common occurance of war in those days", however, the acts of blatant vandalism committed by both parties were primarily centered around religious and sacred icons and an utter lack of regard for the religious system. Resulting damages were severe, as related by Fornander (ibid.):

> His disregard and desecration of the ancient tabu places, the tearing up and overturning the sacred pavement of Liloa, the burning of the sacred pepper-tree supports of the ancient palace of the Hawaiian kings, said to have been builty by Kahoukapu, and his general demolition and destruction of all the sacred and valued mementoes of ancient times, in which that valley was so rich,-these and similar acts were regarded as unpardonable acts of vandalism.

Kamehameha was in Kona when he caught wind of the invasion, and preparations for a naval battle were quickly completed. He "assembled a large fleet of double canoes, many of which were filled with small cannons obtained from traders, and with the sloop which Kameeaimoku had captured from the ship "Eleanor" the preceeding year, he started for Waipio, placing John Young and Isaac Davis in command of his artillery. (Fornander 1969:243–244). Upon

Kamehameha's arrival at Waipiʻo Bay, a bloody combat ensued with Kahekili's fleet who had not yet made landfall. It is said that Kamehameha's artillery was far too heavy handed for Kahekili, and that he and Kaʻeokulani fled back to their respective islands, defeated. According to Kamakau (Kamakau 1992), it was the final battle fought by Kahekili, a precursor to his death in 1793.

One year prior to Kepūwahaʻula, Waipiʻo was also ravaged, although on a less severe level. Threatened by the possibility that Kamehameha and Keawemauhili (ruling chief of Hilo and Puna) would join forces against him, Keōua killed Keawemauhili and seized Hilo. Following his victory, Keōua decided to further launch the war into more rural areas, his intention being to:

> Plunder the country people. He descended into Waipiʻo and broke down the fishponds, drying up Lalakea, Muliwai, and all the other ponds. He pulled up the taro of Waipiʻo, broke down the banks of the taro patches, and robbed the people from Waipiʻo to Waimea (Kamakau 1992:122, 151)

Aside from the obvious loss of human life associated with such warfare, the exploitation of the residents, the ponds, *loʻi*, the burning of the sacred *nīʻoi* (pepper tree) columns and the displacement of Līloa's pavement at Pakaʻalana Heiau in Waipiʻo were tragic as well, and were undoubtedly a huge blow to the community.

Keōua's war campaign subsequently infiltrated into eastern Hāmākua in the late eighteenth century where he led another forceful invasion of at least 20,000 men against Kamehameha and his party of 13,000 men during the two-day battle of Koapāpaʻa (also referred to as Koapapa) in the eastern part of the district (D'arcy 2018; Desha 2000; Fornander 1969; Kalākaua 1972; Kamakau 1992). Referred to as "The Battle of the Empty Guns" (Desha 2000), the skirmish was clandestinely planned by Keōua spurred in an identic manner to his previous invasion of Waipiʻo, and Kamehameha's subjects were exposed to brutal treatment accomplished "by robbing them of their property, by the wantonly killing of men, women and children, the cutting of taro from the fields with overbearing arrogance, and all other malicious acts. Women who were with child were trampled under foot, pierced with small bambus and with sticks and stones" (Fornander 1969:472). These abhorrent acts of brutality triggered Kamehameha to avenge the death of his people, and Desha (2000) further relates that it was Kamehameha's wish to enforce his *Kānāwai Māmalahoa*, or the Law of the Splintered Paddle, against Keōua.

Initially, the battle began deep in the misty forest of Mahiki, then moved further east into Pāʻauhau, and eventually ended up in Kūkaʻiau in eastern Hāmākua. As related by Kamakau (1992:152), the battlefield consisted of "a broad open plain with a grove at the south" and was described as being in the vicinity of Kainehe (Desha 2000). Kinney (1913:33) elaborates:

> The gulch on the south side of Kukaiau is named MAIUUKE-LELELEI. It is famous as the site of a great battle between Kamehameha and King Keoua, of Kau, the fight ending here after it had raged from one end of Hamakua to the other. The deciding engagement took place about a quarter of a mile above the present road, where the old road crossed the gulch. Keoua, when defeated, ran to the place where the KOHOLALELE gulch, north of Kukaiau, joins with the Kukaiau gulch. Here, on the Hilo side, is a stone of refuge, where Keoua remained until the victorious forces had withdrawn, when he returned towards Kau. The stone is called Keoua's stone until today.

Despite being vastly outnumbered with regards to manpower, Kamehameha's warriors were dually armed with weaponry and knowledge of foreign warfare owing to Kamehameha's association with John Young. Kamehameha's army was well-armed with gunnery, and Keōua's militia seized the weapons. However, they did not possess the necessary armaments that Kamehameha had, and as such could not forge an assault in this manner and both parties retreated to their respective districts (Kamakau 1992).

Another battle that reached as far as Kūkaʻiau between Kulukulua, was fought between the king of Hilo named Kulukulua and the king of Hāmākua, Wanuʻa. Wanuʻa was assisted in battle by three of his bravest warriors, Moanonuikalehua, Kamuonuiaiake, and Puupuukaamai, which nearly resulted in his victory (Fornander 1969). However, just before slaughtering Kulukulua, Wanuʻa's attack was interrupted by the arrival of Palila, a courageous and adept warrior and king of Kōloa, Kauaʻi who had been reared by the gods at the *heiau* of Alanapo in Humuʻula, Kauaʻi. Nonetheless, the three fearless warriors were no match for Palila, who vanquished them with a single blow of his war club to the ground and later "hangs their jaws on a tree called Ka-haka-auwae (The shelf of jawbones)" (Beckwith 1970:415).

Shortly thereafter this period of warfare, Hawaiʻi's culture and economy changed drastically as western influences of capitalism and industry established a firm foothold in the islands. The sandalwood (*Santalum ellipticum*) trade was established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961). The industry flourished by 1810, as farmers and fishermen were ordered into the mountains of their district to cut sandalwood and carry it to the coast. Although the laborers were compensated with *kapa* (material), food and fish (Kamakau 1992) the neglect to their personal subsistent duties lead to food shortages, and famine, resulting in a population decline. Kamakau described the collapse of a traditional subsistence system and the industry's detrimental effects on the people, "…this rush of labor to the mountains brought about a scarcity of cultivated food . . . The people were forced to eat herbs and tree ferns, thus the famine [was] called Hi-laulele, Haha-pilau, Laulele, Pualele, ʻAmaʻu, or Hapuʻu, from the wild plants resorted to" (ibid.: 1992:204). Once Kamehameha realized that his people were suffering, he "declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land" (ibid.: 1992:204). Kamehameha I, who resided on the Island of Oʻahu at this time, did manage to maintain some control over the trade on Hawaiʻi Island (Kent 1983; Kuykendall and Day 1976).

In 1793, Captain George Vancouver, who previously visited Hawaiʻi with Cook in 1778, returned leading his own expedition back to Hawaiʻi. Upon his return, Vancouver introduced cattle to Hawaiʻi Island, gifting seventeen heads of steer to Kamehameha I (Barrera 1983). Kamehameha I placed a *kapu* on the cattle, and they were driven to the upland plain of Waimea to increase and multiply (Vancouver in Kuykendall 1938). Archibald Menzies, a naturalist and surgeon with the Vancouver expedition, wrote the following description of the Hāmākua District in 1793 as he sailed off the coast:

> . . . The land we passed in the forenoon rose in a steep bank from the water side and from thence the country stretched back with an easy acclivity for about four or five miles, and was laid out into little fields, apparently well cultivated and interspersed with the habitations of the natives. Beyond this the country became steeply rugged and woody, forming mountains of great elevation. (Menzies 1920:51)

By 1796, Kamehameha had conquered all the island kingdoms except for Kauaʻi. It was not until 1810, when Kaumualiʻi of Kauaʻi gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976). In 1812, Kamehameha I returned to Hawaiʻi island and resided in Kamakahonu in Kailua-Kona, where he ruled for the remainder of his life, continuing his involvement with foreign trade and enforcing the rigid *kapu* system.

The Death of Kamehameha I and the Abolition of the Kapu System (1819-1820)

Kamehameha I died on May 8, 1819 at Kamakahonu in Kailua-Kona, and the changes that had been affecting the Hawaiian culture since the arrival of Captain Cook in the Islands began to accelerate. Following the death of a prominent chief, it was customary to eliminate all of the regular *kapu* that maintained social order and the separation of men and women, elite and commoner. Thus, following Kamehameha's death, a period of *ʻainoa* (free eating) was observed along with the relaxation of other traditional *kapu*. It was the responsibility of the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history, traditional customs were altered (Kamakau 1992).

> The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating (*ʻainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-aliʻi, and in most of the histories of ancient rulers. Free eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992:222)

Immediately upon the death of Kamehameha I, his son and successor, Liholiho was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After the purification ceremonies, Liholiho returned to Kamakahonu where he conducted a series of rebellious acts to deny the reinstatement of the traditional *kapu* laws. These actions included, the consumption of dog meat that was strickly *kapu* to chiefly women and entering the women's *lauhala* house. Many *aliʻi* who witnessed Liholiho's complete disregard, quickly spread word that the *kapu* had been abandoned.

> Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief's tabu and the freeing of the eating tabu. The *kahu* said to the chief, "Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!" and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali'i consented to the free eating and it was accepted on Kauai. (Kamakau 1992:225)

Kekuaokalani, caretaker of the war god *Kūka'ilimoku*, was dismayed by the actions of his cousin, Liholiho, and thereby revolted against him. Kekuaokalani was unsuccessful and was ultimately defeated. Within a year of Kamehameha's death, Liholiho (Kamehameha II) had sent edicts throughout the kingdom renouncing the ancient state religion. By December 1819, he commanded the destruction of *heiau* images and structures, or that the structures be abandoned and left to deteriorate. Kamehameha II, did however, allow personal family religion, '*aumakua* worship, to continue (Kamakau 1992; Oliver 1961). As most of the *kapu* remained null throughout the entire archipelago, the uncanny arrival of the Christian missionaries shortly after, resulted in the abolishment of the *kapu* system, and the traditional religion replaced with Christianity. The end of the *kapu* system, marked significant social and economic changes that greatly affected the lives of the common people. Liholiho eventually moved his court to O'ahu, thereby lessening the burden on the people of Hawai'i Island to manage resource procurement for the chiefly class. The economy shifted from subsistence agriculture to the production of foods and goods that were traded with early visitors. Introduced foods often grown for trade included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845).

Hāmākua 1820-1848: A Land in Transition and Early Historical Accounts

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawai'i. They arrived in Kailua-Kona on March 30, 1820 to a society whose religious system has just been overturned. Eager to spread the Christan gospel, these early missionarie seized the opportunity to fill this religious void. Many of the *ali'i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopted their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the sandalwood trade wrought havoc on the lives of the commoners, as they weakened from the heavy production, exposure, and famine just to fill the coffers of the *ali'i*, who were no longer under any traditional constraints (Kuykendall and Day 1976; Oliver 1961). The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai'i went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry.

Some of the earliest written descriptions of Hāmākua come from the accounts of the first Protestant Missionaries to visit the island. Early Historic visitors to Hāmākua noted the beauty and fertility of this part of the island. In 1823, British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Hawai'i seeking out communities in which to establish church centers for the growing Calvinist mission. Ellis recorded observations made during this tour in a journal. Traveling through the Hāmākua District heading west from Hilo, Ellis described the environs of Hāmākua, particularly between the stretch of Koloaha to the east of the study area to Kapulena to the west, thusly:

> We arose at day-light on the 16th, and shortly after left Tumoarii. We had not travelled more than four or five miles when we reached Kaahua. After breakfast, we proceeded on our journey over a country equal in fertility to any we had passed since leaving Waiakea. The houses were in general large, containing usually three or four families each. Mr. Goodrich was indisposed through the day, which obliged us to travel but slowly. near noon we stopped at Koloaha, and while he reclined beneath the shade of an adjoining grove of trees, I addressed the assembled natives on the subject of religion. After remaining about two hours, we walked to another village, where Mr. Thurston spoke to the people, who gave good attention. We then kept on our way till we reached Malanahae, where a congregation of people assembled, with whom we conversed some short time, then bade

> them farewell, and about three P.M. reached Kapulena, where we preached to upwards of 100 of the people. (Ellis 2004:356)

At Kapulena (northwest of the current study area) Ellis' party split into two groups; Ellis and Thurston continued northwest following the coast to Waipiʻo Valley, and Bishop and Goodrich proceed inland to Waimea, passing nearby the study area:

> On Monday morning Messers. Bishop and Goodrich commenced their journey to Waimea. Having procured a man to carry their baggage, they left Kapulena, and taking an inland direction, passed over a pleasant country, gently undulated with hill and dale. The soil was fertile, the vegetation flourishing, and there was considerable cultivation, though but few inhabitants. (Ellis 2004:357)

Lorenzo Lyons arrived at Kawaihae on July 16, 1832 and replaced Reverend Dwight Baldwin as the minister in Waimea (Maly 1999). Lyons' missionary territory, although centered in Waimea, included the districts of Kohala and Hāmākua. He served as the preeminent missionary of the area of the area until his death in 1886 (Puakō Historical Society 2000), becoming one of the most beloved of the Hawaiian missionaries, known to his parishioners as *Ka Makua Laiana*, *haku mele o ka aina* Mauna (Father Lyons, lyric poet of the mountain country). In 1834, Lyons relocated to Hāmākua following his two-year missionary service in Waimea. He described the journey to Hāmākua thusly:

> . . . If we take the route to Hamakua, there is, in wet weather, a marsh to pass through—not much unlike Bunyan's Slough of Despond—either in going or returning, or both. It is perhaps four miles long—a most dismal place; yet the woods are sometimes vocal with the music of birds, which furnishes a little relief to the tediousness of the way. . . On one route to Hamakua, part of the road is a mere foot-path lying thro' a dense wood of Koa and Ohia. (Doyle 1953:111)

Lyons' also provided one of the earliest descriptions of a wagon read leading from Waimea to Hāmākua:

> We have no roads such as you have in America, but we got to Hamakua after a fashion. Mrs. L was drawn part of the way in a rocking chair attached to the fore wheels of a wagon; a part of the way she was carried in the same chair by natives; and part of the way she walked. The little one was carried by a native. You would have smiled to see how we lived. (Doyle 1953:75)

The Legacy of the *Māhele ʻĀina* of 1848

By the mid-nineteenth century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840 the first Hawaiian constitution had been drafted and the Hawaiian Kingdom shifted from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, the *Mōʻī* (Kamehameha III) and his high-ranking *aliʻi* (chiefs) decided to separate and define the ownership of all lands in the Kingdom (King n.d.). This change was further promoted by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the *Mōʻī*, the *aliʻi* and *konohiki* (land agents), and the *makaʻāinana* (the common people or native tenants).

In 1845 the legislature created the "Board of Commissioners to Quiet Land Titles" (more commonly known as the Land Commission), first to adopt guiding principles and procedures for dividing the lands and granting land titles, and then to act as a court of record to investigate and ultimately award or reject all claims brought before them. All land claims, whether by chiefs for entire *ahupuaʻa* or by tenants for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1846) 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 Land Commission Award (LCAw.) numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of their 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. (Alexander 1920; Soehren 2005).

The *Mōʻī* and some 245 *aliʻi* (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). Once the *Mōʻī* and his *aliʻi* accepted the principles of the Privy Council, the *Māhele ʻĀina* (Land Division) was completed in just forty days (on March 7, 1848), and the names of all of the *ahupuaʻa* and *ʻili kūpono* (nearly independent *ʻili* land division within an ahupuaʻa) of the Hawaiian Islands and the *aliʻi* who claimed them, were recorded in the *Buke Māhele* (also known as the *Māhele* Book) (Soehren 2005). As this process unfolded the *Mōʻī*, Kamehameha III, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. Accordingly, the day after the division when the name the last chief was recorded in the *Buke Māhele*, the *Mōʻī*, Kamehameha III commuted about two-thirds of the lands awarded to him to the Hawaiian Kingdom Government (King n.d.). Unlike the *Mōʻī*, the *aliʻi* and *konohiki* were required to present their claims to the Land Commission to receive their land awards (known as Land Commission Awards or LCAw). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the *Mōʻī* and *aliʻi* became known as "Government Land," while the lands retained by Kamehameha III became known as "Crown Land," and the lands received by the chiefs became known as "Konohiki Land" (Chinen 1958:vii, 1961:13). All lands awarded during the *Māhele* 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.

During the *Māhele*, native tenants of the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to, *kuleana* parcels that they actively lived on or farmed. 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 than the two-year term, and the deadline was extended several times for the Land Commission to finish its work (Maly 2002). In the meantime, 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 "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and the process by which they could apply for fee-simple interest in their *kuleana*.

The work of the Land Commission was completed on March 31, 1855. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which 9,337 were awarded (Maly 2002). The history of the *kuleana* claim and award process is summarized in an 1856 report by the Minister of Interior:

> …During the ten months that elapsed between the constitution of the Board and the end of the year 1846, only 371 claims were received at the office; during the year 1847 only 2,460, while 8,478 came in after the first day of January 1848. To these are to be added 2,100 claims, bearing supplementary numbers, chiefly consisting of claims which had been forwarded to the Board, but lost or destroyed on the way. In the year 1851, 105 new claims were admitted, for Kuleanas in the Fort Lands of Honolulu, by order of the Legislature. The total number of claims therefore, amounts to 13,514, of which 209 belonged to foreigners and their descendants. The original papers, as they were received at the office, were numbered and copied into the Registers of the Commission, which highly necessary part of the work entailed no small amount of labor…
>
> …The whole number of Awards perfected by the Board up to its dissolution is 9,337, leaving an apparent balance of claims not awarded of say 4,200. Of these, at least 1,500 may be ranked as duplicates, and of the remaining 2,700 perhaps 1,500 have been rejected as bad, while of the balance some have not been prosecuted by the parties interested; many have been relinquished and given up to the Konohikis, even after surveys were procured by the Board, and hundreds of claimants have died, leaving no legal representatives. It is probable also that on account of the dilatoriness of some claimants in prosecuting their rights before the Commission, there are even now, after the great length of time which has been afforded, some perfectly good claims on the Registers of the Board, the owners of which have never taken the trouble to prove them. If there are any such, they deserve no commiseration, for every pains has been taken by the Commissioners and their agents, by means of oft repeated public notices and renewed visits to the different districts of the Islands, to afford all and every of the claimants an opportunity of securing their rights… (quoted in Maly 2002:7)

The disposition of the lands of Kapoaula is a complicated matter, and it is important to note that there are inconsistencies in the *Māhele*-era recordkeeping for Leleiōhoku's land award. As a result of the *Māhele*, the entire 1,697 ¼-acre *ahupuaʻa* of Kapoaula (comprising five smaller lands of the same name) was slated to be returned to Kamehameha III by William Pitt Leleiōhoku, the first husband of Harriet Keōpūolani Nāhiʻenaʻena and second husband to Ruth (Luka) Keʻelikōlani (Buke Mahele 1848:23). Combining smaller *ahupuaʻa* in this manner was not uncommon, as Gonschor and Beamer (2014:80) note, "If a group of numbered ahupuaʻa with the same name ended up having the same konohiki, or all becoming Government or Crown land, they were frequently consolidated into one." As Leleiōhoku's lands were to be awarded to him in "Freehold less than Allodial," it appears that Kapoaula was intended to be one of the lands commutated to the Government in exchange for patenting his other lands. The chain of events following this initial decision is somewhat murky, however, Leleiōhoku died in 1848 shortly after the *Māhele* was completed, and Kapoaula was not commutated. The lands awarded to him as a result of the *Māhele* were allocated to his widow and to their son and heir, John William Pitt Kīnaʻu:

> By action of the Privy Council on May 27, 1850, a Resolution was approved for the division of the lands of William Pitt Leleiohoku to be surrendered in Lieu of Commutation as set forth in Vol. 3 of Privy Council Records on page 327 as follows:
>
> > "Resolved that the division of lands between the Government and the widow and heirs of William Pitt Leleiohoku, deceased, this day submitted to the King and Privy Council be, and is hereby approved: and that the Minister of the Interior be, and is hereby authorized to grant a Royal Patent or Patents to Luka Keelikolani, the widow of the said Leleiohoku for such lands as may apportioned to her as her dower in the estate of the said Leleiohoku, and also to grant a Royal Patent or Patents to John Pitt Kinau, the son and heir of the said Leleiohoku for such lands as may be assigned to him as his portion of said estate: Provided however, that nothing in this resolution shall be construed as interfering with the rights of the Land Commission to settle all disputes that may exist as to the title or bounds of any of said lands; and further provided, that nothing therein contained shall be construed as interfering with the rights of native tenants in said lands." (Commisioner of Public Lands 1929:75–76)

Of the thirteen Hāmākua *ahupuaʻa* awarded to Leleiōhoku, nine were relinquished to the *Mōʻī*, and four were retained by him (Kameʻeleihiwa 1992). Kameʻeleihiwa (1992:25) relates that Leleiōhoku

> held 93 *ʻĀina* before the *Māhele*, principally on Hawaiʻi island (73). He gave up 61 percent of his *ʻĀina* to the *Mōʻī*, receiving 36: 25 on Hawaiʻi, 7 on Māui, 2 on Oʻahu, and 1 on Molokaʻi… When Leleiōhoku died soon after the signing of the *Buke Mahele* in 1848, his heirs (his wife Keʻelikōlani and son John Pitt Kīnaʻu) were required to cede 12 or more *ʻĀina*, or another 13 percent, in government commutation. These included 8 *ʻĀina* on Hawaiʻi and 4 on Māui. By 1849, Leleiōhoku's estate had shrunk to 25 percent of its pre-*Māhele* size.

Commutation of the nine Hāmākua *ahupuaʻa* occurred on August 27, 1850, two years after Leleiōhoku's death. Kapoaula was not included among these lands. Leleiōhoku was succeeded by his only heir, and "the substantial *ʻĀina* of Leleiōhoku [including Kapoaula] were left to his son, W.P. Kīnaʻu, with his widow Ruta Keʻelikōlani as guardian" but "Kīnaʻu died as a youth in 1859 and so Leleiōhoku's *ʻĀina* were really inherited by Keʻelikōlani" (Kameʻeleihiwa 1992:307). Before Keʻelikōlani passed away in 1883, she "became one of the largest owners of *ʻĀina* by the time of her death…because she became heir to various *Aliʻi Nui* who died before her" (Kameʻeleihiwa 1992:246).

Leleiōhoku's lands were awarded posthumously as Land Commission Award (LCAw.) 9971. The award itself adds to the confusion over Kapoaula, as it appears that the *ahupuaʻa* was included twice in the award (Soehren 2005). *ʻĀpana* 2 of the award (Figures 11 and 12) is for the *ahupuaʻa* of "Kapoaula" in Hāmākua on Hawaiʻi Island. The award includes a description of the boundary and a map that clearly identifies the land as the *ahupuaʻa* containing the current study area. *ʻĀpana* 18 of the award is for "Kapaaula" in Hamakaua on Hawaiʻi Island. The land is not described in the same detail as *ʻĀpana* 2, only named. The award was finalized on May 2, 1853, five years after Leleiōhoku's death, and a map (Figure 13) was made by Government Surveyor, Curtis Jere (C.J.) Lyons's of the awarded land. With respect to the *Māhele* survey of Hāmākua, Lyons' provided the following description of the district and noted that he was accompanied by natives:

> Hamakua, the present rich cane country, next claimed me. The compass was a magic mystery to the natives, who followed all day long; but the chain, the "kaula-hao" was to their minds the authoritative instrument. To their eyes, it marked the line on the ground as it dragged along. The flags reminded them of the ancient annual procession of Kea Akua Makahiki, and they compared the tripod as it folded up, to the bundled bones of their ancestors. (Lyons in Moffat and Fitzpatrick 1995:60)

A description of the *ahupuaʻa* boundary, as surveyed by Lyons, was included in the LCAw. documentation (the portion including the current study area is bolded; Hawaiian words are italicized):

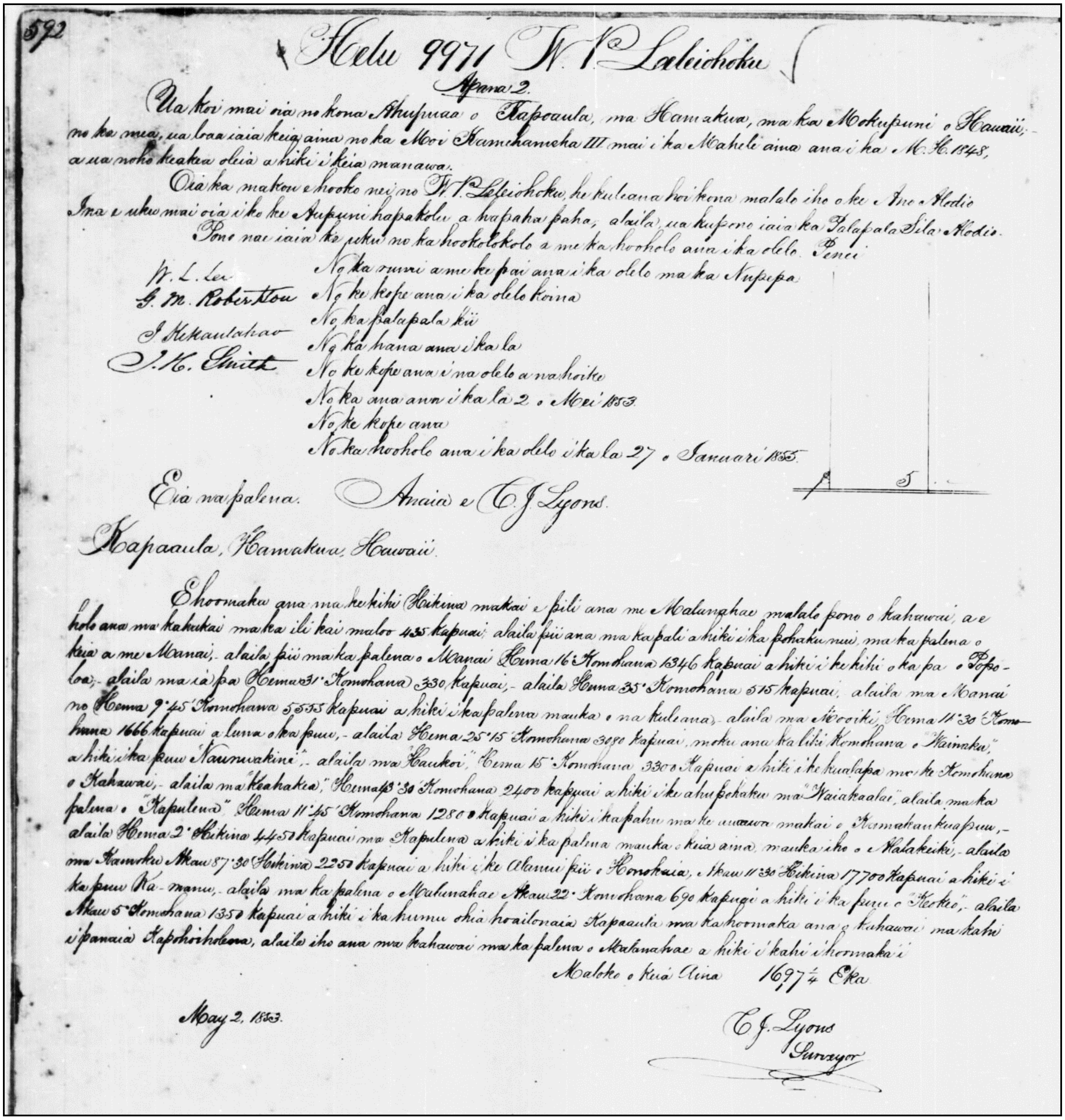
> Starting at the east corner on the *makai* (seaward) side adjoining with Malanahae just below the stream, and running to the *ili kai maloo* (low tide, as when much of the reef is exposed) for 435 feet, then ascending up the cliff to the large stone at the boundary of this [land] and Manai, then ascending on the boundary of Manai Hema 16˚ west 1,346 feet until the *pā* (enclosure) of Popoloa, then from the enclosure south 31˚ west 330 feet, then south 35˚ west 515 feet, then at Manai south 9˚ 45 feet west 5,555 feet until it reaches the *mauka* most *kuleana* boundary, then at Mooiki, south 11˚ 30 feet west 1,666 feet to the top of the hill, then south 25˚ 15 feet west 3,080 feet cutting the western corner of Wainaku, until it reaches the puu "Naunuakini" then at Haukoi, south 15˚ west 3,300 feet until it reaches the embankment on the western side of the stream, then at Keahakea, south 43˚ 30 feet west 2,400 feet until it reaches the *ahupohaku* (stone mound) at Waiakaalae, then on the boundary of Kapulena south 11˚ 45 feet west 12,800 feet until it reaches the marker at the *awawa* (gulch, valley) *makai* of Kamakaukuapuu, **then south 2˚ east 4,450 feet at Kapulena until it reaches the *mauka* most boundary of this land, just below Alalakeiki**, **then at Kamoku north 87˚ 30 feet east 2,250 feet until it reaches the "Alanui pii o Honokaia," north 11˚ 30 feet east 17,700 feet until it reaches puu Ka-manu**, then at the boundary of Malanahae north 22˚ west 690 feet until it reaches puu Keokeo, then north 5˚ west 1,350 feet until it reaches the *ʻōhiʻa* tree marking Kapaaula at the start of the stream at a placed called Kapohoiholena, then descending down the stream on the boundary of Malanahae until the point of commencement.
>
> 1,697 ¼ acres

The land was not patented for another eighty years, when Alfred Wellington (A.W.) Carter, manager of Parker Ranch (which owned the land by that time) was issued Land Patent Grant 8451 on January 8, 1934.

Another version of Lyons' map (Figure 14) includes additional details about the study area. Most importantly, the map indicates that the study area was still forested in 1853. The forests on Mauna Kea traditionally provided Hawaiians with valued resources, especially feathers, plant materials, and wood, and places for ritual activities (Tomonari-Tuggle 1996). Bird-catching was a specialized form of hunting that provided highly-valued feathers to craft specialists, who transformed them into high status goods that included *lei*, *kāhili* (royal insignial plumes), *ʻahu ʻula* (cloaks), *mahiole* (helmets), and *ʻakua hulu manu* (feathered images of gods) (Brigham 1899, 1903, 1918; Buck 1944, 1957; Emerson 1894). The *aliʻi* controlled the collection of feathers through specific requests (Kamakau 1992), as tribute during the *Makahiki*, and through a "standing order" (*palala*) for this item of *hoʻokupu* (Malo 1951). Boundary Commission records examined by Cordy (2003), support the idea that bird-catchers were *makaʻāinana* who hunted birds within their own *ahupuaʻa* on a part-time basis (*contra* Emerson 1894; see also Lass 1998; Linnekin 1988). This suggests only temporary habitation in this part of the forest, which would likely lead to relatively ephemeral evidence of the presence of the bird-catchers. Boundary commission records (see discussion below) indicate that the forests continued to support some bird-catching into the mid-nineteenth century, but the upper forests were significantly altered by livestock, which trampled and grazed them into grasslands. Lyons' map captures this landscape in transition by noting a "Pahua Bipi" [*pāhuʻa,* a clear areas in pastures where it is easy to rope cattle; *bipi*, beef/cattle] located *makai* of the current study area (Pukui and Elbert 1986:301).

The map also depicts two trails, which are highlighted in yellow on Figure 14. The old trail/road referred to as "Honokaia" by Makaenaena is depicted in Figure 15, where it is labeled "Alanui o Honokaia." The trail extends slightly into the southeastern corner of the current study area. From there, the trail follows the parcel's eastern boundary for a short distance before linking with a *mauka*/*makai* trail/road called "Alanui pii uka i ka mauna" which translates literally as "large path going inland to the mountain." This second trail roughly bisects the study area and extends from this junction *makai* towards the *kuleana* lots in the northern portion of Kapoaula. Above the junction at the Honokaia boundary, the Alanui pii uka i ka mauna and the Alanui o Honokaia continue southwards into the neighboring Government land of Kamoku (see Figures 14 and 15).

No *kuleana* awards were made within the current study area. In the *makai* portion of Kapoaula, nine claims for *kuleana* parcels were made by eight claimants, all of which were awarded (Table 2). Figure 16 shows the distribution of *kuleana* awards within Kapoaula. The awarded lands totaled 116.5 acres and ranged between 9.3 and 16.5 acres in size. Twelve *ʻili* names are mentioned in the Native Testimonies: Haleokane, Kealaehu, Kaopapa 1, Kaopapa 2, Kapokuna, Kapuna, Mooiki, Papuaa, Pohokuna, Puna, Ulukanipo, and Uwiuwi. All but one of the testimonies provides only generalized agricultural types (e.g. cultivated fields or *kīhāpai*), one enumerates three distinct plants: *ʻuala*, *kalo*, and *wauke*. *Pāhale*, or house lots, were noted for five of the individuals, and there was a total of nine houses. Two of the awardees received land from their parents, and two received their land prior to 1819.



592

Helu 9971 W. P. Leleiohoku

Apana 2.

Ua koi mai oia no kona Ahupuaa o Kapoaula, ma Hamakua, ma ka Mokupuni o Hawaii, no ka mea, ua loaa iaia keia aina no ka Moi Kamehameha III mai i ka Mahele aina ana i ka M. H. 1848, a ua noho kuakaa oleia a hiki i keia manawa.

Oia ka makou e hooko nei no W. P. Leleiohoku, he kuleana hoi kona malalo iho o ke Ano Alodio Ina e uku mai oia i ko ke Aupuni hapakolu a hapaha paha, alaila, ua kupono iaia ka Palapala Sila Alodio.

Pono nae iaia ke uku no ka hookolokolo a me ka hoohole ana i ka olelo. Penei

W. L. Lee — No ka rumi a me ke pai ana i ka olelo ma ka Nupepa
G. M. Robertson — No ke kope ana i ka olelo koina
J. Kekaulahao — No ka palapala kii
J. H. Smith — No ka hana ana i ka la
No ke kope ana i na olelo a na hoike
No ka ana ana i ka la 2 o Mei 1853.
No ke kope ana
No ka hoohole ana i ka olelo i ka la 27 o Ianuari 1855.

$ 5

Eia na palena. Anaia e C. J. Lyons.

Kapaaula, Hamakua, Hawaii.

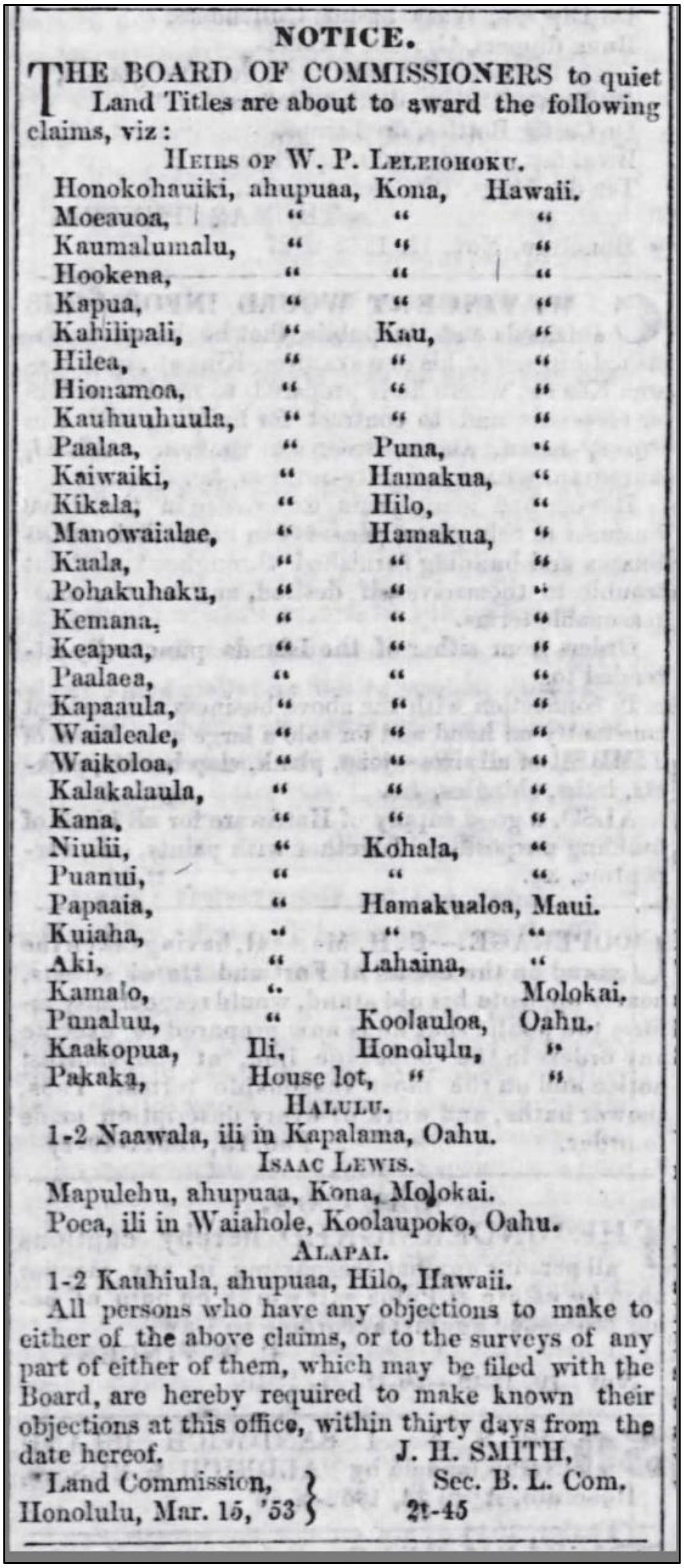
Ehoomaka ana ma ke kihi Hikina makai e pili ana me Malanahae malalo pono o kahawai, a e holo ana ma kahakai ma ka ili kai maloo 435 kapuai; alaila pii ana ma ka pali a hiki i ka pohaku nui, ma ka palena o keia a me Manai; alaila pii ma ka palena o Manai Hema 16° Komohana 1346 kapuai a hiki i ke kihi o ka pa o Popoloa; alaila ma ia pa Hema 31° Komohana 330 kapuai; alaila Hema 35° Komohana 515 kapuai, alaila ma Manai no Hema 9° 45' Komohana 5555 kapuai a hiki i ka palena mauka o na kuleana, alaila ma Keoiki, Hema 11° 30' Komohana 1666 kapuai a luna o ka puu, alaila Hema 25° 15' Komohana 3080 kapuai, moku ana ka liki Komohana o "Wainaku," a hiki i ka puu "Naunuakini", alaila ma "Laukoi", Hema 15° Komohana 3300 kapuai a hiki i ke kualapa me ke Komohana o Kahawai, alaila ma "Keahakea", Hema [illegible] 30' Komohana 2400 kapuai a hiki i ke ahu pohaku ma "Waiakaalae", alaila ma ka palena o "Kapulena", Hema 11° 45' Komohana 1280 kapuai a hiki i ka pahu ma ke auwaa makai o Kamakaukuapuu, alaila Hema 2° Hikina 4450 kapuai ma Kapulena a hiki i ka palena mauka o keia aina mauka iho o Halakeiki, alaila ma Kaunike Akau 87° 30' Hikina 2250 kapuai a hiki i ke Alanui pii o Honokaia, Akau 11° 30' Hikina 17700 kapuai a hiki i ka puu Ka-manu, alaila ma ka palena o Malanahae Akau 22° Komohana 690 kapuai a hiki i ka puu o "Keokeo", alaila Akau 5° Komohana 1350 kapuai a hiki i ka kumu ohia hoailonaia Kapaaula ma ka hoomaka ana o kahawai ma kahi i panaia Kapohiholena, alaila iho ana ma kahawai ma ka palena o Malanahae a hiki i kahi i hoomaka ai.

Maloko o keia Aina 1697¼ Eka

May 2, 1853.

C. J. Lyons
Surveyor

Figure 11. LCAw. 9971 *‘apana* 2 to William Leleiohoku (www.kipukadatabase.com).



NOTICE.

THE BOARD OF COMMISSIONERS to quiet Land Titles are about to award the following claims, viz:

HEIRS OF W. P. LELEIOHOKU.

Honokohauiki,	ahupuaa,	Kona,	Hawaii.
Moeauoa,	“	“	“
Kaumalumalu,	“	“	“
Hookena,	“	“	“
Kapua,	“	“	“
Kahilipali,	“	Kau,	“
Hilea,	“	“	“
Hionamoa,	“	“	“
Kauhuuhuula,	“	“	“
Paalaa,	“	Puna,	“
Kaiwaiki,	“	Hamakua,	“
Kikala,	“	Hilo,	“
Manowaialae,	“	Hamakua,	“
Kaala,	“	“	“
Pohakuhaku,	“	“	“
Kemana,	“	“	“
Keapua,	“	“	“
Paalaea,	“	“	“
Kapaaula,	“	“	“
Waialeale,	“	“	“
Waikoloa,	“	“	“
Kalakalaula,	“	“	“
Kana,	“	“	“
Niulii,	“	Kohala,	“
Puanui,	“	“	“
Papaaia,	“	Hamakualoa,	Maui.
Kuiaha,	“	“	“
Aki,	“	Lahaina,	“
Kamalo,	“		Molokai.
Punaluu,	“	Koolauloa,	Oahu.
Kaakopua,	Ili,	Honolulu,	“
Pakaka,	House lot,	“	“

HALULU.

1-2 Naawala, ili in Kapalama, Oahu.

ISAAC LEWIS.

Mapulehu, ahupuaa, Kona, Molokai.
Poca, ili in Waiahole, Koolaupoko, Oahu.

ALAPAI.

1-2 Kauhiula, ahupuaa, Hilo, Hawaii.

All persons who have any objections to make to either of the above claims, or to the surveys of any part of either of them, which may be filed with the Board, are hereby required to make known their objections at this office, within thirty days from the date hereof.

J. H. SMITH,
Sec. B. L. Com.

Land Commission, Honolulu, Mar. 15, '53

2t-45

Figure 12. Newspaper notice from March 15, 1853 listing Kapoaula (listed as Kapaaula) and other lands to be awarded to Leleiōhoku during the *Māhele* (The Polynesian 1853).

Figure 13. Survey map of LCAw. 9971:2 by C.J. Lyons, study area shaded red.

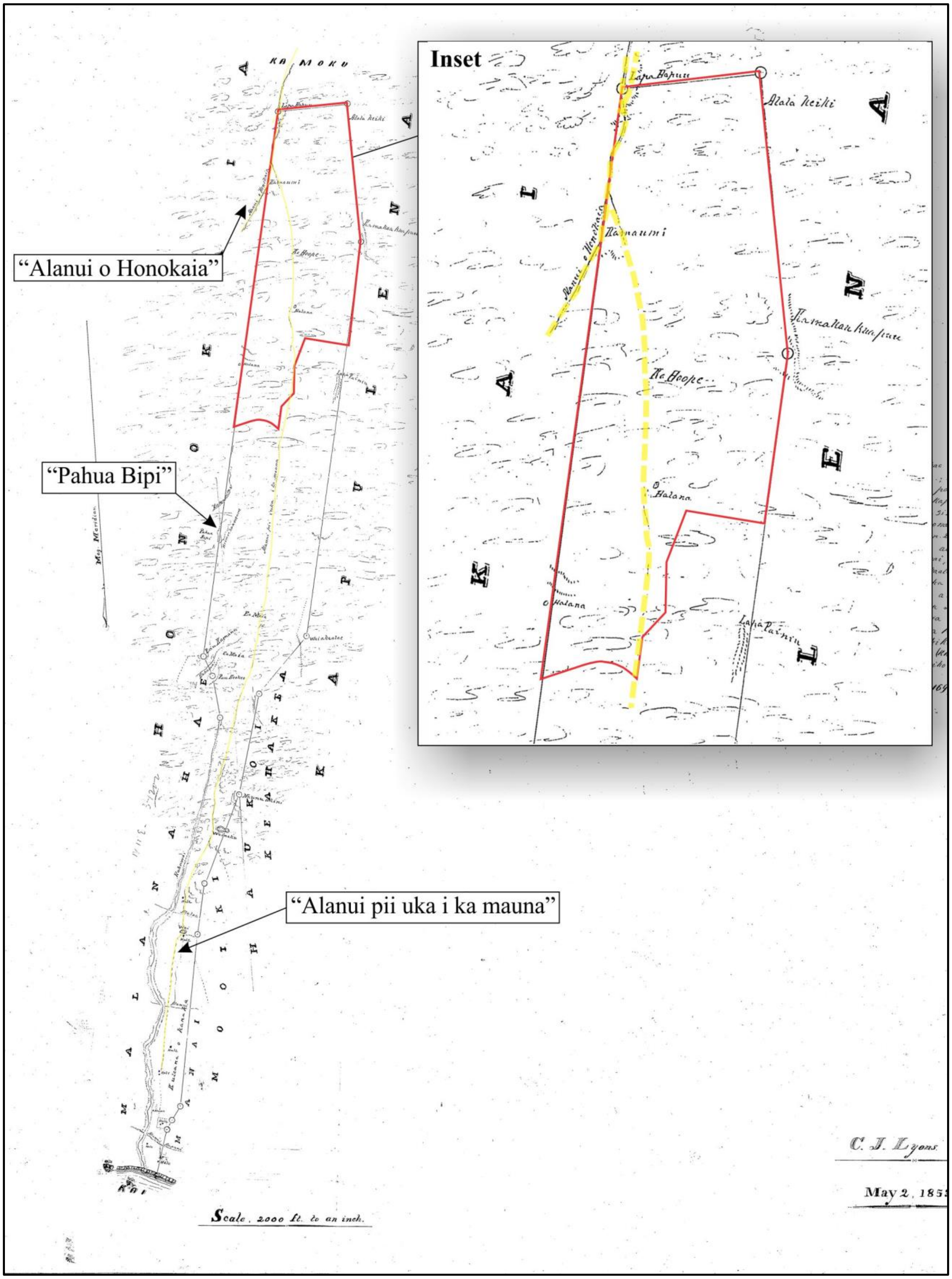


Figure 14. Portion of Registered Map No. 46 with the current study area outlined red (after Lyons 1853).

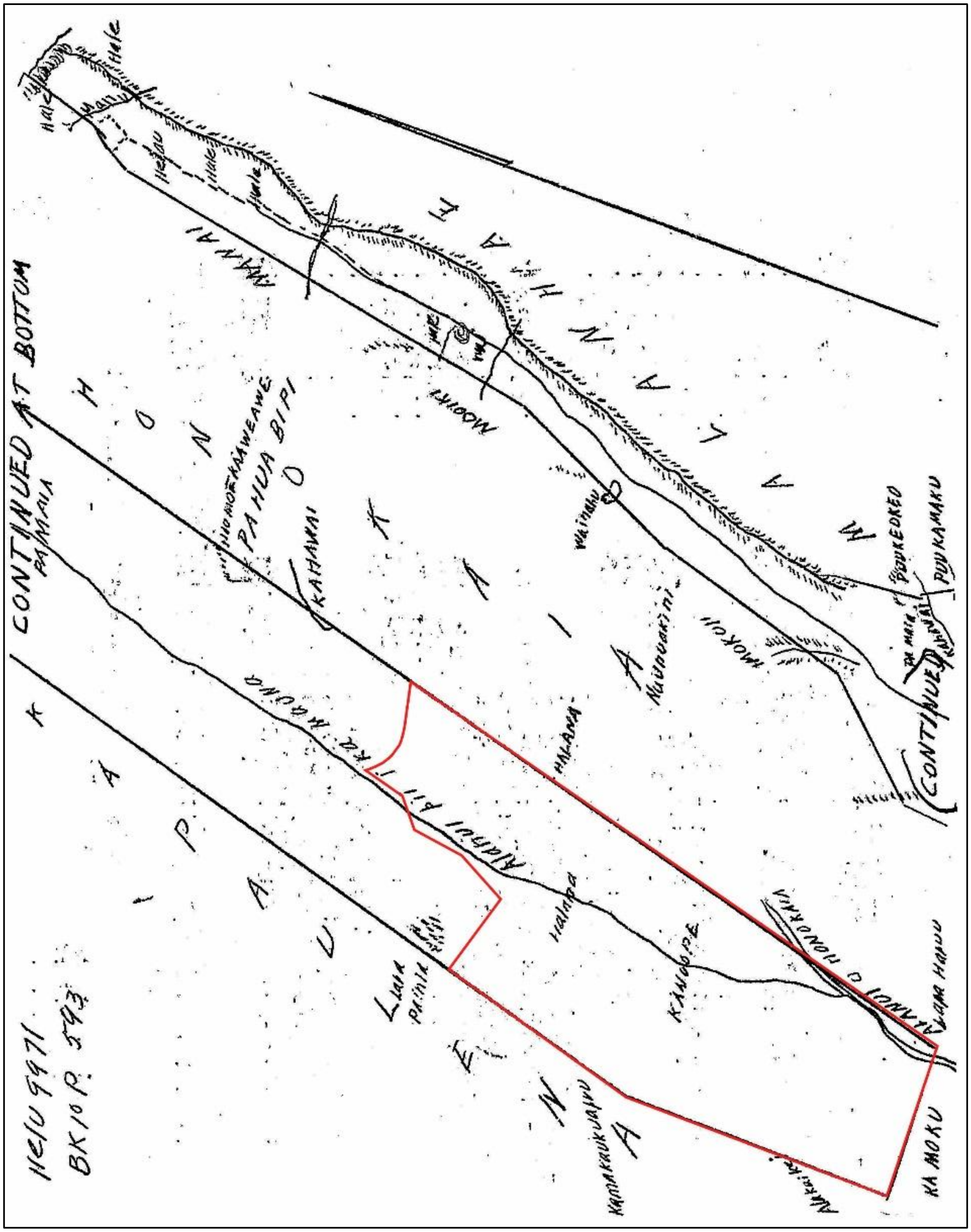


Figure 15. Tracing of C.J. Lyons' survey map of LCAw. 9971:2 with the current study area outlined in red (Office of Hawaiian Affairs 2018).

Table 2. *Kuleana* parcels awarded in Kapoaula Ahupua‘a.

Claimant	***LCAw.***	***‘Ili/Mo‘o ‘Āina***	***Land use***	***Size (ac.)***	***Recv’d From***	***Date***
Kaikuaana	3836	Uwiuwi Kapuna Haleokane	1 house lot 1 house 7 *kīhāpai*	9.3	-	-
Kaakaua	8380	Puna Ulukanipo Papuaa Mooiki	2 houses 12 cultivated fields 8 *kīhāpai*	10.5	Parents	-
Kalakualaau	8384	Pohokuna	8 *kīhāpai*	14	-	<1819
Kaneakaehu	8395	Haleokane	1 house lot 1 house 6 cultivated fields 6 *kīhāpai*	13	Parents	<1819
Pololoa	9841:1 and 2	Uwiuwi	1 house lot 6 cultivated fields	14.5	-	-
Nahao	10409	Kapokuna	12 *kīhāpai*	12.5	-	-
Naiku	10542	Ulukanipo	1 house lot 3 houses 1 *kīhāpai* 3 cultivated fields	12.2	-	-
Pule	10671	Kaopapa 1 & 2	2 houses 4 cultivated fields	14	-	-
Auwae	10992	Kapokuna Kealaehu	1 house lot 2 *‘uala* patches 6 *kalo* patches 1 *wauke* patch	16.5	-	-

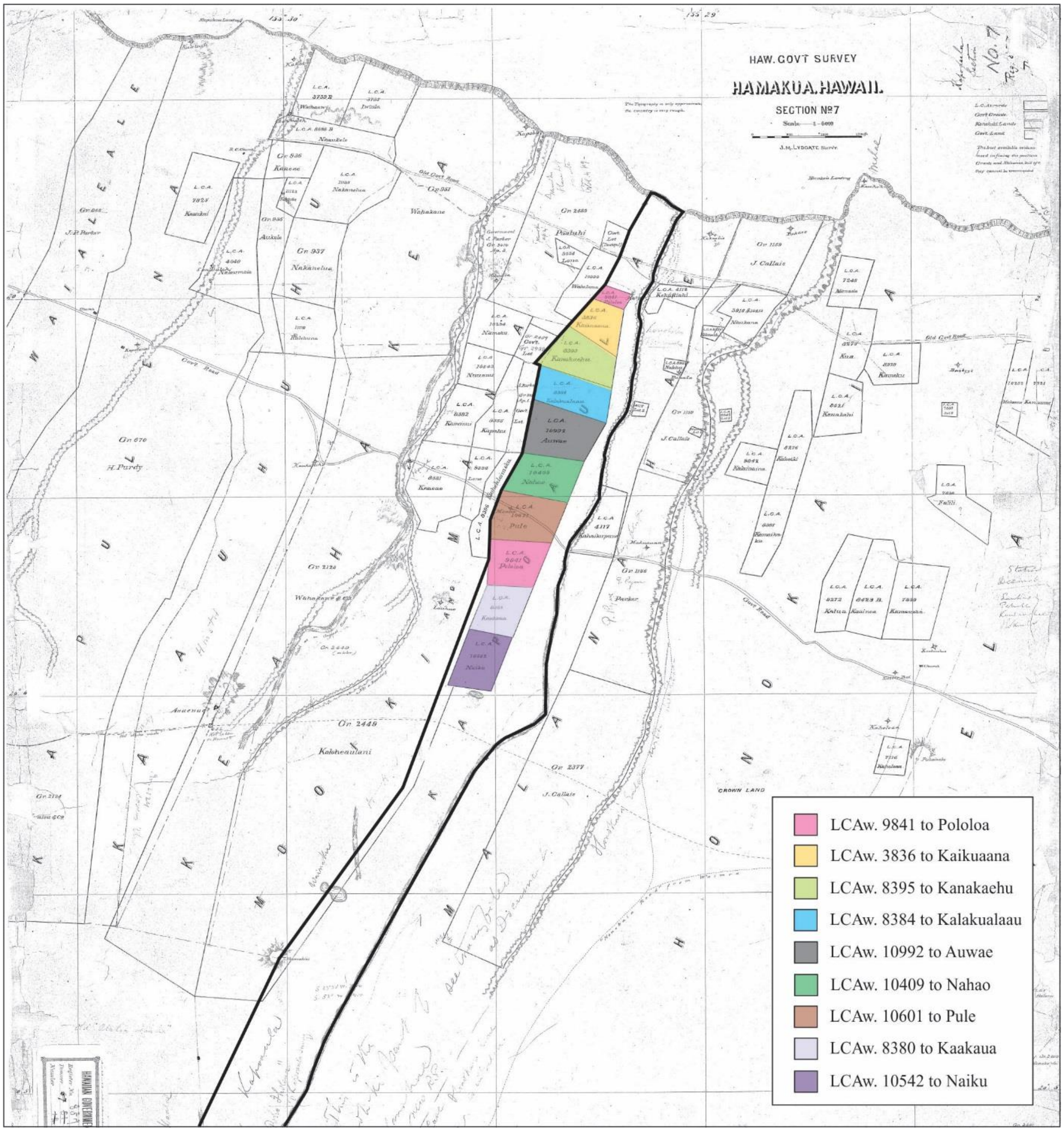


Figure 16. *Kuleana* parcels awarded in Kapoaula Ahupuaʻa.

Boundary Commission Testimony (1862-1873)

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawaiʻi to legally set the boundaries of all the *ahupuaʻa* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and transcribed in English. Although hearings for most *ahupuaʻa* boundaries were brought before the Boundary Commission and later surveyed by Government employed surveyors, in some instances, the boundaries were established through a combination of other methods. In some cases, *ahupuaʻa* boundaries were established by conducting surveys on adjacent *ahupuaʻa*. Or in cases where the entire *ahupuaʻa* was divided and awarded as Land Claim Awards and or Government issued Land Grants (both which required formal surveys), the Boundary

Commission relied on those surveys to establish the boundaries for that *ahupuaʻa*. Although these small-scale surveys aided in establishing the boundaries, they lack the detailed knowledge of the land that is found in the Boundary Commission hearings.

While the boundaries for Kapoaula do not appear to have ever been brought before the Boundary Commission, testimony for the adjacent *ahupuaʻa* of Honokaia was provided by Makaenaena on April 18, 1873. Makaenaena, who was "born before collecting of sandalwood by Boki" (ca. 1829, Kuykendall 1938) may have been about fifty years old at the time of his testimony. In his description, Makaenaena not only names several places in the immediate vicinity of the current project area, but provides insights regarding Precontact land use within the general area. Makaenaena described the boundaries of Honokaia as follows (bolded, underlined, and italicized emphasis added for sections relevant to Kapoaula):

> I was born at **Kawela Hamakua**, Island of **Hawaii**, before the time of collecting sandalwood on the mountains. Have always lived on **Kawela** and **Honokaia**. I am a *kamaaina* of these lands. My father Moopua (now dead) showed me these boundaries when I went with him to catch birds. If we caught birds on other lands, the *Luna* of those lands, would take the birds away from us, and so he pointed out the boundaries to me. **Honokaia** is bounded on the *makai* side by the Sea; on the South East side by **Kawela** and **Au 1st**, *mauka* by **Kamoko** [**Kamoku**], North West side by **Kamoko**, **Kapoaula** and **Malanahae**. There were always in old times fisheries belonging to **Honokaia** extending out to sea a short distance. The boundary at the shore between **Honokaia** and **Kawela** is a large rock in the Sea called **Pohakulelehu**: From this point the boundary between these two lands runs *mauka* to a grove of *Puhala* trees called **Paihala**, thence *mauka* to place at old road called **Kuaiwahia**: Thence *mauka* to grove of *Puhala* trees called **Puanapouli**: Thence to small hill called **Kulanahae**: Thence across Government road to hill called **Puuainako**: Thence to a small mound **Wiliwilihalou**: Thence to a grove of small *ohia* trees on the side of a *pali* at place called **Kauluawaa**: Thence to waterhole called **Kauluawaa**: Thence to grove of *ohia* trees **Kuhewa**: The place called **Ohiakiihelele** is on the land **Honokaia** a short distance from the boundary: From **Kuhewa** the boundary runs *mauka* to **Kawelaloa**: Thence to **Kawahine**: The boundary from the shore follows up the *iwi aina*: From **Kawahine** to to [sic] **Inoino** gulch, and *mauka* to a *pali* called **Palinui**: The brow of *pali* is boundary, level land is on **Honokaia**, and *pali* on **Kawela**: Thence along brow of *pali* and on to **Pakeke**: Thence to **Pohokai**: Thence up a ridge to **Pohopuumaia**, at this point cross the **Inoino** gulch: Thence to place called **Puuloa** at the old **Kawela** road: Thence follow up the old road to **Nahaleopaa** a *puu pahoehoe* in **Inoino** *kahawai:* the *mauka* corner of **Kawela** where it is cut off by **Au 1st**: The place where the boundary of **Honokaia** enters the woods is at the water hole **Kaohiawaa** *mauka* of the grove of *ohia* trees of the same name.
>
> From **Nahaleopaa** the boundary between **Honokaia** and **Au 1st** follows up the old road **Honokaia** one side of road and **Au 1st** on other, to place called **Puuokane hekili** (a small hill or mound): Thence along road to a hill **Puupohaku**: Thence to old *mamake* [*māmaki*] ground called **Waiakekukai**: Thence to **Kalapahaaha**: Thence to small hill **Puulepo**: Thence to **Waiakahoi** a *Kahawai* with a cave it where the bird catchers used to live: Thence **Honokaia** ends and **Au** is cut off by **Kamoko**: Thence boundary of **Honokaia** runs along **Kamoko** to old *Mamake* ground called **Kumaweo**: Thence to *Mamake* grounds called **Nakikapio**: Thence to a ridge called **Makaleha**: Thence *makai* to a hill **Kalapaaki**: Thence to **Kalapa Hapu [Lapa Hapuu]** the *mauka* corner of land of **Kapoaula** The corner of **Kamoku** on boundary of **Honokaia**.
>
> I went with Wiltse when he surveyed the boundary between **Honokaia** and **Kawela**, marked trees and pointed out boundaries. **Kaikauna** went with us. I was born before the collecting of sandalwood by Boki. . . . (Boundary Commission, Hawaii, Vol. A, No. 1, pgs. 238-240)

From Makaenaena's testimony, we learn that Kapoaula bounds Honokaia to the northwest, and that Kalapa/Lapa Hapuu was the southeastern corner boundary between Kapoaula and Honokaia. Makaenaena's testimony also contains references to cultural, natural, and geographic places of significance in the general vicinity of the study area including a grove of *pūhala* trees (Puanapouli), a place with a water hole where *ʻōhiʻa* grew (Kauluawaa), another water hole (Kaohiawaa), two groves of *ʻōhiʻa* trees (Kaohiawaa, Kuhewa), a gulch (Inoino), a *pali* (Palinui), a *puʻu pāhoehoe* (Nahaleopaa), three *māmaki*-growing areas (Kumaweo, Nakikapio, Waiakekukai), an upland stream with cave where bird-catchers dwelled (Waiakahoi), a ridge (Makaleha), numerous hills (Kalapaaki, Kulanahae, Puuainako, Puuokane hekili, Puupohaku), and four old roads (Honokaia, Government road, Kawela, Kuaiwahia). Makaenaena also reveals that the lands of Honokaia were hunting grounds for birds. Furthermore, we learn that Honokaia, undoubtedly just like Kapoaula, had ancient fishing rights extending out to the sea. While traditional land use is not explicitly discussed for Kapoaula in the testimony, Makaenaena's description of the forest land and bird-catching boundaries suggest that bird-catching likely took place in the current study area.

Nā Inoa ʻĀina of Kapoaula Ahupua ʻa

Toponymy or the study of *inoa ʻāina* (Hawaiian place names) is another opportunity to improve our understanding of a place and its history. The following paragraphs contain a presentation of *inoa ʻāina* that were compiled from several map collections including Department of Accounting and General Services Hawaiʻi Registered Maps and the United State Geological Survey (USGS). The earliest maps found in theses collections date back to 1875. *Inoa ʻāina* are recorded and recounted in a variety of Hawaiian oral arts including, *oli* (chants), *mele* (songs), *moʻolelo* (stories), *nane* (riddles) and *ʻōlelo noʻeau* (proverb and poetical expressions). Since the introduction of the written language, place name information has been recorded in ethnographic surveys, historic maps, and a number of early historical documents including *Māhele ʻĀina* records and Boundary Commission testimonies. Kikiloi (2010:75) asserts that the recovery of traditional place names "help to transform once-empty geographic spaces into cultural places enriched with meaning and significance." Place names serve as vehicles of ancestral memory, and when we remember the old name of a place, we remember the words of the *kūpuna* (ancestors), and we recall the wisdom of their teachings (Olivera 2009). Renee Pualani Louis, a Native Hawaiian place name research scholar contends that:

> [place names] are powerful cognitive mechanisms that unfold the richness of the Hawaiian landscape incorporating a plethora of cultural values and are a convergence of the Hawaiian cultural, social, political, and economic order. They are often understood with the moʻolelo (historical account) that accompanies them and usually only by those with its genealogical proximity. As such, they provide a key to the lives and imaginations of Hawaiians. They indicate a holistic and harmonious relationship with the environment and are constant reminders of past events, cautionary tales, and epic tragedies. Knowledge of their meaning provides insight on the importance these place names had in shaping Hawaiian cultural identities. Sharing the names and meanings of places was a conscious act of cultural regeneration. Hawaiian incorporated their culture into the islandscape and used place names as storied symbols in their cartographic tradition. (Louis 2008:1–2)

The following section is a presentation and brief discussion of *inoa ʻāina* that were compiled throughout the course of this study and is by no means intended to be a comprehensive, interpretive or absolute. Rather, the place names presented below should spark ongoing discussion regarding the meanings/interpretations of the names and the stories of these places. Table 3 is a compilation of place names that were compiled from historic maps. Hawaiian diacritical marks are not included in the original listing of place names because they are not used in the original sources, however, a lexicolology column has been added to provide a suggested spelling that utilizes diacritics to aid in pronunciation. The place names presented in the table below have been plotted onto an aerial image and is shown in Figure 17. The *Hawaiian Dictionary* by Pukui and Elbert (1986) was the primary source used for the interpretive translations.

A total of seven place names were identified on the historical map sketched by Lyons (see Figure 14), with all seven noted as present within the current study area, namely Alala Keiki, Alanui o Honokaia, Alanui pii uka i ka mauna, Lapa Hapuu, Ka Hoope, Kamauami, and Kamakaukuapuu. In addition to the aforementioned place names, Lyon's map also shows two *hālana* or areas that are prone to flooding. Outside of the project area boundaries, Lyon's noted another place name, Laha Painiu. Although this place name occurs outside of the study area it has also been included in Table 3. Of the eight total place names recorded within and near the study area, two (Lapa Hapuu and Laha Painiu) make reference to the native vegetions of this region, which includes the *hāpuʻu* fern, and the *paʻiniu* plant. One place name, Alala Keiki makes reference to the *ʻalalā* bird (native crow), which is now extinct in the wild. Two of the names listed by Lyon's (Alanui o Honokaia and Alanui pii uka i ka mauna) makes reference to two trail routes that once passed through the current study area. Although the meaning of the three remaining place names (Ka Hoope, Kamauami, and Kamakaukuapuu), remain somewhat obscured, these names may reference to the characteristics of the natural features that were once visible at these boundary points.

Table 3. List of place names noted on historical maps. **(* located outside of the project area)**

Place Name	*Type*	*Lexicology*	*Literal Translation*	*Interpretation*
Alala Keiki	Boundary	‘Alalā Keiki	*‘alalā* (*Corvus tropicus)* fledgling	May refer to the clamorous sound of the *‘alalā* bird or may have once been a nesting spot for the *‘alalā*.
Alanui o Honokaia	Trail	Alanui O Honokaia	Trail/road of Honokaia	Describes the path originating in Honokaia Ahupua‘a that connected with the Alanui pii uka i ka mauna.
Alanui pii uka i ka mauna	Trail	Alanui pi‘i uka i ka mauna	Road ascending to the mountain	Describes the path leading to the uplands.
Lapa Hapuu	Boundary	Lapa Hāpu‘u	Ridge of hāpu‘u ferns	Likely describes the traditional vegetation that once existed on this ridge.
Ka Hoope	Place	Ka Ho‘opē	The drenched, or the perfumed, or the crushed	May refer to an area the received excess water.
Kamauami	Boundary	Kamau‘ami	The continuous twist	May refer to a natural feature that once existed or still exist in this area.
Kamakaukuapuu	Boundary	Kamākaukuapu‘u	The crooked fishhook	May refer to a natural feature that once existed or still exist in this area.
Laha Painiu*	Boundary	Laha Pa‘iniu	Widespread pa‘iniu (*Astelia sp.*)	Likely describes the traditional vegetation that once existed near this boundary

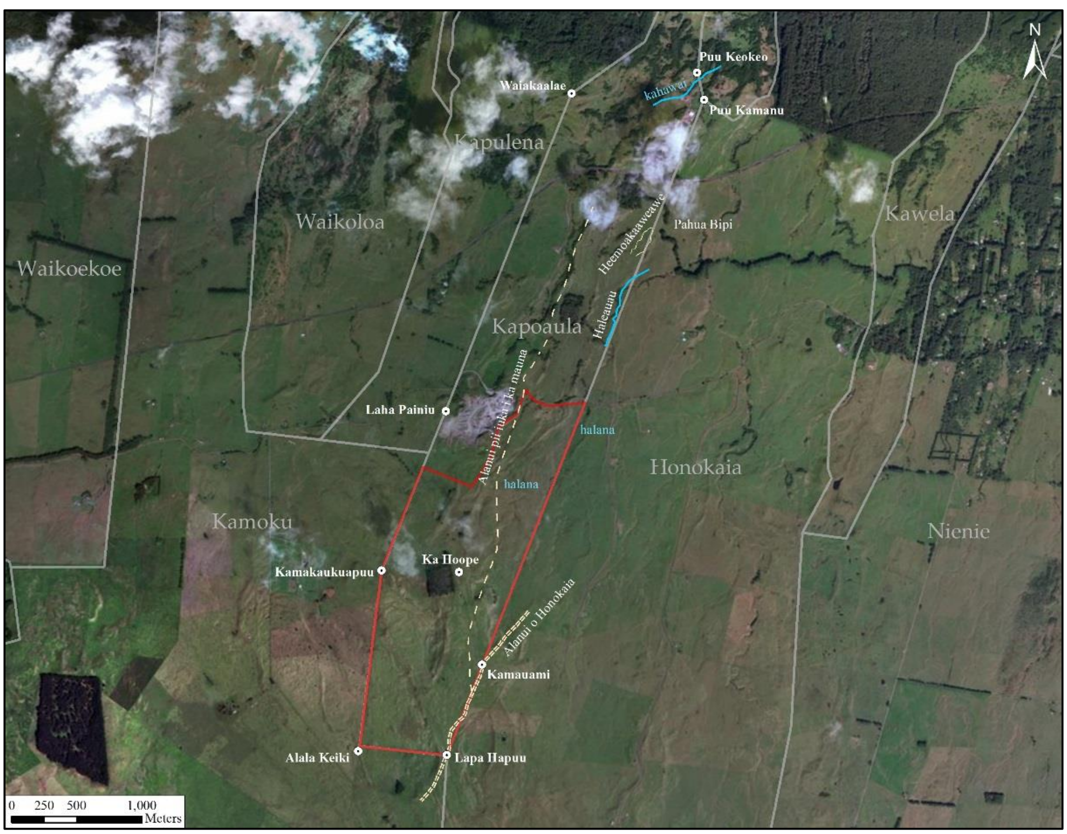


Figure 17. Locations of place names in study area compiled from historic maps.

The Historic Vernacular Landscape of Kapoaula and Hāmākua During the Mid to Late Nineteenth Century

The decades that followed the *Māhele* of 1848 are characterized by a growing detraction to traditional subsistence activities, the result of the arrival of foreigners in Hawai‘i, the introduction of a western economy, and the rise of the cattle industry. Life in Hāmākua began to change drastically, and as a result the population of the district also declined rapidly as native populations were decimated by disease and a depressed birth rate. Epidemics in 1848 and 1849 killed more than 10,000 people in twelve months throughout the Hawaiian Islands (Tomonari-Tuggle 1988). McEldowney (1983) discusses changes in land use and land ownership before and after the *Māhele* that culminated in the eventual displacement of the Hawaiian community in Kohala, and similar events impacted Hāmākua's residents as well. After 1848, when land became a commodity, Hawaiians were often forced off their house lots (and livelihoods) simply because they lacked the cash with which to make the purchase (of land) or pay the property tax. The creation of private property also culminated in a deviation away from the traditional *mauka*-to-*makai* management of whole *ahupua‘a*, as certain industries infiltrated into large swaths of land, such as livestock ranching into dwindling upper forests of Hāmākua and commercial sugarcane cultivation in more coastal areas.

As a result of this shift, leeward, agriculturally marginal areas were abandoned in favor of more productive and wetter sugarcane lands as were remnant inland agricultural fields as they succumbed to the ravages of free-ranging cattle or were bought up by the burgeoning ranching and sugar industries. According to Tomonari-Tuggle (1988), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements where they began building *kuleana* walls to enclose houses, gardens, and animal pens (Tomonari-Tuggle 1988). Walls were built not only to protect homes and gardens from cattle and other free-ranging animals, but also to mark property boundaries as dictated by the new land tenure system that emphasized private land ownership. These new settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. The wetter windward slopes of North Kohala and the Waimea plain were the focus of the shifting settlement pattern and they eventually became the population centers for the district. Tomonari-Tuggle clarifies some of the reasons for this migration:

> Outmigration and a demographic shift from rural areas to growing urban centers reflected the lure of a larger world and world view on previously isolated community. Foreigners, especially whalers and merchants, settled around good harbors and roadsteads. Ali‘i and their followers gravitated towards these areas, which were the sources of Western material goods, novel status items which would otherwise be unavailable. Associated with the emergence of the market, cash-based economy, commoners followed in search of paying employment. (1988:33)

As a result, Hawaiian culture was well on its way towards Western assimilation as industry in Hawai‘i transitioned from the boom-and-bust sandalwood trade, to a short-lived whaling industry, to the more economically lucrative, but environmentally destructive sugar and cattle industries. The written history of Hāmākua in the late nineteenth to the early twentieth century largely reflects news of modern settlers, religious endeavors, and various commercial pursuits in the region. The diffusion of larger, traditional settlements into several more robust population centers was recorded in 1853 when John Wesley Coulter developed a population map of Hawai‘i Island as a result of an island-wide census (Figure 18). With respect to Hāmākua, Coulter identified settlements along the coastline extending from Hilo to the northwestern fringe of Hāmākua and identified one of the major population settlements as being at Waipi‘o Valley.

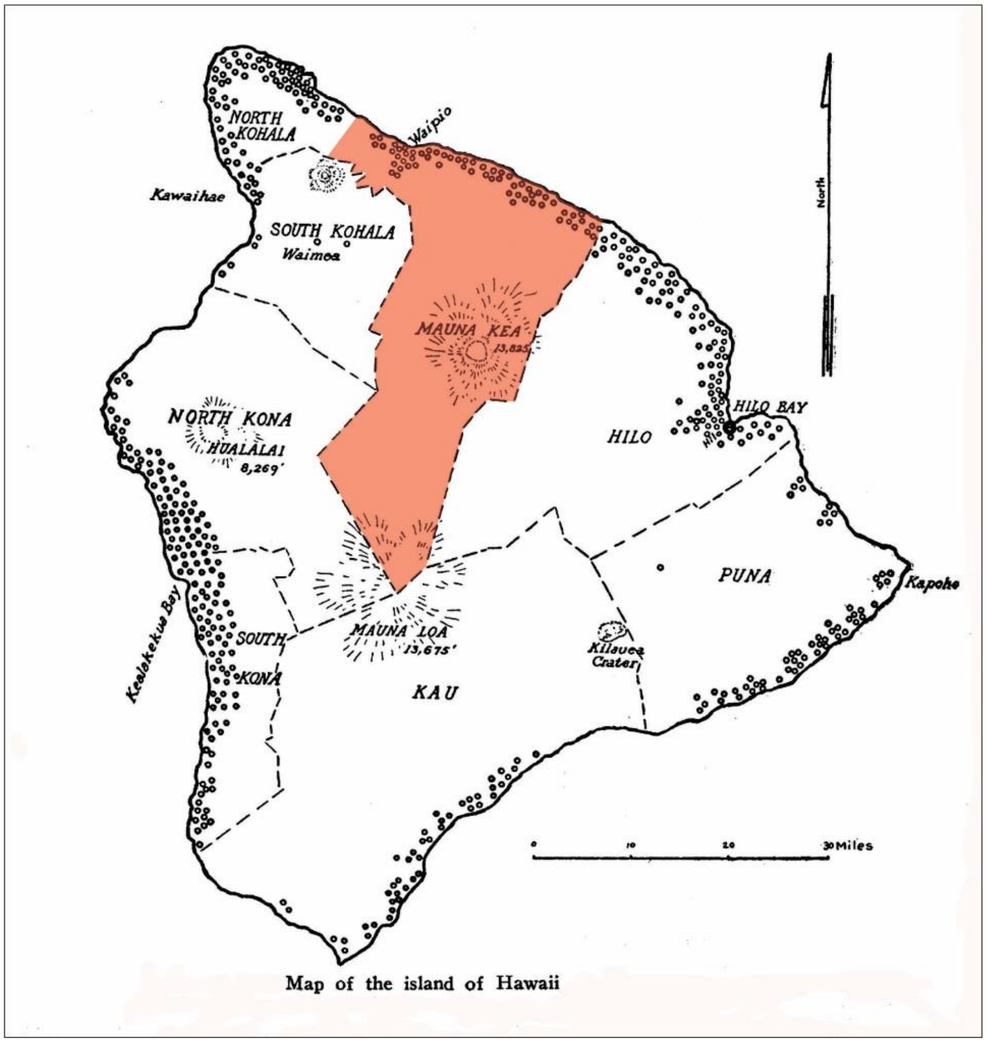


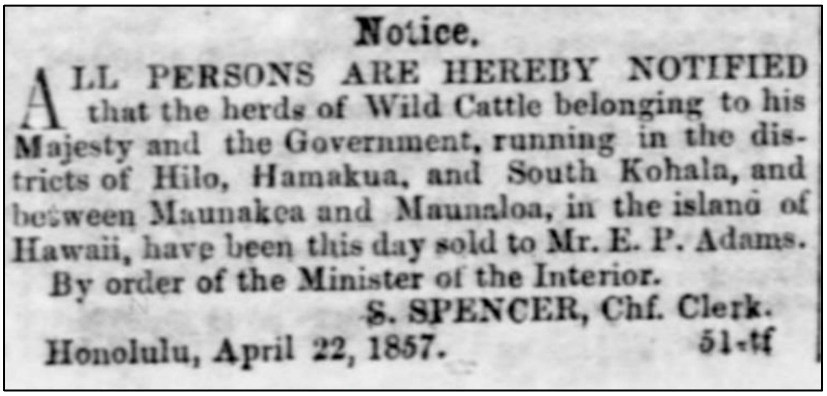
Figure 18. An 1853 "Map of the island of Hawaii" by Coulter showing Hāmākua (shaded red) (after Maly 1999:63).

The Ranching Industry in Kapoaula and Hāmākua

Free-roaming livestock, such as cattle, sheep, and goats were brought to Hawaiʻi in the ships of Western explorers during the late eighteenth century. Upon presenting the first cattle to Kamehameha I in 1789, Captain George Vancouver advised the *Mōʻī* to place a protective ten-year *kapu* on the animals to allow them to multiply and roam freely all throughout Hawaiʻi Island (Vancouver 1984). By the mid-19th century, the unregulated population of livestock became a nuisance to the native farmers and evidence of the impact on the greater environment was cause for concern. During the 1830s, under the administration of Kauikeaouli (Kamehameha III), *vaqueros* (cowboys of Mexican, Indian, and Spanish descent) were brought to Hawaiʻi to train Hawaiians in the handling of both horses and wild cattle. Although Hawaiians quickly adopted the newly introduced animal handling skills, organized ranching operations would not prosper in Hāmākua until the mid-nineteenth century. The cultural introductions made by the *vaqueros* added to the cultural tapestry of the islands that resulted in the creation of Hawaiʻi's *paniolo* (cowboy) culture. The introduction of European livestock had a profound effect on upland Hāmākua and neighboring lands in Kohala.

By the time the *Māhele* began in 1848, John Palmer Parker had struck out on his own, having received two acres of land at Mānā where he built a family house and first ranch buildings (Bergin 2004). He rapidly expanded his landholdings, purchasing 640 acres surrounding Mānā in 1850, and in 1852 he purchased another 1,000 acres. Some of the leased lands would eventually be deeded to the ranch by outright purchase (Bergin 2004). By the mid-1850s, John Parker had turned most of the day to day operations of Parker Ranch over to his son, John Palmer Parker II. The growth of Parker Ranch and its rivals inevitably led to legal clashes over land and cattle throughout the 1860s. Over

12,000 heads of cattle were purportedly roaming the island as early as 1851 (Henke 1929), and the rampant wild cattle population was evident in Hāmākua as early as 1857 (Figure 19).


Notice.

ALL PERSONS ARE HEREBY NOTIFIED that the herds of Wild Cattle belonging to his Majesty and the Government, running in the districts of Hilo, Hamakua, and South Kohala, and between Maunakea and Maunaloa, in the island of Hawaii, have been this day sold to Mr. E. P. Adams.

By order of the Minister of the Interior.

S. SPENCER, Chf. Clerk.

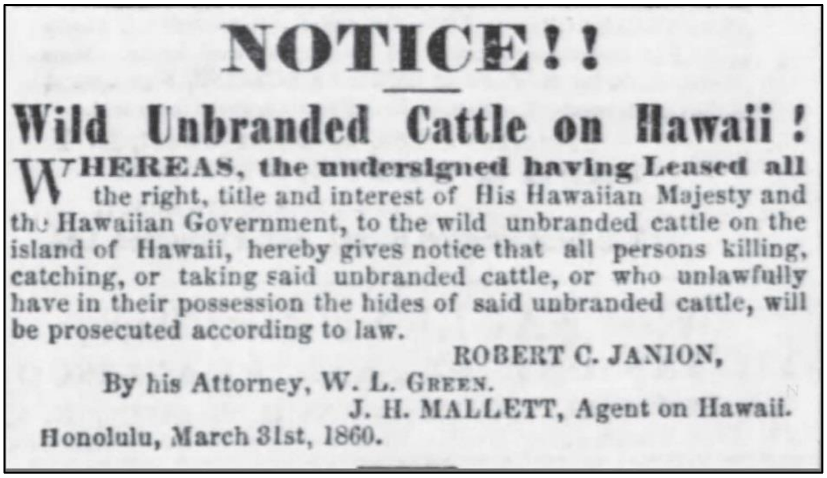
Honolulu, April 22, 1857. 51-tf

Figure 19. Newspaper clipping from April 22, 1857 (The Polynesian 1857).

Two years later in 1859, following the sale of wild cattle to E.P. Adams (see Figure 19), Parker addressed Kamehameha III regarding legitimate ownership of the herds roaming the Hāmākua countryside. Parker's primary concern regarding the cattle was the discernment between truly feral mountain cattle and the herds of original Parker Ranch cattle and their offspring, many of which had escaped branding due to sheer volume and traveled beyond the perimeters of the ranchlands:

> . . . I beg leave to address Your Royal Highness on the subject of the unbranded cattle running in the ohia forest and among the fern on the Hamakua side of this Island on lands adjoining the leasehold lands held by myself and other private individuals all chiefly interested in the grazing business.
>
> The cattle running in the district I speak of are, and have always been considered as totally distinct from the so called Mountain Cattle, inasmuch as they are all the breeding of private heads, and generally speaking a totally different breed. no cattle of any kind were ever seen or heard of in this Hamakua forest until the late Mr. French commenced purchasing and creating a herd and station on this very ground, in which business he was shortly followed by myself and afterwards by Harry Purdy, and on a smaller scale by a few other private individuals, and in the course of time this part of the island became the extensive and valuable private cattle land, the chief and by far the largest proportion of the herds being owned by the late Mr. French, myself and H. Purdy, whilst the Government owned no cattle whatever in this district. From the natives of the country to the Windward of our private lands (a dense forest and almost impenetrable undergrowth covering nearly the whole of it) as the herds increased, it became a impossibility to prevent cattle from time to time getting beyond the reach of our control, and gradually they have filled this land with their offspring, which, tho frequently driven partly out, and collected as occasions and the opportunity served, on their play grounds in the forest, have not been generally branded, tho their private origin and ownership is notorious and cannot be disputed, but at the present moment, a difficulty of an unpleasant nature seems likely to occur, resulting directly from the contract lately made between the Government and Mr. Adams and since, transferred to another party, for the unbranded cattle running in certain districts specified as belonging to the Government.
>
> A diversity of opinion exists as to the present ownership of the unbranded cattle in this bush and altho [sic] I, as perhaps the most interested party in the matter, have never for a moment opposed the Government, would consider it has any claim, yet I would desire now that a question has arisen on the subject, to have the matter settled beyond dispute and with that view, I would respectfully request that your Royal Highness will consider the question and apprise the parties interested of your decision. I may be allowed to report in conclusion that if these unbranded cattles shall be placed at the disposal of any party who may scour the forest with guns, spears and dogs, such a course will apparently result in the injury, and with a high destruction of the tame herds which are now one of the mainstays of this island. (Maly and Maly 2006:88–89)

An early rival of Parker Ranch, the Waimea Grazing and Agricultural Company (WGAC), was founded by Robert C. Janion and William H. Green in 1861 and joined by F. Spencer and Company soon thereafter. The WGAC acquired considerable strategic assets around Waimea in an attempt to monopolize the livestock industry in the region (Bergin 2004). From the outset, Spencer, Janion, and Green maintained an adversarial relationship with Parker Ranch. Land disputes and allegations cattle rustling were common occurrences between these two competing entities. During the early 1860s, Parker successfully thwarted Janion's men from harvesting unbranded cattle on his lands. However, in March of that year, Janion successfully acquired the lease to all wild cattle on Hawai'i Island from the King and the Government, and publicly threatened prosecution to potential offenders (Figure 20).



NOTICE!!

Wild Unbranded Cattle on Hawaii!

WHEREAS, the undersigned having Leased all the right, title and interest of His Hawaiian Majesty and the Hawaiian Government, to the wild unbranded cattle on the island of Hawaii, hereby gives notice that all persons killing, catching, or taking said unbranded cattle, or who unlawfully have in their possession the hides of said unbranded cattle, will be prosecuted according to law.

ROBERT C. JANION,

By his Attorney, W. L. GREEN.

J. H. MALLETT, Agent on Hawaii.

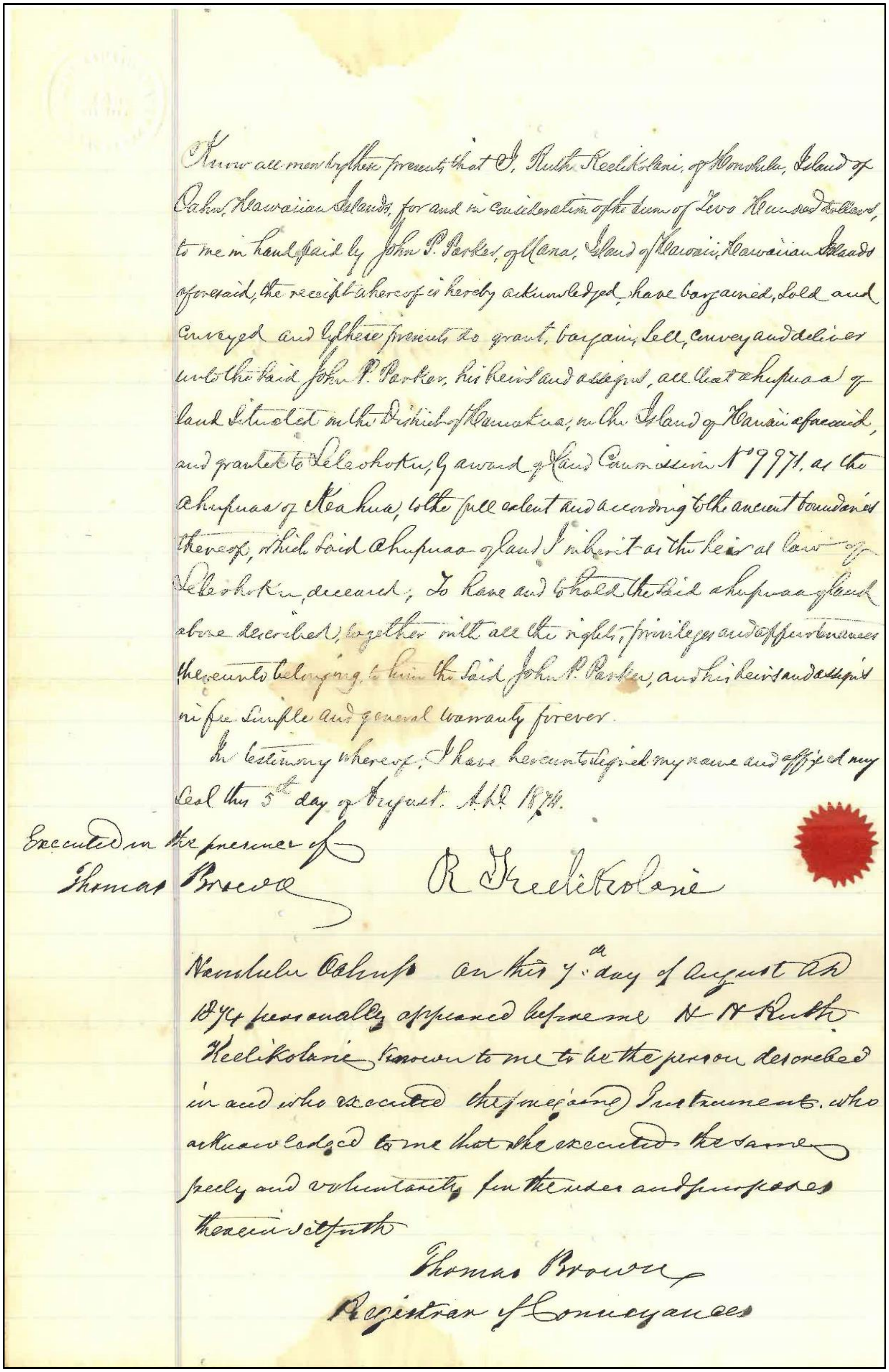
Honolulu, March 31st, 1860.

Figure 20. Newspaper clipping from June 23, 1860 (The Polynesian 1860).

Meanwhile, Frank Spencer contested Parker's claim to more than 17,800 acres in other parts of the island. These disputes were still ongoing when John Palmer Parker, the founder of Parker Ranch, died on August 20, 1868 (Bergin 2004). At this time Parker Ranch controlled about 47,000 acres of land in the region, and the ranch lands were divided evenly between John Parker II and his adopted son and nephew, Sam Parker Sr. By the mid-1880s Sam Parker's poor business dealings had led to a rapidly degenerating financial situation for Parker Ranch, and in 1887 the entire ranching operation was entrusted to Charles R. Bishop and Co. for a fee of $200,000 (Bergin 2004). With the move to trusteeship, new managers were brought in to oversee the day to day operations at the ranch,

Over the course of the next decade, Parker Ranch would outbid the WGAC on important grazing leases and continue the purchase of additional lands, dooming its early rival to bankruptcy (Maly and Maly 2005; Wellmon 1969). Among the lands purchased were several *ahupua'a* in Hāmākua and Kohala belonging to Ruth Ke'elikōlani. Parker Ranch purchased Kapoaula from Ke'elikōlani on August 5, 1874, for a sum of two hundred dollars (Figures 21 and 22; Bureau of Conveyances Liber 39:496). A list of lands bought from Ke'elikōlani appears in an advertisement (Figure 23) taken out by Samuel Parker in 1882 in an attempt to collect outstanding rents.

By the end of the nineteenth century, "most of the upper koa forests of Hāmākua had been converted into cattle ranches" (Henke in Cuddihy and Stone 1990:46). By the early 1900s, Parker Ranch was under the direction of Alfred W. Carter, chosen as the guardian and trustee for Thelma Parker, John Parker III's daughter, upon his death at the age of nineteen. Early on in his tenure as ranch manager, Carter concentrated on acquiring and converting more of the ranch's lands from lease to fee. Much of these grazed lands were divided into paddocks, and transportation and water conveyance infrastructure projects were undertaken to increase the productivity of the rangelands. In 1906, on behalf of Thelma Parker, Carter bought out Sam Parker's half-interest in Parker Ranch for a sum of $600,000. Other important purchases made by Carter during the first dozen or so years of his trusteeship included Humu'ula, Ka'ohe, Waipunalei, and Kahuku Ranch (Bergin 2004). The expansion of Parker Ranch's land- and lease holdings throughout the late nineteenth and early twentieth centuries allowed the ranch to raise cattle and sheep in paddocks around the island. Once ready for the market, these animals would be brought to Waimea for sorting before being driven down to Kawaihae to be shipped.



Know all men by these presents that I, Ruth Keelikolani, of Honolulu, Island of Oahu, Hawaiian Islands, for and in consideration of the sum of Two Hundred Dollars, to me in hand paid by John P. Parker, of Mana, Island of Hawaii, Hawaiian Islands aforesaid, the receipt whereof is hereby acknowledged, have bargained, sold and conveyed and by these presents do grant, bargain, sell, convey and deliver unto the said John P. Parker, his heirs and assigns, all that ahupuaa of land situated in the District of Hamakua, in the Island of Hawaii aforesaid, and granted to Leleohoku, by award of Land Commission No 7971, as the ahupuaa of Keahua, to the full extent and according to the ancient boundaries thereof, which said ahupuaa of land I inherit as the heir at law of Leleohoku, deceased; To have and to hold the said ahupuaa of land above described, together with all the rights, privileges and appurtenances thereunto belonging, to him the said John P. Parker, and his heirs and assigns in fee simple and general warranty forever.

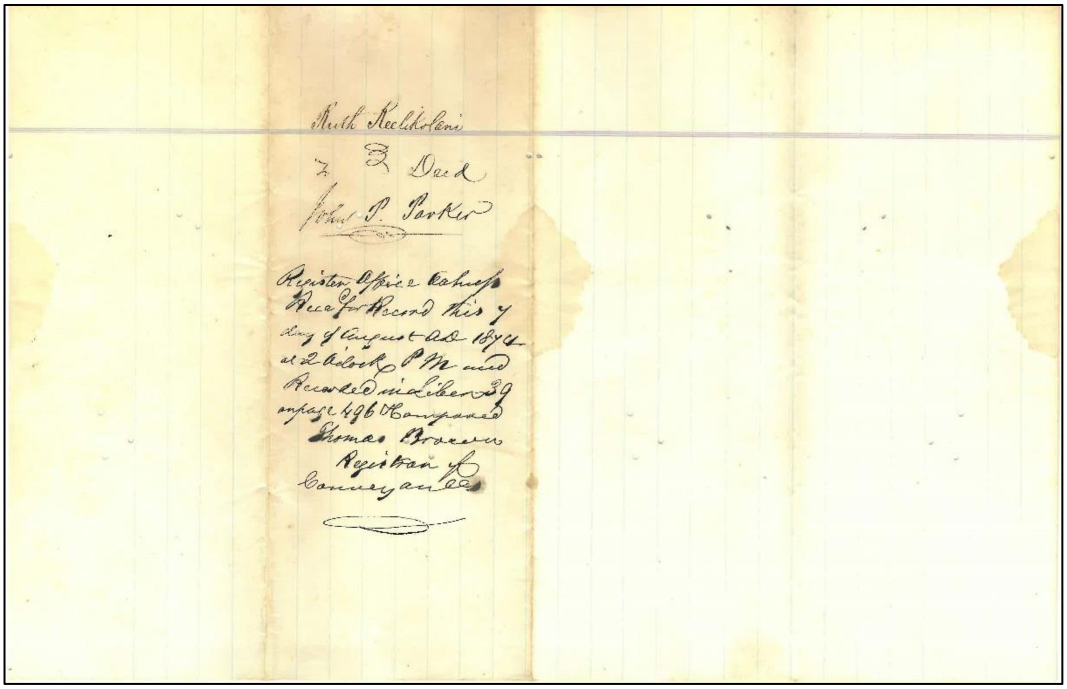
In testimony whereof, I have hereunto signed my name and affixed my seal this 5th day of August. A.D. 1874.

Executed in the presence of
Thomas Brown R Keelikolani

Honolulu Oahu on this 7th day of August AD 1874 personally appeared before me H H Ruth Keelikolani known to me to be the person described in and who executed the foregoing Instrument, who acknowledged to me that she executed the same freely and voluntarily for the uses and purposes therein set forth

Thomas Brown
Registrar of Conveyances

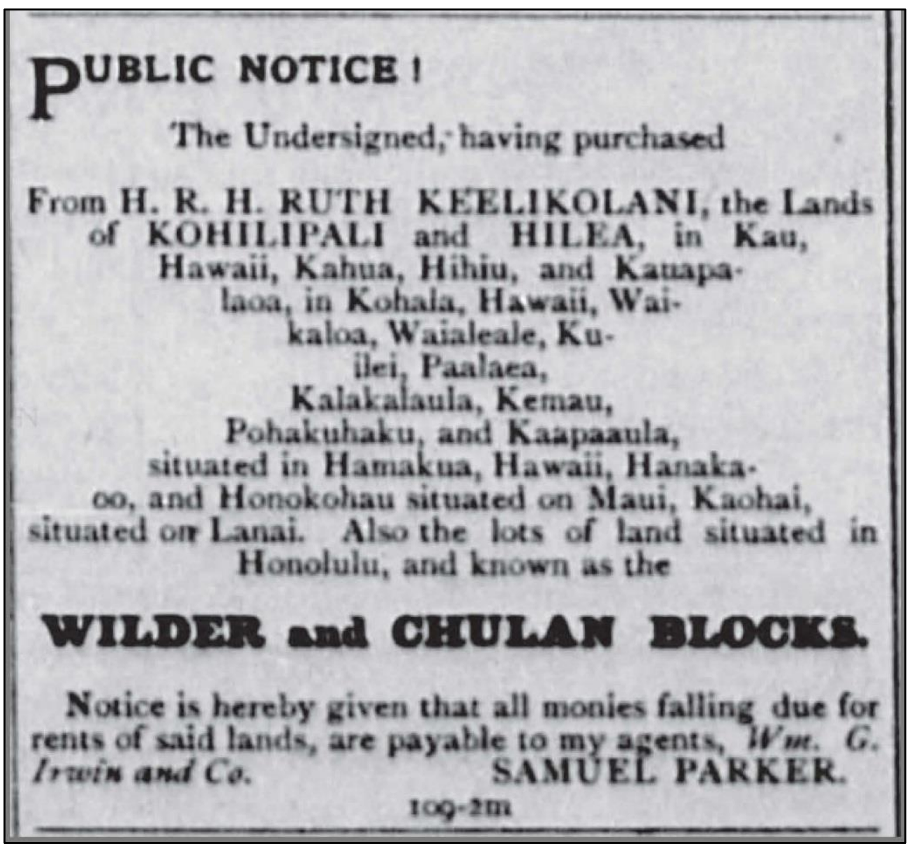
Figure 21. Original deed for purchase of Kapoaula by John Palmer Parker from Ke‘elikōlani on August 5, 1874 (image courtesy of Parker Ranch).



Ruth Keelikolani
to
Deed
John P. Parker

Register Office Oahu
Rec'd for Record this 7
day of August AD 1874
at 2 o'clock P.M. and
Recorded in Liber 39
on page 496 & compared
Thomas Brown
Registrar of
Conveyances

Figure 22. Original deed for purchase of Kapoaula by John Palmer Parker from Ke‘elikōlani on August 5, 1874 (image courtesy of Parker Ranch).



PUBLIC NOTICE!

The Undersigned, having purchased

From H. R. H. RUTH KEELIKOLANI, the Lands of KOHILIPALI and HILEA, in Kau, Hawaii, Kahua, Hihiu, and Kauapalaoa, in Kohala, Hawaii, Waikaloa, Waialeale, Kuilei, Paalaea, Kalakalaula, Kemau, Pohakuhaku, and Kaapaaula, situated in Hamakua, Hawaii, Hanakaoo, and Honokohau situated on Maui, Kaohai, situated on Lanai. Also the lots of land situated in Honolulu, and known as the

WILDER and CHULAN BLOCKS.

Notice is hereby given that all monies falling due for rents of said lands, are payable to my agents, *Wm. G. Irwin and Co.*

SAMUEL PARKER.

109-2m

Figure 23. Public notice published by Samuel Parker regarding purchase of Kapoaula (listed as Kaapaaula) on October 28, 1882 (Daily Honolulu Press 1882).

An Overview of Early Agricultural Pursuits in Hāmākua

Although the livestock industry was proving wildly successful, rampant herds of feral and domestic cattle were beginning to take their toll on Hawai'i's fragile ecosystem, and the once thickly-carpeted upland sectors of Hāmākua, full of native *'ōhi'a*, *'iliahi* (sandalwood), and *koa* interspersed with undergrowth of *hāpu'u* became the focus of commercial exploitation. As early as 1822, the economic promise of Hāmākua emerged and the harvesting of *koa* became a burgeoning enterprise that flourished into a profitable but short-lived industry. While older forest timber was being harvested for fuel, building infrastructure, furniture, and decorative wares, herds of untamed browsing cattle herds hampered new vegetative growth resulting in the near decimation of native forests throughout the islands, particularly in Hāmākua. In the 1830s, "John Parker's ranching neighbors in Mānā were also engaged in logging koa on the Mauna Kea slopes, hauling it to the coast, and shipping the roughly sawed lumber to Honolulu along with cattle" (Wellmon in Cuddihy and Stone 1990:46). Historically, the popularity of *koa* as a building medium eclipsed *'ōhi'a* as Thrum (1883:34) related:

> . . . To the old native artisan, as well as his European successor, this has been perhaps the most valuable of Hawaiian trees, since out of it were built the canoes from the royal fleet down to the smallest fishing craft. Doubtless one of the principal reasons why *koa* was chosen was that it was comparatively easy to work, especially before it was seasoned. It is also much less liable to split and warp than *ohia*, the one other common tree that attained a large size. In early times *koa* sawing was a regular and flourishing business, largely because of the difficulty of obtaining any other kind of lumber, and many of the older houses and churches—with what seems to us now almost reckless extravagance—were built of the finest furniture *koa*. It was not extravagance, however, but economy that prompted its use for such ordinary purposes. The upland region of Hamakua, Hawaii, was the center of the lumbering, which was entirely hand sawing, and from there the lumber was mostly hauled to Waimea and thence to Kawaihae, giving to those places a degree of life and activity which they seem never likely to see again. (Thrum 1883:34)

Simultaneously, the native plant species *hāpu'u* became recognized as products of commerce, and Hāmākua became renowned for its ephemeral involvement in the *pulu* trade, an industry centered on the endemic *hāpu'u pulu* (*Cibotium glaucum*), a tree fern commonly found in the wet forested areas of Hawai'i. Harvesters, many of whom were of native descent went after the *pulu* or the soft, golden colored fibers found at the top of the fern trunk although *pulu* was used traditionally to embalm corpses, the *pulu* harvested for this industry was exported to North America and used to stuff mattresses and pillows (Kepler 1998). The fibers were collected by cutting off the fern fronds and scraping the fibers off the stipe and sometimes the large tree ferns were cut down entirely or pushed over to get to the fibers. Once harvested, the *pulu* was transported to factories for pressing and processing.

The widespread trade in *pulu* began in Hawai'i around 1851. By 1859, 300,000 pounds of *pulu* were being exported from the islands annually, and at its peak in 1862, *pulu* exports reached 649,000 pounds (Cuddihy and Stone 1990). Within Hāmākua, *pulu* was gathered by natives in the uplands where it thrived at elevations ranging between 1,000 and 4,000 feet (Evening Bulletin 1885). An article published in a 1931 edition of the *Honolulu Star-Bulletin* explains:

> Before sugar was exported from the islands in large quantities other products of the soil brought good returns to enterprising men. One year 5000 barrels of potatoes were shipped from Kawaihae alone. At one time, especially during the war between the states, cotton was exported in quite large lots. In the 1850s, an important article of shipment was pulu, which is the soft downy substance found on tree ferns growing on the mountains. Only a few ounces were obtained from each plant where the stem of the leaf shoots out from the stock of the fern. It was the growth of about four years and was picked when it was wet and brought down to the lowlands to be dried. It was gathered by native, men, women and children, who camped in huts for weeks at a time in the highlands in the Hamakua, Hilo, Puna and Kau districts.
>
> The principal dealers in pulu were Messrs. Abel, Harris and Co. who had depots for pressing and baling it at Hamakua, Hilo and Puna. The bulk went to San Francisco where the average price was 14 cents, though it sometimes brought 25 cents. It was used for mattresses, pillows and upholstery. Occasionally some was shipped to Australia, Vancouver and Oregon. in 1851, when the export began, the amount was 2497 pounds, next year it was 27,000 and in 1859, 300,000 pounds were shipped. (Honolulu Star-Bulletin 1931)

The *koa* logging industry sustained throughout the lifetime of the *pulu* industry, and in the 1860s entrepreneurs continued to contemplate the region's further potential for industrial pursuits. As a result, Hāmākua's potential for agricultural industry expansion continued to develop, further propelled by the introduction of non-native botanical cultivars including black mulberry, coffee, cotton, corn, oats, pineapple, cigar tobacco, and wheat. By 1862, sugar, cotton, and coffee (the quality of which was nearly tantamount to that of the Kona variety) were thriving:

> . . . Ask any one in Honolulu who pretends to know anything about Hawaii, where Hamakua is, and you will be told it is a place way round back of the island somewhere. and yet that district is the largest on the island—considerably larg[e]r than the whole of Oahu. In fact, *one-fourth* of what may be called the good land on Hawaii lies in the district of Hamakua; land, too, adapted to the great staples sugar, coffee and cotton. That tract lying between its Hilo boundary and Waipio, some twenty-five miles long, and extending up say seven miles, to an altitude of 3,500 feet, will be found but little inferior to the sugar lands of Hilo. Above that will be found valuable koa and pulu forests, and above that again, towards the mountains, are the so-called "plains"—no better sheep pastures in the world for raising fine wool[.] On the sides of the gulches towards the seashore, coffee is raised but little inferior to that of Kona. Cotton also grows well towards the seashore. . . (The Polynesian 1862)

Over the course of the next decade, *koa* logging continued in Hāmākua, and free-range cattle continued to roam the mountainous plains. Meanwhile, the detrimental impacts to the native upland *ʻōhiʻa* and *koa* forests continued to progress, and the disparity between destruction resulting from logging versus the effects of animal disturbance had become apparent, as evidenced in an 1873 article published in *The Hawaiian Gazette*:

> "About the destruction of our forests I want to say a word. Though I deplore as much as any one the cutting down of forest trees for fuel, still this alone does not tend materially to destroy our forests. For every acre of timber land that is destroyed by the woodman's axe, a *thousand* acres are destroyed by cattle. By judiciously selecting old trees for fire wood, our forests will not be injured, *provided* the cattle can be kept off. It is astonishing to see how quick young trees—koa and ohia—will spring up and grow where wood has been previously cut and the cattle kept off. The koa is a tree of very rapid growth. It is propagated from the seed, millions of which are scattered through our forests every year. As soon, however, as the young plants show themselves the cattle crop them off. The forests on East Maui, for instance, are being *ruined* by cattle. Some who own cattle turn them loose into the forests, and the havoc they make among the young trees is truly deplorable. A few years since, these forests, owing to the dense undergrowth, were almost impenetrable; now the cattle range through them for miles. It is of no use for private individuals to try and stop the evil. Action on this matter must be taken at the coming Legislature; if not, the Islands are ruined. On Hawaii the effects of the cattle on the forests are much more deplorable. Through Hamakua and Waimea thousands of acres of woodland are being destroyed annually. I have seen the results with my own eyes and know of what I affirm" (The Hawaiian Gazette 1873)

The enduring devastating effects of free-range cattle in Hāmākua were also noted by early historic visitors to the district, and in 1873, Isabella Bird visited Hāmākua and published her vivid firsthand account in *The Hawaiian Archipelago: Six Months Among the Palm Groves, Coral Reefs, & Volcanoes of the Sandwich Islands* (Bird 1886). In the following excerpt, Bird (1886:154–155) provides the following brief meticulously detailed depiction of Hāmākua's lush, verdant forests and contemplates the long-term devastation of livestock on the uplands:

> . . . We rode over level, grass-covered ground, till we reached the Hamakua bush, fringed with dead trees, and full of ohias and immense fern trees, some of them with a double tier of fronds, far larger and finer than any that I saw in New Zealand. There are herds of wild goats, cattle, and pigs on the island and they roam throughout this region, trampling, grubbing, and rending, grinding the bark of the old trees and eating up the young ones. This ravaging is threatening at no distant date to destroy the beauty and alter the climate of the mountainous region of Hawaii. The cattle are a hideous breed-all bones, hide, and horns.

Hāmākua's forests were threatened not only by livestock trampling of forested areas and incessant timber overharvesting, but also by wild fires that intermittently swept through the district. One such fire originated from six isolated locations in 1901 and swept through roughly 50,000 acres of Hāmākua forest land (Horner 1904). As detailed in an article published in an April 8, 1902 edition of *The Hawaiian Star*:

> During the summer of 1901, a considerable portion of the forest lying between Mauna Kea and the coast on the north was burned over very severely. There is very little question but that most of the trees in this section are so badly burned that they will die and blow down, thus furnishing fuel for succeeding forest fires. The undergrowth had been destroyed by cattle so that the fire had swept; in

fact, if this had been a virgin forest with a rank undergrowth it would probably have been impossible to set it on fire. The forest had been so opened up by cattle that it died out thoroughly as is proved by the almost complete destruction of the humus so that the bare soil is now exposed. This latter result would be extremely favorable to the natural restocking of this burned area by self sown seed but, very unfortunately, cattle are grazing in the forest and will destroy any young growth that may come up.

Within the present generation, forest fires have been almost unknown in the Hawaiian Islands but the indiscriminate pasturing of cattle in the forests makes their destruction by fire not only possible but extremely probably either through malice or carelessness in burning brush, cane trash or by camping parties.

A large part of the burned forest is on government land which has been leased until 1906, but it is extremely important that the government should induce the lessee, by an extention [sic] of time on his cane land lease or in some other way, to absolutely exclude cattle from this forest and protect it by fencing.

The forests in the remainder of the northern portion of the district of Hamakua are being rapidly destroyed by cattle, both wild and tame, so that the whole section within a few years will be a continuation of the Waimea plains unless adequate means are taken to protect the forests from cattle.

. . . On the whole the forests of Hamakua are in very poor condition and in some sections fast disappearing soley on account of cattle grazing and the consequent forest fire. (The Hawaiian Star 1902)

Ultimately, the continued degradation of the native forests were a catalyst for change in Hāmākua and throughout Hawai‘i. Since the early 1800s, the detrimental effects of free-range cattle, deforestation, and wildfire damage were prevalent and subsequent efforts were made to restore the upland forests to a natural, healthy habitat. One of these efforts focused primarily on preserving Hāmākua’s valuable stream-fed watersheds in order to facilitate and sustain agricultural pursuits, and it was proposed that lands encompassing the area between Laupāhoehoe in North Hilo and ‘Āwini in North Kohala be set aside and included in the proposed Hāmākua Forest Reserve. On December 23, 1904, the section of the Hāmākua Forest Reserve comprising the northern portion of Hāmākua inclusive of the *makai* section of Kapoaula was permanently established (Figure 24).

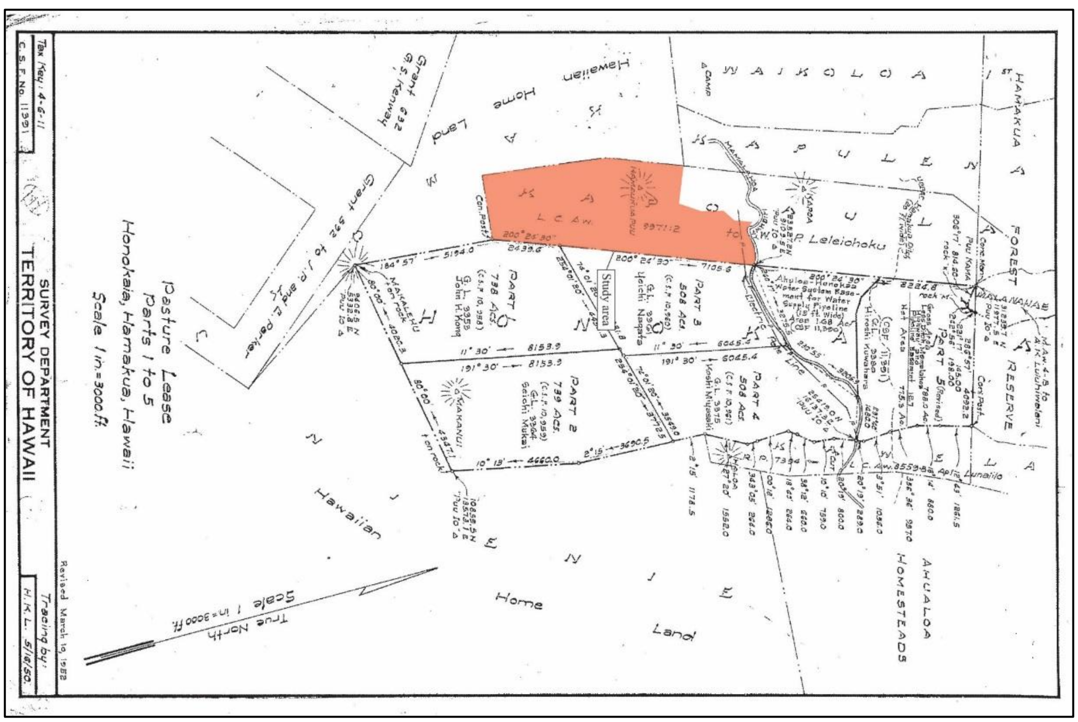


Figure 24. Copy of Survey Furnished (C.S.F.) Map No. 11391 showing current study area in relation to *mauka* boundary of the Hāmākua Forest Reserve.

A Concise History of the Honokaʻa Sugar Plantation

Following the signing of a reciprocity treaty between the Kingdom of Hawaiʻi and the United States of America just three years later in 1876, sugarcane plantations developed and spread rapidly throughout the islands (Fong et al. 2005). Hāmākua's rich soil and plentiful water supply made it the premier location for growing sugar on the island of Hawaiʻi (Hazlett et al. 2007). The dawn of a new industry was born that year in Hāmākua, and nearly 200 acres of cane was being cultivated by the Honokaʻa Sugar Plantation, the forerunner to what would eventually become the Honokaʻa Sugar Company in 1878:

> HAMAKUA, HAWAII,—A correspondent, traveling on Hawaii, thus writes about this district: "For agricultural pursuits and new enterprises, Hamakua offers the most promising inducements. It possesses any quantity of fertile land. Coffee, cotton, corn, wheat, oats, are produced to perfection, and at Honokaa Plantation I saw some of the prettiest cane-fields to be found anywhere. The right principle is being pursued here—one party plants and another manufactures on equal shares. There is now about 170 acres of cane growing which will be ready for the mill at the end of the present year. There is room for a dozen plantations in this beautiful district." (The Pacific Commercial Advertiser 1876)

Between 1876 and 1888, twenty sugar plantations sprang up along the Hāmākua coastline (Dorrance and Morgan 2000). The fields were originally unirrigated and for twenty-five years ratoon crops were grown in many areas because reaching the fields to replant was difficult. Eventually harvesting was accomplished using a combination of hand labor, flumes, and railroad (Dorrance and Morgan 2000). An 1877 account published in *The Pacific Commercial Advertiser* elucidates upon the newly blossoming sugar industry, and illustrates the district's exceptional agricultural potential for not only the continued exploitation of the flourishing cane fields, but also for its capacity to support a large populace:

> The District of Hamakua may become a most productive district. In commenting on lands we have spoken of them as sugar lands, as that will doubtless be the staple product; but there is almost no land that is not cultivatable, and everywhere the fruits of the tropics and many of the temperate zone can be raised. . . The fact that most all the finest lands back of the district are held by graziers, whose immense herds are already making inroads upon them, is full of danger to the prosperity of Hamakua, which should at any cost be saved from the fate of Waimea. The law under which the Commision acts, provides that cultivated lands should be taxed for improvements, but in a district like this it would be manifestly unjust that the small amount of cultivated land should pay taxes while the great bulk of the lands more valuable should escape because their proprietors fail to develop them; and your Commissioners would suggest that lands capable of cultivation should bear their taxation according to their value, as otherwise an unfair discrimination is made against industry and enterprise. Here, as elsewhere, the great requisite is population,—people to develop the resources of the district which ought to sustain a population of 10,000 in easy circumstances. Where mills are established on the factory principle of grinding for cultivators of small tracts, every encouragement should be given and aid extended in the way of the improvements suggested. As to the amount of land capable of cultivation, there are doubtless many thousands of acres, but in the absence of accurate surveys no estimate can be made. There is doubtless sufficient cane land to raise sugar cane enough for ten to fifteen mills.
>
> . . . As in the case of Hamakua District, good lands are spoken of as cane lands or coffee lands; but these lands are adapated to the cultivation, in many places, of oranges, limes and other fruits. Forests of Sumach are growing wild, and as this has been said to be the Sumach of commerce. . . The Districts of Hilo and Hamakua should support a population of 30,000 to 40,000, and the Commission are of opinion that the expense of introducing immigrants and inducing the settlement of these districts by the improvements suggested, will be fulling returned to the Government in the increasing revenues of the districts. (The Pacific Commercial Advertiser 1877)

By 1883 the Honokaʻa Sugar Company was prospering, having produced roughly 1,200 tons of sugar:

> From Mana to Honokaa, twelve miles, one rides two-thirds of the distance through a dead forest with an occasional glimpse of verdure in the form of living ferns; this changes suddenly to the very reverse, the native trees and vines look fresher by contrast, the grass is long and luxuriant, the cattle seem to be the picture of health and some native birds are overhead. I was told that from twelve to fifteen varieties of native woods may be found here, including the sandal wood which is becoming very scarce: most of these woods are specially adapted for making furniture. Honokaa is naturally

> hilly with precipitous cliffs, some two hundred feet high, on the coast line. About 1,500 acres of land are utilized for growing cane which is manufactured at the Honokaa mill, which will produce this year 1,200 tons of sugar. The climate of Hamakua is very healthy, being tempered by the trade winds in the day time and by cool land breezes at night. Coffee and tobacco grow wild, but are not cultivated to any extent. Of fruits may be found the loquat, mango, orange, lime, citron, lemon, banana, breadfruit, tamarind, mountain apple and guava. . . (Buckland 1883)

Although many of the early agricultural pursuits attempted in Hāmākua were surmised to have been potentially "well nurtured by the plantation interests," most fell victim to the dominant sugar industry that reigned over Hāmākua (Hilo Tribune 1905). However, although sugarcane interests held monopoly in the district, the thriving industry was not exempt from adversity. Incessant timber overharvesting and continued livestock trampling of forested areas continued to plague the district, generating a serious predicament for the Honokaʻa Sugar Company:

> Manager Watt of Honokoa [Honokaʻa] plantation, Hamakua, Hawaii, writes to the Bureau of Agriculture concerning the deforestation that is going on in his district. He complains that the wild cattle and the Portuguese homesteaders living there, combined, are completely destroying the trees, and, unless something is done to stop this destruction, forests in Hamakua will be things of the past. The rainfall is getting less and less every year, and the plantation managers and owners are getting scared. (The Hawaiian Star 1893)

The current study area was not part of any sugar plantation, but instead became part of Parker Ranch. However, the seaward portions of Kapoaula (up to 1,400 feet elevation) were included in the lands of the Honokaʻa Sugar Company. Lands cultivated in sugarcane extended from Kahaupu Gulch between the *ahupuaʻa* of Pāʻauhau and Kaao northeast of the study area, all the way to the edge of Waipiʻo Valley. By the end of the nineteenth century, the Hāmākua Ditch Company begun construction of an Upper Hāmākua Ditch to water the sugarcane fields in the area. The ditch, which brought water from Kawainui Stream in the Kohala Mountains to the Honokaʻa Plantation and beyond was completed in August of 1907 (Wilcox 1996). Charles Wickliffe Baldwin published a detailed description of Hāmākua in the *Geography of the Hawaiian* Island in 1908, and describes the Upper Hāmākua Ditch as well as the particulars of watering and transporting cane:

> Hamakua.—Outside of the Waipio region Hamakua has no running streams, or even springs. This is due to the abrupt slope of this part of the island, which allows the water to run off readily, and to the fact that the gulches run up towards the Waimea plateau, thus having no good watershed back of them.
>
> Two ditches have been recently constructed, bringing the Waipio water upon the Hamakua lands. The plantations nearest the gulch use this water for irrigating and fluming their cane, and a portion is used for establishing waterworks for the different villages. Thus great changes have been brought about in this district, for, while rain is abundant as a rule, at times there are severe droughts, when water is very scarce.
>
> Owing to the lack of streams of water and to the abrupt slope, the plantations of Hamakua have had great difficulty in finding means for transporting their cane to the mills. Kukaiau has constructed a complete system of trolley cables. The cane is tied up in bundles and fastened to a trolley which is then placed upon the wire, and so it glides swiftly to the mill. Paauilo has accomplished the difficult task of laying a railroad up through its fields. The other plantations of the district have built railroads out on either side of the mill, sending the cane down to these tracks by gravity roads or flumes. . .
>
> . . . Each mill has its own landing. The sugar is swung out to the boat or vessel by means of a derrick which is operated by a donkey engine. In rough weather these landings cannot be used at all.
>
> Next to Kona Hamakua is the chief coffee district of Hawaii. One of the finest coffee estates of the group is in this distrct, at Kalopa, above Paauhau—the Louisson Plantation. It is said that the trees of this plantation bear so heavily that when the berries are ripe, it appears as if a red blanket were spread over the field.
>
> The largest place in Hamakua is Honokaa. Paauhau, Paauilo, Waipio, and Kukuihaele are important places as well. (Baldwin 1908:69–71)

In 1909, the Hāmākua Ditch Company became the Hawaiian Irrigation Company, and under that name work began on a second ditch, the Lower Hāmākua Ditch, which carried water from Waipiʻo Stream to the Honokaʻa Plantation and beyond. The Lower Hāmākua Ditch was completed in 1910 (Wilcox 1996). A 1909 map shows a network of tunnels, flumes, various ditches, reservoirs, the Old Māmalahoa Highway, and the alignment of the Lower Hāmākua Ditch in the *makai* portion of Kapoaula, and illustrates the relationship between the Honokaʻa Sugar Plantation lands in the *makai* portion of the *ahupuaʻa* and the more *mauka* Parker Ranch lands that comprise the entirety of the current study area (Figure 25).

In 1928, the administration of the Honokaa Sugar Company and the Pacific Sugar Mill was brought under one manager. The partial merger was a success and soon yielded a ten-fold increase in production compared to the original harvest (Dorrance and Morgan 2000; Kalima 1993). A year later in 1929, the Honokaʻa Sugar Company began utilizing the Pacific Sugar Mill's Kukuihaele Landing to direct ship raw sugar to San Francisco, and continued to use it until it was shut down during World War II (Dorrance and Morgan 2000). Following the war, after the 1946 *tsunami* destroyed the railroad rendering it inoperable, shipment resumed from Kukuihaele Landing until 1949 when bulk sugar began to be shipped via trucks for export from the port of Hilo (ibid.). In 1951, Theo Davies bought F.A. Schaefer & Company in order to acquire Honokaʻa Sugar Company. In 1972, Davies purchased Pāʻauhau Sugar Company and merged it with Honokaʻa Sugar Company. And in 1979, the Honokaʻa Sugar Company was merged with Laupāhoehoe Sugar Company to form Davies' Hamakua Sugar Company, which in 1984 was purchased by Francis Morgan who dropped Davies from the name and created Hāmākua Sugar Company. Hāmākua Sugar Company operated from 1984 until 1993, when the fields were harvested for the last time and the 36,000-acre plantation shut down for good.

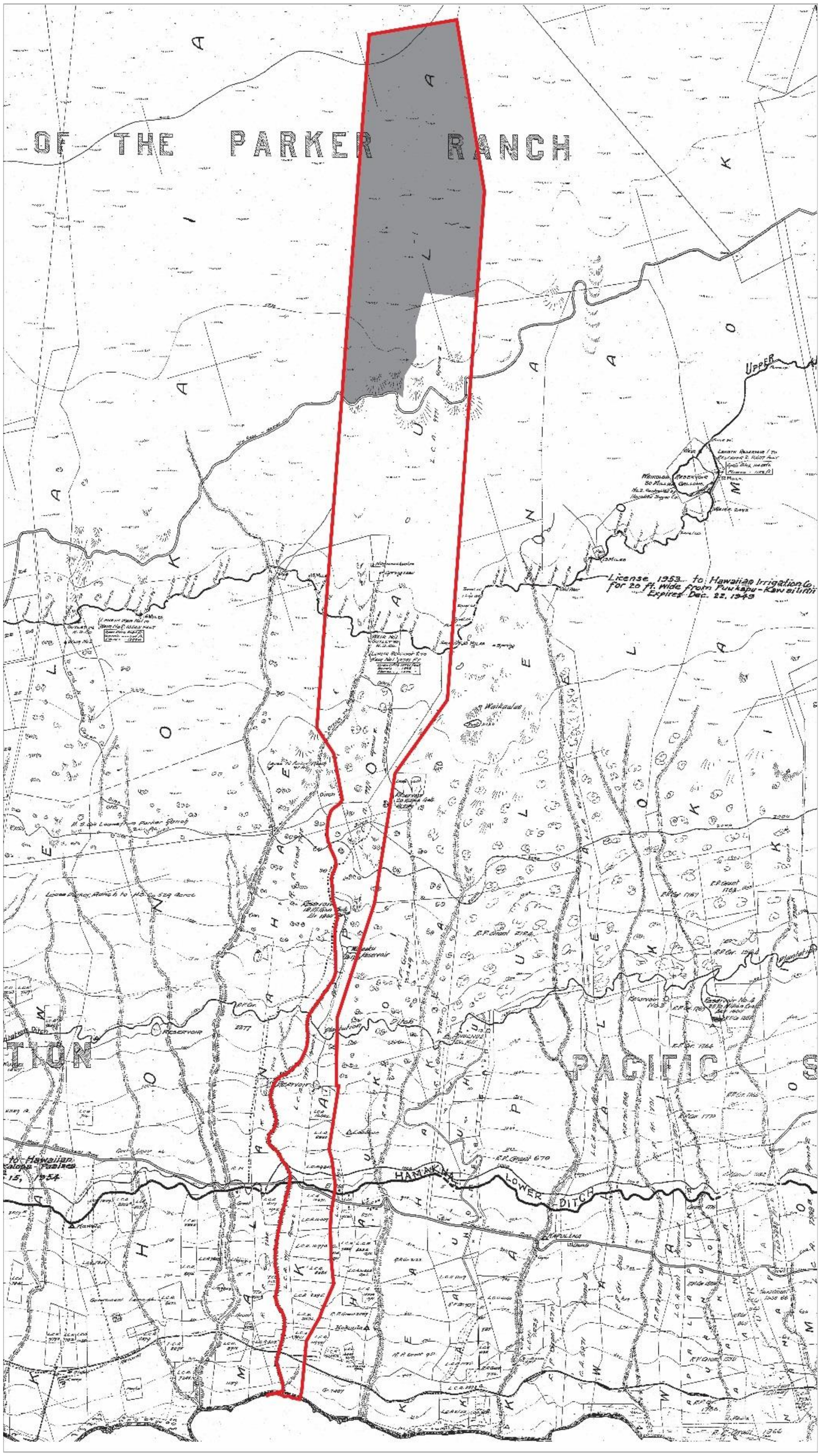


Figure 25. Portion of 1909 Hawai‘i Registered Map No. 2640 by A.J. Williamson showing the study area within the lands of Parker Ranch and the lands of Honoka‘a Sugar Company and Pacific Sugar Mill.

The Development of the Government Road (Alanui Aupuni) in Hāmākua and Land Use in the Study Area During the Early to Late Twentieth Century

The effects of disease and outmigration combined with changes in land tenure and the economy that occurred in Hāmākua during the middle of the nineteenth century ultimately led to a transition in conventional transportation methods. Initially, early *mauka-makai* trail systems served as idealized route of travel that, during the Precontact to early Historic Period, theoretically provided an important network that facilitated supplemental inter-*ahupuaʻa* commodity exchange between coastal communities and upland regions (Mills 2002). Maly (2001)) relates that typically these *alahele* (trails) were referred to as "*ala piʻi uka* or *ala piʻi mauna* (trails which ascend to the uplands or mountain)". Within Kapoaula and the current study area, a single *mauka-makai* trail is present which is referred to on historical maps as *alanui pii uka i ka mauna*. Additionally, a short segment of a *mauka-makai* trail (alanui o Honokaia) belonging to the adjacent *ahupuaʻa* of Honokaia intrudes slightly into the northeastern portion of the study area.

The earliest published depiction of a trail from Hilo to Hāmākua was published in the *Pacific Commercial Advertiser* on February 17, 1859 (Figure 26). The route appears as a solid line extending northwest from Hilo into Hāmākua, and two diverging trail segments that proceed in a southwesterly direction towards Mauna Kea where it adjoins another trail leading from the eastern flank of Mauna Kea to Kawaihae. However, the scale of the map, which was drawn to show the progress of the lava flow from the Mauna Loa eruption, does not allow for any detailed information about the route. While the position of the trail is shown in very general terms, the basic route segment across through the eastern portion of Hāmākua appears to have persisted at least until the turn of the twentieth century, when the Belt Road redirected traffic across Hāmākua.

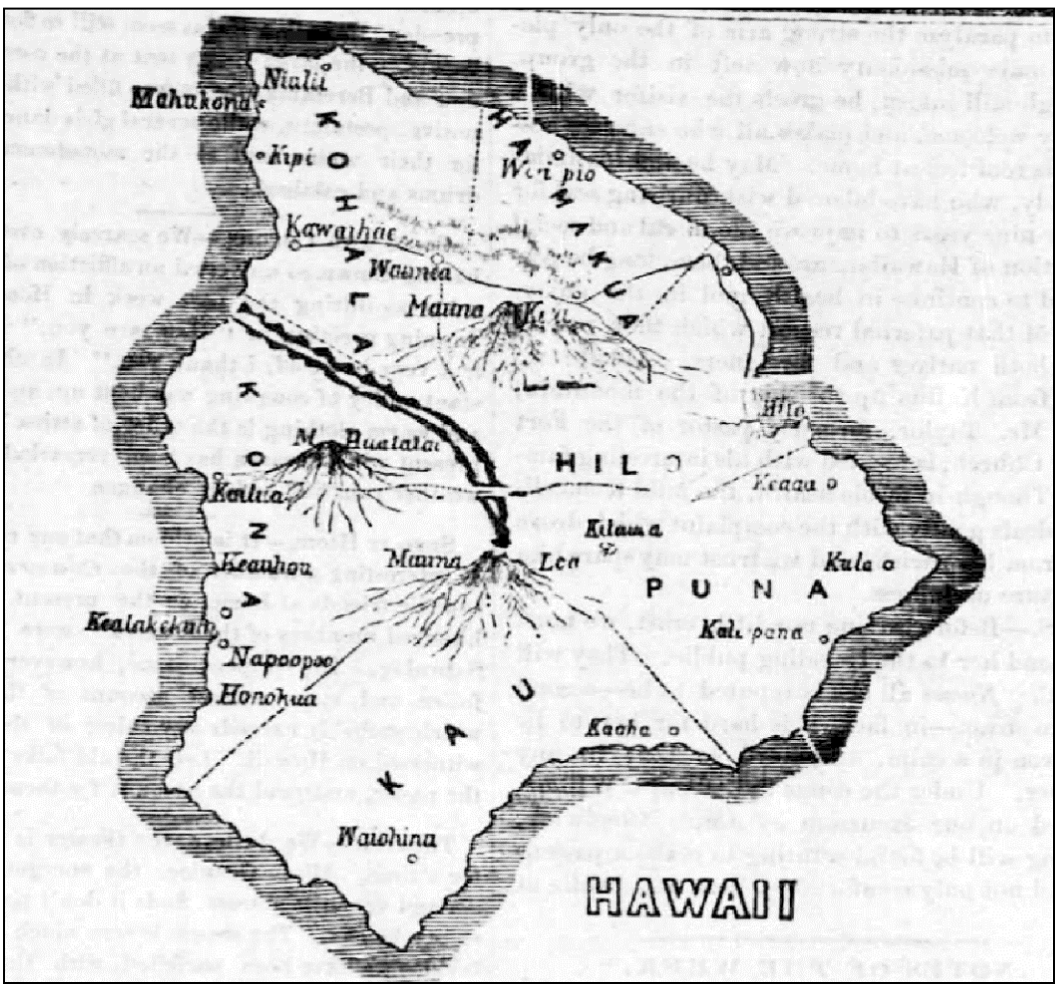


Figure 26. Map of Hawai'i Island published in the *Pacific Commercial* Advertiser on February17, 1859, showing a trail extending from Hilo into Hāmākua (The Pacific Commercial Advertiser 1859).

The introduction of horses to Hawai‘i eased arduous, long-distance travel and facilitated access to “mission stations, landings, and key areas of resource collection” (National Park Service Ala Kahakai National Historic Trail 2009), and as a result, narrower footpaths such as early *mauka*/*makai* trail networks and the *alaloa* largely fell into disuse, being abandoned for straighter, leveler, and wider paths that could accommodate larger groups of people, horses and horse-drawn carts while providing a more direct destination trajectory (Mills 2002); thus, the concept of a western-style Government Road (*Alanui Aupuni*) was born. The importance of having a well-maintained transportation network in the islands was emphasized in the following excerpt from *The Pacific Commercial Advertiser*:

> ***Overview of Road Laws and Development in the Kingdom of Hawai‘i (1840-1857)***
>
> Roads are the most accurate tests of the degree of civilization in every country. Their construction is one of the first indications of the emergence of a people from a savage state, and their improvement keeps pace with the advance of a nation in wealth and science. They are the veins and arteries through which flow the agricultural productions and commercial supplies, which are essential for the prosperity of the state. Agriculture is a great measure dependent upon good roads for its success and rewards.
>
> The history of road making in this kingdom does not date far back. The first law that we find recorded was enacted in 1840, which as well as the laws of 1846 and 1850 gave to the Governors a general control of the roads, with power to make new roads and employ prisoners in their construction. But no system of road making has ever been introduced, and the whole subject has been left to be executed as chance dictated. In 1852, road supervisors were made elective by the people, at the annual election in January. This change worked no improvement in the roads, as the road supervisors, in order to remain popular, required the least possible amount of labor, and in many districts an hour or two of work in the morning was considered as a compliance with the road law. Under this law the road supervisors were pretty much to themselves, and although accountable to the Minister of the Interior, they considered favor of their constituents of more importance. This law was found productive of more evil than good, and during the last session of the legislature a new road law was passed, which goes in to force on the 1st of January 1857. This new law gives to the Minister of the Interior the appointment of road supervisors throughout the Kingdom, who are subject to such general instructions (we suppose in regard to the construction of roads) as he may issue. . . (in Maly 1999:66)

Generally the condition of the late nineteenth century roadways on Hawai‘i Island left much to be desired, particularly in Hāmākua. Historic accounts of the old road leading from Waimea to Hilo through Hāmākua often characterize it as a perilous journey over rugged, meandering terrain along dangerous, flood-prone mountainous contours and chasms. The following excerpt elaborates on the district’s need for a formal road:

> . . . I have thus particularized Hamakua as being not only one of the largest and most valuable districts, but as the one most in need of an outlet. The same drawback to the advancement of the country from the want of good roads is evident throughout the island, although in some districts where the face of the country is more favorable, and the people more thickly settled, and public spirited perhaps, the roads will be found in much better order, yet there is plenty of room for improvement. (The Polynesian 1862)

In prospecting Hāmākua for land suitable for development, a report was made by the Royal Commissioners on Development of Resources. Formed by King David Kalākaua in 1877, commissioners conducted examinations of lands along the Hāmākua/Hilo coastline and consulted with residents in an effort to learn about needs and natural resources. On February 27, 1877, Hāmākua was examined for its agricultural potential, and the following report summarizing the poor road conditions near the current study area was published in *The Pacific Commercial Advertiser*:

> . . . The land of Kapulena is rough and stony on the lower part, though above the road it has several hundred acres of fair land for cane or coffee. . .The land is rolling, not so level as generally represented, and the Government road is an illustration of the folly of appointing incompetent road-makers and supervisors. There are no insuperable obstacles to the construction of a good cart road from Waipio to Paauhau, and it should be built. All the roads in the district show shameful neglect. (Carter et al. 1877)

In the last quarter of the nineteenth century, repairs of the existing Hāmākua-bound wagon roadway, particularly through the gulches, were proposed and it was recommended that a safer government-appropriated road providing access to landings be constructed (The Pacific Commercial Advertiser 1878). The arduous journey along this road from Hilo to Hāmākua was further detailed by Dutton (1883:169):

> Waimea is a starting point from which a journey may easily be made to the eastern coast in the district of Hamakua. This district is certainly one of the most curious in the world, and indeed its features could barely exist elsewhere than in a tropical island situated within the trade-wind belt. The slopes of Mauna Kea, descending at first swiftly—afterwards more gently—toward the sea, are suddenly terminated on the coat by cliffs ranging from 100 or 200 to 700 or 800 feet in height. These coastwise cliffs are exceedingly steep, approaching in many places the vertical, and plunging at once into water of considerable depth. Here the coast receives the full brunt of the long steady swell of the Pacific, rolling for thousands of miles before the powerful trade-wind. The erosive action of the sea-waves is probably as efficient here as in any part of the world, for it is very powerful and unremitting. That the waves have eaten into this coast for several miles does not seem to be in the least degree doubtful.
>
> The slopes leading inland from the crest of this cliff are for several miles very moderate, hardly exceeding 300 feet to the mile, suggesting a gently sloped and slightly diversified platform. This platform is deeply scored by a surprising number of large ravines, so abrupt that in many portions they may well be called canons. Their sides have slopes varying from thirty to forty-five degrees, and have sometimes a greater angle of acclivity. The number of these is very great, and they occur at intervals averaging a little more than half a mile. Along the coast between Hilo and Kohala and within a distance of about forty miles there are nearly seventy of these ravines, reckoning both great and small. A land journey coastwise through this Hamakua district would be quite impossible, had not a very fair horse-trail been excavated with much labor and expense. This trail could not have been built along the margin of the sea because the deep water washes the face of a vertical cliff. it could not have been easily built far inland on account of the jungle and quagmire. There was no better way than to descend and ascend every one of these sixty or seventy ravines by zigzag courses dug out of the sides of the ravine walls. The only difficulty is the great labor and exhaustion which they entail upon the pack-animals. A man can go easily up and down on foot leading his horse without the slightest sense of insecurity and with no more fatigue than would be incident to ascending and descending a very long series of stairways, but the pack-animal must carry his burden.

As the primary transportation artery for the island, the road leading through the Hāmākua District required strict maintenance to remain safe and operable. Over the course of the next two decades, the poor and unsafe condition of the road appears to have improved steadily, as attested to by an anonymous correspondent in 1889:

> MR. EDITOR: Having had occasion to ride over a certain part of our Hamakua Government road, and contrasting their present state to the nonentity of a Government road heretofore, I would wish to make a few remarks.
>
> Our district of Hamakua, Hilo excepted, is probably as serrated a landscape as any on the Hawaiian Islands—it is literally a mass of hills and hollows. A few months ago it was almost an impossibility to drive over the road for a distance of six or eight miles. Now, thanks to the energetic work of our Road Board, we can easily gallop over our heretofore serrated hills and mud-bound hollows, passing over them as a vista of the past.
>
> It is strange, but still an undeniable fact, that our road supervisors in times past did not attend to our roads; possibly on account of no money or probably too much. A year ago should anyone have alluded to the possibility of a carriage running over our roads, the matter would be simply derided. Now, we can ride in carriages or gallop on horseback through Hamakua as easily as on the Island of Oahu. We can meet the energetic enterprise of our Road Board with grateful thanks, and we can also commend Mr. J.R. Mills (who has given much of his unoccupied time to the interests of our Hamakua Road Board), to strangers and friends who may possibly pass through our district, and who may make remarks about our recent improvements and our hitherto impassible roads. He will assuredly tell them that through the energetic endeavors of J.M. Horner at Kukaiau, of W.H. Rickard at Honokaa, and W. Horner at Kukuihaele (these gentlemen forming our Road Board) has ben consummated the reality of a pleasant carriage drive through Hamakua. Mr. Mills has had charge of most of the roads, and should these gentlemen have full power to act we firmly believe in two or three years there would be no difficulty in driving a steam road engine through our heretofore almost impassible district. (The Hawaiian Gazette 1889)

In 1881, Lieutenant Henry Whalley Nicholson sailed to Hawaiʻi and visited the Hāmākua District. In his uncomplicated and candid narrative, Nicholson (1881:194) provided a succinct statement regarding the atrocious state of the road conditions, and specified that although "this tract of land [Hāmākua] has fine grazing qualities, and is well adapted to the cultivation of cane and coffee: but the few roads are execrable, and means of transport laborious". However, by 1894, the Hāmākua road was described as being in "pretty fair condition, better than it ever was" (The Hawaiian Gazette 1894a). By this time, the Government was being petitioned to "put the prisoners at work on the Hamakua and Hilo Government roads" (The Hawaiian Gazette 1894b), and over the course of the next few years the development of the Hāmākua roadway in the stretch between Hilo, Honokaʻa, and Waipiʻo continued. In January 1898, $2,500.00 of government funds were appropriated for Hāmākua roadwork and $22,000.00 for the "re-grading main road and roads to landings" (Dole 1898:116).

By the end of the nineteenth century a "new" road to Waimea (the Old Government Road now currently known as the Old Māmālahoa Highway) was constructed across Kapoaula Ahupuaʻa, forming the *makai* boundary of the current study area. However, over the next decade the growing exacerbation of many Hāmākua residents over the poor condition of the Government Road persisted, and in 1907 improvements to the road practically ceased altogether except for general patching repairs. A series of complaints raised by Honokaʻa community members culminated in May of that year in the reproach of road supervisor Samuel Kamae, Sr., criticizing him for his incompetency. However, William N. Purdy, a member of the Board of Supervisors for Hāmākua, contended that it was not Kamae's incompetency that resulted in the poor condition of the road but rather the funding, manpower, and severe weather conditions that resulted in landslides.

Hāmākua visitor, American author Henry Kinney (1913:36), published an account of his journey through Hāmākua during the early 1900s in his book titled *The Island of Hawaii*. Kinney's narrative acts as a virtual expedition through the district and includes a concise description of roadways (including the Old Government Road) in the vicinity of the study area:

> From the north end of the village [Honokaʻa] a section of the belt road leads, through the AHUALOA homesteads, to Waimea (Kohala). The government road also runs northward, through the Honokaa cane fields, past the KAPULENA village. Beyond this several roads branch from it. AT a junction of two roads, from mauka, with the main road, a short distance above a reservoir, the south branch road is merely a plantation road of no purport to the traveler. The north branch joins Mud Lane further mauka (thus leading to Waimea). The same is the case with the next mauka branch road. Further on, by a warehouse, a road leads makai to the Kukuihaele landing.

A 1909 map (Hawaiʻi Registered Map No. 2640) prepared by A.J. Williamson shows the location of the "new" road to Waimea (the Old Government Road/Old Māmalahoa Highway), a network plantation-related infrastructure associated with the Honokaʻa Sugar Plantation lands in the *makai* portion of Kapoaula and the Parker Ranch lands that encompass the *mauka* portion of the *ahupuaʻa* including the current study area (see Figure 25).

Over the years, the state of the Old Government Road fell into deterioration, and by 1912 it was said to be "practically impassable for automobiles" (The Honolulu Advertiser 1912). Substantial changes to the area surrounding the study parcel began shortly thereafter with the formal development of the Old Māmalahoa Highway, which was constructed in the early 1900s and served as the primary Waimea-Hilo connector route (Figure 27). The condition of the roadway (identified in the general vicinity of the study area as the "Ahualoa" Road) was chronicled by a party of legislators and senators from Kauaʻi, Oʻahu, and Maui in 1925 during a jaunt from Hilo to Waimea:

> The party had a late luncheon at Honokaa, later, while enroute to Waimea, inspecting the Ahualoa road. A resolution offered by Silva in the house recently asked that the work on this road be examined. Completed, only four months ago, the surface of the road shows already woeful deterioration and disintegration. It is charged the road will not last the life of the public loan bonds, the proceeds of which were used in its construction. (The Honolulu Advertiser 1925)

A later map that depicts only the *makai* portion of the current study area (Hawaiʻi Registered Map No. 2761 prepared by Chas. L. Murray in 1927), shows that the road to Waimea (labeled "Government Road") which is coterminous with the northern boundary of the study area, was realigned during the first quarter of the twentieth century (Figure 28). Dates of construction for the bridges fronting the survey area along the current alignment of the Old Māmalahoa Highway indicate that the realignment occurred in 1924 (MKE Associates LLC and Fung Associates, Inc. 2013).

Due to the tough road conditions on the driver and automobile, the use of the Old Government Road was short lived, and the Government decided to begin construction on a wider, more improved road. The new Belt Road (Highway 19) as it passes through Hāmākua was finished in 1933 and passes *makai* of the study area. A description of the new Belt Road was provided in an article in the July 1933 edition of *The Friend* newspaper, below is an excerpt from the article about the road finishing ceremony:

> “The formal opening of the new belt road on the island of Hawaii, July 22, 1933, was an important occasion, attended by the Governor and his party from Honolulu and many excursionists.
>
> The proposal has been made that the new road be named “Mamalahoe,” commemorating the famous edict by King Kamehameha I, “the Law of the Splintered Paddle” making Hawaii’s highways safe for the traveler.
>
> A colorful celebration on Saturday was followed by a unique service of worship in the historic Kailua Church the following day. A sermon by the Rev H. P. Judd, broadcast by radio throughout the islands, was a feature of this service. . .” (*The Friend* Vol. CIII, No. 7, July 1933:147)

Incremental improvements to the Belt Road continued for the next four decades, with the new road closely mirroring the Old Government Road in many sections. According to Ruzicka (2010:6):

> Except for this stretch [Hilo to Pā‘auilo], the belt road through Hamakua in the 1920s generally followed the same positioning as the railroad tracks only from Hilo northward to the area of Ookala. Here the roadway diverted inland along Kaula Gulch and then ran bout a mile inland of the shore to Paauilo. The path of the roadway angled slightly more inland the further up the coast from Paauilo it went, being about 1 ½ mile inland at Honokaa.

The section of Hawai‘i Belt Road extending between Honoka‘a and Waimea was completed in 1964, thereby allowing more direct access between the two locales (The Honolulu Advertiser 1964).

For the remainder of the twentieth century, the current study area was used almost exclusively as pasture. One exception to this was an experimental planting of tropical ash (*Fraxinus* sp.) trees in the central portion of the study area. More than 1,500 acres of tropical ash were planted in Hawai‘i beginning in 1924 (Whitesell et al. 1971). Information concerning the planting of this stand could not be located, but it is possible that the stand was planted in ca. 1930 by the Civilian Conservation Corps (CCC).

The stand of trees is also depicted on a 1951 Plat Map (Figure 29) of the parcel. This map also shows in detail the ranching infrastructure in the study area and the survey markers used to produce the survey. Survey markers shown include three concrete posts at parcel boundary corners and the “Kamakaukuapuu” triangulation station near the parcel’s western boundary *makai* of the ash stand. Ranching infrastructure includes a waterhole in the upper and lower portions of the study area and a network of cattle trails connecting these waterholes with others outside the current study area. This cattle trail network contrasts with the distinctly linear routes of the Alanui pii uka i ka mauna and the Alanui o Honokaia depicted on maps from a century before (see Figures 14 and 15). Although it is possible to follow the cattle trails in a *mauka-makai* direction, they do not appear to follow either of the older trails very closely. The tropical ash stand in also depicted, as is a gravel pit straddling the Old Māmalahoa Highway at the northern boundary of the study area. Based on aerial photographs taken in 1954 (Figure 30), the stand of trees was well established by mid-century, and these two features are also visible on the 1957 USGS quadrangle map (Figure 31). After being under ownership of Parker Ranch for over 135 years, the current study area was sold to the current landowner, Siglo Forest LLC, on March 2, 2018, and the entirety of the parcel has remained as undeveloped pasture throughout the twentieth century (Figure 32) and into the present day.

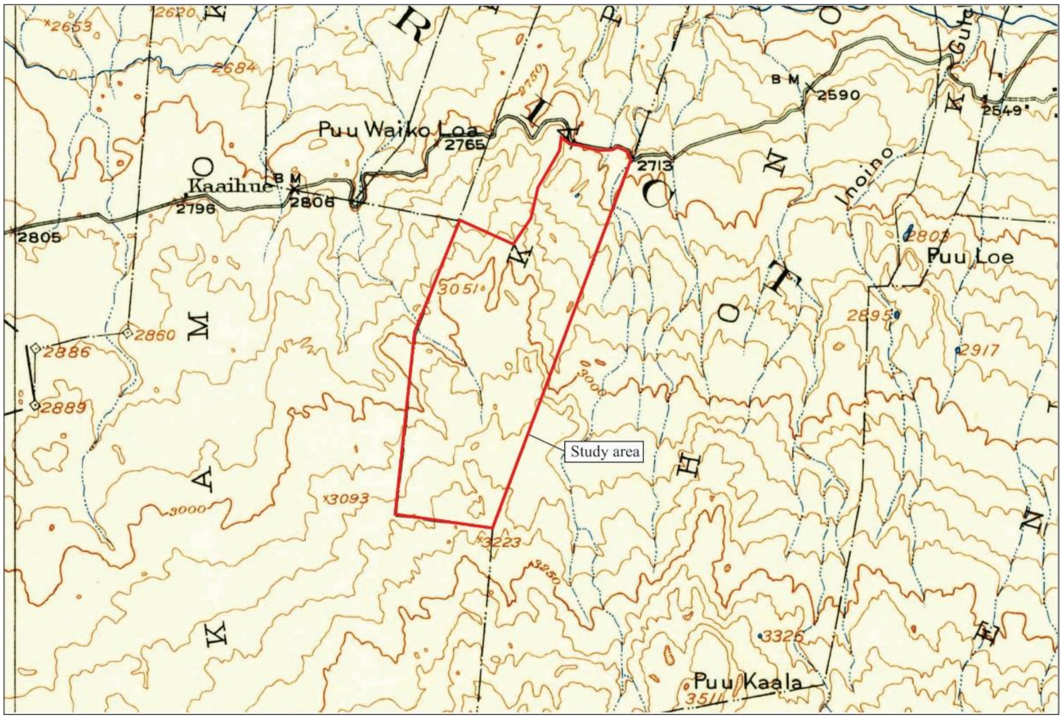


Figure 27. Portion of 1916 Waipio USGS quadrangle map with study area indicated in red.

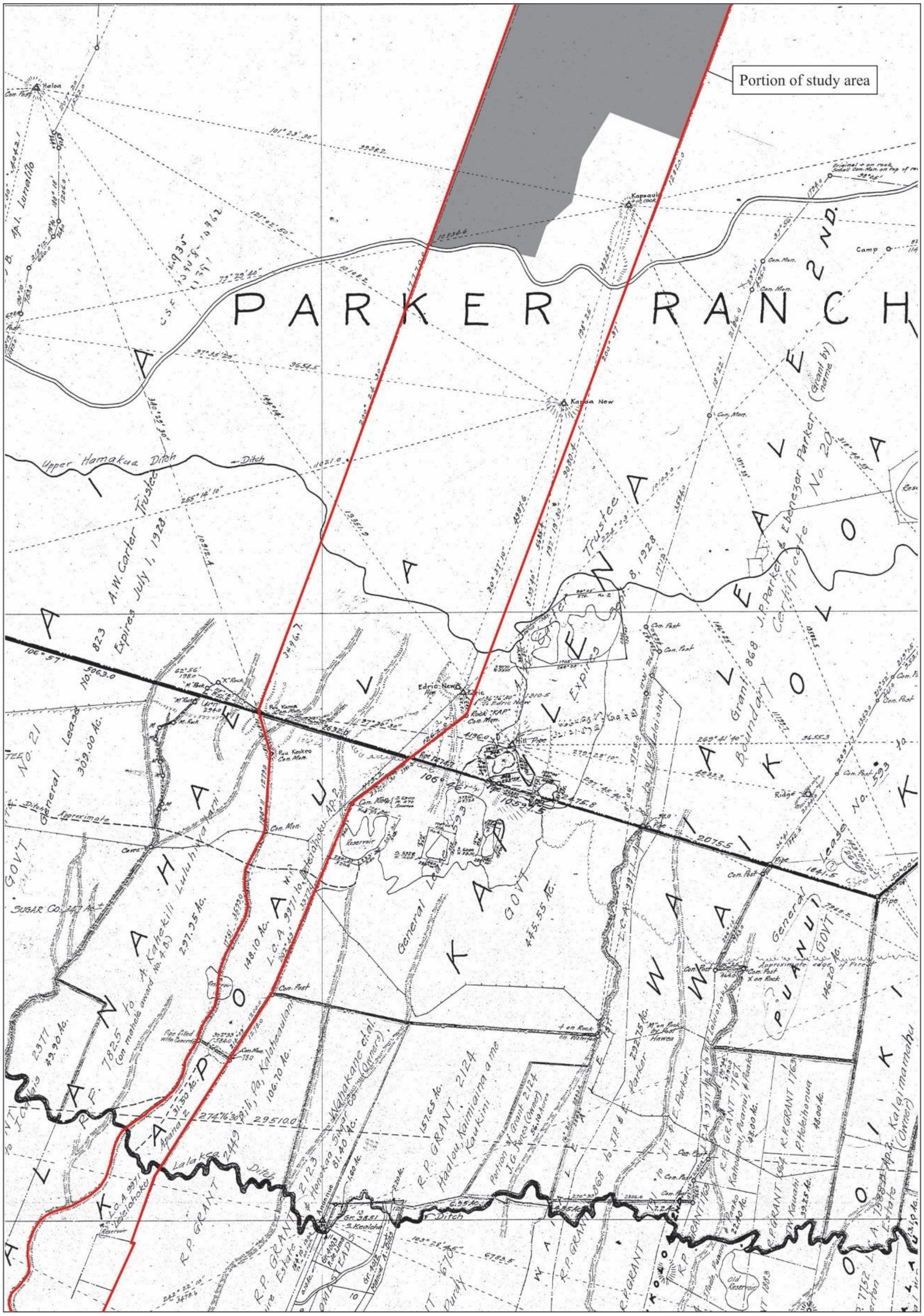


Figure 28. Portion of 1927 Hawai‘i Registered Map No. 2761 by C.L. Murray showing portion of current study area and Kapoaula Ahupua‘a.

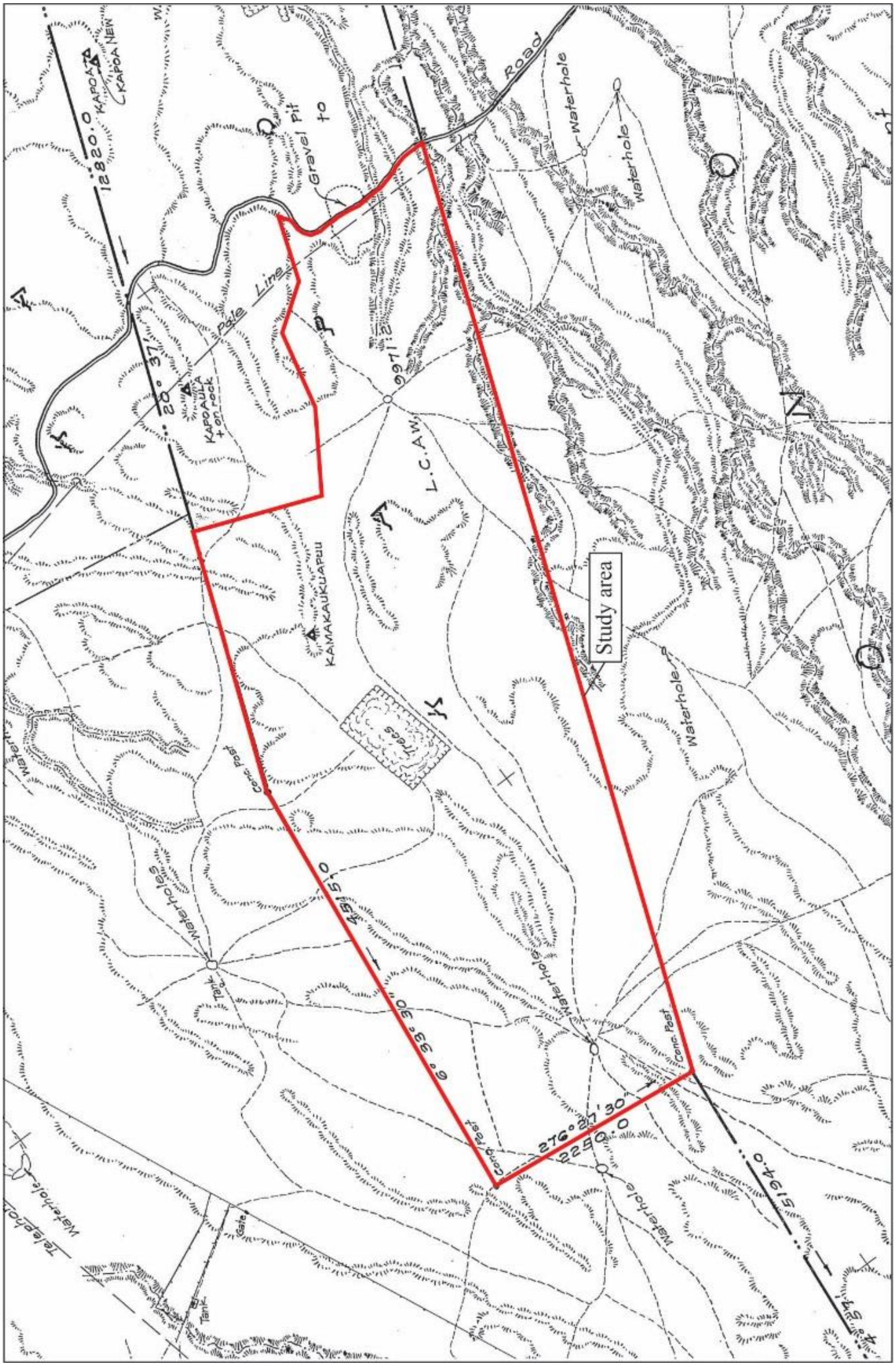


Figure 29. Portion of 1951 Plat Map 6.2 H.H. by T.Y. Awana with current study area outlined in red (Aki and Lane 1951).

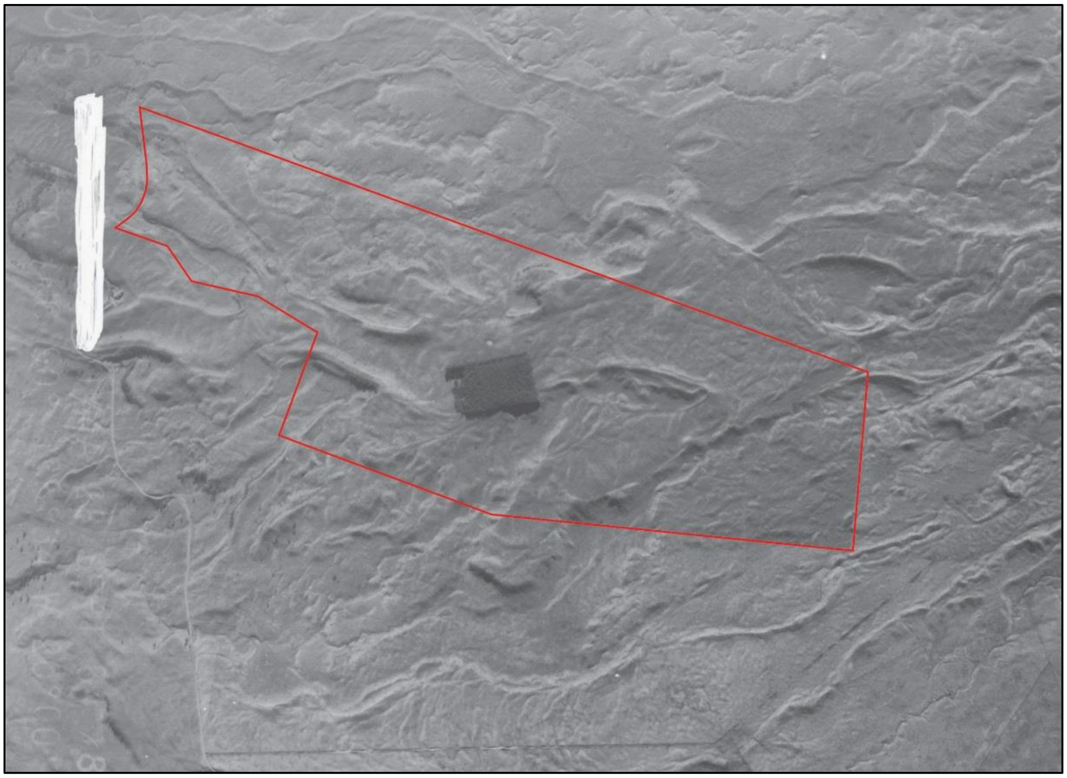


Figure 30. September 28, 1954 USGS aerial photograph of the study area (outlined in red).

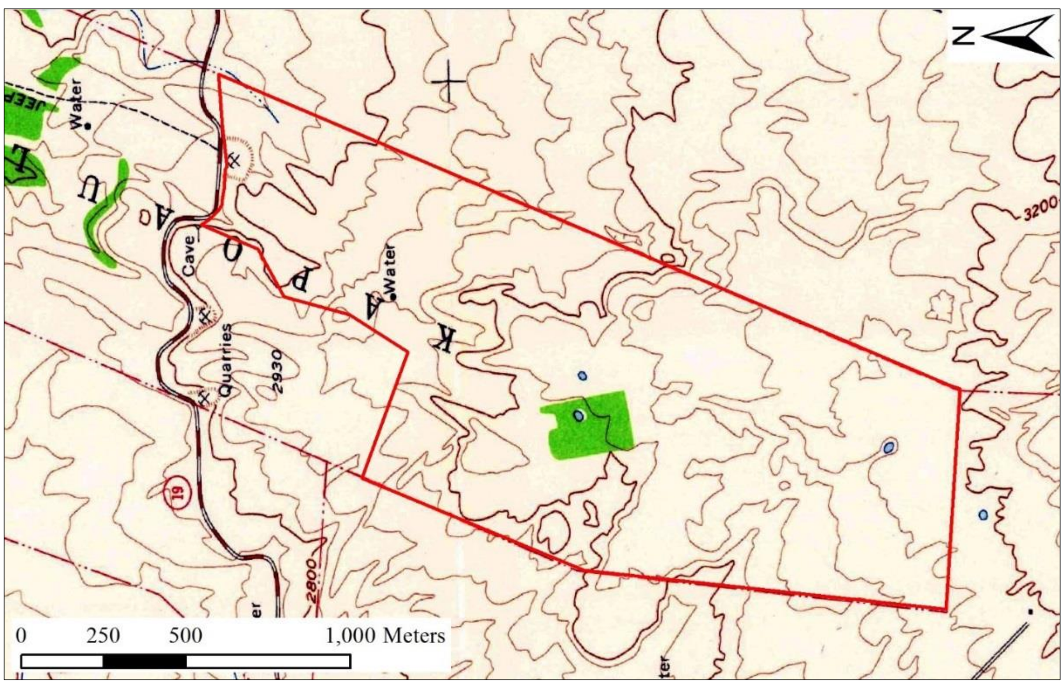


Figure 31. Portion of 1957 Kukuihaele USGS quadrangle map showing stand of tropical ash trees (shaded green) (United States Geological Survey 1957).

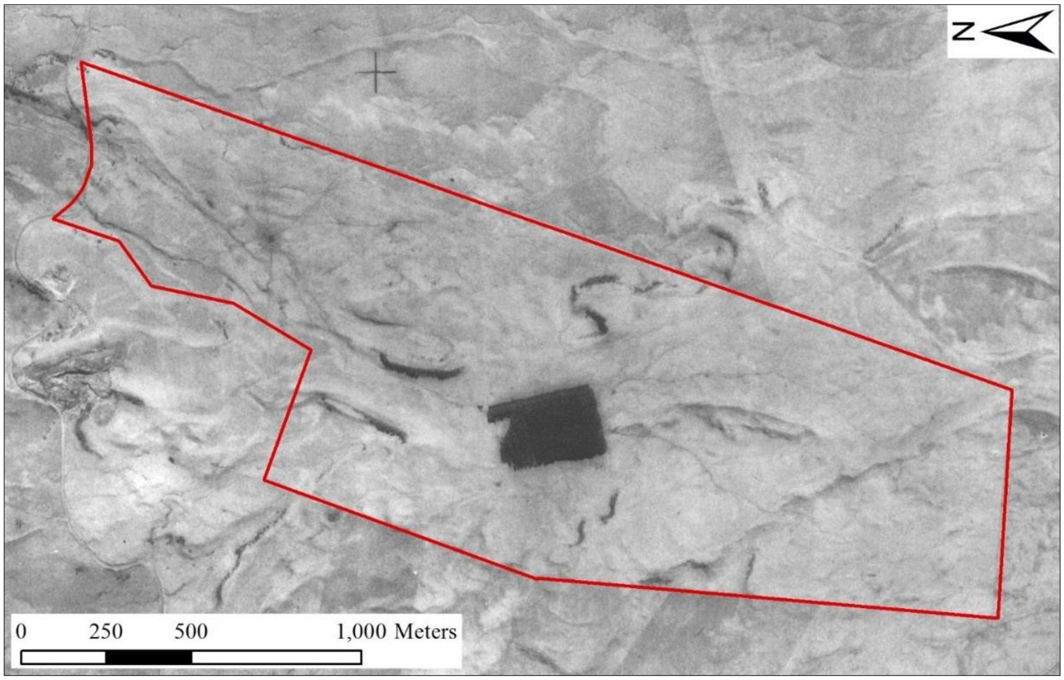


Figure 32. January 7, 1977 USGS aerial photograph of the study area (outlined in red).

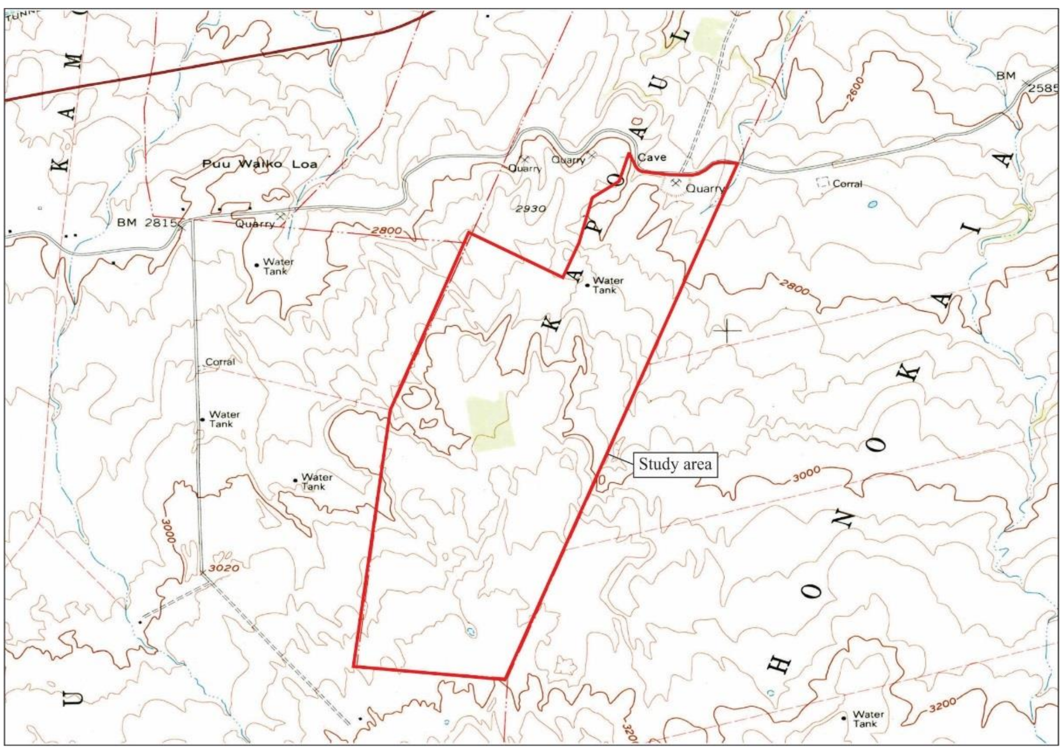


Figure 33. Portion of 1982 Kukuihaele USGS quadrangle map showing stand of tropical ash trees (shaded light green), water tank, and quarry site in study area (outlined in red).

SUMMARY OF ARCHAEOLOGICAL AND CULTURAL STUDIES CONDUCTED IN THE VICINITY OF THE STUDY AREA

Very few formal archaeological studies have been conducted in the immediate vicinity of the current study area, although Cordy (1994) prepared *A Regional Synthesis of the Hāmākua District, Island of Hawai'i*, in which he summarizes the general Precontact and early Historic land use patterns of the region (including the lands of the study area) in an effort to provide a predicative archaeological model for the district. The most relative and proximate of these studies are presented in Table 4 and Figure 34 and are summarized below.

Table 4. Archaeological studies conducted for Kapoaula and of general vicinity.

Year	*Author(s)*	*Type of Study*	*Ahupua'a*
1994	Cordy	Regional Synthesis	Various
1999	Cleghorn	Inventory Survey	
2005	Fong et al.	Literature Review, Field Check, Cultural Impact Evaluation	Honokaia
2009	Rechtman	Archaeological Survey and Limited Cultural Assessment	Honokaia
2015	Clark et al.	Inventory Survey	Honokaia
2019	Kepa'a and Barna	Archaeological Assessment	Kapoaula

Previous Archaeological Studies Conducted in the Vicinity of the Current Study Area

In *A Regional Synthesis of the Hāmākua District, Island of Hawai'i*, Dr. Ross Cordy (1994) summarizes the general Precontact and early Historic land use patterns for the subregion of East Hāmākua, which includes Kapoaula Ahupua'a (Cordy 1994). The summary is based on a review of *Māhele* records and a detailed examination of archival historical information. Cordy (1994) defines four general environmental zones within East Hāmākua: (1) the Sea-shore, (2) the Seaward Upland Slopes, (3) the 'Ōhi'a-Koa Forest Zone, and (4) The Gulches. The current study area is located just above the Seaward Upland Slopes within the 'Ōhi'a-Koa Forest Zone. The Seaward Upland Slopes was the primary farming and residential zone of East Hāmākua. House sites in this zone were common between the sea cliffs and the cross-island trail (near the present-day Highway 19). Garden plots (*māla*, *kīhāpai*, and *kula*), which were generally non-irrigated, tended to be located in close proximity to the house lots. In the *mauka* regions of this zone, some scattered fields were present that were not associated with permanent residences. Dryland *kalo* was the dominant crop of The Seaward Upland Slopes, but sweet potatoes and bananas were also commonly grown (Cordy 1994).

In the 'Ōhi'a-Koa Forest Zone, the Precontact and early Historic peoples of East Hāmākua utilized the natural resources of the forest. Activities in this zone included gathering bark to make fishing nets, collecting *māmaki* to make *kapa*, and catching birds for their feathers. At lower elevations within the 'Ōhi'a-Koa Forest Zone small plantings of supplemental crops such as bananas and *kalo* were also present. Habitation in this zone typically occurred at caves and campsites that were occupied for short durations of time (Cordy 1994).

Cleghorn (1999) conducted an Archaeological Inventory Survey (AIS) at Inoino Bridge located along the Old Māmalahoa Highway to the northeast of the current study area comprising TMKs: (3) 4-6-011:037 and 038 (see Figure 34). As a result of the study, four small caves (Caves 1, 2, 3, and 4) in the 'Ōhi'a-Koa Forest Zone were identified. The caves, which were all recorded under the State Inventory of Historic Places (SIHP) designation Site 21405, are located in Kawela Ahupua'a along its boundary with Honokaia Ahupua'a. Each of caves contained stone constructions including platforms, walls, and alignments. Cleghorn (1999) suggested that the platforms within three of the caves, based on their formal attributes, may have been Precontact burial monuments. However, no excavations or structural dismantling was performed during the survey to determine if human remains were indeed present within the stone structures. Cleghorn (1999) also recorded the Historic Inoino Bridge across Inoino Gulch, which was replaced by a new Inoino Bridge subsequent to the completion of the study.

In 2005, Fong et al. (2005) conducted a literature review, field check and cultural impact evaluation for approximately 2,500 acres of Department of Hawaiian Home Lands (DHHL) Lands in Honokaia Ahupua'a (TMKs: (3) 4-6-011: 003, 011, 012, and 013), to the east/southeast of the current study area (see Figure 34). The literature review included a study of archival sources, historic maps, Land Commission Awards (LCAw.), and previous archaeological studies relative to Honokaia. These resources were used to construct a history of land use within the *ahupua'a*. The field inspection, which included limited pedestrian survey and aerial survey, was conducted by two archaeologists over a span of three days. The inspection was intended to identify any surface archaeological features present within the 2,500 acres and to assess the potential impacts to any such features so that sensitive areas that might require further investigation or mitigation prior to any development could be dealt with. As a result of the field check a single archaeological site – a Historic wall, possibly a dam or gulch crossing – was recorded, but was not considered significant and as such, was not assigned an SIHP site number. Two other structures, a corral and a quarry, were noted within the survey area, but were determined to lack archaeological or historical significance, as both were less than fifty years old. Fong et al. (2005) did not provide a map showing the location of any of the potential archaeological features identified. Site 21405, previously recorded by Cleghorn (1999) within Inoino Gulch, was also relocated and inspected by Fong et al. (2005), and a fifth cave (Cave 5) containing two crude, mounded walls was identified at the site. As a result of the inspection, it was determined that all five of the caves were located just beyond the boundaries of the study area. Given the absence of significant sites within the Fong et al. (2005) study area, it was concluded that the development of the area would have no effect on historic resources.

In 2009, Rechtman Consulting, LLC (Rechtman et al. 2009) conducted an archaeological survey and limited cultural assessment for a roughly 1.3 kilometer-long access road across three parcels northeast of the current study area (see Figure 34). The study involved a visual inspection of the access road corridor along the eastern boundary of Honokaia Ahupuaʻa from Highway 19 to the Old Māmalahoa Highway and phone interviews with five individuals from the Honokaia ʻOhana group. No archaeological resources of any kind were observed during the pedestrian survey, and no resources (landforms, vegetation, etc.) of a traditional cultural nature were present. The individuals interviewed for the study had no information regarding significant cultural places or practices that may have occurred within the study area and the only recollection of the area was that it was previously used for ranching. Given the negative findings of the study, Rechtman et al. (2009) concluded that development of the proposed access road route would not significantly impact any known historic properties or any cultural resources and practices of a traditional and customary nature. It was therefore recommended that no further historic preservation work or mitigation was needed.

In 2015, ASM Affiliates (Clark et al. 2015) conducted an AIS a portion of a portion of TMK: (3) 4-6-013:001-046 in Honokaia Ahupuaʻa to the east/southeast of the current study area for the proposed installation of a gravity-fed non-potable water system and appurtenances in the Honokaia Pastoral Lots Subdivision (see Figure 34). As a result of the study, a single archaeological site (Temporary Site 1), consisting of a short alignment of stacked boulders and cobbles on the northeastern slope of an intermittent drainage channel, was identified near the northern boundary of the study area. The site was fully documented during the study, however it was concluded by Clark et al. (2015) that much like a similar alignment previously identified by Fong et al. (2005), the site retained no integrity and was therefore not considered to be significant. As such, it was not assigned an SIHP Site number.

An archaeological inventory survey of the roughly 564-acre subject parcel (TMK: (3) 4-7-007-011) was completed in 2019 by ASM Affiliates (Kepaʻa and Barna 2019) for the proposed Kapoaula Koa Forest Management Plan. Although no archaeological sites or other historic properties were identified within the current study area, a detailed cultural-historical background was prepared, which identified two trail routes. Efforts to identify the physical routes of the trails were made, however, it was found that extensive cattle trampling, erosion, and the incursion of pasture grass since the mid-19th century had obscured these trail routes, leaving no physical trace of their existence. Given the negative findings for archaeological resources, an archaeological assessment report was prepared, which concluded that the proposed project would not impact any known historic properties.

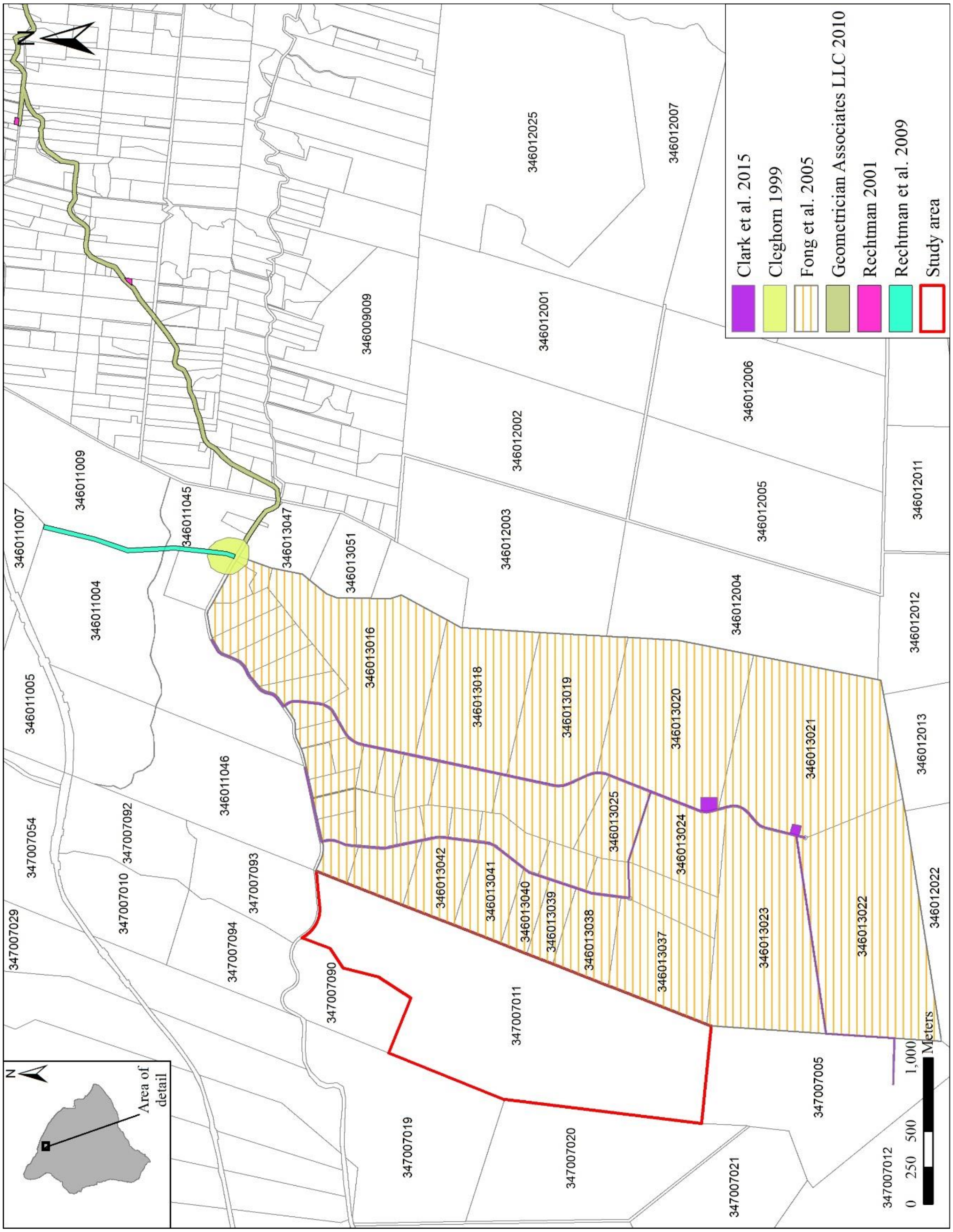


Figure 34. Previous archaeological and cultural studies conducted in the vicinity of the study area.

Cultural Studies Conducted for Kapoaula and General Vicinity

There have been five culturally-based studies conducted in the vicinity of the current study area that focused on Kapouaula Ahupuaʻa, the adjacent land divisions of Honokaia, Malanahae, Kapulena and Haukoʻi, and the general interior *mauka* lands of Hāmākua (Table 5 and Figure 34). While none of these studies identified impacts to cultural resources and practices within the study area, the information garnered as a result provides pertinent information regarding general traditional and historical land-use practices, modes of transportation, and cultural activities in the region. The findings of these studies are summarized below.

Table 5. Cultural studies conducted for Kapoaula and of general vicinity.

Year	*Author(s)*	*Type of Study*	*Ahupuaʻa*
2001	Rechtman	Archaeological survey and Limited Cultural Assessment	Āhualoa
2005	Fong, Shideler, and Hammatt	Literature Review, Field Check and Cultural Impact Evaluation	Honokaia
2009	Rechtman and Clark	Archaeological and Limited Cultural Assessment	Honokaia
2009	Rechtman	Cultural Assessment	Haukoʻi
2010	Terry	Final Environmental Assessment	Lauka, Kuliahaʻi, Koloaha, and Ahualoa
2011	Escott and Spear	Cultural Impact Assessment	Malanahae, Kapoaula, Kapulena, Waiʻaleʻale 1st and 2nd, Niupuka, and Hanapai

The earliest cultural study was conducted in 2001 by Rechtman Consulting, LLC (Rechtman 2001) as part of an Environmental Assessment (EA) associated with the placement of water tanks at two locations in the Āhualoa Homesteads (see Figure 34). The scope of the study concentrated on identifying cultural sites, past and ongoing traditional and Hawaiian activities, and included an examination of cultural and historical resources in addition to limited consultation. As a result, no historic sites were present during the archaeological survey and given the past land use for sugarcane cultivation, Rechtman (2001) concluded that the development of the water tank facilities would not adversely affect any historic or traditional cultural properties.

In 2005, Cultural Surveys Hawaiʻi, Inc. (Fong et al. 2005) conducted a cultural impact evaluation to accompany a literature review and field check for the Department of Hawaiian Home Lands (DHHL) in support of the Honokaia Pastoral Lots Development Project within the adjacent *ahupuaʻa* of Honokaia (see Figure 34). As part of this study, an attempt was made to contact individuals, organizations, and agencies from the Honokaia community. As part of the study of the DHHL Honokaia Lands, Fong et al. (2005) made an attempt to contact several individuals, organizations, and agencies by e-mail regarding traditional cultural properties in Honokaia. Only one organization, *Hui Mālama O Nā Kūpuna O Hawaiʻi Nei* headed by Mr. Halealoha Ayau, responded to the e-mail. Mr. Ayau indicated that the members of the organization primarily wanted to make sure that cultural monitors were present during excavations to assure that applicable burial treatment laws would be adhered to (see Fong et al. 2005:36). Fong et al. (2005) reviewed several areas of possible cultural concerns for properties that could by impacted by the proposed development of the DHHL lands including archaeological sites, burials, gathering rights, hunting rights, trails, and storied places, but no traditional cultural properties were identified within the area, so no impacts were expected.

In November of 2009, Rechtman Consulting, LLC (Rechtman et al. 2009) conducted an archaeological and limited cultural assessment of a roughly 1.3 kilometer (4,400-ft.) long access road corridor in Honokaia Ahupuaʻa (see Figure 34). The purpose of the proposed access road was to provide access for the installation and maintenance of a new power line. As part of the study, an attempt was made to contact several individuals, organizations, and agencies regarding traditional cultural properties in Honokaia. One organization, *Hui Mālama O Nā Kūpuna O Hawaiʻi Nei* headed by Mr. Halealoha Ayau, responded. Mr. Ayau indicated that the members of the organization primarily wanted to make sure that cultural monitors were present during excavations to assure that applicable burial treatment laws would be adhered to. In addition, phone interviews with knowledgeable community members were conducted. Interviewees recalled the Rechtman et al. (2009) project area as being pasture and ranch lands, although no specific information regarding significant cultural places or practices was obtained. Given the extensive land use for cattle ranching throughout the late nineteenth and twentieth centuries which has significantly altered the landscape, Rechtman et al. (2009) concluded that development associated with the access road would not adversely affect any historic or traditional cultural properties.

In August 2009, Rechtman Consulting, LLC (Rechtman 2009) conducted a cultural assessment to accompany an EA associated with the development of the proposed Kapulena Well, a 0.3 million gallon (MG) water tank, and an associated 20-foot wide access/utility corridor within nearby Haukoʻi Ahupuaʻa (see Figure 34). Intensive agricultural activities that previously occurred in the area over the course of more than 80 years has significantly altered the land. Thus, traditional cultural resources were not identified during this study. Consultation for this project involved a discussion with the landowner who explained that pig hunting was the only activity that occurred on the property. With prior consent, he allowed a few local hunters to access the macadamia orchard. The landowner had never observed or seen evidence of any traditional cultural activity on his property, nor had anyone ever sought his permission to conduct such activities on the property. As a result of the study, no cultural resources were identified within the Rechtman (2009) project area, and it was concluded that no historic properties would be affected by the development of the Kapulena Well.

In 2010, Geometrician Associates LLC prepared an EA (Geometrician Associates LLC 2010) for the proposed Transmission Waterline extending from Āhualoa to Honokaʻa (see Figure 34). The scope of work for the study included discussions with individuals and organizations who had knowledge of cultural resources, practices, and beliefs on lands in the vicinity of the study area. As a result of the study, members of the former Hawaiian Civic Club of Hāmākua, as well as the Office of Hawaiian Affairs (OHA) were contacted. Those consulted for the study were not aware of any cultural or historical resources along the route of the transmission waterline, and in a letter from SHPD to Ron Terry of Geometrician Associates, LLC (Aiu 2010), SHPD concluded that the proposed project would not affect historic properties.

Most recently, in 2011, Scientific Consultant Services, Inc. (Escott and Spear 2011) prepared a CIA as part of an EA for the proposed development of Kapulena Agricultural Park (see Figure 34). The scope of the study encompassed the *ahupuaʻa* of Malanahae, Kapoaula, Kapulena, Waiʻaleʻale 1st and 2nd, Niupuka, and Hanapai. Consultation for this study was sought from the Director of Native Rights, Land and Culture, OHA, the Kuakini Civic Club, and the Kona Hawaiian Civic Club, however none of the aforementioned organizations responded with any information concerning cultural resources within the study area. Additionally, fourteen informants including descendants of families who were awarded Land Commission Awards, former Hāmākua Sugar Company employees, and individuals with long-standing connections to lands in the Hāmākua District were contacted. Of the fourteen individuals, twelve responded. Eight of those individuals had knowledge of the (Escott and Spear 2011) project area, however none recalled past or ongoing cultural practices occurring there. As a result of the study, it was concluded that no historic properties would be affected by the development the Kapulena Agricultural Park.

3. CONSULTATION

Gathering input from community members with genealogical ties and long-standing residency or relationships to the study area is vital to the process of assessing potential cultural impacts to resources, practices, and beliefs. It is precisely these individuals that ascribe meaning and value to traditional resources and practices. Community members often possess traditional knowledge and in-depth understanding that are unavailable elsewhere in the historical or cultural record of a place. As stated in the OEQC Guidelines for Assessing Cultural Impacts, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present authors' further contention that the oral interviews should also be used to augment the process of assessing the significance of any identified traditional cultural properties. Thus, it is the researcher's responsibility to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary.

In an effort to identify individuals knowledgeable about traditional cultural practices and/or uses associated with the current subject property, a public notice was submitted to the Office of Hawaiian Affairs (OHA) for publication in their newspaper, *Ka Wai Ola*. The notice was submitted via email on February 27th and was published on March 24, in the April 2019 publication (Appendix A).

Although no responses were received as a result of the *Ka Wai Ola* publication, eight individuals were contacted via email and/or phone: Leon No‘eau Peralto, Director for Hui Mālama I Ke Ala ‘Ūlili based in Pa‘auilo, Hāmākua was contacted via email. In the email response, Mr. Peralto explained that he was not familiar with the Kapoaula area and declined the interview but recommended that ASM staff speak with Chauncey Kalā Lindsey AhSing from the Mauna Kea Forest Restoration Project. Consultation letters were also emailed to Pōmai Bertlemann on March 14, 2019 and to the group Mālama Hāmākua on March 27, 2019, from which no responses were received.

As part of the interview process and with the consent of the interviewees, the interviews were audio recorded for note taking purposes only (audio files not available). Upon completion of the interview, Lokelani Brandt prepared an interview summary, which was emailed to the interviewees for review. Aside from the phone interview with Mr. Hatayama, the remaining three interviewees were asked to review the draft summary and make any necessary edits. With the approval of the interviewees, the finalized version of the summaries has been presented below.

GARY RAPOZO

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DR. BILLY BERGIN

A phone interview was conducted on March 29, 2019, with the distinguished, Dr. Billy Bergin, a long-time Parker Ranch veterinarian who recalled spending much time at Kapoaula. Dr. Bergin stated that Kapoaula was within the Mānā Division of Parker Ranch and that this area was used almost exclusively for breeding cows. He explained that the last Super Intendent of the Mānā Division was Charlie Kimura, who had recently passed in March of 2019. With respect to the ancient history of the area, Dr. Bergin spoke of the name of the *ahupuaʻa* and noted that typically *ahupuaʻa* names commemorate significant events, persons, or things, however, he did not recall any such information being shared with him by other noted Parker Ranch *paniolo* such as Charlie Stevens or Sonny Keakealani. Although no explicit *moʻolelo* are known that describes the naming of the place, Dr. Bergin explained that in the Hawaiian language, the word *poa*, which makes up a portion of the name Ka-poa-ula, is a *paniolo* term that refers to the gelding of male horses. He further explained that *ula* is associated with the color red. He suggested that the name Kapoaula may be interpreted as "the-red-gelding" and may perhaps be associated with some other significant event that occurred there but whose story has not been recollected.

WILLIAM AKAU

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CHAUNCEY KALĀ LINDSEY-AH SING

On March 14, Lokelani Brandt contacted Chauncy "Kalā" Lindsey-AhSing, the Mauna Kea Forest Restoration Project Coordinator regarding the proposed reforestation project. Kalā indicated that he was aware of the proposed reforestation project but explained that he was not familiar with the Kapoaula area and was therefore, not able to provide detailed information concerning any known Historic properties or any ongoing traditional cultural practices associated with the area. Although, no explicit information was provided, Kalā expressed via email that he "…supports native reforestation and the sustainable harvest of those resources in appropriate areas."

4. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are natural features of the landscape and historic sites, including traditional cultural properties. In the Hawaiʻi Revised Statutes–Chapter 6E a definition of traditional cultural property is provided.

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties. As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

- a Be associated with events that have made an important contribution to the broad patterns of our history;
- b Be associated with the lives of persons important in our past;
- c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- d Have yielded, or is likely to yield, information important for research on prehistory or history;
- e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion d at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion e. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Paʻakai O Ka ʻĀina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

A review of the cultural historical background literature provides stirring details about Hāmākua's Precontact and early Historic Period. The precipitous, well-watered, and once forested environment that swept along the northern flanks of Mauna Kea is honored in many traditional accounts and this unique environ ultimately shaped the early settlement patterns of this region. Descriptions of the lush *koa-ʻōhiʻa* forest that once extended upland, an extensive *kukui* grove blanketed the lower wet windward slopes, which was incorporated into the early agricultural practices of this region. Unlike the valleyed West Hāmākua (Hāmākua Komohana) region with Waipiʻo as the main seat of Precontact politics, East Hāmākua (Hāmākua Hikina), including the lands of Kapoaula, with its rolling uplands lands and narrow gulches, became the choice location for various agricultural and pastoral enterprises.

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APPENDIX A.
KA WAI OLA PUBLIC NOTICE

PUBLIC NOTICE

ASM Affiliates is preparing a Cultural Impact Assessment (CIA) in advance of a proposed Forest Management Plan for the planting of *koa* trees and associated native forest plants on roughly 555 acres of land situated on a portion of TMK (3) 4-7-007:011, located in Kapoaula Ahupuaʻa, Hāmākua District, Island of Hawaiʻi. We are seeking consultation with any community members that might have knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices that may be occurring on or in the general vicinity of the subject property, that may be impacted by the proposed project. If you have and can share any such information please contact Lokelani Brandt lbrandt@asmaffiliates.com, or Aoloa Santos asantos@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikaula Street, Hilo, HI 96720.

Ka Wai Ola, Apelila (April) 2019, 36 (4):21

APPENDIX D

PHASE I ENVIRONMENTAL SITE ASSESSMENT

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PHASE I
ENVIRONMENTAL SITE ASSESSMENT REPORT
FOR
TMK (3) 4-7-007:011
WAIMEA, ISLAND OF HAWAII 96743

564.549 ACRES

MNA PROJECT 02529_5

MARCH 9, 2018

Myounghee Noh & Associates

Environmental Studies and Consulting Services

200 Kohola Street, Hilo, Hawaii, USA 96720 • 808.935.8727
99-1046 Iwaena Street, Suite 210A, Aiea, Hawaii, USA 96701 • 808.484.9214

This Phase I ESA report is prepared for:

SIGLO FOREST LLC
P.O. Box 490
Paauilo, Hawaii 96776

PHASE I
ENVIRONMENTAL SITE ASSESSMENT REPORT
FOR
TMK (3) 4-7-007:011
WAIMEA, ISLAND OF HAWAII 96743

564.549 acres

MNA Job No. 2529_5

March 9, 2018

I declare that, to the best of my professional knowledge and belief, I meet the definition of *Environmental professional* as defined in §312.10 of 40 CFR 312.

I have the specific qualifications based on education, training, and experience to assess a *property* of the nature, history, and setting of the *subject property*. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR 312.

Myounghee Noh, Environmental Professional
Principal

Myounghee Noh & Associates, L.L.C.
Environmental Studies and Consulting Services
200 Kohola Street, Hilo, HI 96720
Tel (808) 935-8727
www.noh-associates.com

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Appendix B Site Reconnaissance Photographs

CONTRIBUTORS

Project Coordinator	Jennah Oshiro
Site Assessors	Jennah Oshiro and Adam Custer
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Technical Editor	Jessica Walsh, Environmental Professional
QA Review	Myounghee Noh, Environmental Professional

LIST OF ABBREVIATIONS

AST	Aboveground Storage Tank
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CESQG	Conditionally Exempt Small Quantity Generators
CORRACTS	RCRA Facilities that are undergoing “corrective action”
EC / IC	Engineering Control / Institutional Control
EDR	Environmental Data Resources, Inc.
EPA	Environmental Protection Agency
ERNS	Emergency Response Notification System
ESA	Environmental Site Assessment
HDOH	State of Hawaii Department of Health
HEER	Hazard Evaluation and Emergency Response
HELCO	Hawaii Electric Light Company
HFD	County of Hawaii Fire Department
HREC	Historical Recognized Environmental Condition
LQG	Large Quantity Generator
MNA	Myounghee Noh & Associates, L.L.C.
NFA	No Further Action
NFRAP	No Further Remedial Action Planned
NLR	No Longer Regulated Generators
NPL	National Priorities List
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Condition
SEMS	Superfund Enterprise Management System (Archive)
SHWB	Solid and Hazardous Waste Branch
SQG	Small Quantity Generator
SWD	Solid Waste Division
TMK	Tax Map Key
TSD	Treatment, Storage, and Disposal
USGS	United States Geological Survey
UIC	Underground Injection Control
UST	Underground Storage Tank
VRP	Voluntary Response Program

EXECUTIVE SUMMARY

Myounghee Noh & Associates, L.L.C. (MNA), was retained in January 2018 to conduct a Phase I Environmental Site Assessment (ESA) for the *subject property* occupying 564.549 acres in Waimea, Island of Hawaii, identified by Tax Map Key (TMK) Island 3, Zone 4, Section 7, Plat 007, and Parcel 011 [TMK (3) 4-7-007:011]. The subject property is owned by the Parker Land Trust. This Phase I ESA was completed for SIGLO FOREST LLC, potential buyer of the subject property.

The purpose of this Phase I ESA is to identify *recognized environmental conditions (RECs)* at the subject property, with respect to the range of contaminants within the scope of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and petroleum products.

The subject property is located in Waimea, in a high precipitation region in the north of the Island of Hawaii. Located approximately 1 mile south of State Route 19 (Mamalahoa Highway), the property is accessed via Old Mamalahoa Highway. A small dirt road from Old Mamalahoa Highway travels from the north through the center of the subject property to the south, and ends at approximately the center of the subject property.

FINDINGS

No records of National Priorities List (NPL) sites, Federal Resource Conservation and Recovery Act (RCRA) CORRACTS and Non-CORRACTS Treatment Storage Disposal Facilities, Delisted NPL sites, Federal Comprehensive Environmental Response, Compensation, and Liability Information System sites, landfill or solid waste disposal sites, State Voluntary Cleanup sites, Federal RCRA Generator sites, State registered underground storage tank sites, engineering control/institutional control registries, Federal Emergency Response Notification System list sites, or Federal or State Brownfields sites were identified at the subject property or surrounding area. No sites were identified by Environmental Data Resources Inc., for the standard environmental record sources.

Review of U.S. Geological Survey topographic maps and historical aerial photographs for the subject property and surrounding properties did not indicate any RECs.

There were no structures or indications of the past presence of structures on the subject property. The subject property was primarily grassland for cattle grazing, with an approximately 14-acre non-native forested area in the center. The property was subdivided into eight paddocks with fencing. Cattle were periodically rotated between the paddocks. No indications of *RECs* were observed during the site reconnaissance.

A user questionnaire completed by SIGLO FOREST LLC representative, Nick Koch, indicated that there may be a green waste stockpile on the subject property. Documents in connection with the subject property were also provided by the client. On 24 June 2015, the State of Hawaii Department of Health (HDOH) Hazard Evaluation and Emergency Response (HEER) Office issued a letter to the property owner, Parker Land Trust, in regards to the parcel. The letter indicated that HEER Office was contacting landowners that the owner may be interested in being listed in their Brownfields Inventory for possible eligibility for Environmental Protection Agency redevelopment funding, due to the property being previously identified as an illegal dump site. Upon review of the HDOH Solid and Hazardous Waste Branch (SHWB) records, it was found that the adjoining property to the northwest, located at TMK (3) 4-7-007:090, contained an illegal dump. Additionally, no indications of an illegal dump were observed during the site reconnaissance or during review of aerial photographs of the subject property. MNA also conducted an interview with Harry “Haia” Auweloa, who stated that he was not aware of any green waste or dump sites on the property. Because the adjoining property at TMK (3) 4-7-007:090 was formerly a part of the subject property, it was concluded that the "green waste" and "illegal dump" speculations in the user provided documents were the result of confusion stemming from the adjoining property previously being a part of the subject property TMK. According to review of the County of Hawaii tax records, the adjoining property was split from the subject property in 2004. As a result, it is presumed that there was no green waste or illegal dump at the subject property.

In 2004, HDOH SHWB identified the illegal dump area at the northeast portion of the TMK (3) 4-7-007:090, adjacent to Old Mamalahoa Highway. Records indicated that the illegally dumped materials included green waste; construction and demolition waste including concrete, rebar, sheet metal, metal piping, plastic piping, and lumber; automotive debris including tires, axles, engine, and frame parts; and a small volume of household waste. No hazardous waste, toxic materials, or controlled substances were encountered. In 2008, the SHWB determined that No Further Action was necessary. More information on the illegal dump area and cleanup activities are included in Section 4.2.2. Based on the solid waste observed and cleaned up from the site, it is likely that petroleum products from the automobile debris were released to the site.

Based on the relative distance of the illegal dump site to the subject property and apparent flooding in the area, it is possible that petroleum product residues from automotive parts entered the subject property. The groundwater quality at the subject property is unknown, and is considered a data gap. The potential petroleum product release from the illegal dump site to the subject property is an *historical REC* (HREC) which could lead to a REC, if the groundwater was impacted.

An HREC is defined per ASTM E1527-13 as a past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted use criteria established by a regulatory authority, without subjecting the property to any required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls).

RECOGNIZED ENVIRONMENTAL CONDITIONS

MNA performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM E 1527-13 of the 564.549-acre subject property identified as TMK (3) 4-7-007:011 in Waimea, Island of Hawaii. Any exceptions to, or deletions from, this practice are described in Section 7.0 of this report. This assessment has revealed no evidence of *recognized environmental conditions*, as defined by ASTM, in connection with the *subject property*, except the following:

- The potential petroleum product release from the illegal dump site to the subject property is an HREC which could lead to a REC, if the groundwater was impacted.

1.0 INTRODUCTION

This report presents the results of a Phase I Environmental Site Assessment (ESA) conducted during January through March 2018 for the subject property occupying a 564.549 acres of the parcel identified by Tax Map Key (TMK) Island 3, Zone 4, Section 7, Plat 007, and Parcel 011 [TMK (3) 4-7-007:011], Waimea, Island of Hawaii. The location of the subject property is identified in Figure 1.

This Phase I ESA was conducted by Myounghee Noh & Associates, L.L.C., herein referred to as MNA, for SIGLO FOREST LLC, potential buyer of the subject property. At the time of this Phase I ESA, the subject property was owned by the Parker Land Trust.

1.1 PURPOSE

The purpose of this Phase I ESA is to identify any *recognized environmental conditions* (RECs) at the subject property, with respect to a range of contaminants within the scope of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and petroleum products. This practice is intended to permit a user to satisfy one of the requirements to qualify for the innocent landowner defense to CERCLA liability, "all appropriate inquiry into the previous ownership and uses of the site consistent with good commercial or customary practice." The term *recognized environmental condition* denotes the presence, or likely presence, of any hazardous substances or petroleum products on the property under conditions that indicate an existing release, a past release, or a material threat of a release into structures on the property or into the ground, groundwater, or surface water of the property (ASTM International, 2013).

This report is part of the Phase I ESA conducted for the subject property. The assessment was conducted in accordance with the practices described in Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (ASTM International, 2013).

1.2 DETAILED SCOPE OF SERVICES

A Phase I ESA has four components: records review, site reconnaissance, interview, and report. MNA conducted this ESA using information sources with the potential to identify past or current releases of hazardous substances or petroleum products into the subject property. Adjoining properties were also evaluated for their potential to impact the subject property. Per the ASTM International Phase I ESA Standard, adjoining properties include parcels touching the subject property as well as those properties across a roadway (ASTM International, 2013).

1.2.1 Site History

Where available and as needed, MNA researched historical and current topographic maps, tax records, fire insurance maps, regulatory agency websites, and aerial photographs to identify previous and current uses of the property, adjoining properties, and the surrounding area.

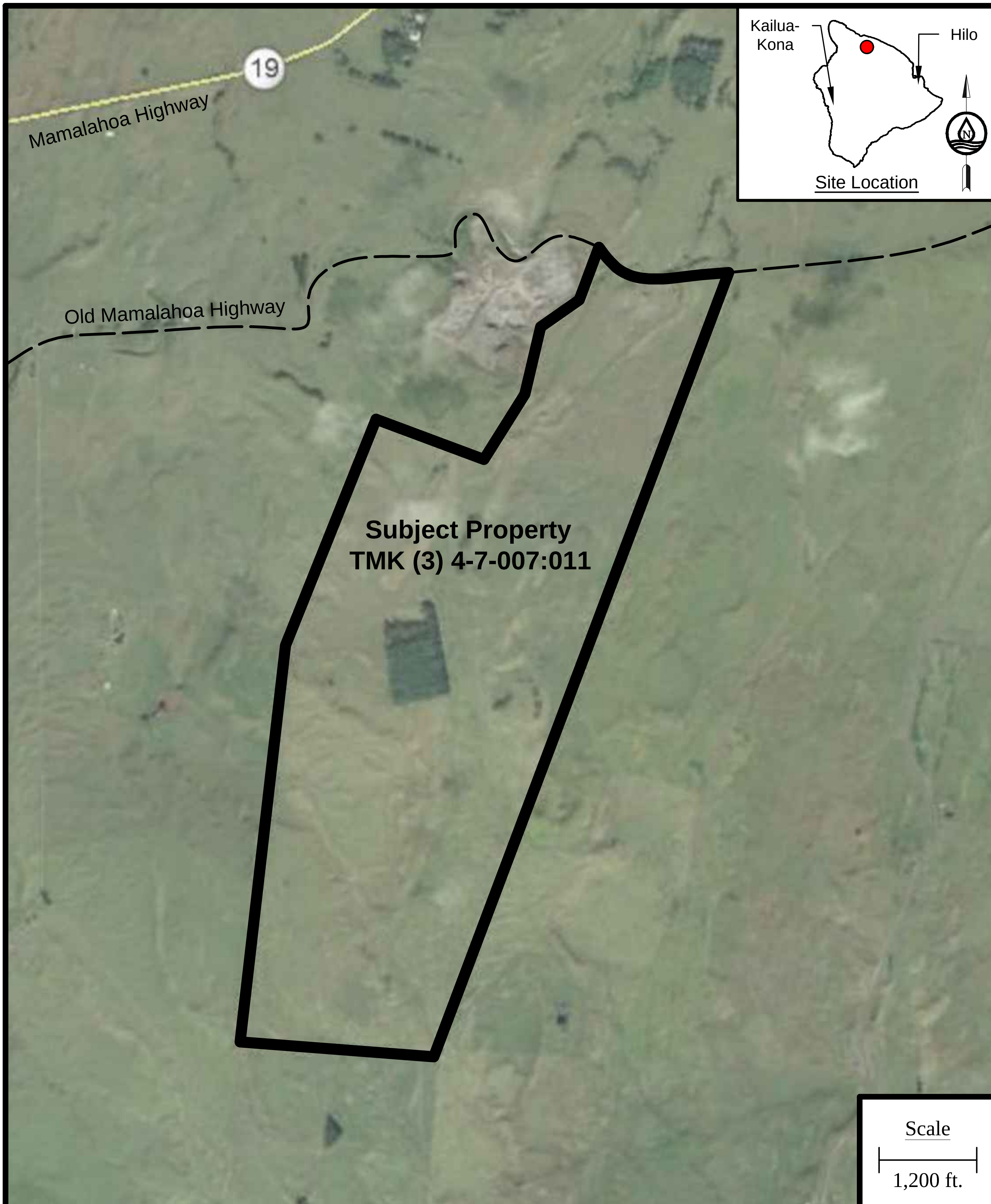


Figure 1. Site Location Map
Phase I Environmental Site Assessment
TMK (3) 4-7-007:011
Waimea, Hawaii

March 2018

Myounghee Noh & Associates, L.L.C.

2529_5

1.2.2 Regulatory Records

MNA examined government records with respect to environmental conditions, citations, complaints, and permits at the subject property, at adjoining properties, and within the surrounding area. MNA utilized a records search provided by Environmental Data Resources, Inc. (EDR), to review records from the following federal and state programs:

- National Priorities List (NPL)
- Delisted NPL
- Resource Conservation and Recovery Act (RCRA) facilities that are undergoing "corrective action" (CORRACTS)
- RCRA-Treatment, Storage, & Disposal (TSD)
- Comprehensive Environmental Response, Compensation & Liability Information System (CERCLIS) List
- Superfund Enterprise Management System Archive [SEMS; formerly CERCLIS No Further Remedial Action Planned (NFRAP) List]
- Federal and Hawaii State Brownfields
- Hawaii Solid Waste & Landfill
- Leaking Underground Storage Tank (Leaking UST)
- Underground Storage Tank (UST)
- Emergency Response Notification System (ERNS)
- RCRA – Generators, including those No Longer Regulated (NLR)
- Hawaii Sites of Interest (State Hazardous Waste Sites)
- Federal and state releases
- Federal and Hawaii State Land Use Controls
- Hawaii Voluntary Cleanup Sites

Additionally, MNA requested environmental case files from the Hawaii Department of Health (HDOH), the Hawaii Electric Light Company (HELCO), and the County of Hawaii Fire Department (HFD).

1.2.3 Site Reconnaissance

MNA performed a site reconnaissance to obtain information indicating the likelihood of contamination, to interview available site personnel, and to conduct a brief assessment of the adjoining properties. During the site reconnaissance, MNA looked for a variety of indicators of environmental hazards including, but not limited to, stained surface soil, dead or stressed vegetation, hazardous substances, aboveground and underground storage tanks, disposal areas, groundwater wells, drywells, and sumps. Sampling and testing of soil, surface water, or groundwater were not part of this assessment.

1.2.4 Site Geology and Hydrogeology

MNA reviewed published information for the property and surrounding area on surface and subsurface conditions such as topography, drainage, surface water bodies, subsurface geology, and groundwater. MNA used this information to assess the potential for migration and impact of the subject property by releases of hazardous substances or petroleum products at off-site properties.

1.2.5 Data Evaluation and Reporting

MNA evaluated the information collected, and prepared this report as part of the assessment. Section 2 presents the site background information; Section 3 user provided information; Section 4 information collected from records review; Section 5 site reconnaissance; Section 6 interviews; Section 7 data gaps; Section 8 key findings and opinion; and Section 9 conclusion.

1.3 SIGNIFICANT ASSUMPTIONS

The conclusion presented in this report is based upon the assumption that reasonably ascertainable and relevant information pertaining to the environmental condition of the subject property was made available to MNA during the assessment. Information obtained from government agencies and other resources is presumed to be accurate and updated. Additionally, information collected in interviews is collected in "good faith" and believed to be true and accurate to the best knowledge of the interviewee.

1.4 LIMITATIONS AND EXCEPTIONS

The Phase I ESA provides a "snapshot" of the property conditions at the time of the assessment. Findings, opinions, and conclusions apply to property conditions existing at the time of the investigation and those reasonably foreseeable. They do not apply to conditions at, or changes to, the property, of which MNA is not aware, could not reasonably be aware, and has not had the opportunity to evaluate.

This report is based upon visual observations of the subject property and its vicinity, interpretation of the available historical and regulatory information and documents reviewed, and interviews of individuals with knowledge of the subject or surrounding property. MNA cannot ensure the accuracy of the historical or regulatory information. This report is intended exclusively for the purpose outlined and applies only to the subject property.

This Phase I ESA excludes asbestos, lead paint, unexploded ordnance, munitions and explosives of concern, and investigation of geotechnical concerns. No surface or subsurface investigation was involved.

1.5 SPECIAL TERMS AND CONDITIONS

This Phase I ESA was conducted and prepared by MNA for the exclusive use of SIGLO FOREST LLC. This report shall not be relied upon or transferred to any other party without written authorization from SIGLO FOREST LLC.

1.6 USER RELIANCE

This report is an instrument of service of MNA, which summarizes its findings and opinions with respect to *recognized environmental conditions* at the subject property. Findings and opinions are predicated on information that MNA obtained on the dates and from individuals stated herein, from public records reviewed, a site reconnaissance, and ancillary Phase I ESA activities. This assessment relies upon the accuracy and completeness of the information provided. The information obtained for this assessment is used without extraordinary verification. It is possible that other information exists and is discovered, or environmental conditions change subsequent to the submittal of this Phase I ESA report, to which MNA shall not be held responsible for exclusion.

2.0 SITE DESCRIPTION

This section contains location and legal description; site and vicinity general characteristics; current subject property use; structures, roads, and other improvements; past subject property use; and current and past use of adjoining properties.

2.1 LOCATION AND LEGAL DESCRIPTION

The subject property is 564.549 acres of parcel TMK (3) 4-7-007:011, in the community of Waimea, Hamakua District, Island of Hawaii. According to the County of Hawaii tax records, the subject property does not have a physical address (County of Hawaii, 2018). The property is located adjacent to the south of Old Mamalahoa Highway, and approximately 1 mile south of State Highway 19 (Mamalahoa Highway). A TMK map is presented in Figure 2.

2.2 SITE AND VICINITY GENERAL CHARACTERISTICS

The subject property is located in a rural area, with commercial and public facilities available in Waimea (Kamuela), about 8.5-mile drive from the property. The subject property is approximately 5 miles south of the Pacific Ocean, in a high precipitation region in the north of the Island of Hawaii. The subject property is on the lower northern slopes of Mauna Kea in an area predominantly used as cattle pastureland.

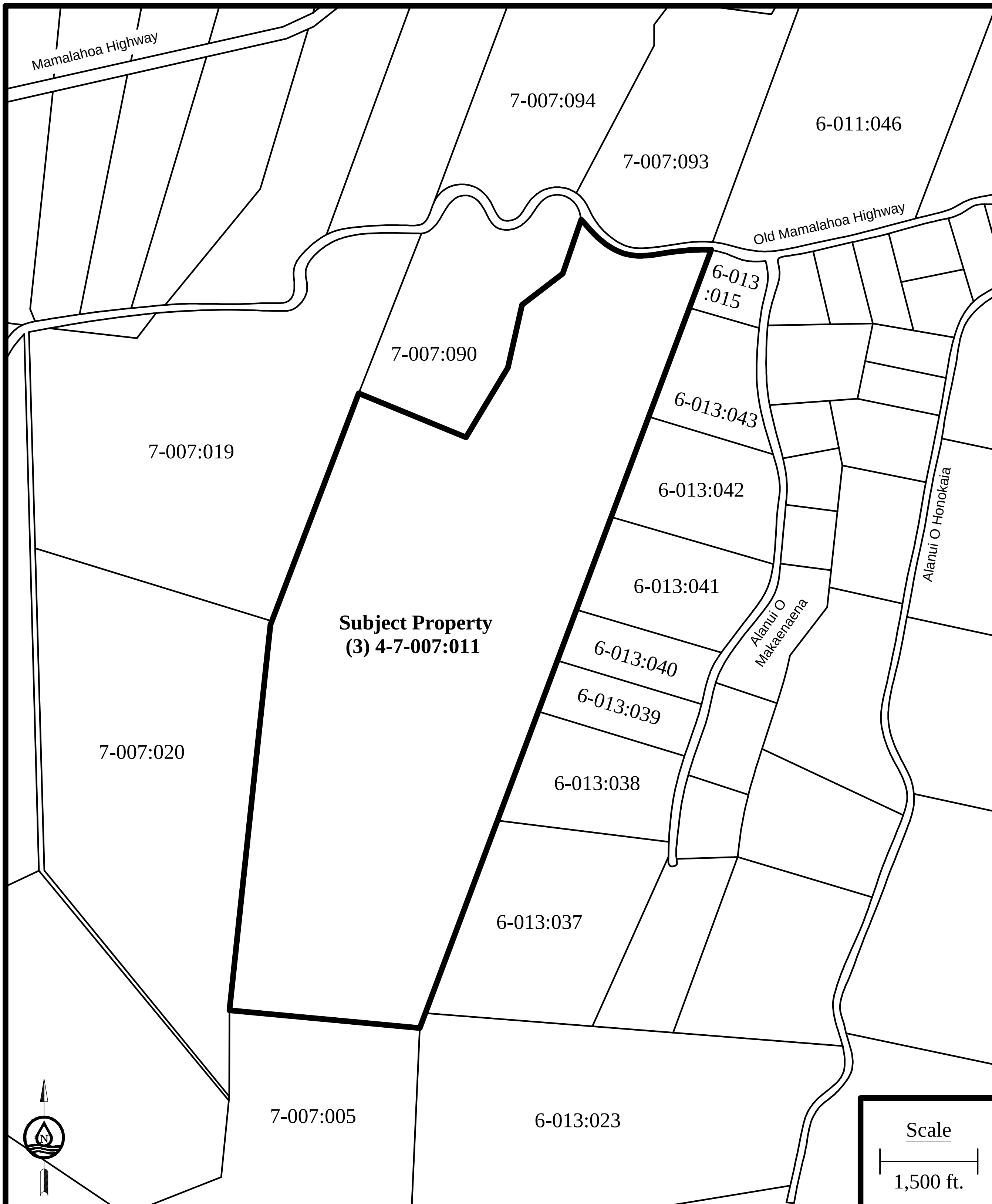
Waimea has a rich history of missionaries, livestock industry, native Hawaiians, paniolo (Hawaiian cowboys), and as home of well-known Parker Ranch. Its country living, relatively cool climate, astronomy observatory offices, schools, and verdant mountain beauty have attracted newcomers over the years; the U.S. Census counted 6,798 and 9,212 residents of Waimea town in 2000 and 2010, respectively. Waimea’s population includes farmers, ranchers, educators, astronomers and technicians, health professionals, realtors, contractors, architects, bankers, small business owners, and employees of the hotel, livestock, and lumber industries.

2.3 GEOLOGY

The Island of Hawaii is of volcanic origin and was accumulated by the combination of Kohala, Mauna Kea, Mauna Loa, Kilauea, and Hualalai volcanoes. The island is comprised of numerous thin, extremely permeable tholeiitic (relatively rich in silicon and iron) basalt lava flows (Stearns, 1985).

Hawaii, the youngest and largest Hawaiian Island, is larger than all the other Hawaiian Islands combined. Hazlett and Hyndman (1996) describe the island as follows:

> It [Hawaii Island] sprawls over an area the size of Connecticut, spanning 90 miles from north to south and 80 miles from east to west. Five large volcanoes coalesce to make the visible part of the Big Island; a sixth lies buried beneath the surface. The southern part of the island is still volcanically active and building out along much of the coastline. To the north, volcanism is in the waning stages. Of all the Hawaiian Islands, the Big Island shows the greatest diversity of rocks and landscapes (Hazlett & Hyndman, 1996).



Myounghee Noh & Associates, L.L.C.

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Figure 2. TMK Map
Phase I Environmental Site Assessment
TMK (3) 4-7-007:011
Waimea, Hawaii

March 2018

Mink and Lau described the geology in the Honokaa Aquifer System, as follows:

> The Hamakua lavas are exposed throughout the aquifer system but in places are covered by Laupahoehoe Volcanics, mostly at higher elevations. Pahala Ash blankets much of the region. In addition, many local ash beds are layered within the main formation. No substantial sediments occur. Cliffs rise several hundred feet at the coast.

The subject property measures approximately 1.5 miles in length, with the northern boundary at 2,800 feet in elevation and the southern boundary at 3,200 feet in elevation (Environmental Data Resources, Inc., 2018). The subject property is located on the lower northern slope of the post-shield phase Mauna Kea volcano, the highest summit of the Hawaiian Islands, and the State's only volcano known to have been glaciated. The subject property is underlain by lavas of the Hamakua Volcanics, basalt lava flows (Pleitocene) from Mauna Kea volcano and Laupahoehoe Volcanics lava flows (Pleitocene) (Sherrod, Sinton, Watkins, & Brunt, 2007).

The United States Department of Agriculture Natural Resources Conservation Service classifies five soil types at the subject property. Information for the soil types are provided in Table 1.

Table 1. Subject Property Soil Types

Soil Type	Percent of Subject Property	Capacity to Transmit Water	Drainage Class	Typical Profile (inches below ground surface)
Maile hydrous silt loam, 0-6% slopes	48.9%	Moderately high to high (0.20 to 1.98 in/hr)	Well drained	0-5: hydrous silt loam 5-8: ashy sandy loam 8-60: hydrous silty clay loam
Honokaa highly organic hydrous silty clay loam, 20-35% slopes	29.6%	Moderately high to high (0.20 to 1.98 in/hr)	Well drained	0-7: highly organic hydrous silty clay loam 7-65: hydrous silty clay loam
Honokaa highly organic hydrous silty clay loam, 0-10% slopes	18.4%	Moderately high to high (0.57 to 1.98 in/hr)	Well drained	0-7: highly organic hydrous silty clay loam 7-65: hydrous silty clay loam
Maile-Waiakea-Rock outcrop complex, 6-35% slopes	2.9%	Moderately high to high (0.20 to 2.00 in/hr)	Well drained	0-5: hydrous silt loam 5-8: ashy sandy loam 8-60: hydrous silty clay loam
Honokaa highly organic hydrous silty clay loam, 10-20% slopes	0.3%	Moderately high to high (0.57 to 1.98 in/hr)	Well drained	0-7: highly organic hydrous silty clay loam 7-65: hydrous silty clay loam

2.4 HYDROLOGY AND HYDROGEOLOGY

The HDOH Safe Drinking Water Branch established an Underground Injection Control (UIC) line to serve as a boundary between drinking water and non-drinking water portions of aquifers. Areas above (mountain side) the UIC line are within drinking water portions of the aquifer, while areas below (ocean side) the UIC line are in non-drinking water portions of the underlying aquifer. The subject property is above the UIC line in a drinking water portion of the aquifer (Hawaii Department of Health Safe Drinking Water Branch, 2014).

The hydraulic gradient, and therefore the expected direction of travel of the basal groundwater within the basaltic formation is, in general, from mountain areas to the shoreline. According to Mink and Lau (1993), the subject property is located above the Honokaa Aquifer System of the East Mauna Kea aquifer sector and described the hydrogeology and aquifer as follows:

> Hydrology. At the coast the average annual rainfall is about 60 in. It increases to 120 in. at an elevation of about 3,500 ft, then diminishes to 20 in. at higher elevations. Streams are perennial in their upper reaches where they are fed by perched water, but most are non-perennial at the cost. Virtually no stream flow measurements have been made.
>
> Groundwater. Perched groundwater occurs on ash beds, and dike water at considerable depths occurs as the rift zones are approached. However, basal groundwater is the principal resource. The zone of basal water is about 10 miles wide. It is fresh and easily developed by deep wells.

Table 2 and Table 3 provide information about the Honokaa upper and lower aquifers (Mink & Lau, 1993).

Table 2. Upper Honokaa Aquifer System

Aquifer Code	**80201214**
Island Code	8–Hawaii
Aquifer Sector	02–East Mauna Kea
Aquifer System	01–Honokaa
Aquifer Type, hydrogeology	2–High Level, fresh water not in contact with sea water
Aquifer Condition	1–Unconfined, where water table is upper surface of saturated aquifer
Aquifer Type, geology	4–Perched, aquifer on an impermeable layer
Status Code	**21111**
Development Stage	2–Potential Use
Utility	1–Drinking
Salinity	1–Fresh (<250 mg/L Cl^-)
Uniqueness	1–Irreplaceable
Vulnerability to Contamination	1–High

mg/L Cl^--milligrams per liter of chloride

Table 3. Lower Honokaa Aquifer System

Aquifer Code	**80201111**
Island Code	8–Hawaii
Aquifer Sector	02–East Mauna Kea
Aquifer System	01–Honokaa
Aquifer Type, hydrogeology	1–Basal, fresh water in contact with seawater
Aquifer Condition	1–Unconfined, where water table is upper surface of saturated aquifer
Aquifer Type, geology	1–Flank, horizontally extensive lavas
Status Code	**11112**
Development Stage	1–Currently used
Utility	1–Drinking
Salinity	1–Fresh (<250 mg/L Cl^-)
Uniqueness	1–Irreplaceable
Vulnerability to Contamination	2–Moderate

mg/L Cl^--milligrams per liter of chloride

According to the Hawaii Groundwater & Geothermal Resources Center, there are two wells in the vicinity of the subject property. Based on the nearby well data, it is estimated that groundwater at the subject property is located more than 1,000 feet below ground surface. Information for the two wells is included in Table 4 (University of Hawaii at Manoa, 2012).

Table 4. Vicinity Well Information

Well Information / Well ID	6235-001 Waimea C C	6331-002 Ahualoa Deepwell
Latitude/Longitude	20.043/-155.596	20.05/-155.519
Owner	Asia Pacific Group, LLC	Dept. of Water Supply Hawaii-Hilo
User	Asia Pacific Group, LLC	Dept. of Water Supply Hawaii-Hilo
Spud Date	1991	2007
Elevation	2,814 ft. above msl	2,598 ft. above msl
Well Depth	1,415 ft. above msl	1,700 ft. above msl
Well Head	1,657 ft. above msl	1,324.91 ft. above msl
Approximate distance/location to subject property	3 miles west	1.25 miles northeast
MNA estimated groundwater depth	1,157 ft. bgs	1,273.09 ft. bgs

Note: MNA estimated groundwater depth by elevation minus well head. This assumes that the well head is located near the top of the water table. Groundwater depth may vary.
bgs below ground surface ID Identification msl mean sea level

The Federal Emergency Management Agency flood map for the area (1551660225FE, effective 9/29/2017) indicates that the subject property is Flood Zone X, or areas outside of the 500-year flood zone (Federal Emergency Management Agency, 1988).

2.5 CURRENT USE OF THE SUBJECT PROPERTY

The subject property was owned by the Parker Land Trust. The property was pastureland for cattle grazing.

2.6 STRUCTURES, ROADS, AND OTHER IMPROVEMENTS

One water tank was present on the southern portion of the subject property. The subject property was undeveloped pastureland. The subject property was accessed via Old Mamalahoa Highway by a light duty dirt road that traveled north to south through the property, and ended at approximately the center of the subject property.

2.7 PAST USES OF THE SUBJECT PROPERTY

Information regarding past uses of the subject property was obtained from a review of tax records (County of Hawaii, 2018), historic topographic maps and aerial photographs, and interviews. According to the County of Hawaii Real Property Tax Office, Parker Land Trust owns the subject property, and has since circa 1961. Mr. Richard Smart is Parker Ranch's late owner. Table 5 summarizes available information regarding the historical use and users of the subject property.

Table 5. Users and Primary Uses of Subject Property

Period (approx.)	Owner/Lessee	Area (acres)	Primary Use
TMK (3) 4-7-007:011, Old Mamalahoa Highway, Waimea			
2004-Present	Parker Land Trust	564.549	Ranching
2004	**95 acres to new TMK (3) 4-7-007:090**		
2004	**Area revised to 659.549 acres**		
1994-2004	Hawaii Meat Company, Ltd.	659.282	Ranching
1994	**Area revised to 659.282 acres**		
1961-1994	Richard Smart Trust	647.1	Ranching
Prior to 1961	A.W. Carter Trustee	647.1	Ranching

TMK - Tax Map Key

2.8 CURRENT AND PAST USES OF ADJOINING PROPERTIES

Information regarding past uses of the adjoining properties was obtained from review of tax records (County of Hawaii, 2018), historic topographic maps and aerial photographs, and interviews. The property use information is summarized in Table 6.

Table 6. Users and Primary Uses of Adjoining Properties

Period (approx.)	Owner/Lessee	Area (acres)	Primary Use
TMK (3) 4-6-011:046; 46-4440 Old Mamalahoa Highway, Waimea Adjoining property to the Northeast			
2006-Present	Hawaiian Home Lands/ Paula Iwalani Boteilho	275.017	Ranching
2005-2006	Hawaiian Home Lands	275.017	Ranching
2005	**TMK created from TMK (3) 4-6-011:004**		
1995-2005	Hawaiian Home Lands/ Honokaa Ranch, Inc.	650.755	Ranching
1991-1995	State of Hawaii DLNR/ Honokaa Ranch, Inc.	650.755	Ranching
1978-1991	State of Hawaii DLNR/ Brilhante Hawaii, Inc.	650.755	Ranching
1978	**33.923 acres to TMK (3) 4-6-011:044**		
1975-1978	State of Hawaii/ William Brilhante	684.678	Ranching
1975	**Area revised**		
1963-1975	State of Hawaii/ Richard Smart	687.667	Ranching
1963	**8.523 acres into road, 80.81 acres to TMK (3) 4-6-011:005**		
1959-1963	State of Hawaii/ Richard Smart	777	Ranching
1952-1959	Territory of Hawaii/ Richard Smart	777	Ranching
1951-1952	Territory of Hawaii/ Hiroshi Kuwahara	777	Ranching
1951	**Area revised**		
1944-1951	Territory of Hawaii/ Richard Smart	385.6	Ranching
Prior to 1944	Territory of Hawaii/	385.6	Ranching

Period (approx.)	Owner/Lessee	Area (acres)	Primary Use
	A.W. Carter Trust		
TMK (3) 4-6-013:015; No street address, Waimea Adjoining property to the East			
2014-Present	Hawaiian Home Lands/ Pamela Jean Ramos	14	Ranching
2011-2014	Hawaiian Home Lands/ Dolores Ramos	14	Ranching
2011	**TMK created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii/ A.W. Carter Trust	2,475.7	Ranching
TMK (3) 4-6-013:023; No street address, Waimea Adjoining property to the Southeast			
2011-Present	Hawaiian Home Lands	225	Ranching
2011	**TMK created from TMK (3) 4-6-013:016**		
2011	**TMK (3) 4-6-013:016 created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii/ A.W. Carter Trust	2,475.7	Ranching
TMK (3) 4-6-013:037; No street address, Waimea Adjoining property to the East			
2013-Present	Hawaiian Home Lands/ Yvonne DeLuz	102.634	Ranching
2011-2013	Hawaiian Home Lands	102.634	Ranching

Period (approx.)	Owner/Lessee	Area (acres)	Primary Use
2011	**TMK created from TMK (3) 4-6-013:016**		
2011	**TMK (3) 4-6-013:016 created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii A.W. Carter Trust	2,475.7	Ranching
TMK (3) 4-6-013:038; No street address, Waimea Adjoining property to the East			
2011-Present	Hawaiian Home Lands	50	Ranching
2011	**TMK created from TMK (3) 4-6-013:016**		
2011	**TMK (3) 4-6-013:016 created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii/ A.W. Carter Trust	2,475.7	Ranching
TMK (3) 4-6-013:039; No street address, Waimea Adjoining property to the East			
2011-Present	Hawaiian Home Lands	25	Ranching
2011	**TMK created from TMK (3) 4-6-013:016**		
2011	**TMK (3) 4-6-013:016 created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching

Period (approx.)	Owner/Lessee	Area (acres)	Primary Use
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii/ A.W. Carter Trust	2,475.7	Ranching
TMK (3) 4-6-013:040; No street address, Waimea Adjoining property to the East			
2011-Present	Hawaiian Home Lands	25	Ranching
2011	**TMK created from TMK (3) 4-6-013:016**		
2011	**TMK (3) 4-6-013:016 created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii/ A.W. Carter Trust	2,475.7	Ranching
TMK (3) 4-6-013:041; No street address, Waimea Adjoining property to the East			
2011-Present	Hawaiian Home Lands	50	Ranching
2011	**TMK created from TMK (3) 4-6-013:016**		
2011	**TMK (3) 4-6-013:016 created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii/	2,475.7	Ranching

Period (approx.)	Owner/Lessee	Area (acres)	Primary Use
	A.W. Carter Trust		
TMK (3) 4-6-013:042; No street address, Waimea Adjoining property to the East			
2011-Present	Hawaiian Home Lands	50	Ranching
2011	**TMK created from TMK (3) 4-6-013:016**		
2011	**TMK (3) 4-6-013:016 created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii/ A.W. Carter Trust	2,475.7	Ranching
TMK (3) 4-6-013:043; No street address, Waimea Adjoining property to the East			
2011-Present	Hawaiian Home Lands	36	Ranching
2011	**TMK created from TMK (3) 4-6-013:016**		
2011	**TMK (3) 4-6-013:016 created from TMK (3) 4-6-011:003**		
2005-2011	Hawaiian Home Lands	739.311	Ranching
1975-2005	State of Hawaii DLNR/ Richard Smart	739.311	Ranching
1975	**Area revised**		
1959-1975	State of Hawaii/ Richard Smart	739	Ranching
1953-1959	Territory of Hawaii/ Richard Smart	739	Ranching
1951-1952	Territory of Hawaii/ Seichi Mukai	739	Ranching
1951	**Various acreage to various TMKs**		
1944-1951	Territory of Hawaii/ Richard Smart	2,475.7	Ranching
Prior to 1944	Territory of Hawaii/ A.W. Carter Trust	2,475.7	Ranching
TMK (3) 4-7-007:005; No street address, Waimea Adjoining property to the South			
2000-Present	Hawaiian Home Lands/ Glenn Bertelmann	282.506	Ranching
1977-2000	Hawaiian Home Lands/ Beatrice Bertelmann	282.506	Ranching
1977	**Area revised to 282.506 acres**		

Period (approx.)	Owner/Lessee	Area (acres)	Primary Use
1972-1977	Hawaiian Homes Commission/ Beatrice Bertelmann	282	Ranching
1952-1971	Hawaiian Homes Commission/ Archibald Bertelmann	282	Ranching
1953	**TMK dropped into TMK (3) 4-7-007:001 and resubdivided**		
1950-1953	Hawaiian Homes Commission/ Richard Smart	1,579	Ranching
1945-1950	Territory of Hawaii/ Richard Smart	1,579	Ranching
Prior to 1945	Territory of Hawaii/ A.W. Carter Trust	1,579	Ranching
TMK (3) 4-7-007:019; 47-4837 Old Mamalahoa Highway, Waimea Adjoining property to the West			
2005-Present	Hawaiian Home Lands/ Elizabeth Camara	271.724	Ranching
1991-2005	Hawaiian Home Lands/ Martin Daffodil	271.724	Ranching
1978-1991	Hawaiian Home Lands/ Martha Lazarus	271.724	Ranching
1977-1978	Hawaiian Home Lands/ Eleazer Lazarus	271.724	Ranching
1977	**Area revised to 271.724 acres**		
1952-1977	Hawaiian Home Lands/ Eleazer Lazarus	275	Ranching
1952	**TMK created from TMK (3) 4-7-007:001**		
1953	Hawaiian Homes Commission	3,055.13	Ranching
1948-1953	Territory of Hawaii	3,055.13	Ranching
Prior to 1948	Territory of Hawaii Hawaiian Irrigation Co., Ltd.	3,055.13	Ranching
TMK (3) 4-7-007:020; 47-4841 Old Mamalahoa Highway, Waimea Adjoining property to the West			
2013-Present	Hawaiian Home Lands/ Paakaula and Kuuipookala Kalawaianui Micah and Isaiah Kaaihui	271.304	Ranching
2012-2013	Hawaiian Home Lands/ Joseph Nakoa Paakaula and Kuuipookala Kalawaianui Micah and Isaiah Kaaihui	271.304	Ranching
2005-2012	Hawaiian Home Lands/ William Kalawaianui Joseph Nakoa	271.304	Ranching
2005	Hawaiian Home Lands/ William Kalawaianui	271.304	Ranching
1993-2005	Hawaiian Home Lands/ Randolph Nakoa	271.304	Ranching
1952-1993	Hawaiian Home Lands/ William Kalawaianui	271.304	Ranching

Period (approx.)	Owner/Lessee	Area (acres)	Primary Use
1977	**Area revised to 271.304 acres**		
1953-1977	Hawaiian Home Lands/ William Kalawaianui	275	Ranching
1953	**TMK created from TMK (3) 4-7-007:001**		
1953	Hawaiian Homes Commission	3,055.13	Ranching
1948-1953	Territory of Hawaii	3,055.13	Ranching
Prior to 1948	Territory of Hawaii/ Hawaiian Irrigation Co., Ltd.	3,055.13	Ranching
TMK (3) 4-7-007:090; No street address, Waimea Adjoining property to the Northwest			
2004-Present	Kapoaula Land, LLC	95	Quarry
2004	Parker Land Trust	95	Quarry
2004	**TMK created from TMK (3) 4-7-007:011**		
1994-2004	Hawaii Meat Company, Ltd.	659.282	Quarry
1994	**Area revised**		
1961-1994	Richard Smart Trust	647.1	Quarry/Ranching
Prior to 1961	A.W. Carter Trustee	647.1	Ranching
TMK (3) 4-7-007:093; 47-4411 Hawaii Belt Road, Waimea Adjoining property to the North			
2012-Present	Cindy and Paul Andrade	104.532	Ranching
2011-2012	Alfred Jose Andrade Family LTD Partnership	104.532	Ranching
2011	**TMK created from TMK (3) 4-7-007:010**		
2002-2011	Alfred Jose Andrade Family LTD Partnership	418.045	Ranching
1999-2002	Title Holdings 90115 LLC	418.045	Ranching
1999	**Area revised**		
1994-1999	Hawaii Meat Company, Ltd.	417.989	Ranching
1994	**Area revised for pipeline easement**		
1966-1994	Richard Smart Trust	451.675	Ranching
1966	**8.685 acres dropped into road, acreage to TMK (3) 4-7-007:054 and :055**		
Prior to 1966	A.W. Carter Trustee	629.763	Ranching
TMK (3) 4-7-007:094; 47-4411 Hawaii Belt Road, Waimea Adjoining property to the Northwest			
2012-Present	Jolette Rapozo Trust	104.532	Ranching
2011-2012	Alfred Jose Andrade Family LTD Partnership	104.532	Ranching
2011	**TMK created from TMK (3) 4-7-007:010**		
2002-2011	Alfred Jose Andrade Family LTD Partnership	418.045	Ranching
1999-2002	Title Holdings 90115 LLC	418.045	Ranching
1999	**Area revised**		
1994-1999	Hawaii Meat Company, Ltd.	417.989	Ranching
1994	**Area revised for pipeline easement**		
1966-1994	Richard Smart Trust	451.675	Ranching
1966	**8.685 acres dropped into road, acreage to TMK (3) 4-7-007:054 and :055**		
Prior to 1966	A.W. Carter Trustee	629.763	Ranching

DLNR Department of Land and Natural Resources TMK - Tax Map Key

3.0 USER PROVIDED INFORMATION

User provided information was obtained by having a representative of SIGLO FOREST LLC, Nick Koch, complete a "User Questionnaire" administered by MNA. The information in the following sections was obtained from the questionnaire.

3.1 ENVIRONMENTAL LIENS OR ACTIVITY AND USE LIMITATIONS

Mr. Koch was unaware of any environmental cleanup liens or activity and land use limitations for the subject property.

3.2 SPECIALIZED KNOWLEDGE

Mr. Koch indicated that he had no specialized knowledge or experience related to the property or nearby properties, nor did he have reasonably ascertainable information of any spills, chemical releases, or environmental cleanups at the site. He indicated that there is no known contamination believed to be present. Mr. Koch indicated that there may be green waste on the subject property.

3.3 VALUATION REDUCTION

The user had no information pertaining to the valuation reduction of the site. Mr. Koch indicated that the purchase price reflects fair market value.

3.4 REASON FOR PERFORMING THE PHASE I ESA

The purpose of this Phase I ESA is to identify any *recognized environmental conditions* at the subject property, within the scope of ASTM Standard 1527-13, for due diligence in connection with a Purchase Agreement between the Parker Land Trust (Seller) and SIGLO FOREST LLC.

4.0 RECORDS REVIEW

Under ASTM 1527-13, records are to be reviewed by the environmental professional who may help identify RECs in connection with the subject property.

4.1 STANDARD ENVIRONMENTAL RECORD SOURCES

MNA used Environmental Data Resources, Inc., to search standard federal and state government databases for hazardous substance or petroleum product releases that could impact the subject property. A copy of the EDR report is provided in Appendix A.

ASTM E 1527-13 specifies a minimum search distance for specific environmental record sources. The following sources are specified for <u>incidents or sites within 1 mile of the subject property</u>:

- Federal NPL site list
- Federal RCRA CORRACTS TSD facilities list
- State-equivalent NPL

The following sources are specified for <u>incidents or sites within ½ mile of the subject property</u>:

- Federal Delisted NPL site list
- Federal CERCLIS list
- Federal SEMS-Archive site list (formerly CERLIS-NFRAP)

- Federal RCRA non-CORRACTS TSD facilities list
- State-equivalent CERCLIS
- State landfill and/or solid waste disposal site list
- State leaking UST list
- State voluntary cleanup program sites
- State Brownfield Sites

The following sources are for incidents on the subject and adjoining properties:

- Federal RCRA generators list
- State registered UST list

Finally, the following are for incidents for the subject property:

- Federal Institutional Controls (IC) and Engineering Controls (EC) Registries
- Federal ERNS list
- State IC and EC Registries

MNA also searches additional record sources including the following.

- Federal Brownfields Sites within ½ mile of the subject property
- Federal Release Sites (FINDS) for the subject property
- State Releases list (SPILLS) for the subject property

The following subsections summarize the results of the EDR records review for the datasets listed above (Environmental Data Resources, Inc., 2018).

4.1.1 Federal National Priorities List

The NPL, maintained by the U.S. Environmental Protection Agency (EPA), is a list of highly contaminated sites that have been identified by Superfund Amendments and Reauthorization Act of 1986. There were no NPL sites identified within 1 mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.2 Federal RCRA CORRACTS TSD Facilities List

The RCRA CORRACTS TSD facilities list maintained by the EPA contains generators, transporters, treaters, storers, and disposers of hazardous waste that have reported violations and are subject to corrective actions. There were no RCRA CORRACTS TSD within 1 mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.3 Delisted NPL Site List

This list, maintained by the EPA, contains delisted NPL sites. No delisted NPL sites were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.4 Federal CERCLIS List

The CERCLIS list, maintained by the EPA, contains sites that are either proposed to be or are on the NPL list, as well as sites that are in the screening and assessment phase for possible inclusion on the NPL. No federal CERCLIS sites were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.5 Federal SEMS-Archive Site List

SEMS-Archive (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS-Archive by the EPA in 2015. The SEMS-Archive list, maintained by the EPA, contains designated CERCLA sites that, to the best of the EPA's knowledge, assessment has been completed and has determined that no further steps will be taken to list the sites on the NPL. No SEMS-Archive sites were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.6 Federal RCRA non-CORRACTS TSD Facilities List

The RCRA non-CORRACTS TSD facilities list, maintained by the EPA, contains RCRA permitted facilities that treat, store, or dispose of hazardous waste. No RCRA TSD facilities listed were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.7 State Hazardous Waste Sites

The SHWS records are the states' equivalent to CERCLIS. In Hawaii, the CERLIS-equivalent is the Sites of Interest database, maintained by the HDOH Hazardous Evaluation and Emergency Response (HEER) Office. These sites may or may not already be listed on the federal CERCLIS list. Priority sites planned for cleanup using state funds are identified along with sites where cleanup will be paid for by responsible parties. No SHWS were identified within 1 mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.8 State Landfill/Solid Waste Disposal Sites

The HDOH records contain an inventory of permitted landfills in the State of Hawaii. No permitted solid waste landfills, incinerators, or transfer stations were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.9 State Leaking UST List

This list, maintained by the HDOH Solid and Hazardous Waste Branch (SHWB), is an inventory of sites with Leaking USTs. No Leaking UST facilities were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.10 State Voluntary Cleanup Sites

The state voluntary cleanup sites list, maintained by the HDOH HEER Office, contains sites participating in the state's Voluntary Response Program (VRP). No facilities participating in the state VRP were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.11 State Brownfield Sites

This database, maintained by the HDOH HEER Office, is an inventory of state designated brownfield sites. Under the Small Business Liability Relief and Brownfields Revitalization Act, a brownfield is defined as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant." The EPA provides grants and loans to state and local governments for the assessment, cleanup, and redevelopment of these properties. Properties located on the state brownfield list may have received federal funding under this program or be designated a brownfield for state administration or funding purposes. No state brownfield sites were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.12 Federal RCRA Generators List

The RCRA Generators list, maintained by the EPA, contains small and large quantity generators of hazardous waste. The determination of generator size is used to establish the risk that the facility poses to public health and the environment and consequently, the amount of regulation and reporting required. Large Quantity Generators (LQG) are facilities that generate more than a 1,000 kg/month of hazardous waste and/or more than 1 kg/month of acute hazardous waste. Small Quantity Generators (SQG) are facilities that generate less than 1,000 kg/month but more than 100 kg/month of hazardous waste and/or less than 1 kg/month of acute hazardous waste.

Conditionally Exempt Small Quantity Generators (CESQG) are facilities that generate less than 100 kg/month of hazardous waste and/or less than 1 kg/month of acute hazardous waste. The EPA also maintains the RCRA NLR list. This list contains facilities that were once on the RCRA generators list, but are no longer in business, no longer in business at the listed address, or are no longer generating hazardous waste substances in quantities that require reporting. No LQG, SQG, CESQG, or NLR were identified within ¼ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.13 State Registered UST List

The HDOH SHWB maintains a database of known USTs. No USTs were identfied within ¼ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.14 Federal IC and EC Registries

The Federal IC and EC registries contain federally listed sites that are required to implement Institutional Controls (IC) or Engineering Controls (EC). Because the sites may continue to be impacted by past use, future use of the property may be restricted in order to protect human health and the environment. Land use controls can be either ICs or ECs. ICs are limitations on how the property may be used such as prevention of soil disturbance. ECs are physical structures or devices located on the property that contain or limit human or environmental exposure to contamination. ECs need to be maintained or protected to be effective. No Federal IC or EC sites were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.15 Federal ERNS List

The ERNS list, maintained by the EPA, contains CERCLA hazardous substance releases or spills, as maintained at the National Response Center. No incidents were identified on the subject property (Environmental Data Resources, Inc., 2018).

4.1.16 State ICs and ECs Registries

The State IC and EC registries contain state listed sites that have either state-required ICs or ECs in place. Because the sites may continue to be impacted by past use, future use of the property may be restricted in order to protect human health and the environment. Land Use Controls can be either ICs or ECs. ICs are limitations on how the property may be used. ECs are physical structures or devices located on the property that contain or limit exposure to contamination. ECs need to be maintained or protected to be effective. No State IC or EC sites were identified within ½ mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.17 U.S. Brownfields

U.S. Brownfields are real property, of which the expansion, redevelopment, or reuse may be complicated by the presence of a hazardous substance, pollutant, or contaminant. No U.S. Brownfields sites were identified within one mile of the subject property (Environmental Data Resources, Inc., 2018).

4.1.18 Facility Index System/Facility Registry System

The FINDS is a centrally managed EPA database that identifies facilities, sites, or places of environmental interest in the United States. No FINDS sites were identified in proximity to the subject property (Environmental Data Resources, Inc., 2018).

4.1.19 Hazardous Materials Incident Reporting System

The Hazardous Materials Incident Reporting System, also called SPILLS or SPILLS90, includes hazardous materials spills that were reported to state Department of Transportation. No SPILLS sites were identified in proximity to the subject property (Environmental Data Resources, Inc., 2018).

4.2 ADDITIONAL RECORD SOURCES

MNA reviewed additional environmental records as needed and available. Additional record sources filed by the HDOH SHWB and the HEER Office, HFD, and HELCO were requested. MNA reviewed available online records for the subject and adjoining properties.

4.2.1 Subject Property

MNA requested records for review from the HDOH SHWB, HEER Office, HFD, and HELCO. HDOH and HFD responded that they had no records on file for the subject property. No transformers were observed on or adjacent to the subject property during the site reconnaissance. HELCO responded to the records request and confirmed that there were no oil-filled electrical equipment on the subject property.

MNA reviewed publicly available information posted on the HEER Office website and found that the subject property was not listed on the HEER Sites of Interest Lookup Spreadsheet or the Emergency Response Lookup Spreadsheet. MNA reviewed the HDOH Environmental Health Warehouse and found that there were no sites of interest shown on the subject property (State of Hawaii, Department of Health HEER Office, 2018).

Documents in connection with the subject property were provided by the client. On 24 June 2015, the HEER Office issued a letter to the property owner, Parker Land Trust, in regards to the subject property. The letter indicated that the department was reaching out to parties that may be interested in being listed in their Brownfields Inventory and may quality for EPA Brownfields grants to help with cleanup due to the property being listed as an illegal dump site.

4.2.2 Surrounding Properties

MNA requested records for review from the HDOH on 26 and 29 January 2018 for TMK (3) 4-7-007:090, the adjoining property to the northwest. The HEER Office responded that they had no records on file for the adjoining property.

MNA reviewed publicly available information posted on the HEER Office website and found that the adjoining properties were not listed on the HEER Sites of Interest Lookup Spreadsheet or the Emergency Response Lookup Spreadsheet. MNA reviewed the HDOH Environmental Health Warehouse and found that there were no sites of interest shown in the vicinity of the subject property (State of Hawaii, Department of Health HEER Office, 2018).

HDOH SHWB responded with records for review, as follows:

Kapoaula Gravel Quarry, Old Mamalahoa Highway, TMK (3) 4-7-007:090, (northwest adjoining property)

On 18 October 2004, the SHWB Solid Waste Division (SWD), notified DeLuz Trucking & Gravel, LLC, (DeLuz Trucking) that an inspection of the property conducted on 29 September 2004 indicated that the site may be operating as an illegal dump site for green waste, tires, and construction and demolition waste, on the northeast side gulch of the site. The site was owned by Kapoaula Land, LLC, and used by DeLuz Trucking as an aggregate quarry and crushing facility. On 11 July 2006, a formal letter from the SWD notified Edwin DeLuz of DeLuz Trucking that they were in violation of operating an unpermitted solid waste management system. During a previous site inspection, over six stockpiles of demolition waste such as used lumber, pallets, green waste material, concrete pylons, and metal were observed.

A November 2006 Work Plan by Tropical Marine Environments, Inc., detailed the proposed trenching, removal, and disposal activities for cleanup of the dump site. Target areas were identified at the east side near Old Mamalahoa Highway and the southeast slope of the gulch area. It was estimated that 858 tons of green waste; 100 cubic yards of metal stockpile; and an unknown quantity of lumber, metal, concrete slabs, rebar, and other solid wastes were at the site. The work plan proposed segregation of green waste from construction and demolition waste, proper disposal of green waste, disposal of construction and demolition waste at a permitted facility, visual observation for hazardous materials and controlled substances, recording of all activities, and analytical sampling if hazardous materials or controlled substances were encountered.

Monthly progress reports from December 2008 to January 2008 documented work conducted at the site. A letter dated 25 February 2008 from Tropical Marine Environments to the SWD stated that no work could be completed that month due to site flooding caused by heavy rainfall. Heavy rains resulted in as much as 4 feet of standing water starting from the third week of January to 22 February 2008, which halted work. Photographs were submitted and documented the site flooding.

A final report dated 12 October 2008 by Tropical Marine Environments indicated that waste removal began following acceptance of the work plan on 21 November 2006 and was completed on 21 June 2008. Construction and demolition material were taken to the West Hawaii Landfill, tires were removed by Arizumi Tire Disposal, and scrap metal was taken to Hawaii Metal Recovery Corporation. The excavated work area was trapezoidal in shape and encompassed approximately 35,000 square feet. Solid waste encountered included green waste; construction and demolition waste including concrete, rebar, sheet metal, metal piping, plastic piping, and lumber; automotive debris including tires, axles, engine, and frame parts; and a small volume of household waste. No hazardous waste, toxic materials, or controlled substances were encountered. SWD inspected the site on 17 June 2008 and determined the cleanup substantially complete. Only some stockpiled wastes were left for removal from the site.

On 12 November 2008, the SHWB SWD determined that cleanup was complete and No Further Action was required at the site. Refer to Section 8.2 for determination of potential impact of the illegal dump site to the subject property.

4.3 HISTORICAL USE INFORMATION ON THE SUBJECT PROPERTY

MNA reviewed historical use information for the subject property, including aerial photographs and United States Geological Survey (USGS) topographic maps. No fire insurance maps were available.

4.3.1 Historical Aerial Photographs

Aerial photographs of the subject, adjoining, and surrounding properties were provided by EDR (Environmental Data Resources, Inc., 2018). Photographs from the years 1954, 1965, 1977, and 2002 were reviewed (Table 7). Included in this section are the details from those photos.

Table 7. Aerial Photograph Details

Date	Image Type	Approximate Scale
1954	Black & White	1"=1,125’
1965	Black & White	1"=1,125’
1977	Black & White	1"=1,125’
2002	False Color	1"=1,125’

For the aerial photographs, the following observations were made:

<u>1954</u>: Old Mamalahoa Highway is adjacent to the north of the subject property. A forested rectangular plot of land is located in the center of the subject property; a small pond is located to the east of the forested area. The remainder of the subject property and all surrounding properties appear to be grasslands.

<u>1965</u>: The pond is no longer visible on the subject property. Trails and fence lines are visible throughout the subject property. A small road is located to the north of the subject property and ends at the northern boundary. A quarry is located on the adjoining property to the northwest. Highway 19 is visible to the north of the subject property.

<u>1977</u>: No changes from the 1965 photograph were observed.

<u>2002</u>: Structures are visible on properties to the west and northeast. No structures are visible on the subject property.

MNA reviewed historical aerial imagery available from Google Earth. Photographs from the years 2010 and 2013 were reviewed. For the reviewed aerial imagery, the following observations were made:

2010: In this image dated 05 January 2010, the subject property appears to be grassland; no structures are visible. Trails and fence lines are visible throughout the subject property. A rectangular forested area is located in the center of the subject property. Numerous troughs were visible throughout property. One water tank was visible in the southern portion of the property. Old Mamalahoa Highway is adjacent to the north and State Highway 19 (Mamalahoa Highway) is located approximately 1 mile north of the subject property. A quarry is visible on the adjoining property to the northwest. The surrounding properties appear to be used as pasture for cattle grazing.

2013: In this image dated 18 January 2013, cattle were observed throughout the subject property. No other changes to the subject property or surrounding properties from the 2010 image are observed.

4.3.2 Historical Topographic Maps

USGS topographic maps that cover the subject property and vicinity were reviewed. Maps were available for the years 1916, 1930, 1957, 1982, 1995, and 2013 (Environmental Data Resources, Inc., 2018). A copy of the historical topographic maps provided by EDR is included in Appendix A. The maps of the subject property and surrounding area depicted the following:

1916: Old Mamalahoa Road is depicted adjacent to the north of the subject property. A stream is depicted running from the west and ending in the approximate center of the subject property. Several streams are depicted on the adjoining properties to the north, east, and west.

1930: There are more elevation gridlines depicted on the map. The streams are not depicted on this map. No other changes from the 1916 map are observed.

1957: Old Mamalahoa Highway is depicted as a secondary highway. A vegetated area is shown in the center of the subject property. Four small ponds are visible on the subject property, two in the center and two to the south. A water tank is depicted on the northern portion of the property. A jeep trail from the north ends at the northern boundary of the subject property, at a quarry. A cave and quarries are depicted on the adjoining property to the northwest. The subject property is depicted in a land area designated at “Kapoaula.” Elevation of the subject property is 2,800 ft at the northern end and 3,200 ft at the southern end.

1982: Only one of the four small ponds is depicted on the subject property. Old Mamalahoa Highway is identified as a light duty road. Highway 19 (Mamalahoa Highway) is located approximately 1 mile to the north of the subject property and is depicted as a primary highway. Several water tanks and corrals are depicted on the surrounding properties, indicating that the area was used for cattle ranching.

1995: Corrals are not depicted on the map. No other changes from the 1982 map are observed.

2013: Quarries and water tanks are not depicted on the map. Fewer landmarks are depicted. No other changes from the 1995 map are observed.

4.3.3 Sanborn Fire Insurance Map

No Sanborn Fire Insurance maps were available for the subject property.

5.0 SITE RECONNAISSANCE

The site reconnaissance was conducted by Jennah Oshiro and Adam Custer on 05 February 2018. The site reconnaissance focused on identifying *recognized environmental conditions* (RECs) with the ability to impact the subject property. A site map of the subject property is presented in Figure 3. Refer to Section 8.1 for determination of impact of the observations made during the site reconnaissance to the subject property.

5.1 METHODOLOGY AND LIMITING CONDITIONS

The site reconnaissance was conducted by visually inspecting the subject property while driving and on foot. MNA looked for a variety of environmental hazard indicators including, but not limited to, stained surface soil, dead or stressed vegetation, hazardous substances, aboveground and underground storage tanks, disposal areas, groundwater wells, drywells, and sumps. Figure 3 presents the path walked and other notable features. Photographs from the site reconnaissance are presented in Appendix B and are referred to within this section.

5.2 GENERAL SITE SETTING

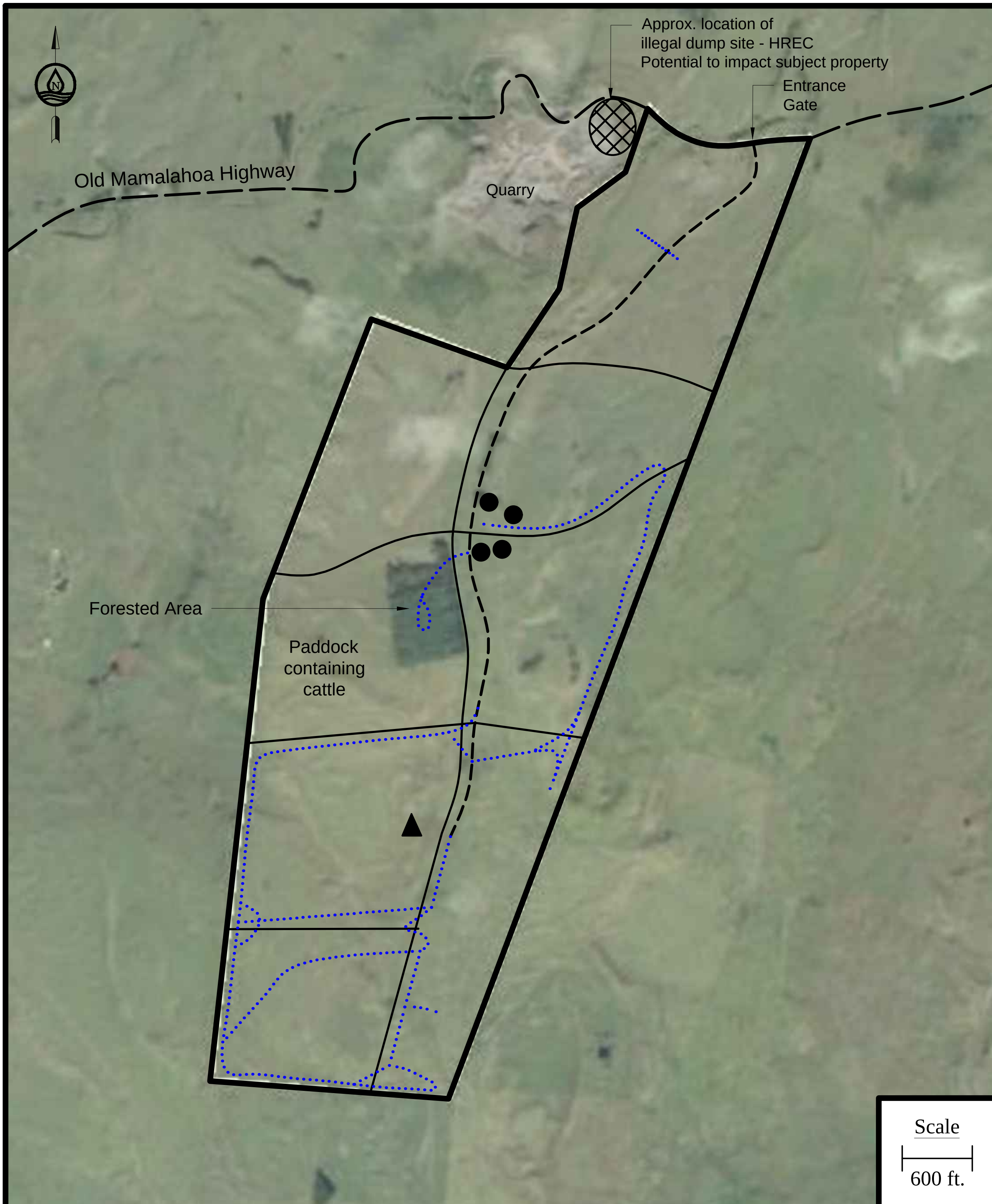
The subject property was located adjacent to the south of Old Mamalahoa Highway (Photographs 1 and 2). The subject property was undeveloped, with no indications that structures have previously existed on the property. The adjoining property to the northwest was a quarry (Photographs 3 and 4). All other adjoining properties were undeveloped pastureland (Photographs 5 - 10).

5.3 EXTERIOR OBSERVATIONS

The subject property was accessed via Old Mamaloahoa Highway through a gated entrance on the northern border (Photograph 11). The gate was locked and the property was fenced, preventing unauthorized access. One light duty dirt road traveled north to south through the property, and ended at approximately the center of the subject property (Photograph 12). No other roads were present on the property. The subject property was delineated with boundary markers along the property boundaries. MNA observed survey markers at the northeast, southwest, and southeast corners of the subject property (Photographs 13 - 15).

The subject property was subdivided into eight separate paddocks with cattle and electric fencing (Photographs 16 - 20). Cattle were observed grazing in a paddock, which included the forested area (Photograph 21). The property was pastureland with the exception of one forested area, in the center of the subject property (Photographs 22 and 23). Lines of trees were observed, indicating that the trees were planted (Photograph 24). Four small ponds were observed in the center of the property, near the forested area (Photographs 25 - 27).

One 400-gallon water tank was located on the subject property and is serviced by a private waterline that enters the subject property from the south (Photograph 28). Several troughs were located throughout the property and were manually filled (Photograph 29). No transformers were observed on or adjacent to the subject property.



HREC - Historical Recognized Environmental Condition; defined as a past release of any hazardous substances or petroleum products that has occured in connection with the property and has been addressed to the satisfaction of the applicable regulatory agency.

Subject Property Boundary
Light Duty Road
Path Taken
Pond (15 ft. x 15 ft.)
Water Tank
Fence line

Myounghee Noh & Associates, L.L.C.

2529_5

Figure 3. Site Map
Phase I Environmental Site Assessment
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Waimea, Hawaii

March 2018

5.4 INTERIOR OBSERVATIONS

No structures were observed on the subject property; therefore, no interior observations were made.

5.5 HAZARDOUS SUBSTANCES AND PETROLEUM PRODUCTS

No hazardous substances or petroleum products were observed on the subject property.

5.6 ABOVEGROUND AND UNDERGROUND STORAGE TANKS

One above ground water storage tank was observed. MNA observed no other indications of aboveground or underground storage tanks or associated accessories, such as vent pipes, fill ports, or dispensers, on the subject property.

6.0 INTERVIEWS

MNA interviewed Keoki Wood, Livestock Manager for Parker Ranch, via email on 27 February 2018. Harry "Haia" Auweloa, Grazing Unit Ranch Hand for Parker Ranch, was interviewed by MNA via telephone on 02 March 2018. Both interviews were administered by Jennah Oshiro. Three attempts were made to conduct an interview with an operator of the DeLuz Trucking for the adjoining property to the northwest. However, DeLuz Trucking had not responded to the request and therefore an interview with DeLuz Trucking was not conducted at the time of this writing.

6.1 KEOKI WOOD, LIVESTOCK OPERATIONS MANAGER, PARKER RANCH

On 27 February 2018, MNA interviewed Keoki Wood, Livestock Operations Manager of Parker Ranch. Mr. Wood stated that he has worked at the subject property since 2002 and since then, the property has only been used for cattle grazing. Mr. Wood indicated that there have been no past issues with the property, other than that there is no water meter associated with the property. He said that the property has always been considered a productive pasture.

Mr. Wood indicated that he had no knowledge of any spills, chemical releases, environmental cleanups, environmental cleanup liens, engineering controls, land use restrictions, or institutional controls at the site.

6.2 HARRY "HAIA" AUWELOA, GRAZING UNIT RANCH HAND, PARKER RANCH

On 02 March 2018, MNA interviewed Harry "Haia" Auweloa, Grazing Unit Ranch Hand of Parker Ranch. Mr. Auweloa has worked on the subject property since September 2016, and is responsible for overseeing the general day to day operations of the cattle pasture. He said that to his knowledge, the subject property has always been used as pastureland for cattle grazing. The adjoining properties were also once all owned by Parker Ranch and used as pastureland. He indicated that approximately 15 years ago, many of the adjoining properties were acquired by Hawaiian Homelands and were subdivided. The properties remained to be used as pastureland.

Mr. Auweloa indicated that there was one water aboveground storage tank on the site. He also stated that there were four year-round ponds on the site, and eight seasonal ponds. Mr. Auweloa said that there was no green waste or dump site on the subject property.

Mr. Auweloa indicated that he had no knowledge of any spills, chemical releases, environmental cleanups, environmental cleanup liens, engineering controls, land use restrictions, or institutional controls at the site.

7.0 DATA GAPS AND DEVIATIONS

There were no deviations from the ASTM method during this Phase I ESA; however, the unknown groundwater quality at the subject property is considered a data gap.

8.0 KEY FINDINGS AND OPINION

This section evaluates the key findings of this assessment and makes a determination as to the presence of RECs, if any.

8.1 SUBJECT PROPERTY

8.1.1 Non-REC

No records of NPL sites, Federal RCRA CORRACTS and Non-CORRACTS Treatment Storage Disposal Facilities, Delisted NPL sites, Federal Comprehensive Environmental Response, Compensation, and Liability Information System sites, landfill or solid waste disposal sites, State Voluntary Cleanup sites, Federal RCRA Generator sites, State registered underground storage tank sites, IC/EC control registries, Federal Emergency Response Notification System list sites, or Federal or State Brownfields sites were identified at the subject property.

A user questionnaire completed by SIGLO FOREST LLC representative, Nick Koch, indicated that there may be a green waste stockpile on the subject property. Documents in connection with the subject property were also provided by the client. On 24 June 2015, the HDOH (HEER Office issued a letter to the property owner, Parker Land Trust, in regards to the parcel. The letter indicated that HEER Office was contacting landowners that the owner may be interested in being listed in their Brownfields Inventory for possible eligibility for Environmental Protection Agency redevelopment funding, due to the property being previously identified as an illegal dump site. Upon review of the HDOH SHWB records, it was found that the adjoining property to the northwest, located at TMK (3) 4-7-007:090, contained an illegal dump. Additionally, no indications of an illegal dump were observed during the site reconnaissance or during review of aerial photographs of the subject property. MNA also conducted an interview with Harry “Haia” Auweloa, who stated that he was not aware of any green waste or dump sites on the property. Because the adjoining property at TMK (3) 4-7-007:090 was formerly a part of the subject property, it was concluded that the “green waste” and “illegal dump” speculations in the user provided documents were the result of confusion stemming from the adjoining property previously being a part of the subject property TMK. According to review of the County of Hawaii tax records, the adjoining property was split from the subject property in 2004. As a result, it is presumed that there was no green waste or illegal dump at the subject property.

Review of U.S. Geological Survey topographic maps and historical aerial photographs for the subject property and surrounding properties did not indicate any *RECs*.

There were no structures or indications of the past presence of structures on the subject property. The subject property was primarily grassland for cattle grazing, with an approximately 14-acre non-native forested area in the center. The property was subdivided into eight paddocks with fencing. Cattle were periodically rotated between the paddocks. No indications of *RECs* were observed during the site reconnaissance.

The HDOH, HFD, and HELCO responded that they had no records or information regarding the subject property.

8.1.2 REC

There were no *RECs* identified on the subject property. However, the unknown groundwater quality resulting from an illegal dump site on the adjoining property could lead to a *REC*.

8.2 SURROUNDING AREA

8.2.1 Non-REC

No records of NPL sites, Federal RCRA CORRACTS and Non-CORRACTS Treatment Storage Disposal Facilities, Delisted NPL sites, Federal Comprehensive Environmental Response, Compensation, and Liability Information System sites, landfill or solid waste disposal sites, State Voluntary Cleanup sites, Federal RCRA Generator sites, State registered underground storage tank sites, engineering control/institutional control registries, Federal Emergency Response Notification System list sites, or Federal or State Brownfields sites were identified for the surrounding area. No sites were identified by Environmental Data Resources Inc., for the standard environmental record sources

Information provided as part of the interviews or user questionnaire did not indicate any *RECs*.

The HDOH HEER Office responded that they had no records or information regarding the adjoining property to the northwest.

8.2.2 REC

There were no RECs identified in the area surrounding the subject property. However, based on the previous illegal use of the land for waste disposal and apparent flooding of the areas, the groundwater may have been impacted by leachates, particularly from the industrial waste (Section 8.2.3).

8.2.3 HREC

In 2004, HDOH SHWB identified the illegal dump area at the northeast portion of the TMK (3) 4-7-007:090, adjacent to Old Mamalahoa Highway. Records indicated that the illegally dumped materials included green waste; construction and demolition waste including concrete, rebar, sheet metal, metal piping, plastic piping, and lumber; automotive debris including tires, axles, engine, and frame parts; and a small volume of household waste. No hazardous waste, toxic materials, or controlled substances were encountered. In 2008, the SHWB determined that No Further Action was necessary. More information on the illegal dump area and cleanup activities are included in Section 4.2.2. Based on the solid waste observed and cleaned up from the site, it is likely that petroleum products from the automobile debris were released to the site.

Based on the relative distance of the illegal dump site to the subject property and apparent flooding in the area, it is possible that petroleum product residues from automotive parts entered the subject property. The groundwater quality at the subject property is unknown, and is considered a data gap. The potential petroleum product release from the illegal dump site to the subject property is an *historical REC* (HREC) which could lead to a REC, if the groundwater was impacted.

An HREC is defined per ASTM E1527-13 as a past release of any hazardous substances or petroleum products that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authority or meeting unrestricted use criteria established by a regulatory authority, without subjecting the property to any required controls (for example, property use restrictions, activity and use limitations, institutional controls, or engineering controls).

9.0 CONCLUSION

MNA performed a Phase I Environmental Site Assessment in conformance with the scope and limitations of ASTM E 1527-13 of the 564.549-acre subject property identified as TMK (3) 4-7-007:011 in Waimea, Hawaii. Any exceptions to, or deletions from, this practice are described in Section 7.0 of this report. This assessment has revealed no evidence of *recognized environmental conditions*, as defined by ASTM, in connection with the *subject property*, except for the following:

- The presence of an illegal dump site on the adjoining property to the northwest is an HREC, with potential to impact groundwater quality at the subject property.

REFERENCES

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APPENDIX A Environmental Data Resources Report and Maps

Siglo Phase I ESA Waimea
66-1304 MAMALAHOA HWY
Honokaa, HI 96727

Inquiry Number: 5168800.2s
January 25, 2018

The EDR Radius Map™ Report with GeoCheck®

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

66-1304 MAMALAHOA HWY
HONOKAA, HI 96727

COORDINATES

Latitude (North):	20.0347470 - 20˚ 2' 5.08''
Longitude (West):	155.5472230 - 155˚ 32' 50.00''
Universal Tranverse Mercator:	Zone 5
UTM X (Meters):	233534.0
UTM Y (Meters):	2217224.8
Elevation:	3052 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5949328 KUKUIHAELE, HI
Version Date:	2013
South Map:	5949264 MAKAHALAU, HI
Version Date:	2013

MAPPED SITES SUMMARY

Target Property Address:
66-1304 MAMALAHOA HWY
HONOKAA, HI 96727

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION

NO MAPPED SITES FOUND

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL - National Priority List
Proposed NPL - Proposed National Priority List Sites
NPL LIENS - Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL - National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY - Federal Facility Site Information listing
SEMS - Superfund Enterprise Management System

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE - Superfund Enterprise Management System Archive

Federal RCRA CORRACTS facilities list

CORRACTS - Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF - RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG - RCRA - Large Quantity Generators
RCRA-SQG - RCRA - Small Quantity Generators
RCRA-CESQG - RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS - Land Use Control Information System
US ENG CONTROLS - Engineering Controls Sites List

US INST CONTROL Sites with Institutional Controls

Federal ERNS list

ERNS Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS Sites List

State and tribal landfill and/or solid waste disposal site lists

SWF/LF Permitted Landfills in the State of Hawaii

State and tribal leaking storage tank lists

LUST Leaking Underground Storage Tank Database
INDIAN LUST Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST Underground Storage Tank Listing
UST Underground Storage Tank Database
INDIAN UST Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

ENG CONTROLS Engineering Control Sites
INST CONTROL Sites with Institutional Controls

State and tribal voluntary cleanup sites

VCP Voluntary Response Program Sites
INDIAN VCP Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS Brownfields Sites

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI Report on the Status of Open Dumps on Indian Lands
ODI Open Dump Inventory
DEBRIS REGION 9 Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL Delisted National Clandestine Laboratory Register

CDL	Clandestine Drug Lab Listing
US CDL	National Clandestine Laboratory Register

Local Land Records

LIENS 2	CERCLA Lien Information

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
SPILLS	Release Notifications
SPILLS 90	SPILLS 90 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated
FUDS	Formerly Used Defense Sites
DOD	Department of Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
ROD	Records Of Decision
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
FUSRAP	Formerly Utilized Sites Remedial Action Program
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
ABANDONED MINES	Abandoned Mines
FINDS	Facility Index System/Facility Registry System
DOCKET HWC	Hazardous Waste Compliance Docket Listing
UXO	Unexploded Ordnance Sites
ECHO	Enforcement & Compliance History Information
FUELS PROGRAM	EPA Fuels Program Registered Listing
AIRS	List of Permitted Facilities
DRYCLEANERS	Permitted Drycleaner Facility Listing

EXECUTIVE SUMMARY

Financial Assurance - - - - - - - - - - Financial Assurance Information Listing
UIC - Underground Injection Wells Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP - EDR Proprietary Manufactured Gas Plants
EDR Hist Auto - - - - - - - - - - - - - - - - EDR Exclusive Historical Auto Stations
EDR Hist Cleaner - - - - - - - - - - - - - EDR Exclusive Historical Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS - Recovered Government Archive State Hazardous Waste Facilities List
RGA LF - Recovered Government Archive Solid Waste Facilities List
RGA LUST - - - - - - - - - - - - - - - - - - - Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

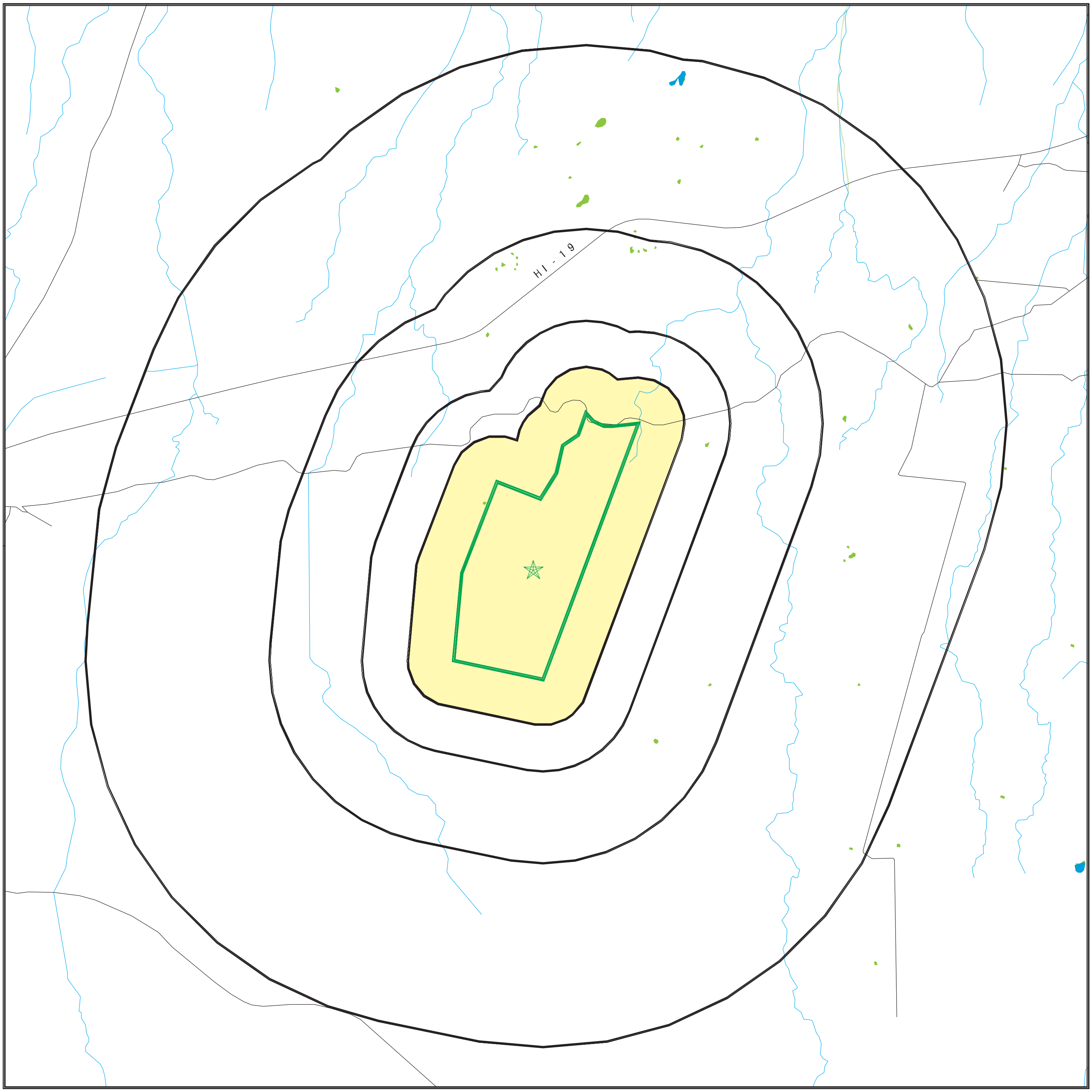
Surrounding sites were not identified.

Unmappable (orphan) sites are not considered in the foregoing analysis.

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 5168800.2S



Target Property	
Sites at elevations higher than or equal to the target property	
Sites at elevations lower than the target property	
Manufactured Gas Plants	
National Priority List Sites	
Dept. Defense Sites	

0 3/4 1 1/2 3 Miles

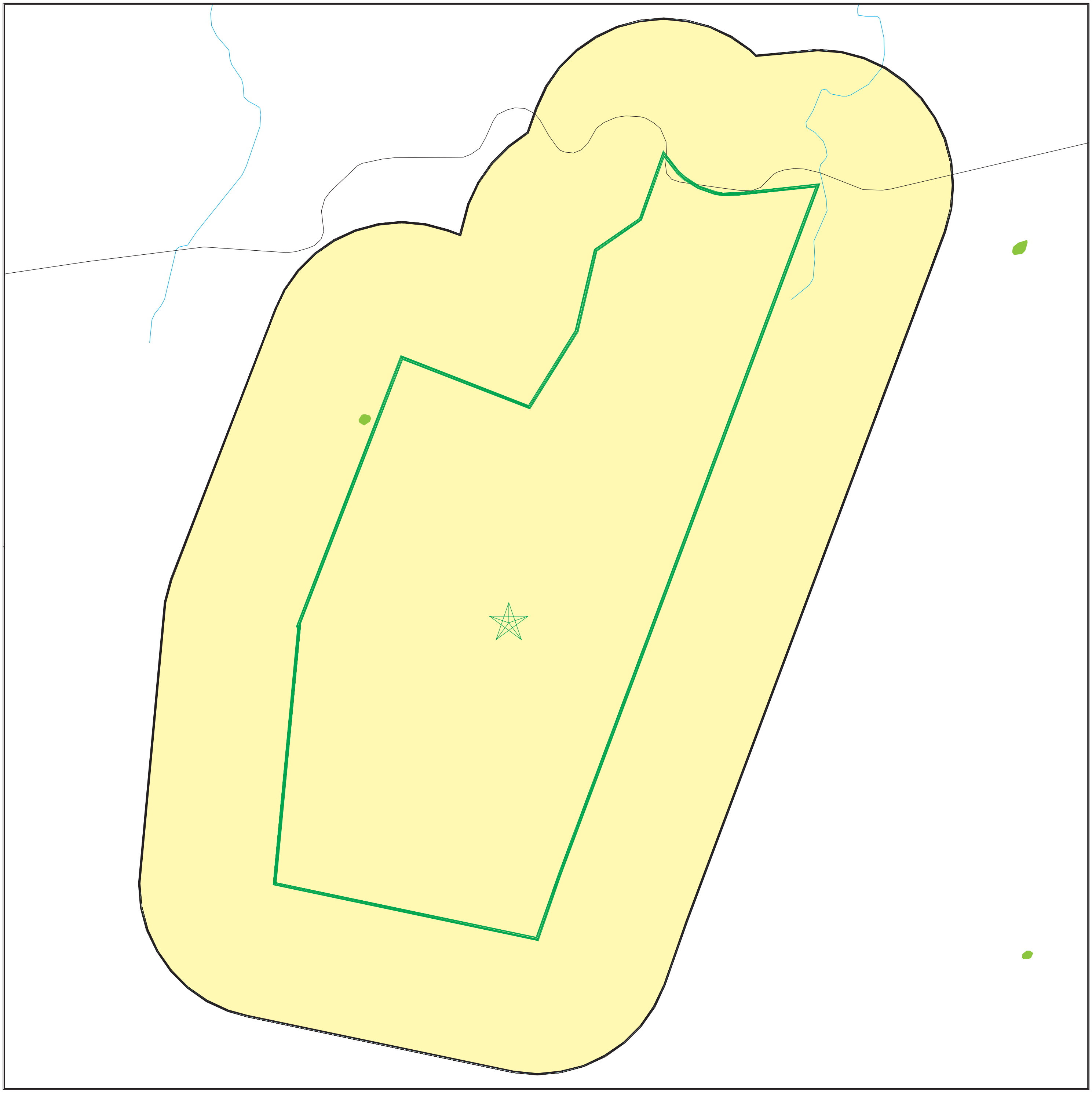
Indian Reservations BIA
100-year flood zone
500-year flood zone
National Wetland Inventory
State Wetlands

Upgradient Area

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Siglo Phase I ESA Waimea ADDRESS: 66-1304 MAMALAHOA HWY Honokaa HI 96727 LAT/LONG: 20.034747 / 155.547223	CLIENT: Myounghee Noh and Associates CONTACT: Jennah Oshiro INQUIRY #: 5168800.2s DATE: January 25, 2018 3:56 pm

DETAIL MAP - 5168800.2S



Target Property

Sites at elevations higher than or equal to the target property

Sites at elevations lower than the target property

Manufactured Gas Plants

Sensitive Receptors

National Priority List Sites

Dept. Defense Sites

0 1/4 1/2 1 Miles

Indian Reservations BIA

100-year flood zone

500-year flood zone

National Wetland Inventory

State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Siglo Phase I ESA Waimea	CLIENT:	Myounghee Noh and Associates
ADDRESS:	66-1304 MAMALAHOA HWY	CONTACT:	Jennah Oshiro
	Honokaa HI 96727	INQUIRY #:	5168800.2s
LAT/LONG:	20.034747 / 155.547223	DATE:	January 25, 2018 3:56 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.125		0	0	0	0	0	0
Proposed NPL	1.125		0	0	0	0	0	0
NPL LIENS	0.125		0	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.125		0	0	0	0	0	0
Federal CERCLIS list								
FEDERAL FACILITY	0.625		0	0	0	0	NR	0
SEMS	0.625		0	0	0	0	NR	0
Federal CERCLIS NFRAP site list								
SEMS-ARCHIVE	0.625		0	0	0	0	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.125		0	0	0	0	0	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.625		0	0	0	0	NR	0
Federal RCRA generators list								
RCRA-LQG	0.375		0	0	0	NR	NR	0
RCRA-SQG	0.375		0	0	0	NR	NR	0
RCRA-CESQG	0.375		0	0	0	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.625		0	0	0	0	NR	0
US ENG CONTROLS	0.625		0	0	0	0	NR	0
US INST CONTROL	0.625		0	0	0	0	NR	0
Federal ERNS list								
ERNS	0.125		0	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.125		0	0	0	0	0	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.625		0	0	0	0	NR	0
State and tribal leaking storage tank lists								
LUST	0.625		0	0	0	0	NR	0
INDIAN LUST	0.625		0	0	0	0	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.375		0	0	0	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
UST	0.375		0	0	0	NR	NR	0
INDIAN UST	0.375		0	0	0	NR	NR	0
State and tribal institutional control / engineering control registries								
ENG CONTROLS	0.625		0	0	0	0	NR	0
INST CONTROL	0.625		0	0	0	0	NR	0
State and tribal voluntary cleanup sites								
VCP	0.625		0	0	0	0	NR	0
INDIAN VCP	0.625		0	0	0	0	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.625		0	0	0	0	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.625		0	0	0	0	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
INDIAN ODI	0.625		0	0	0	0	NR	0
ODI	0.625		0	0	0	0	NR	0
DEBRIS REGION 9	0.625		0	0	0	0	NR	0
IHS OPEN DUMPS	0.625		0	0	0	0	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	0.125		0	NR	NR	NR	NR	0
CDL	0.125		0	NR	NR	NR	NR	0
US CDL	0.125		0	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	0.125		0	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	0.125		0	NR	NR	NR	NR	0
SPILLS	0.125		0	NR	NR	NR	NR	0
SPILLS 90	0.125		0	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.375		0	0	0	NR	NR	0
FUDS	1.125		0	0	0	0	0	0
DOD	1.125		0	0	0	0	0	0
SCRD DRYCLEANERS	0.625		0	0	0	0	NR	0
US FIN ASSUR	0.125		0	NR	NR	NR	NR	0
EPA WATCH LIST	0.125		0	NR	NR	NR	NR	0
2020 COR ACTION	0.375		0	0	0	NR	NR	0
TSCA	0.125		0	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
TRIS	0.125		0	NR	NR	NR	NR	0
SSTS	0.125		0	NR	NR	NR	NR	0
ROD	1.125		0	0	0	0	0	0
RMP	0.125		0	NR	NR	NR	NR	0
RAATS	0.125		0	NR	NR	NR	NR	0
PRP	0.125		0	NR	NR	NR	NR	0
PADS	0.125		0	NR	NR	NR	NR	0
ICIS	0.125		0	NR	NR	NR	NR	0
FTTS	0.125		0	NR	NR	NR	NR	0
MLTS	0.125		0	NR	NR	NR	NR	0
COAL ASH DOE	0.125		0	NR	NR	NR	NR	0
COAL ASH EPA	0.625		0	0	0	0	NR	0
PCB TRANSFORMER	0.125		0	NR	NR	NR	NR	0
RADINFO	0.125		0	NR	NR	NR	NR	0
HIST FTTS	0.125		0	NR	NR	NR	NR	0
DOT OPS	0.125		0	NR	NR	NR	NR	0
CONSENT	1.125		0	0	0	0	0	0
INDIAN RESERV	1.125		0	0	0	0	0	0
FUSRAP	1.125		0	0	0	0	0	0
UMTRA	0.625		0	0	0	0	NR	0
LEAD SMELTERS	0.125		0	NR	NR	NR	NR	0
US AIRS	0.125		0	NR	NR	NR	NR	0
US MINES	0.375		0	0	0	NR	NR	0
ABANDONED MINES	0.375		0	0	0	NR	NR	0
FINDS	0.125		0	NR	NR	NR	NR	0
DOCKET HWC	0.125		0	NR	NR	NR	NR	0
UXO	1.125		0	0	0	0	0	0
ECHO	0.125		0	NR	NR	NR	NR	0
FUELS PROGRAM	0.375		0	0	0	NR	NR	0
AIRS	0.125		0	NR	NR	NR	NR	0
DRYCLEANERS	0.375		0	0	0	NR	NR	0
Financial Assurance	0.125		0	NR	NR	NR	NR	0
UIC	0.125		0	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.125		0	0	0	0	0	0
EDR Hist Auto	0.250		0	0	NR	NR	NR	0
EDR Hist Cleaner	0.250		0	0	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	0.125		0	NR	NR	NR	NR	0
RGA LF	0.125		0	NR	NR	NR	NR	0
RGA LUST	0.125		0	NR	NR	NR	NR	0
- Totals --		0	0	0	0	0	0	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

Map ID Direction Distance Elevation	Site	Database(s)	EDR ID Number EPA ID Number

NO SITES FOUND

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 12/11/2017
Date Data Arrived at EDR: 12/22/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 12/22/2017
Next Scheduled EDR Contact: 04/16/2018
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 12/11/2017
Date Data Arrived at EDR: 12/22/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 12/22/2017
Next Scheduled EDR Contact: 04/16/2018
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 12/11/2017
Date Data Arrived at EDR: 12/22/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 14

Source: EPA
Telephone: N/A
Last EDR Contact: 12/22/2017
Next Scheduled EDR Contact: 04/16/2018
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 11/07/2016
Date Data Arrived at EDR: 01/05/2017
Date Made Active in Reports: 04/07/2017
Number of Days to Update: 92

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 01/05/2018
Next Scheduled EDR Contact: 04/16/2018
Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA’s Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 12/11/2017
Date Data Arrived at EDR: 12/22/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 21

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 01/17/2018
Next Scheduled EDR Contact: 04/30/2018
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that. based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 12/11/2017
Date Data Arrived at EDR: 12/22/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 21

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 01/17/2018
Next Scheduled EDR Contact: 04/30/2018
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 09/13/2017
Date Data Arrived at EDR: 09/26/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 10

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 04/09/2018
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 09/13/2017
Date Data Arrived at EDR: 09/26/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 10

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 04/09/2018
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/13/2017
Date Data Arrived at EDR: 09/26/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 10

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 04/09/2018
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 09/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/26/2017	Telephone: (415) 495-8895
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 01/19/2018
Number of Days to Update: 10	Next Scheduled EDR Contact: 04/09/2018
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/26/2017	Telephone: (415) 495-8895
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 01/19/2018
Number of Days to Update: 10	Next Scheduled EDR Contact: 04/09/2018
	Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 05/22/2017	Source: Department of the Navy
Date Data Arrived at EDR: 06/13/2017	Telephone: 843-820-7326
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 11/08/2017
Number of Days to Update: 94	Next Scheduled EDR Contact: 02/26/2018
	Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 08/10/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/30/2017	Telephone: 703-603-0695
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 01/19/2018
Number of Days to Update: 44	Next Scheduled EDR Contact: 03/12/2018
	Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 08/10/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/30/2017	Telephone: 703-603-0695
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 01/19/2018
Number of Days to Update: 44	Next Scheduled EDR Contact: 03/12/2018
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal ERNS list

ERNS: Emergency Response Notification System
Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/18/2017
Date Data Arrived at EDR: 09/21/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 22

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 04/09/2018
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

SHWS: Sites List
Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 03/16/2017
Date Data Arrived at EDR: 03/17/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 182

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/22/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Semi-Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Permitted Landfills in the State of Hawaii
Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 09/17/2012
Date Data Arrived at EDR: 04/03/2013
Date Made Active in Reports: 05/10/2013
Number of Days to Update: 37

Source: Department of Health
Telephone: 808-586-4245
Last EDR Contact: 12/28/2017
Next Scheduled EDR Contact: 04/09/2018
Data Release Frequency: Varies

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank Database
Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 08/01/2017
Date Data Arrived at EDR: 08/30/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 16

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 12/01/2017
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Semi-Annually

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 05/01/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 78

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 04/24/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 71

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 04/25/2017
Date Data Arrived at EDR: 11/07/2017
Date Made Active in Reports: 12/08/2017
Number of Days to Update: 31

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 04/13/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 78

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 04/14/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 71

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 04/26/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 78

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 04/14/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 71

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 10/14/2016
Date Data Arrived at EDR: 01/27/2017
Date Made Active in Reports: 05/05/2017
Number of Days to Update: 98

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Semi-Annually

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 05/15/2017
Date Data Arrived at EDR: 05/30/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 136

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 01/09/2018
Next Scheduled EDR Contact: 04/23/2018
Data Release Frequency: Varies

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 08/01/2017
Date Data Arrived at EDR: 08/30/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 16

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 12/01/2017
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 04/14/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 71

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 10/14/2016
Date Data Arrived at EDR: 01/27/2017
Date Made Active in Reports: 05/05/2017
Number of Days to Update: 98

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 04/26/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 71

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 04/24/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 12/08/2017
Number of Days to Update: 134

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 05/02/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 71

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 05/01/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 78

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 04/13/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 78

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 04/25/2017
Date Data Arrived at EDR: 07/27/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 78

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 01/23/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

State and tribal institutional control / engineering control registries

ENG CONTROLS: Engineering Control Sites

A listing of sites with engineering controls in place.

Date of Government Version: 03/16/2017
Date Data Arrived at EDR: 03/17/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 182

Source: Department of Health
Telephone: 404-586-4249
Last EDR Contact: 11/22/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Varies

INST CONTROL: Sites with Institutional Controls

Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 03/16/2017
Date Data Arrived at EDR: 03/17/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 182

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/22/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

VCP: Voluntary Response Program Sites
Sites participating in the Voluntary Response Program. The purpose of the VRP is to streamline the cleanup process in a way that will encourage prospective developers, lenders, and purchasers to voluntarily cleanup properties.

Date of Government Version: 03/16/2017
Date Data Arrived at EDR: 03/17/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 182

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/22/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 12/20/2017
Next Scheduled EDR Contact: 04/09/2018
Data Release Frequency: Varies

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Sites
With certain legal exclusions and additions, the term ‘brownfield site’ means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

Date of Government Version: 03/16/2017
Date Data Arrived at EDR: 03/17/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 182

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/22/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites
Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 08/21/2017
Date Data Arrived at EDR: 09/20/2017
Date Made Active in Reports: 12/08/2017
Number of Days to Update: 79

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 04/02/2018
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands
Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 10/30/2017
Next Scheduled EDR Contact: 02/12/2018
Data Release Frequency: Varies

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations
A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 01/22/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: No Update Planned

ODI: Open Dump Inventory
An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land
A listing of all open dumps located on Indian Land in the United States.

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Serivces, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 11/03/2017
Next Scheduled EDR Contact: 02/12/2018
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register
A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 07/13/2017
Date Data Arrived at EDR: 09/06/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 30

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 11/28/2017
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: No Update Planned

CDL: Clandestine Drug Lab Listing
A listing of clandestine drug lab site locations.

Date of Government Version: 08/04/2010
Date Data Arrived at EDR: 09/10/2010
Date Made Active in Reports: 10/22/2010
Number of Days to Update: 42

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/21/2017
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Varies

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/13/2017
Date Data Arrived at EDR: 09/06/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 30

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 12/11/2017
Date Data Arrived at EDR: 12/22/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 12/22/2017
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 09/21/2017
Date Data Arrived at EDR: 09/21/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 22

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 04/09/2018
Data Release Frequency: Quarterly

SPILLS: Release Notifications

Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 03/16/2017
Date Data Arrived at EDR: 03/17/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 182

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/22/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Varies

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 03/10/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/11/2013
Number of Days to Update: 39

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 09/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/26/2017	Telephone: (415) 495-8895
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 01/19/2018
Number of Days to Update: 10	Next Scheduled EDR Contact: 04/09/2018
	Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/31/2015	Source: U.S. Army Corps of Engineers
Date Data Arrived at EDR: 07/08/2015	Telephone: 202-528-4285
Date Made Active in Reports: 10/13/2015	Last EDR Contact: 11/22/2017
Number of Days to Update: 97	Next Scheduled EDR Contact: 03/05/2018
	Data Release Frequency: Varies

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005	Source: USGS
Date Data Arrived at EDR: 11/10/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 10/13/2017
Number of Days to Update: 62	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005	Source: U.S. Geological Survey
Date Data Arrived at EDR: 02/06/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 10/11/2017
Number of Days to Update: 339	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/03/2017	Telephone: 615-532-8599
Date Made Active in Reports: 04/07/2017	Last EDR Contact: 11/17/2017
Number of Days to Update: 63	Next Scheduled EDR Contact: 02/26/2018
	Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 10/17/2017
Date Data Arrived at EDR: 11/01/2017
Date Made Active in Reports: 12/08/2017
Number of Days to Update: 37

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 04/09/2018
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 11/06/2017
Next Scheduled EDR Contact: 02/19/2018
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 04/22/2013
Date Data Arrived at EDR: 03/03/2015
Date Made Active in Reports: 03/09/2015
Number of Days to Update: 6

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 11/09/2017
Next Scheduled EDR Contact: 02/19/2018
Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 06/21/2017
Date Made Active in Reports: 01/05/2018
Number of Days to Update: 198

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 12/22/2017
Next Scheduled EDR Contact: 04/02/2018
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 01/10/2018
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 2

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 01/10/2018
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 10/27/2017
Next Scheduled EDR Contact: 02/05/2018
Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 12/11/2017
Date Data Arrived at EDR: 12/22/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 21

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/22/2017
Next Scheduled EDR Contact: 03/19/2018
Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 11/02/2017
Date Data Arrived at EDR: 11/17/2017
Date Made Active in Reports: 12/08/2017
Number of Days to Update: 21

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 05/07/2018
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 10/17/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 3

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 12/22/2017
Next Scheduled EDR Contact: 02/19/2018
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB’s who are required to notify the EPA of such activities.

Date of Government Version: 06/01/2017
Date Data Arrived at EDR: 06/09/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 126

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 01/12/2018
Next Scheduled EDR Contact: 04/23/2018
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System
The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016
Date Data Arrived at EDR: 11/23/2016
Date Made Active in Reports: 02/10/2017
Number of Days to Update: 79

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 01/09/2018
Next Scheduled EDR Contact: 04/23/2018
Data Release Frequency: Quarterly

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 08/18/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: Quarterly

MLTS: Material Licensing Tracking System
MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/30/2016
Date Data Arrived at EDR: 09/08/2016
Date Made Active in Reports: 10/21/2016
Number of Days to Update: 43

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 11/20/2017
Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data
A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 12/05/2017
Next Scheduled EDR Contact: 03/19/2018
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List
A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/08/2017
Next Scheduled EDR Contact: 03/19/2018
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database
The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 05/24/2017
Date Data Arrived at EDR: 11/30/2017
Date Made Active in Reports: 12/15/2017
Number of Days to Update: 15

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 10/26/2017
Next Scheduled EDR Contact: 02/05/2018
Data Release Frequency: Varies

RADINFO: Radiation Information Database
The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 10/02/2017
Date Data Arrived at EDR: 10/05/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 8

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 01/04/2018
Next Scheduled EDR Contact: 04/16/2018
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing
A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing
A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data
Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 02/12/2018
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 09/30/2017
Date Data Arrived at EDR: 11/10/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 63

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 01/04/2018
Next Scheduled EDR Contact: 04/02/2018
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 02/22/2017
Date Made Active in Reports: 09/28/2017
Number of Days to Update: 218

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/20/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 07/14/2015
Date Made Active in Reports: 01/10/2017
Number of Days to Update: 546

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 01/09/2018
Next Scheduled EDR Contact: 04/23/2018
Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 12/23/2016
Date Data Arrived at EDR: 12/27/2016
Date Made Active in Reports: 02/17/2017
Number of Days to Update: 52

Source: Department of Energy
Telephone: 202-586-3559
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 02/19/2018
Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 06/23/2017
Date Data Arrived at EDR: 10/11/2017
Date Made Active in Reports: 11/03/2017
Number of Days to Update: 23

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 11/22/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 10/10/2017
Date Data Arrived at EDR: 11/03/2017
Date Made Active in Reports: 12/15/2017
Number of Days to Update: 42

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 12/22/2017
Next Scheduled EDR Contact: 04/16/2018
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 10/29/2017
Date Data Arrived at EDR: 11/28/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 45

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 11/28/2017
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 12/01/2017
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 12/01/2017
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

ABANDONED MINES: Abandoned Mines

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 09/25/2017
Date Data Arrived at EDR: 09/26/2017
Date Made Active in Reports: 10/20/2017
Number of Days to Update: 24

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 12/19/2017
Next Scheduled EDR Contact: 03/26/2018
Data Release Frequency: Quarterly

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/23/2017
Date Data Arrived at EDR: 09/06/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 9

Source: EPA
Telephone: (415) 947-8000
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 03/19/2018
Data Release Frequency: Quarterly

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 06/27/2017
Date Data Arrived at EDR: 11/21/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 202-564-0527
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Varies

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 09/30/2016
Date Data Arrived at EDR: 10/31/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 73

Source: Department of Defense
Telephone: 703-704-1564
Last EDR Contact: 01/02/2018
Next Scheduled EDR Contact: 04/30/2018
Data Release Frequency: Varies

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 09/02/2017
Date Data Arrived at EDR: 09/06/2017
Date Made Active in Reports: 10/20/2017
Number of Days to Update: 44

Source: Environmental Protection Agency
Telephone: 202-564-2280
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 03/19/2018
Data Release Frequency: Quarterly

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 11/20/2017
Date Data Arrived at EDR: 11/20/2017
Date Made Active in Reports: 01/12/2018
Number of Days to Update: 53

Source: EPA
Telephone: 800-385-6164
Last EDR Contact: 01/19/2018
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Quarterly

AIRS: List of Permitted Facilities
A listing of permitted facilities in the state.

Date of Government Version: 01/02/2018
Date Data Arrived at EDR: 01/04/2018
Date Made Active in Reports: 01/17/2018
Number of Days to Update: 13

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 01/02/2018
Next Scheduled EDR Contact: 04/16/2018
Data Release Frequency: Varies

DRYCLEANERS: Permitted Drycleaner Facility Listing
A listing of permitted drycleaner facilities in the state.

Date of Government Version: 01/02/2018
Date Data Arrived at EDR: 01/04/2018
Date Made Active in Reports: 01/17/2018
Number of Days to Update: 13

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 01/02/2018
Next Scheduled EDR Contact: 04/16/2018
Data Release Frequency: Varies

Financial Assurance: Financial Assurance Information Listing
A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 12/18/2017
Date Data Arrived at EDR: 12/26/2017
Date Made Active in Reports: 01/16/2018
Number of Days to Update: 21

Source: Department of Health
Telephone: 808-586-4226
Last EDR Contact: 12/19/2017
Next Scheduled EDR Contact: 03/26/2018
Data Release Frequency: Varies

UIC: Underground Injection Wells Listing
A listing of underground injection well locations.

Date of Government Version: 02/07/2013
Date Data Arrived at EDR: 02/12/2013
Date Made Active in Reports: 04/09/2013
Number of Days to Update: 56

Source: Department of Health
Telephone: 808-586-4258
Last EDR Contact: 11/21/2017
Next Scheduled EDR Contact: 03/12/2018
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants
The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historical Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historical Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A	Source: EDR, Inc.
Date Data Arrived at EDR: N/A	Telephone: N/A
Date Made Active in Reports: N/A	Last EDR Contact: N/A
Number of Days to Update: N/A	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A	Source: Department of Health
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/08/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 191	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A	Source: Department of Health
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/17/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 200	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/03/2014
Number of Days to Update: 186

Source: Department of Health
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Oil/Gas Pipelines
Source: PennWell Corporation
Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data
Source: PennWell Corporation
This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association’s annual survey of hospitals.
Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.
Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.
Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics’ primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.
Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics’ primary database on private school locations in the United States.

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Office of Planning
Telephone: 808-587-2895

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

SIGLO PHASE I ESA WAIMEA
66-1304 MAMALAHOA HWY
HONOKAA, HI 96727

TARGET PROPERTY COORDINATES

Latitude (North):	20.034747 - 20˚ 2’ 5.09’’
Longitude (West):	155.547223 - 155˚ 32’ 50.00’’
Universal Tranverse Mercator:	Zone 5
UTM X (Meters):	233534.0
UTM Y (Meters):	2217224.8
Elevation:	3052 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5949328 KUKUIHAELE, HI
Version Date:	2013
South Map:	5949264 MAKAHALAU, HI
Version Date:	2013

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

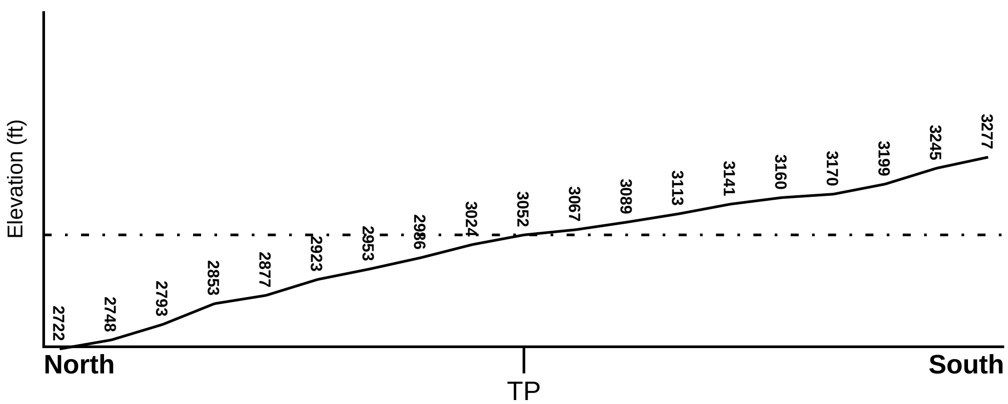
TOPOGRAPHIC INFORMATION

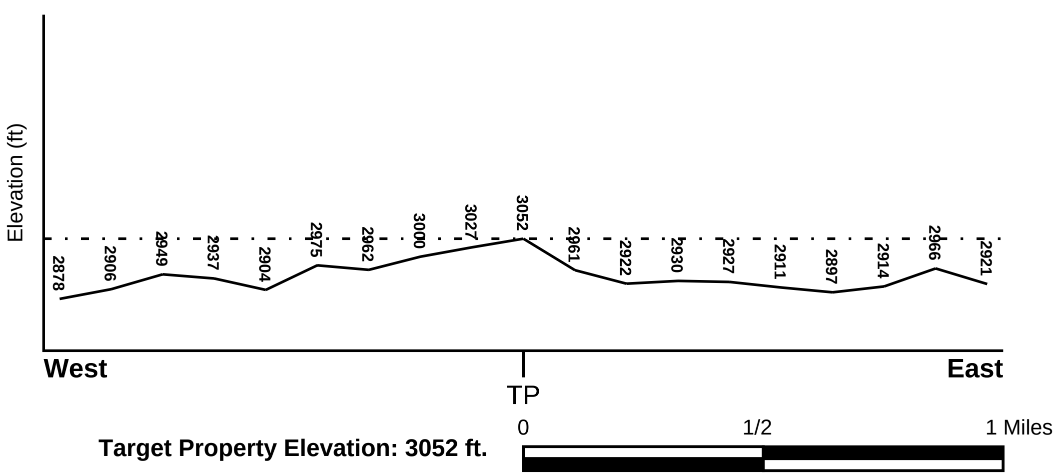
Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General NNE

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES





Target Property Elevation: 3052 ft.

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Flood Plain Panel at Target Property	FEMA Source Type
1551660200C	FEMA Q3 Flood data

Additional Panels in search area:	FEMA Source Type
Not Reported	

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
KUKUIHAELE	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

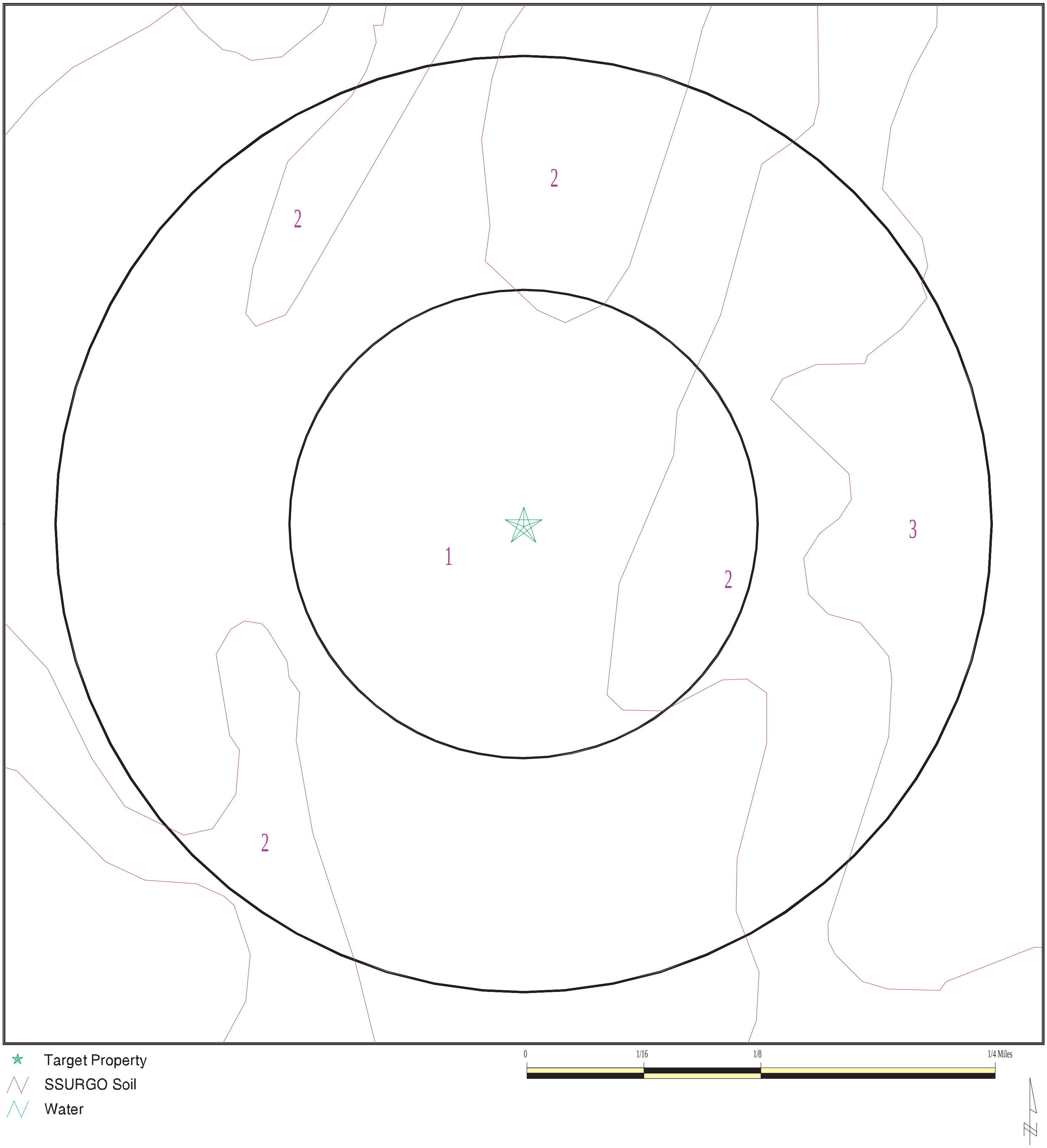
Era: -
System: -
Series: -
Code: N/A *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: -

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 5168800.2s



SITE NAME:	Siglo Phase I ESA Waimea
ADDRESS:	66-1304 MAMALAHOA HWY Honokaa HI 96727
LAT/LONG:	20.034747 / 155.547223

CLIENT:	Myounghee Noh and Associates
CONTACT:	Jennah Oshiro
INQUIRY #:	5168800.2s
DATE:	January 25, 2018 3:56 pm

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture’s (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Maile

Soil Surface Texture: silt loam

Hydrologic Group: Class B - Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils with moderately coarse textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	14 inches	silt loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	OH-T (proposed)	Max: 42 Min: 5	Max: 7.3 Min: 5.6
2	14 inches	59 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	OH-T (proposed)	Max: 14.11 Min: 1.41	Max: 7.3 Min: 6.1

Soil Map ID: 2

Soil Component Name: Rough broken land

Soil Surface Texture: silty clay loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	OH-T (proposed)	Max: 141 Min: 14	Max: 5 Min: 4.5
2	9 inches	29 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	OH-T (proposed)	Max: 141 Min: 14	Max: 6 Min: 5.1
3	29 inches	59 inches	bedrock	Not reported	Not reported	Max: 0.42 Min: 0.02	Max: Min:

Soil Map ID: 3

Soil Component Name: Honokaa

Soil Surface Texture: silty clay loam

Hydrologic Group: Class C - Slow infiltration rates. Soils with layers impeding downward movement of water, or soils with moderately fine or fine textures.

Soil Drainage Class: Well drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: High

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	5 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	OH-T (proposed)	Max: 42.34 Min: 14.11	Max: 6.5 Min: 5.6
2	5 inches	64 inches	silty clay loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	OH-T (proposed)	Max: 4.23 Min: 1.41	Max: 6.5 Min: 5.6

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

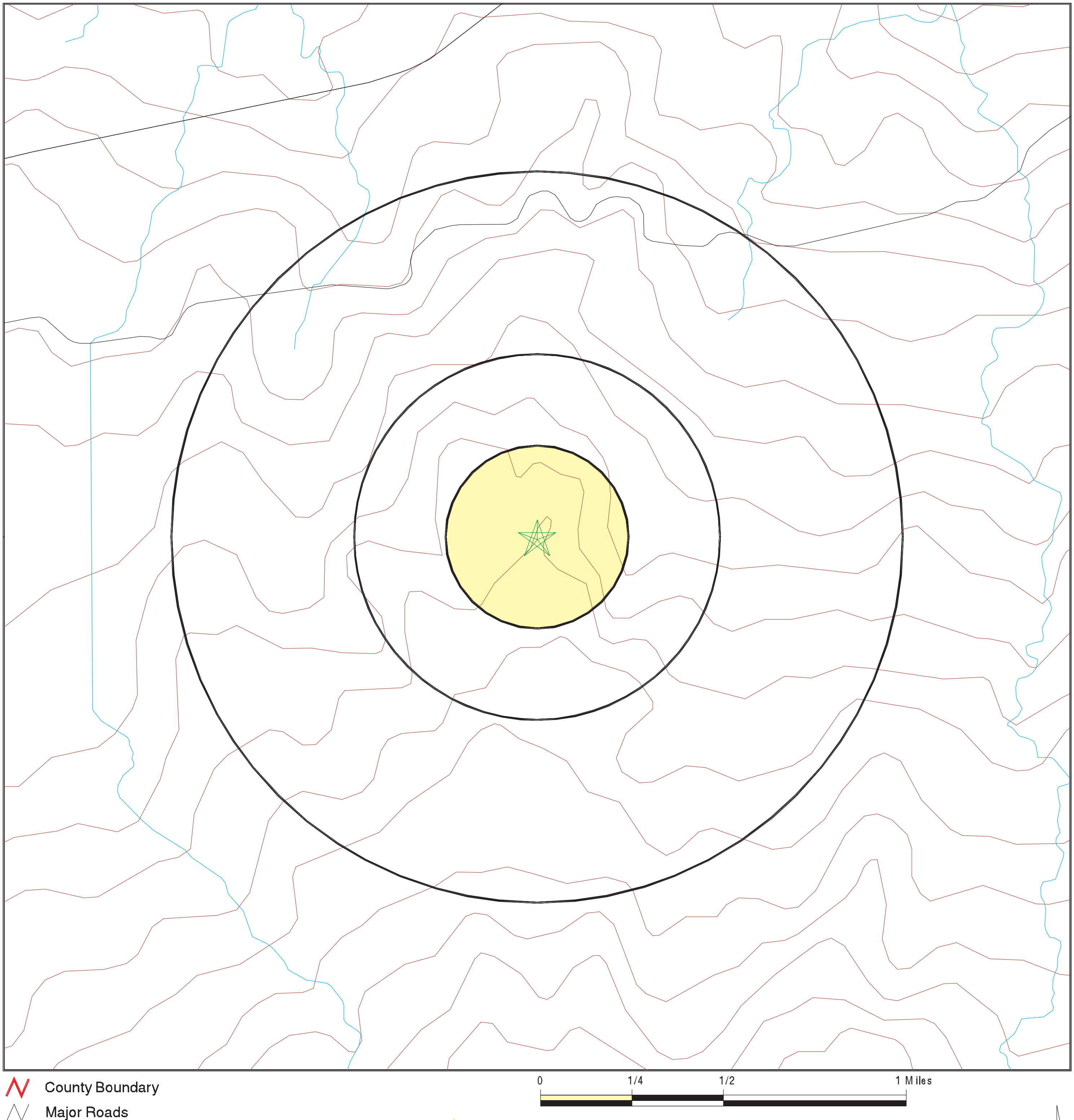
Note: PWS System location is not always the same as well location.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

PHYSICAL SETTING SOURCE MAP - 5168800.2s



County Boundary
Major Roads
Contour Lines
Earthquake epicenter, Richter 5 or greater
Water Wells
Public Water Supply Wells
Cluster of Multiple Icons

Groundwater Flow Direction
GI Indeterminate Groundwater Flow at Location
GV Groundwater Flow Varies at Location

SITE NAME:	Siglo Phase I ESA Waimea	CLIENT:	Myounghee Noh and Associates
ADDRESS:	66-1304 MAMALAHOA HWY	CONTACT:	Jennah Oshiro
	Honokaa HI 96727	INQUIRY #:	5168800.2s
LAT/LONG:	20.034747 / 155.547223	DATE:	January 25, 2018 3:56 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Federal EPA Radon Zone for HAWAII County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for Zip Code: 96727

Number of sites tested: 7

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.557 pCi/L	100%	0%	0%
Living Area - 2nd Floor	Not Reported	Not Reported	Not Reported	Not Reported
Basement	Not Reported	Not Reported	Not Reported	Not Reported

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.
Source: FEMA
Telephone: 877-336-2627
Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Office of Planning
Telephone: 808-587-2895

HYDROGEOLOGIC INFORMATION

AQUIFLOW[R] Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Well Index Database
Source: Commission on Water Resource Management
Telephone: 808-587-0214
CWRM maintains a Well Index Database to track specific information pertaining to the construction and installation of production wells in Hawaii

OTHER STATE DATABASE INFORMATION

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

Siglo Phase I ESA Waimea

66-1304 MAMALAHOA HWY

Honokaa, HI 96727

Inquiry Number: 5168800.8

January 26, 2018

EDR Historical Topo Map Report

with QuadMatch™

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topo Map Report

01/26/18

Site Name:	Client Name:
Siglo Phase I ESA Waimea	Myounghee Noh and Associates
66-1304 MAMALAHOA HWY	99-1046 Iwaena Street
Honokaa, HI 96727	Aiea, HI 96701
EDR Inquiry # 5168800.8	Contact: Jennah Oshiro

EDR Topographic Map Library has been searched by EDR and maps covering the target property location as provided by Myounghee Noh and Associates were identified for the years listed below. EDR's Historical Topo Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topo Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the late 1800s.

Search Results:		***Coordinates:***	
P.O.#	NA	**Latitude:**	20.034747 20° 2' 5" North
Project:	Siglo Phase I ESA TMK 34700	**Longitude:**	-155.547223 -155° 32' 50" West
		UTM Zone:	Zone 5 North
		UTM X Meters:	233538.04
		UTM Y Meters:	2217356.55
		Elevation:	3053.99' above sea level

Maps Provided:

2013
1995
1982
1957
1930
1916

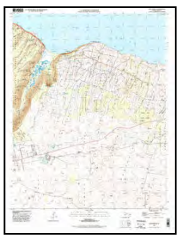
Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

2013 Source Sheets

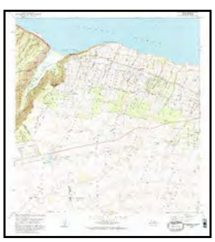
Kukuihaele
2013
7.5-minute, 24000

1995 Source Sheets



Kukuihaele
1995
7.5-minute, 24000
Aerial Photo Revised 1995

1982 Source Sheets



Kukuihaele
1982
7.5-minute, 24000
Aerial Photo Revised 1977

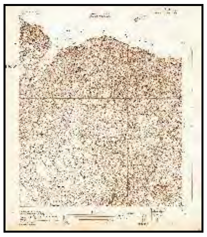
1957 Source Sheets

Kukuihaele
1957
7.5-minute, 24000
Aerial Photo Revised 1954

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1930 Source Sheets



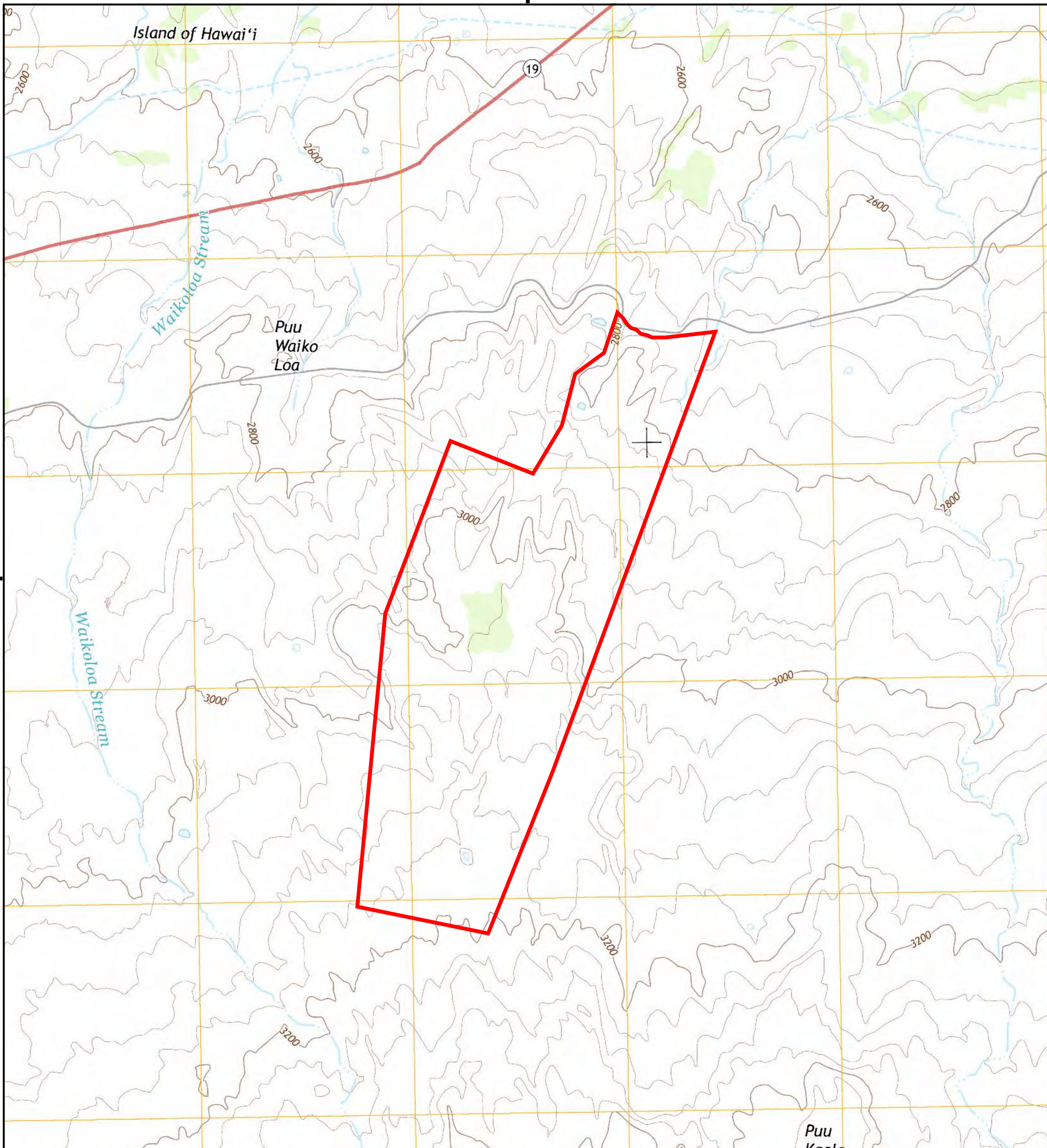
KUKUIHAELE
1930
7.5-minute, 31680

1916 Source Sheets

Waipio
1916
15-minute, 62500

Historical Topo Map

2013



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE

W E

SW S SE

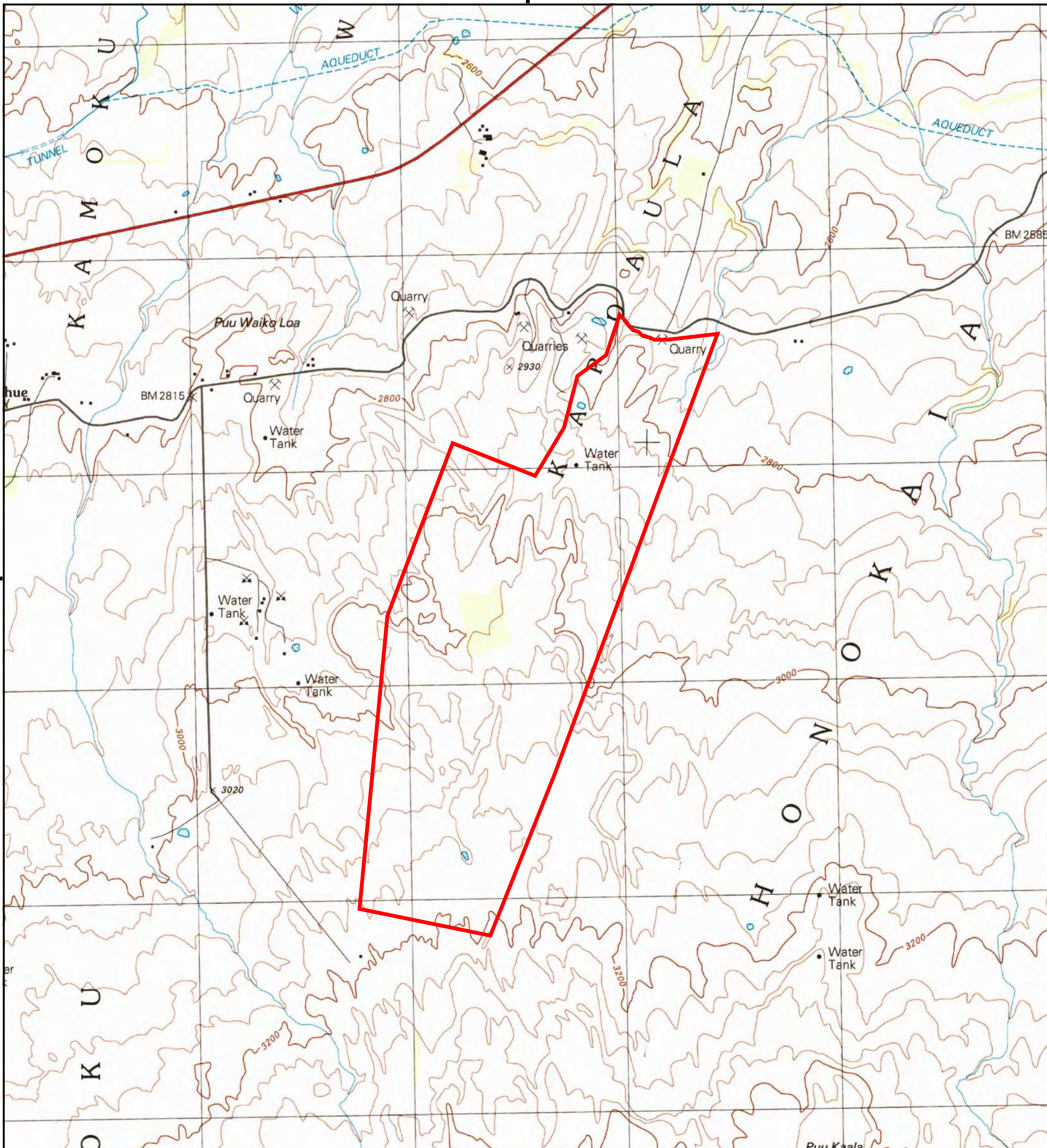
TP, Kukuihaele, 2013, 7.5-minute

SITE NAME: Siglo Phase I ESA Waimea
ADDRESS: 66-1304 MAMALAHOA HWY
Honokaa, HI 96727
CLIENT: Myounghee Noh and Associates

N

Historical Topo Map

1995



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NW N NE
W E
SW S SE

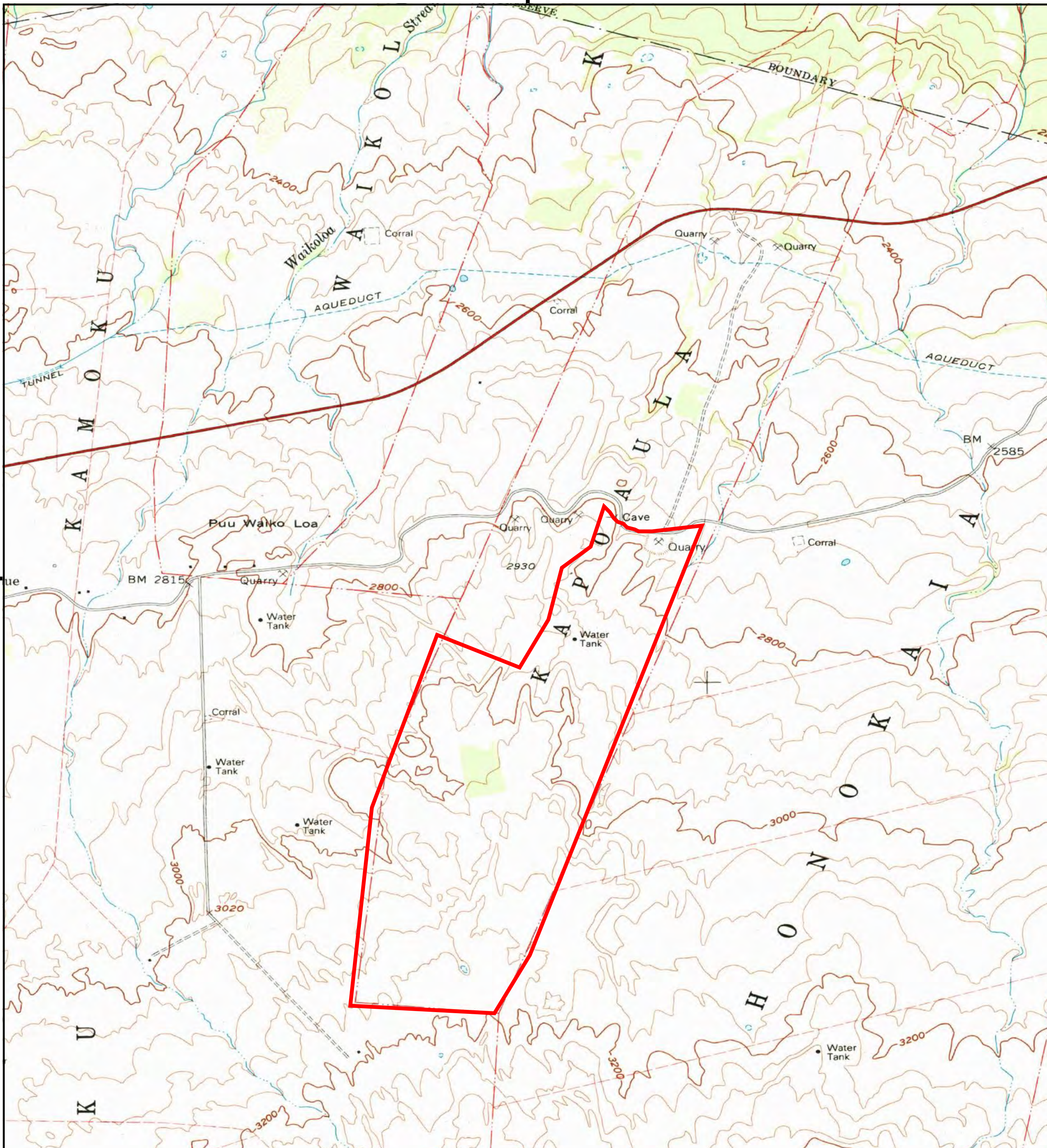
TP, Kukuihaele, 1995, 7.5-minute

SITE NAME: Siglo Phase I ESA Waimea
ADDRESS: 66-1304 MAMALAHOA HWY
Honokaa, HI 96727
CLIENT: Myounghee Noh and Associates

N

Historical Topo Map

1982



This report includes information from the following map sheet(s).

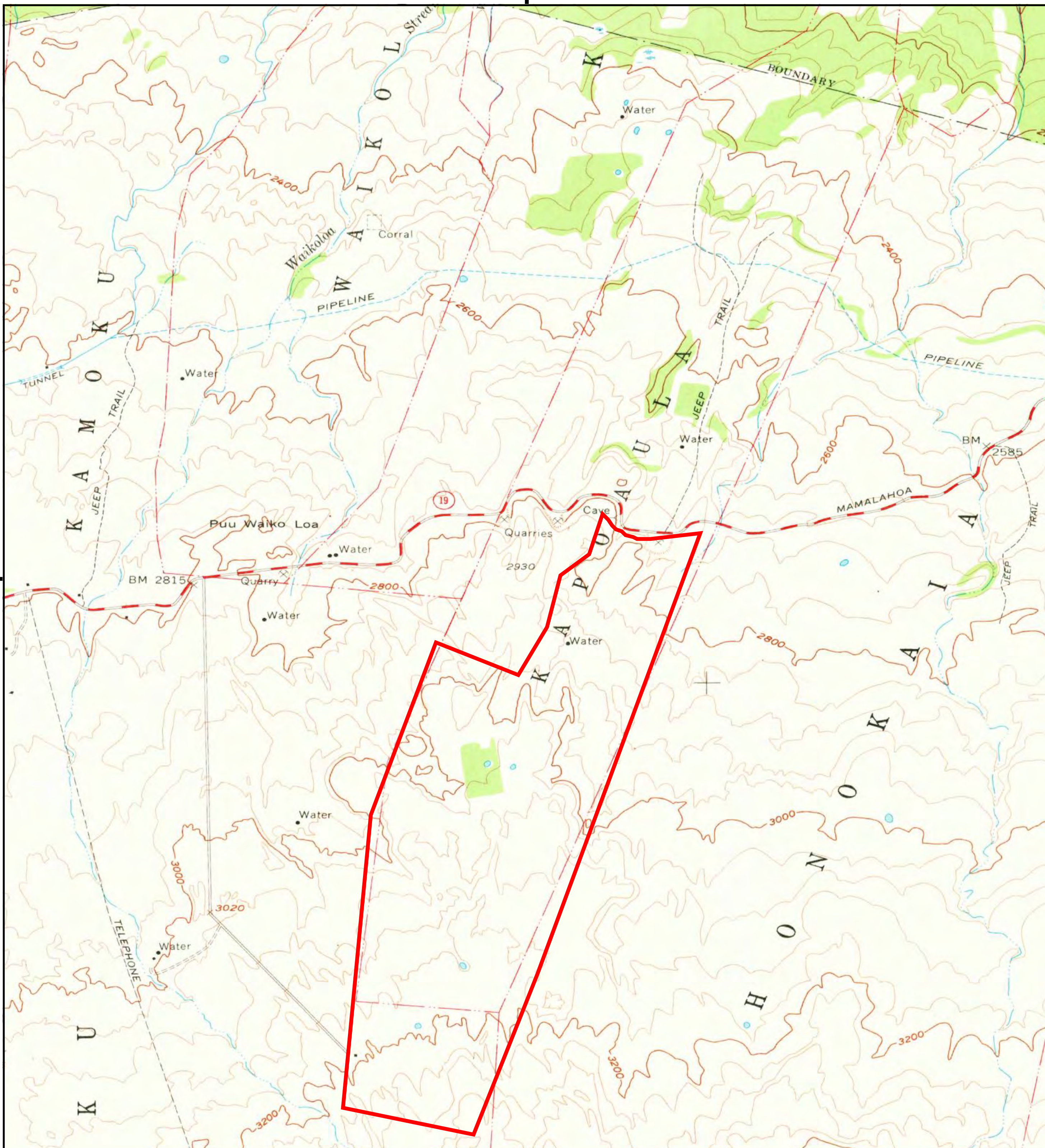
0 Miles 0.25 0.5 1 1.5

TP, Kukuihaele, 1982, 7.5-minute

SITE NAME: Siglo Phase I ESA Waimea
ADDRESS: 66-1304 MAMALAHOA HWY
Honokaa, HI 96727
CLIENT: Myounghee Noh and Associates

Historical Topo Map

1957



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

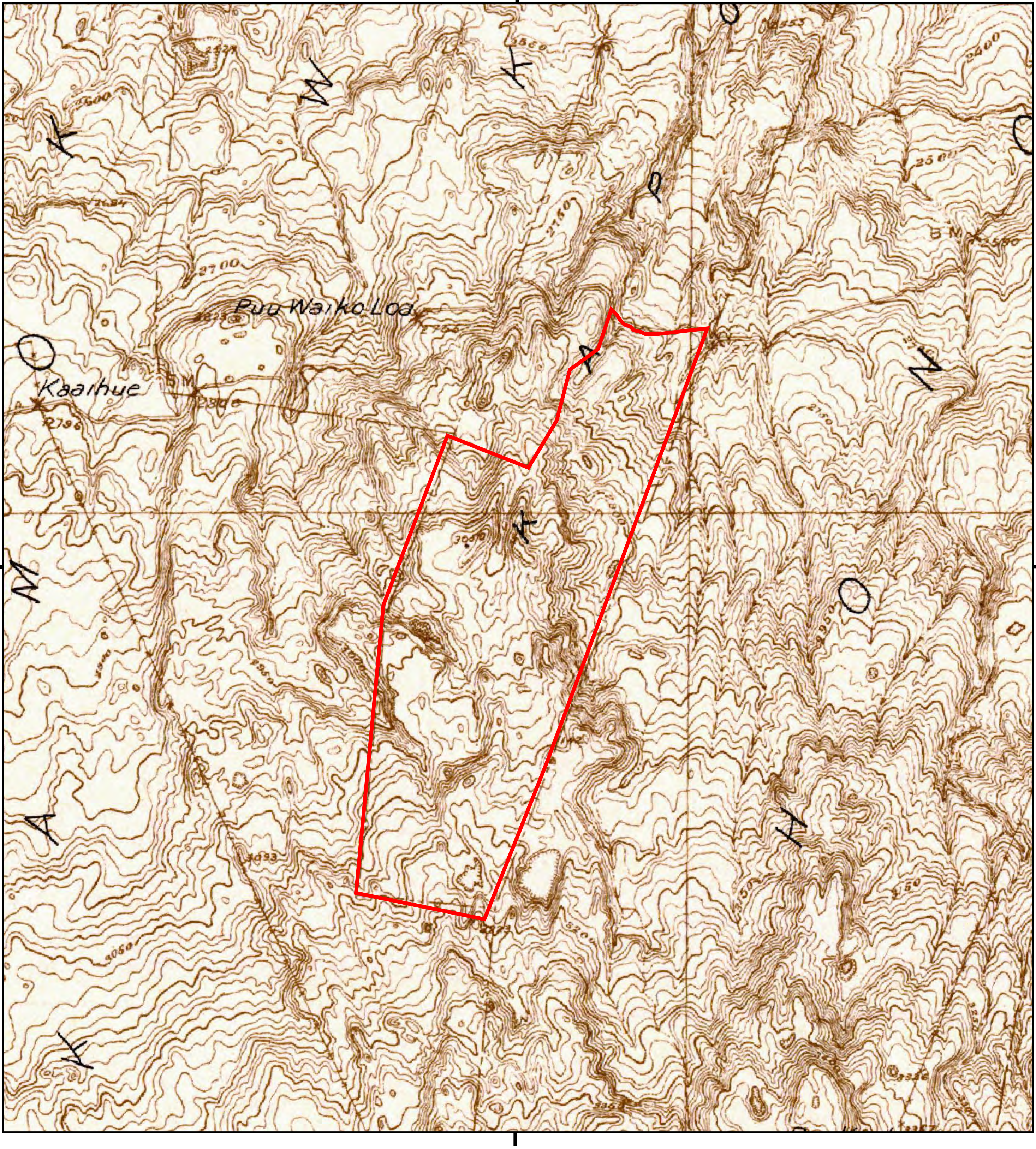
TP, Kukuihaele, 1957, 7.5-minute

SITE NAME: Siglo Phase I ESA Waimea
ADDRESS: 66-1304 MAMALAHOA HWY
Honokaa, HI 96727
CLIENT: Myounghee Noh and Associates

N

Historical Topo Map

1930



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0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, KUKUIHAELE, 1930, 7.5-minute

SITE NAME: Siglo Phase I ESA Waimea
ADDRESS: 66-1304 MAMALAHOA HWY
Honokaa, HI 96727
CLIENT: Myounghee Noh and Associates

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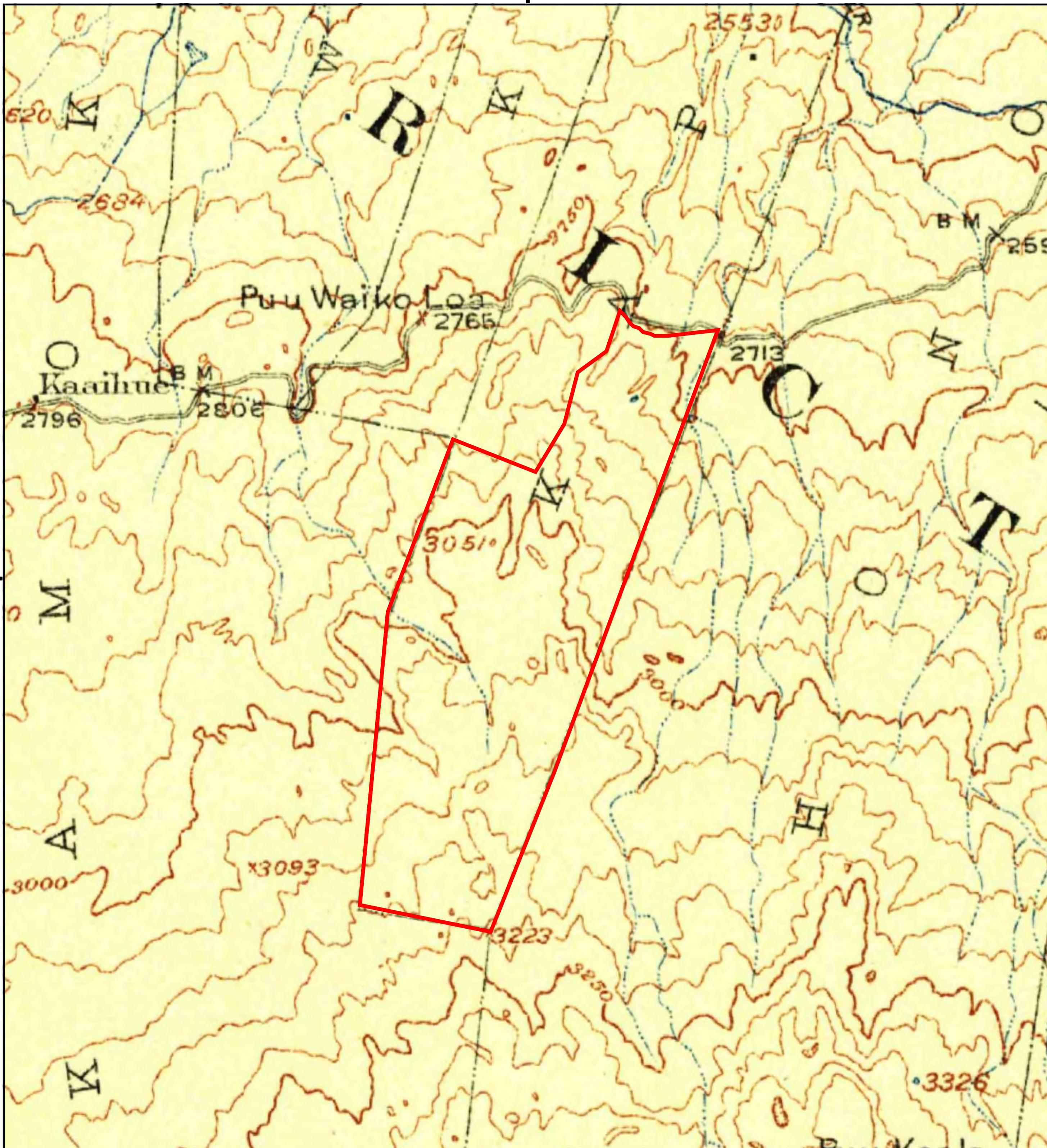
Historical Topo Map

1916



This report includes information from the following map sheet(s).

0 Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

TP, Waipio, 1916, 15-minute

SITE NAME: Siglo Phase I ESA Waimea
ADDRESS: 66-1304 MAMALAHOA HWY
Honokaa, HI 96727
CLIENT: Myounghee Noh and Associates

N

APPENDIX B Photographs

Photograph 1. A view of Old Mamalahoa Highway from the subject property, facing west (05 February 2018).

Photograph 2. A view of Old Mamalahoa Highway from the subject property, facing east (05 February 2018).

Photograph 3. A view of the quarry on the adjoining property to the northwest, operated by DeLuz Trucking & Gravel, LLC (DeLuz Trucking), from the subject property (05 February 2018).

Photograph 4. A view of the quarry on the adjoining property to the northwest, operated by DeLuz Trucking, from the property entrance on Old Mamalahoa Highway (05 February 2018).

Photograph 5. A view of the adjoining property to the north, adjacent to Old Mamalahoa Highway. The property was pastureland for cattle grazing (05 February 2018).

Photograph 6. A view of the adjoining property to the northeast, adjacent to Old Mamalahoa Highway. The property was pastureland for cattle grazing (05 February 2018).

Photograph 7. A view of the adjoining properties to the east, from the subject property. Land to the left of the fence (arrow) was the subject property, land to the right of the fence were adjoining properties. All eastern adjoining properties appeared to be pastureland for cattle grazing (05 February 2018).

Photograph 8. A view of the adjoining property to the south, from the subject property. The property was pastureland for cattle grazing (05 February 2018).

Photograph 9. A view of the adjoining property to the south, from the subject property. Cattle are visible on the property (05 February 2018).

Photograph 10. A view of the adjoining property to the west, from the subject property. The property was pastureland for cattle grazing (05 February 2018).

Photograph 11. A view of the entrance gate to the subject property, accessed via Old Mamalahoa Highway. The gate was locked and the property was fenced, preventing unauthorized access (05 February 2018).

Photograph 12. A view of the light duty dirt road that is used to access portions of the subject property. The road ran from the northern property boundary, through the center of the property to the south, and ended in the approximate center of the property (05 February 2018).

Photograph 13. A view of the northeast corner survey marker on the subject property, which was accessed to view adjoining properties (05 February 2018).

Photograph 14. A view of the southwest corner survey marker on the subject property, which was accessed to view adjoining properties (05 February 2018).

Photograph 15. A view of the southeast corner survey marker on the subject property, which was accessed to view adjoining properties (05 February 2018).

Photograph 16. A view the center of the subject property, taken from the center of the property facing west. This area was at a higher elevation and was used to view a larger area of the subject property. A water trough is visible (05 February 2018).

Photograph 17. A view the eastern portion of the subject property, taken from the center of the property facing east. This area was at a higher elevation and was used to view a larger area of the subject property (05 February 2018).

Photograph 18. A view the center of the subject property, taken from the center of the property facing north. This area was at a higher elevation and was used to view a larger area of the subject property. The forested area is visible in the background (05 February 2018).

Photograph 19. A view of the southern portion of the subject property, facing west. Land to the left of the fence is on the adjoining property to the south, land to the right of the fence is on the subject property (05 February 2018).

Photograph 20. A view of eastern portion of the subject property, facing north. This paddock was pastureland for cattle grazing (05 February 2018).

Photograph 21. A view of cattle in a paddock on the subject property. The paddock pictured also contained the forested area of the subject property (05 February 2018).

Photograph 22. A view of the forested area of the subject property, located in the center of the property (05 February 2018).

Photograph 23. A view of the forested area of the subject property, located in the center of the property (05 February 2018).

Photograph 24. A view of the forested area of the subject property. Lines of trees were observed, indicating that the trees were planted (05 February 2018).

Photograph 25. A view of one of the ponds observed in the center of the subject property (05 February 2018).

Photograph 26. A view of another one of the ponds observed in the center of the subject property (05 February 2018).

Photograph 27. A view of a dried up pond observed in the center of the subject property (05 February 2018).

Photograph 28. A view of the 400-gallon water tank observed on the subject property. The water tank was serviced by a private waterline that enters the subject property from the south (05 February 2018).

Photograph 29. A view of one the troughs observed on the subject property. The troughs are manually filled (05 February 2018).

APPENDIX E

PUBLIC INVOLVEMENT CORRESPONDENCE

E1 PRE-ASSESSMENT CONSULTATION

E2 DRAFT EA COMMENTS AND REPONSES (*TBP FOR FINAL EA*)

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APPENDIX E1
PRE-ASSESSMENT CONSULTATION

In preparation of the Draft EA, a pre-assessment consultation letter was sent to agencies and organizations on February 8, 2019. The distribution list and correspondence received is included in this Appendix E1 and summarized in Table E1. Key issues included:

If a date is not noted in that column, then Cardno did not receive a reply from that party during the pre-assessment comment period. Response letters to the pre-assessment consultation letter are included in this Appendix E1 following Table E1. The comments were considered during preparation of the Draft EA.

Table E1. Distribution List for Pre-Assessment Consultation Letter

Date of Response – If Any	*Addressees*
State Parties	
	State of Hawaiʻi Department of Health, Environmental Planning Office P.O. Box 3378 Honolulu, HI 96801
	State of Hawaiʻi Department of Land and Natural Resources P.O. Box 621 Honolulu, HI 96809
	State of Hawaiʻi Office of Hawaiian Affairs 75-1000 Henry St., Suite 205 Kailua-Kona, HI 96740 Emailed: anitam@oha.org
County Agencies and Officials	
	Talmadge Magno, Administrator Hawaiʻi County. Civil Defense Agency 920 Ululani St. Hilo, HI 96720
March 5, 2019 Mitchell K. Kanehailua, Jr. Assistant Police Chief Area I Operations Bureau	Police Chief, Paul Ferreira County of Hawaiʻi Police Department 349 Kapiolani St. Hilo, HI 96720
	Hawaiʻi County Planning Department Michael Yee, Director 101 Pauahi St., Suite 3 Hilo, HI 96720
	District 1, County Councilmember Valerie T. Poindexter Emailed: Valerie.poindexter@hawaiicounty.gov
February 25, 2019 Ben Ishii, Division Chief Engineering Division	Hawaiʻi County Department of Public Works David Yamamoto, Director 101 Pauahi St., Suite 7 Hilo, HI 96720
	Fire Chief, Darren J. Rosario County of Hawaiʻi Fire Department

Date of Response – If Any	*Addressees*
	25 Aupuni St. Hilo, HI 96720
February 21, 2019	Hawai‘i County Department of Environmental Management 345 Kekūanāo‘a St., Suite 41 Hilo, HI 96720
Local Organizations	
	Hawaiian Cultural Center of Hāmākua P.O. Box 1981 Honoka‘a, HI 96727 Emailed: Info.hccoh@gmail.com
	Mālama Hāmākua Emailed: Malamahamakua@gmail.com
	Cory Harden for Sierra Club Emailed: 333cory@gmail.com
	Parker Ranch Mauna Kea LLC 66-1304 Māmālahoa Hwy. Kamuela, HI 96743
	Kapoaula Land LLC Manager: Kevin M. Balog P.O. Box 9 Kamuela, HI 96743
Private Surrounding Individuals – Addresses not provided for privacy	
	Dahana Ranch
	Glenn Bertelmann
	Jolette A. Rapozo Trust
	Pamela Jean Ramos
	Paula Iwalani Boteilho
	Yvonne L. K. Deluz
	Walter L. Jr. Puhi
	Irene L. Fergerstrom
	Paul, David, and Cindy Lou Andrade
	Kalawaianui, Paakaula Kalawaianui, Kuuipookala Kaaihue, Micah
	Elizabeth B. Camara

Legend: HI = Hawai‘i; Hwy. = Highway; P.O. = post office; St. = Street.

February 8, 2019

Cardno

Pacific Guardian Center
737 Bishop Street
Mauka Tower, Suite 3050
Honolulu, HI 96813
USA

Phone: +1 808 528 1445
Fax: +1 808 528 0768

www.cardno.com

Subject: Early Consultation for Kapoaula Koa Forest (HRS) Forest Stewardship Management Plan, Environmental Assessment, Island of Hawai`i, TMK–(3) 4-7-007-011

To Whom It May Concern,

Our firm in association with Mr. Ron Terry owner of Geometrician Associates is in the process of preparing a Draft Environmental Assessment (EA) in compliance with Chapter 343, HRS, and Title 11, Chapter 200, HAR for a proposed project involving State funds to be utilized for implementation of an existing forest stewardship management plan.

Siglo Forest, LLC acquired the 564-acre Kapoaula property from Parker Ranch to obtain long-term access for the purposes of planting koa trees. In an effort to convert pastureland back to a semblance of the native koa-ʻōhiʻa forest that once stood in this area and to provide, controlled future uses of the forest for commercial products (see map on following page). Forestry Solutions Inc. has authored a site-specific forestry management plan for the area. Through implementation of the site-specific forestry management plan, in approximately 50 years, the property will consist of a mixed-species native forest with steep sloped areas primarily for native species conservation and less steeply sloped, less erodible primarily used for timber production. The resulting koa forest will provide a sustainable, long-term, predictable source of instrument grade wood, produce high-quality wood for other uses, and provide habitat for native species, inspiring others to plant trees on their land for similar purposes. The ten-year objectives are as follows:

- Reforest the entire property with koa and a complement of associated native forest plants.
- Improve the quality of wood to be harvested in the future by:
  - planting seed from known, high-quality sources; and
  - utilizing cuttings propagated from trees identified as having superior color, figure and form.
- Intensive management of koa for saw timber on those areas of the property with slopes less than 20%--accounting for 70% of the property or 390 acres.
- Reforest the remaining upland areas with a multi-species native forest, utilizing koa as a pioneer species—accounting for 30% of the area or 163 acres.
- Protect planted forest from wind by planting fast-growing, cattle resistant windbreaks.

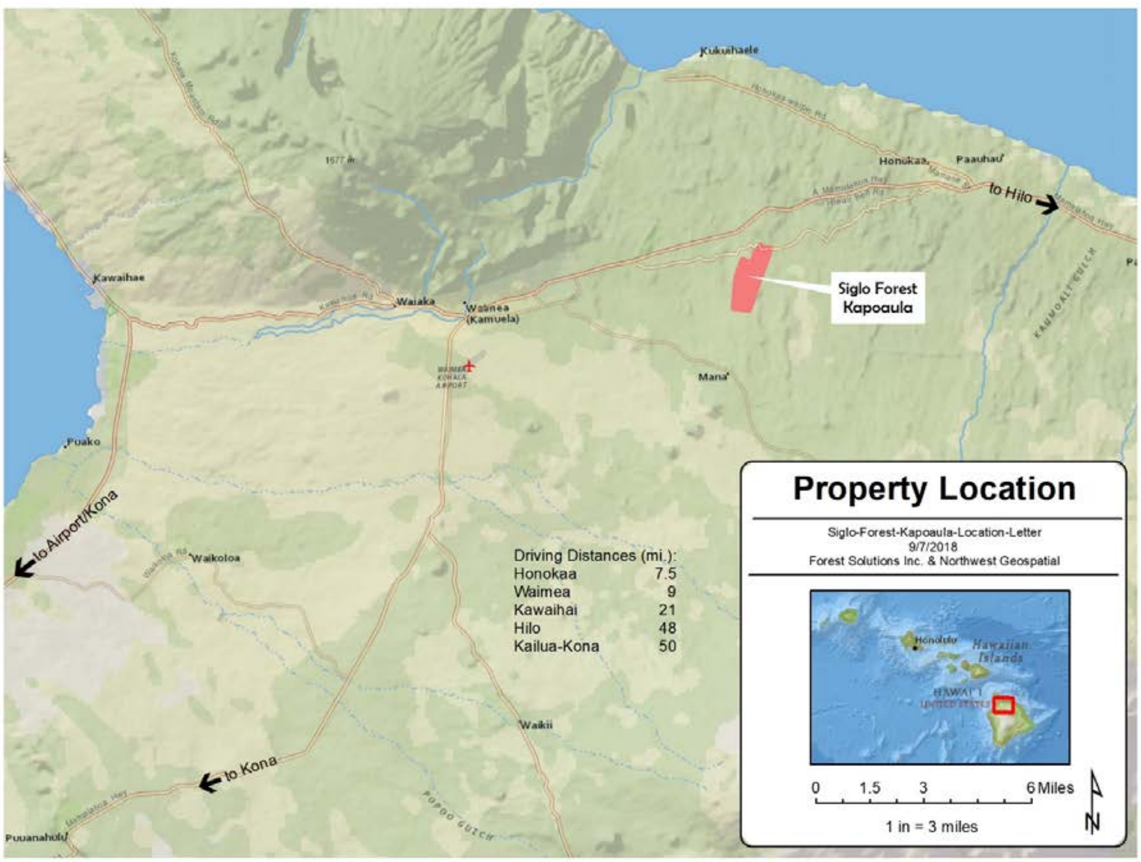
The areas of investigation in the EA will include but not be limited to the following: water quality assurance; wastewater treatment; flora, fauna, and ecosystems; traffic impacts; geology, soils, and hazards; flooding and drainage impacts; social, cultural and community impacts; cultural impacts; historic sites; and economic impacts.

We would appreciate your comments on any special environmental conditions or impacts related to the project. Please contact me at Kerry.Wells@cardno-gs.com or (808) 349-0929 if you have any questions or require clarification. Kindly indicate whether you wish to receive notice of the availability of the EA when completed.

Sincerely,

Kerry Wells

Kerry Wells
Project Manager
Direct +1 808 349 0929
Email: Kerry.Wells@cardno-gs.com



Harry Kim
Mayor

Wilfred M. Okabe
Managing Director

William A. Kucharski
Director

Diane A. Noda
Deputy Director

County of Hawai'i
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
345 Kekūanāo'a Street, Suite 41 · Hilo, Hawai'i 96720
Ph: (808) 961-8083 · Fax: (808) 961-8086
Email: cohdem@hawaiicounty.gov

February 21, 2019

Via email: kerry.wells@cardno-gs.com

Ms. Kerry Wells
Project Manager
Cardno
737 Bishop Street, Suite 3050
Honolulu, Hawai'i 96813

Re: Kapoaula Koa Forest Stewardship Management Plan
Early Consultation for Environmental Assessment
Tax Map Key: (3) 4-7-007:011

Dear Ms. Wells:

The Department of Environmental Management, County of Hawai'i, received your early consultation notification dated February 8, 2019, and it has been reviewed by our Solid Waste Division and Wastewater Division.

The Solid Waste Division has the following recommendation:

- It is strongly recommended that greenwaste diversion be included as part of the project specifications. Based on the project location, the West Hawai'i Organics Facility located in Pu'uanahulu is an option for the owner to drop off greenwaste.

Thank you for requesting comments. It is not necessary to notify us when the EA is available.

Sincerely,

William A. Kucharski
Director

WK:mef

Harry Kim
Mayor

Wil Okabe
Managing Director

David Yamamoto, P.E.
Director

Allan G. Simeon, P.E.
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS

Aupuni Center
101 Pauahi Street, Suite 7 · Hilo, Hawai'i 96720-4224
(808) 961-8321 · Fax (808) 961-8630
public_works@hawaiicounty.gov

February 25, 2019

ATTN: Kerry Wells
Cardno
737 Bishop Street
Maunka Tower, Suite 3050
Honolulu, HAWAII 96813
(via email to Kerry.Wells@cardno-gs.com)

SUBJECT: EARLY CONSULTATION OF KAPOAULA KOA FOREST (HRS) FOREST STEWARDSHIP MANAGEMENT PLAN, ENVIRONMENTAL ASSESSMENT
HAMAKUA DISTRICT, ISLAND OF HAWAII
TMK: (3) 4-7-007:011

We received the subject dated February 11, 2019 and have the following comments:

The subject parcel is in an area designated as Zone X on the Flood Insurance Rate Map (FIRM) by the Federal Emergency Management Agency (FEMA). Zone X is an area determined to be outside the 500-year floodplain.

All development-generated runoff shall be disposed of on site and not directed toward any adjacent properties. A drainage study shall be prepared and the recommended drainage system shall be constructed meeting the approval of the Department of Public Works.

All activities shall comply with the requirements of Hawaii County Code, Chapter 10, Erosion and Sedimentary Control. Agricultural operations may qualify for a conservation program with the applicable soil and water conservation district. An approved conservation program would be an exclusion to Chapter 10.

Construction within the County right-of-way shall comply with HCC, Chapter 22, County Streets.

Should there be any questions concerning this matter, please contact Ms. Robyn Matsumoto in our Engineering Division at (808) 961-8924.

BEN ISHII, Division Chief
Engineering Division

RM

Harry Kim
Mayor

Paul K. Ferreira
Police Chief

Kenneth Bugado Jr.
Deputy Police Chief

County of Hawai`i

POLICE DEPARTMENT

349 Kapiolani Street • Hilo, Hawai`i 96720-3998
(808) 935-3311 • Fax (808) 961-8865

March 5, 2019

Kerry Wells, Project Manager
64-5266 Puu Nani Drive
Kamuela, HI 96743
Kerry.Wells@cardno-gs.com

Subject: Early Consultation for Kapoaula Koa Forest (HRS) Forest Stewardship Management Plan, Environmental Assessment, Island of Hawai`i
TMK-(3) 4-7-007-011

Staff, upon reviewing the provided documents, does not anticipate any significant impact to traffic and/or public safety concerns.

Thank you for allowing us the opportunity to comment.

We would like to receive notice of the availability of the EA when completed.

If there are any questions, please contact Captain Jason Cortez at (808) 775-7533.

for: MITCHELL K. KANEHAILUA, JR.
ASSISTANT POLICE CHIEF
AREA I OPERATIONS BUREAU

AJC:lli/19HQ0193