DAVID Y. IGE
GOVERNOR OF HAWAII

CARTY S. CHANG
INTERIM CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 22, 2015

Ref. No.: 14HD-170
Author: LD-WTM

MEMORANDUM:

TO: Jessica Wooley, Director
Office of Environmental Quality Control

FROM: Carty S. Chang, Acting Chairperson
Board of Land and Natural Resources

SUBJECT: Final Environmental Assessment and Anticipated Finding of No Significant Impact for Napuu Water, Inc., Easement on State Lands for Photovoltaic Array at Puuwaawaa, North Kona, Hawaii, Tax Map Key: (3) 7-1-001:006.

The Department of Land and Natural Resources, Land Division, hereby transmits the Final Environmental Assessment and Findings of No Significant Impact (FEA-FONSI) for the above referenced project for publication in the next available edition of the Environmental Notice.

We have enclosed a completed OEQC Bulletin Publication Form, one (1) copy of the FEA-FONSI, a CD with an Adobe Acrobat PDF file of the same and an electronic copy of the publication form in MS Word for your review.

Should you or your staff have any questions, please feel free to call Wesley Matsunaga, at the Hawaii District Land Office at (808) 961-9590. Thank you.

Enclosures

cc: Land Board Member
Central Files
District Files

APPLICANT ACTIONS
SECTION 343-5(C), HRS
PUBLICATION FORM (JULY 2012 REVISION)

Project Name: Na Puʻu Water Inc. Easement on State Land for Solar Photovoltaic Array
Island: Hawaiʻi
District: North Kona
TMK: (3rd) 7-1-001:006 (por.)
Permits:
Hawaiʻi State BLNR: approval of the easement
Hawaiʻi State DLNR Engineering Division: review and approval of
Hawaiʻi County: Building Permit
Approving Agency:
Hawaiʻi State Department of Land and Natural Resources
c/o Land Division, Hawaii District
75 Aupuni Street, Room 204
Hilo HI 96720
Wesley T. Matsunaga, Land Agent 808-961-9590
Applicant:
Na Puʻu Water Inc.
PO Box 2217
Kamuela HI 96743
Consultant:
Geometrician Associates
PO Box 396
Hilo HI 96721
Ron Terry 808-969-7090

Status (check one only):

__DEA-AFNSI	Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day comment period ensues upon publication in the periodic bulletin.
_X_FEA-FONSI	Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov; no comment period ensues upon publication in the periodic bulletin.
__FEA-EISPN	Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day consultation period ensues upon publication in the periodic bulletin.
__Act 172-12 EISPN	Submit the approving agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov. NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.
__DEIS	The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.
__FEIS	The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.
__ Section 11-200-23 Determination	The approving agency simultaneous transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the applicant. No comment period ensues upon publication in the periodic bulletin.
__Statutory hammer	

Acceptance	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it failed to timely make a determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and that the applicant's FEIS is deemed accepted as a matter of law.
__Section 11-200-27 Determination	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.
__Withdrawal (explain)	

Summary: Napu‘u Water Inc. (NWI) is a small, non-profit, community based, and member-owned water system serving the local residents of Pu‘uanahulu-Pu‘u Wa‘awa‘a area. NWI owns, maintains, and operates two 2,500-foot deep groundwater wells that are sufficient for local community needs. The cost for electricity to pump water from these deep wells burdens the local residents and ranchers. The proposed action is the granting of an easement over a 1.74-acre portion of State land adjacent to one of the wells. The land would be used for a ground-mounted solar photovoltaic array consisting of approximately 800 monocrystalline solar panels and a flywheel energy storage system capable of storing 400 kWhrs of energy. These renewable energy facilities would reduce reliance on fossil fuel energy and stabilize and reduce pumping costs on the Pu‘u Wa‘awa‘a Well. The project would provide a substantial benefit to the local community served by NWI and would also contribute to the State of Hawai‘i’s goals of gaining energy independence and using renewable energy sources. No archaeological, cultural or biological resources are present. Some visual impact will occur, but the location adjacent to an existing technology building that already contains solar panels is an appropriate context.

FINAL ENVIRONMENTAL ASSESSMENT

Na Puʻu Water Inc.
Easement on State Land for Solar Photovoltaic Array

TMK (3) 7-1-001:006 (por.), Puʻu Waʻawaʻa
North Kona District, Hawaiʻi Island, State of Hawaiʻi

February 2015

Prepared for:
State of Hawaiʻi
Department of Land and Natural Resources
Division of Forestry and Wildlife

FINAL ENVIRONMENTAL ASSESSMENT

Na Puʻu Water Inc.
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TMK (3) 7-1-001:006 (por.), Puʻu Waʻawaʻa
North Kona District, Hawaiʻi Island, State of Hawaiʻi

APPLICANT:

Na Puʻu Water Inc.
PO Box 2217
Kamuela HI 96743

APPROVING AGENCY:

State of Hawaiʻi
Department of Land and Natural Resources
PO Box 621
Honolulu, HI 96809

CONSULTANT:

Geometrician Associates LLC
PO Box 396
Hilo, HI 96721

CLASS OF ACTION:

Use of State Land

This document is prepared pursuant to:

The Hawaiʻi Environmental Policy Act,
Chapter 343, Hawaiʻi Revised Statutes (HRS), and
Title 11, Chapter 200, Hawaiʻi Department of Health Administrative Rules (HAR).

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SUMMARY OF THE PROPOSED PROJECT, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Napuʻu Water Inc. (NWI) is a small, non-profit, community based, and member-owned water system serving the local residents of Puʻuanahulu-Puʻu Waʻawaʻa area. NWI owns, maintains, and operates two 2,500-foot deep groundwater wells that are sufficient for local community needs. The cost for electricity to pump water from these deep wells burdens the local residents and ranchers. The proposed action is the granting of an easement over a 1.74-acre portion of State land adjacent to one of the wells. The land would be used for a ground-mounted solar photovoltaic array consisting of approximately 800 monocrystalline solar panels and a flywheel energy storage system capable of storing 400 kWhrs of energy. These renewable energy facilities would reduce reliance on fossil fuel energy and stabilize and reduce pumping costs on the Puʻu Waʻawaʻa Well. The project would provide a substantial benefit to the local community served by NWI and would also contribute to the State of Hawaiʻi's goals of gaining energy independence and using renewable energy sources. No archaeological, cultural or biological resources are present. Some visual impact will occur, but the location adjacent to an existing technology building that already contains solar panels is an appropriate context.

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

1.1 Project Location, Description and Purpose and Need

Napuʻu Water Inc. (NWI) is a small, non-profit, community based and member-owned water system serving the local residents of Puʻuanahulu, Puʻu Lani Ranch and the adjacent agricultural and ranching areas of Puʻu Waʻawaʻa, which are located above 2,000 feet in elevation in the far north of Kona on the Island of Hawaiʻi (Figures 1-2). The NWI serves a combined community population of 330 people with 147 connections, including 132 residential connections, 3 cattle ranchers with 7 connections, 4 active (formerly 6) Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife connections including the 5 MG Puuwaawaa reservoir, the Big Island Country Club, the HELCO Puʻuanahulu substation, and the Puʻuanahulu Volunteer Fire Station. NWI owns, maintains, and operates two 2,500-foot deep groundwater wells that are sufficient for local community needs. The cost for electricity to pump water from these deep wells burdens the local residents and ranchers.

The proposed action is the granting of an easement by the State of Hawaiʻi to NWI over a 1.74-acre portion of State land identified by TMK (3) 7-1-001:006 adjacent to one of the wells and the Puʻu Waʻawaʻa Ranch Energy Lab. The land would be used for a ground-mounted solar photovoltaic array consisting of approximately 800 monocrystalline solar panels and a flywheel energy storage system capable of storing 400 kWhrs (kilowatt hours, a unit of energy). The energy facilities would be ancillary to a water well and would help reduce reliance on fossil fuel energy and stabilize and reduce pumping costs on the Puʻu Waʻawaʻa Well (State Well No. 4560-01). The project would provide a substantial benefit to the local community served by NWI and would also contribute to the State of Hawaiʻi's goals of gaining energy independence and using renewable energy sources.

At this time it is difficult to project exactly the quantity of savings and the reduced cost per user. This can only be determined by experience in running the system and evaluating the difference between previous years and a period of time since the system has been in operation. The savings may translate into reducing the escalation of fees as the cost of utility power rises, or into actual reduced costs from using less utility purchased power. This will also depend on the success of and efficiency of the proposed storage system, which could substantially add to the savings by allowing NWI to pump longer with solar power. Regardless of whether or not there are any monetary savings realized by the system, NWI considers the security in an emergency situation where there is no grid power available a critical benefit. This is especially true in a disaster scenario where even diesel fuel for a generator may be unavailable. In a catastrophic scenario, NWI will still be able to provide water to the community for basic needs. An added benefit for the entire island population will be demonstration and testing of a successful energy security measure, which other communities may wish to adopt for their own water systems.

Figure 1. Project Location Map

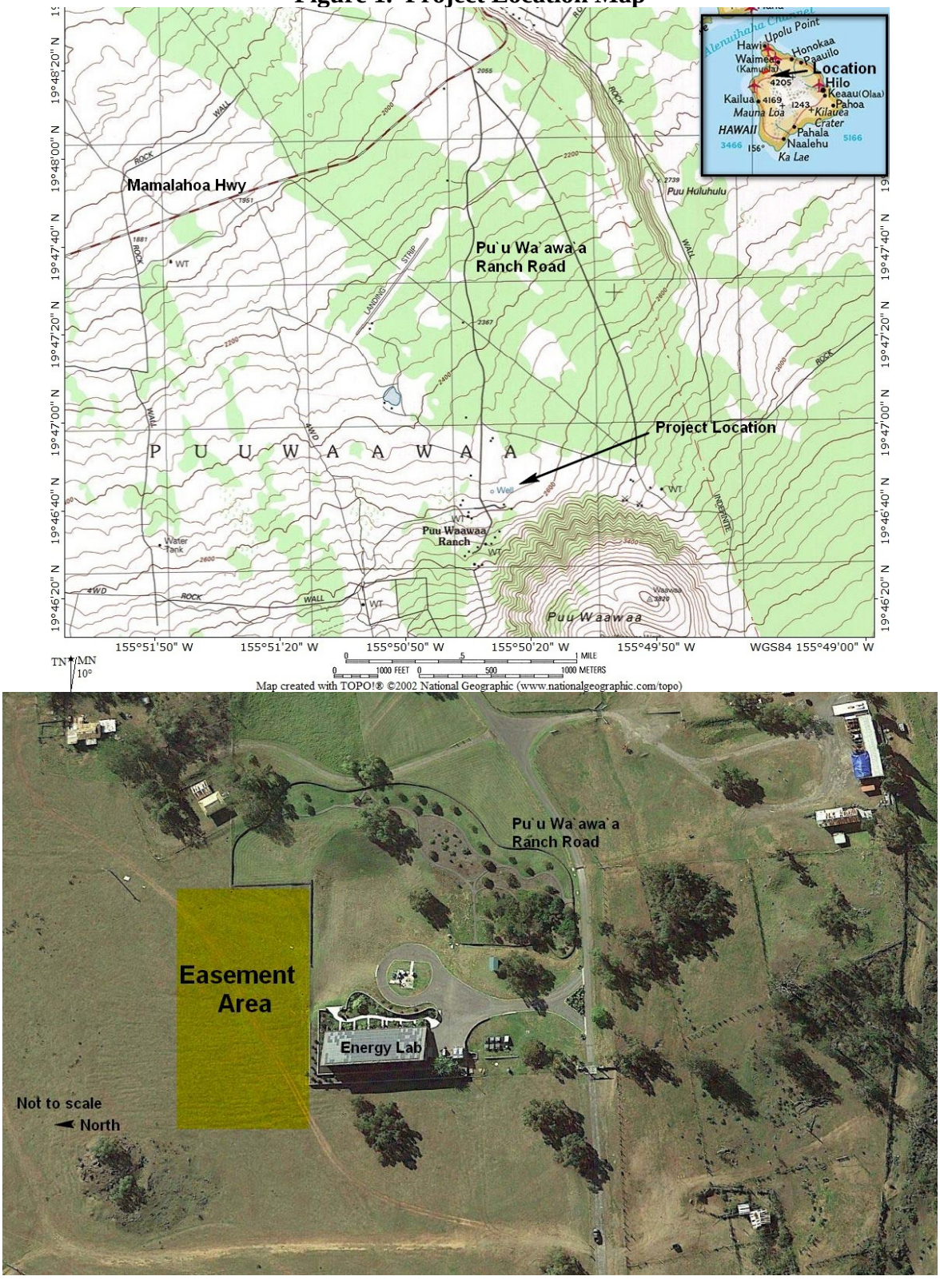
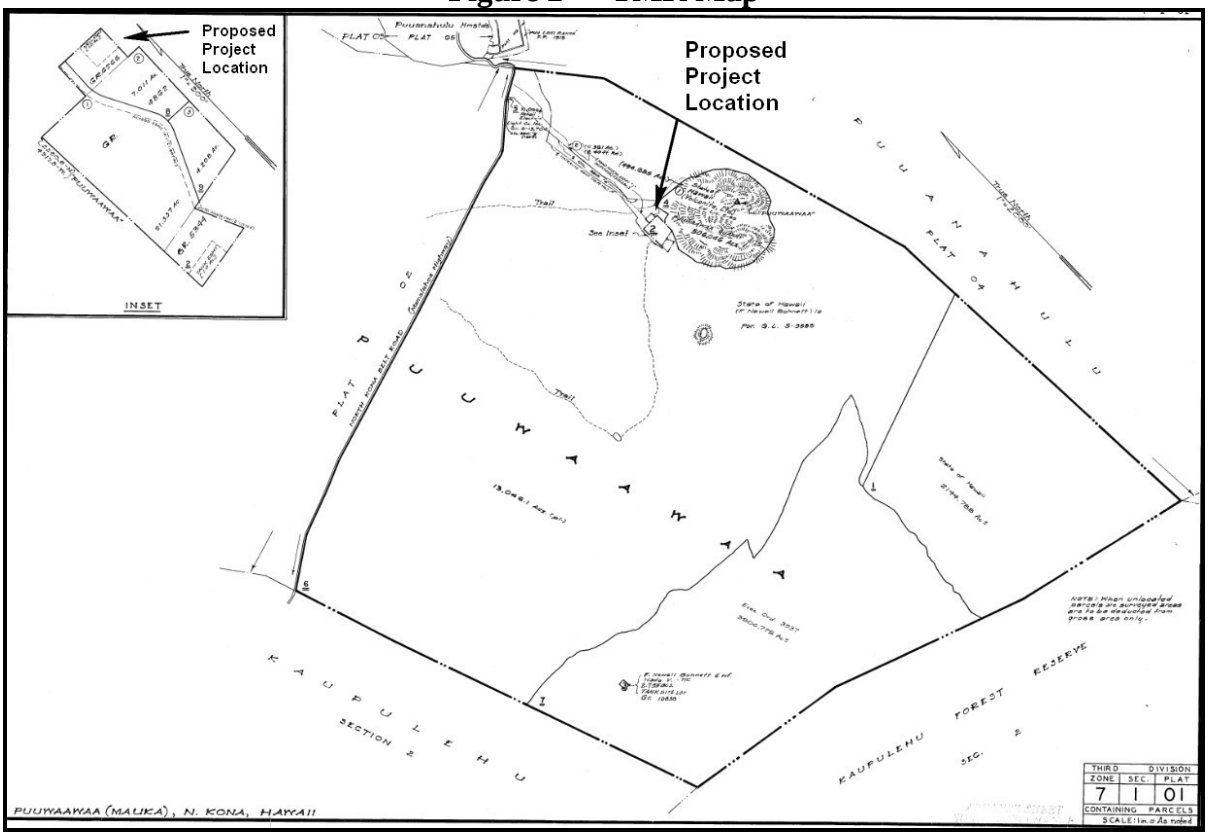


Figure 2 TMK Map



Source: Hawai‘i County Tax Maps. Note: Some labels removed/moved

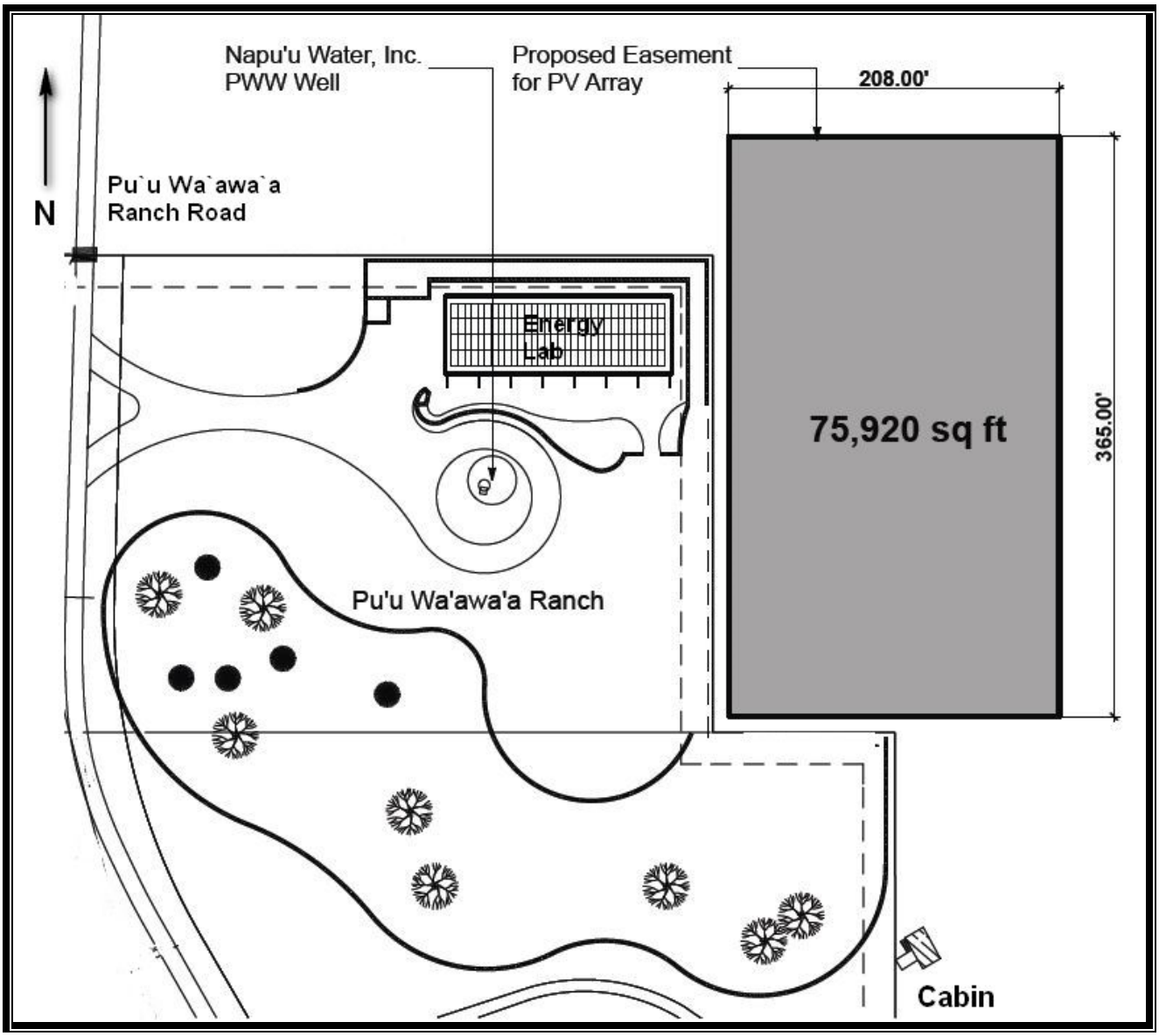
Figure 3 Project Site Photographs

▼ 3a Project site mauka (area highlighted and outlined)

Figure 3 Project Site Photographs

3b View from road makai ▲ ▼ 3c View makai from public area near summit (project site not visible)

Figure 4. Site Plan



On the average day, the solar panels would need to produce about 650 to 780 kWhrs during their daytime operation in order to pump water from the aquifer to the surface and into the NWI 100,000-gallon main tank for distribution to the NWI customers. Energy in excess of that required to pump water would be stored in the flywheel storage system, to allow pumping at night or when solar energy production is low. Flywheel energy storage works by accelerating a rotor (flywheel) to a very high speed and maintaining the energy in the system as rotational energy. When energy is extracted from the system, the flywheel's rotational speed is reduced as a consequence of the principle of conservation of energy; adding energy to the system correspondingly results in an increase in the speed of the flywheel. The project will install ten flywheels with the capacity to store a total of 100 kWhrs of energy. For the present, the well's electrical system will remain connected to the HELCO grid, as a backup.

In terms of appearance, each solar panel is approximately 39 by 61 inches in size. They will be mounted on screw piles (with no need for concrete), with their low sides about three feet and their high sides about five feet above the ground. They will be tilted slightly south and will have single-axis tracking that will enable them to follow the sun as it moves across the sky from east to west. The planned Amber Kinetics Flywheels have steel rotor cores and are less massive, tall and expensive than many other flywheels. Each two-foot tall, four-foot diameter flywheel will be contained below grade and housed in a precast concrete vault. The total flywheel space will require three feet of excavation in an area approximately 10 feet wide by 30 feet long. To protect the integrity of the facility from feral and other grazing animals, chain link fencing will be installed around the perimeter. The solar panels and flywheel can be simply removed at such a time when they need replacement or are no longer needed. If and when desired, the site can easily be restored to its current pasture condition.

Temporary construction access will be through an informal side road within the pasture *makai* of the facility that currently "short-cuts" through the pasture. Some visual impact will occur, but the location adjacent to an existing technology building that already contains solar panels is an appropriate context. The area is not visible from the summit of Puʻu Waʻawaʻa nor the trails that access it, and few members of the public would actually have the occasion to see the panels.

The system is being funded through an arrangement in which Sunwize, an independent third party that will operate the system, will provide energy through a Purchase Power Agreement (PPA) in to NWI at a rate half of current HELCO electric rates. Excess power can also be sold HELCO through a net metering agreement.

This portion of Puʻu Waʻawaʻa is under the control of the Department of Land and Natural Resources, Division of Forestry and Wildlife (DLNR-DOFAW) and is used for pasture. All land uses that DLNR authorizes on State land at Puʻu Waʻawaʻa are subject to the review and advice of the Puʻu Waʻawaʻa Advisory Council. Furthermore, research on the State lands at Puʻu Waʻawaʻa is cooperatively managed by the DLNR and the U.S. Forest Service through its Hawaii Experimental Tropical Forest (HETF) program. The *Management Plan for the Ahupuaʻa of Puʻu Waʻawaʻa and the Makai Lands of Puʻu Anahulu* calls for a grazing plan for the area; a

grazing plan is under development and may be ready within a few years, according to DOFAW. Grazing at the 1.74-acre project site currently appears to consist mainly of feral sheep and feral pigs, along with horses belonging to a private party. Grazing reduces fuel load, and the feral pigs and sheep that wander this area may restock game for hunters in other parts of Pu‘u Wa‘awa‘a. To the applicant’s knowledge, the State does not derive revenues from these uses that would be reduced to even a negligible degree by loss of these 1.74 acres. Given the large extent of pasture land, it would not appear that use of this small portion of pasture would conflict with any management or research objectives for the area, and the transition to renewable energy sources is a fulfillment of critical State energy goals. A detailed examination of the consistency of the proposed project with management plans and goals for these entities is presented in Section 3.6.4.

The applicant will be working with the State DLNR and its advisory bodies to determine and fulfill any conditions that might be associated with the easement, including annual rental, determination of applicable permits (if any), decommissioning requirements, and other issues. The project would begin immediately after the Board of Land and Natural Resources (BLNR) approval of the lease and obtaining building permits. Within two months of approval, the solar panels would be ready to begin production; an additional week would be required to construct and incorporate the flywheel energy storage system.

1.2 Environmental Assessment Process

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

1.3 Public Involvement and Agency Coordination

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

State:
- Department of Land and Natural Resources
- Department of Health
- Office of Hawaiian Affairs

County:
- Planning Department
- Police Department
- Fire Department
- County Council

Private:
- Sierra Club
- Puʻuanahulu Community Association
- Puʻu Waʻawaʻa Advisory Council

Copies of communications received during early consultation are contained in Appendix 1a, and comments to the Draft EA and responses to these comments are contained in Appendix 1b. 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 sentence.

PART 2: ALTERNATIVES

2.1 Action Alternatives

The proposed project is described above in Section 1.1 and the project site is depicted in Figures 1 to 4.

2.2 Alternative Actions and Sites

As a non-profit that serves a variety of customers in the Puʻu Waʻawaʻa-Puʻuanahulu community, NWI has carefully considered the issue of how to reduce and stabilize its major cost, electricity for pumping water. The wind regime is not favorable for wind turbines to reliably produce power, especially given the need to store large quantities when winds are calm or absent. There are no potential hydroelectric sources, and techniques such as biomass or geothermal would not be practical or cost-effective to even explore at this point, given the scale of energy demand. Therefore, no other alternative technologies were identified as practical and none are studied in this EA.

An alternative location within a reasonable distance of the well would require use of either other State land or private land at the Puʻu Waʻawaʻa Ranch property, owned by Henk and Akemi Rogers. The Ranch is a customer of NWI. Although the Ranch is cooperating with NWI to accommodate the project, it has very limited land under its control and its owners stated that all potentially available land is dedicated to existing and planned projects.

As shown in Figures 1 to 4, the proposed location is directly adjacent to the well and also abuts private property with cooperative landowners. No ranch infrastructure would be disrupted and the project does not interfere with legal access. The project site lacks sensitive resources such as archaeological sites and native species. It is located close enough to the steep foreslope of Puʻu Waʻawaʻa Cinder Cone to be sheltered from view from the public viewpoints at the top of the hill. The location directly adjacent to Puʻu Waʻawaʻa Ranch's Energy Lab would make the solar panel facility appear as an extension of the built environment rather than an outlier, reducing scenic impacts. Although there are theoretically a very large number of potential alternative 1.74-acre portions of State land on the 13,000-acre plus Puʻu Waʻawaʻa property, none has this unique combination of advantages and none is currently under study in the EA.

In a comment in response to the EA (see Appendix 1b), DLNR-DOFAW noted that :

> *"...there may be significantly fewer hours of sunlight near Pu'u Wa'awa'a hill as compared to other areas in the Forest Reserve (such as below the Mamalahoa Highway). Even though it may be cost prohibitive and out of the scope of this project, the DEA should mention whether installing PY below the highway, where there is substantially more sunlight, was considered in the alternatives and why it isn't a viable option for this project."*

DLNR-DOFAW makes a valid point concerning the sunlight component of the site selection process. However, while it is clear that there are fewer hours of usable sun at the location proposed than locations *makai* of the Mamalahoa Highway (about 2 miles distant from the proposed site) or near Queen Kaʻahumanu Highway (about 7 miles away), the system is sized to utilize the available solar window at the site. The tradeoff between close proximity with less sunlight versus a distant location with more sunlight is a more efficient use of resources. In addition, since NWI is planning to utilize storage for the system, it would be difficult to provide that additional benefit if it were located further away. The energy security aspect of the project would be nullified if it were connected to the utility grid just as a means for net metering, and a billing arrangement with the utility. By having it in close proximity with the point of use, it ensures that the system can be optimized, and completely off-grid if desired in the future. Furthermore, there is a distinct physical security advantage to having the solar panels located near the well, the Puʻu Waʻawaʻa Ranch Energy Lab, and occupied homes. Finally, NWI states that wheeling of electricity (defined as "the movement of electricity, owned by a power supplier and sold to a retail consumer, over transmission and distribution lines owned by neither one - www.cepc.net/rewhl.htm" is currently not allowed by HELCO across TMK property lines, even if it is entirely within properties with the same owner. Although NWI believes this is an unreasonable condition, it adds yet another reason to remove a distant generation site from consideration.

2.3 No Action

Under the No Action Alternative, the easement would not be granted and the project would not be constructed. The area would continue to be used as pasture for feral animals, with no revenue to the State. NWI would continue to pay high electrical rates for its water pumping. The applicant believes that this would present no advantage to the State of Hawaiʻi and would be a disadvantage for not only the non-profit but virtually the entire community, which are its customers. The No Action Alternative is considered in this EA for the purposes of comparison with the proposed project.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

The 1.74 acres of a pasture that is the location for the proposed easement and energy facilities are referred to throughout this EA as the *project site*. The term *project area* is used to describe the general environs of this part of North Kona and Puʻu Waʻawaʻa[1].

3.1 Physical Environment

3.1.1 Climate, Geology, Soils and Geologic Hazards

Environmental Setting

The project site is located at 2,600 feet in elevation at the foot of the *makai*-facing slope of Puʻu Waʻawaʻa. This prominent regional landmark is a large cone of trachyte pumice that erupted a type of viscous lava that is little known elsewhere on the surface of Hualālai Volcano. It is the only place in the Hawaiian Island where large chunks of obsidian have been found (McDonald et al 1983).

The average annual rainfall here is about 27 inches (Giambelluca et al 2014), and temperatures are generally mild (65-75°F.) and show a definite but moderate seasonal variability. Tradewinds are often blocked by the bulk of the Mauna Kea and Hualālai volcanoes as well as Puʻu Waʻawaʻa itself. Winds are thus generally light and upslope in the day and downslope at night. Higher wind episodes do occur, particularly during kona storms, when winds may blow from the southwest. This is also the time of the most intense episodes of rainfall (UH Hilo Dept. of Geography 1998).

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

In terms of seismic risk, the entire Island of Hawaiʻi is rated Zone 4 Seismic Hazard (*Uniform Building Code, 1997 Edition*, Figure 16-2). Zone 4 areas are at risk from major earthquake damage, especially to structures that are poorly designed or built, as the 6.7-magnitude quake of October 15, 2006, demonstrated.

[1] The place name Puʻu Waʻawaʻa has at least five different spellings. This document uses one of the most common, and except where providing direct quotes with other spellings, has attempted to be consistent.

Impacts and Mitigation Measures

In general, geologic conditions impose no constraints on the use of the project site for a solar energy array and flywheel storage facility. Solar photovoltaic panels are lightweight and sturdy and generally not at risk from earthquakes, but all applicable codes will be followed for their installation. The panels will be mounted on the ground, and there is no need to disturb the surface. The space for the flywheel energy storage component is only 10 feet wide by 30 feet long and 3 feet deep. Appropriate seismic standards would be followed during any construction of the flywheel facility.

In a letter of March 24, 2014 in response to early consultation (see Appendix 1a for full text), the Hawai‘i DLNR stated, among other concerns:

> "What is the susceptibility of the proposed project site to land-slides originating on the Puu Waawaa cinder cone and how might the project affect erosion [?]"

The project site does not appear to be subject to subsidence, landslides or other forms of mass wasting. As shown in the maps and photos in Figures 1-3, above, it is located about 700 feet from the actual base of the cinder cone, and there is no evidence of any history of landslides extending to the project site. In between the project site and the cinder cone itself are several old DLNR cabins that the applicant is unaware of having ever been subject to landslides. In the unlikely event that a landslide were to occur, these cabins would be at far more risk than the more distant solar project site.

In a letter commenting on the Draft EA (see Appendix 1b), DLNR-DOFAW indicated concern about high winds destroying the solar array, based on recent wind damage to other structures in the area. In fact, there is extremely little risk that wind will blow away or destroy the solar panels. The roof of the Energy Lab was dislodged in very high winds, which was due entirely to the fact that the structure, which was built in the 1950s, was not build to current code standards and was heavily damaged by termites. Modern code compliance dictates that new structures must withstand wind loading and uplift forces determined for the specific site location. The PV Tracker Array will be anchored to the ground using screw piles that will provide the code-compliant uplift resistance. These piles have auger like properties that resist uplift forces in excess of the historical wind gusts data for this area. This was a requirement that NWI stipulated to the company providing the PPA in lieu of pouring concrete footings into excavated earth, which NWI avoided in order to minimize disturbance to the ground surface.

3.1.2 Drainage, Water Features and Water Quality

Existing Environment

No water bodies such as streams, lakes or ponds exist at or near the project site. FEMA has not prepared Flood Insurance Rate Maps (FIRM) for the area and there are no mapped flood hazards on or near the project site. The area is therefore considered within Flood Zone X, outside of the

500-year floodplain. Reconnaissance of the site indicates there are no areas of local (non-stream related) flooding present on the project site.

In the Hawaiian Islands, precipitation that is not lost through evapotranspiration or conducted through streams into the ocean percolates into the ground to collect in the aquifers under the island before slowly making its way to the sea. As streams in Hawai‘i are generally flashy or even ephemeral, underground water is the most reliable source of water supply, because there is little daily or seasonal change in water tables. Water may be trapped between vertical confining layers such as dikes or perched above horizontal confining layers such as volcanic ash soil, forming high level aquifers. This water may overflow, creating natural streams or springs.

If water continues to diffuse through the layers of rock, sand, soil and gravel, it will reach sea level. Fresh water has a lower density than seawater and will float on the salt water in a body that is shaped like a lens and is called the basal aquifer. Due to the difference in densities, for every foot the lens extends above sea level it extends 40 feet below sea level, although the lower areas contain a zone of mixing. As a result, most of the fresh water in a basal aquifer lies below sea level. Basal water tables have inland gradients that can rise as much as four feet per mile in high rainfall areas. This fresh water is the source of much of the groundwater available in the State.

The State Commission on Water Resources Management (CWRM) classifies aquifers for groundwater regulatory purposes. The aquifer tapped by the Pu‘u Wa‘awa‘a Well (State Well No. 8-4560-01) is the classified as the Kiholo Aquifer System, Code 80902. This coding refers to Hawai‘i Island (6), Hualalai Aquifer Sector (09), and Kiholo Aquifer System (02). The surface boundaries of the aquifer extend from the summit of Huālalai to the coast as an expanding wedge from Ka Lae O Mano to about Weliweli, including the Pu‘uanahulu and Pu‘u Wa‘awa‘a areas. CWRM estimates the sustainable yield at approximately 18 mgd, and the highest 12-month use recorded in the Hawai‘i County Water Use and Development Plan was 4.06 mgd, about 22 percent of the sustainable yield (Hawai‘i County DWS 2010). NWI operates its system to alternately pump the Pu‘u Lani Ranch Well (located about 2.5 miles north in Pu’uanahulu) and the Pu‘u Wa‘awa‘a Well a month at a time. Depending on demand, the system pumps between 1.2 and 2.0 million gallons per month, with a total average about 1.6 million gallons per month, and a per well average of 0.8 million gallons per month. NWI thus currently uses about 0.053 mgd, or far less than 0.5 percent of the sustainable yield of the aquifer.

Impacts and Mitigation Measures

Risks for flooding or impacts to water quality associated with the proposed project are negligible. The design and construction of the solar array does not require grading, and there is only minor grading and excavation of less than 500 square feet required for the flywheel area.

Depending on technology, solar panels may contain certain hazardous materials, particularly metals, which can pose a risk to water quality if they are improperly handled or disposed of. The monocrystalline panels planned for installation are mainly silicon and aluminum, with minimal hazardous substances and are not considered hazardous material. This issue is discussed in

greater detail in Section 3.1.5, below. The project would impose minimal risk to water quality, generally far less than that posed by any built structure, including cabins or fencing.

The project is not expected to alter the quantity of water withdrawn from the aquifer under the existing well permits, but simply to reduce the cost and increase the energy security of the well pumping operation.

3.1.3 Flora, Fauna and Ecosystems

Existing Environment, Impacts and Mitigation Measures

Geometrician Associates conducted a botanical survey of the project site in March 2014. It is important to note that other areas of Pu‘u Wa‘awa‘a away from the ranch headquarters have native plants, including rare species, in a dry forest ecosystem that in many places has high habitat value. As noted in the *Management Plan for the Ahupua‘a of Pu‘u Wa‘awa‘a and the Makai Lands of Pu‘u Anahulu* and by the U.S. Forest Service’s Hawaii Experimental Tropical Forest, the tropical dry forest found at Pu‘u Wa‘awa‘a is one of the most endangered forest types in the world, threatened by wildfire, invasive species, and land cover changes. Although Pu‘u Wa‘awa‘a has both highly degraded as well as intact forests, it includes an elevational gradient that supports all the major dry and mesic forest types in Hawai‘i. Large areas of Pu‘u Wa‘awa‘a are designated as critical habitat for various organisms, and the pasture section that is the project site has been designated as critical habitat for *Hibiscadelphus hualalaiensis* and *Manduca blackburnii* (Blackburn’s sphinx moth, discussed below). Biological research in this forest found a great diversity of plants, land snails, arthropods, and birds, both native and non-native. Seventeen species of endangered plants are present, along with eleven endangered bird species and one insect (Hawai‘i DLNR 2003; U.S. Forest Service: http://www.hetf.us/page/puu_waa_waa/)

The project site itself is not located within a natural or semi-natural dry forest. It instead consists of 1.74 acres of short-grass pasture located between several buildings at the center of the ranch infrastructure, in a matrix of pasture grass and scattered non-native trees such as Brazilian pepper (*Schinus mollus*) and silver oak (*Grevillea robusta*).

The dominant plant is Kikuyu grass (*Cenchrus clandestinus*), an alien widely established on the island of Hawai‘i. Although invasive, it is highly valued for cattle forage. There were relatively few other plants present in the pasture during the March 2014 survey, although it should be recognized that pasture weeds vary with rainfall and grazing regime. We observed mullein (*Verbascum* sp.), fireweed (*Senecio madagascariensis*), Sodom apple (*Solanum sodomeum*), lantana (*Lantana camara*), Bermuda grass (*Cynodon dactylon*) and goosefoot (*Chenopodium murale*). All are non-native, and several are invasives. Conversion of this portion of the pasture to energy facility use will not affect ecologically sensitive vegetation.

Pastures generally do not provide habitat for native fauna. The Short-eared Owl (*Asio flammeus sandwichensis*), an endemic sub-species of this near-cosmopolitan diurnal owl species, could

hunt in the area. In addition, the Pacific Golden Plover (*Pluvialis fulva*) is an indigenous migratory species regularly seen in grass areas and pastures throughout the State between August and April each year. In the larger North Kona project area, there are a number of wide-ranging threatened or endangered birds that are sometimes present, including Hawaiian Petrel or *ua'u* (*Pterodroma sandwichensis*), Newell's Shearwater or *'a'o* (*Puffinus auricularis newelli*), Hawaiian Hawk or 'Io (*Buteo solitarius*), and Nēnē (*Branta sandvichensis*). None of the nesting or roosting habitat requirements for these species is found at the project site, which is short-grass pasture with no trees or shrubs. It should be noted that areas of Pu'u Wa'awa'a away from the ranch headquarters that are forested with native trees may support a large variety of native birds. At the project site, a large variety of non-native birds are present, including Black Francolin (*Francolinus francolinus*), Zebra Dove (*Geopelia striata*) and Common Myna (*Acridotheres tristis*).

The endangered Hawaiian hoary bat or ope'ape'a (*Lasiurus cinereus semotus*) is present in many areas on the island of Hawai'i and has been observed in a variety of vegetation in Kona. The bats may forage for flying insects over the project site on a seasonal basis. Bats roost in trees or shrubs taller than 15 feet and can be vulnerable during the pupping season from June 1 to September 15 each year. There are no trees or shrubs on the 1.74-acre pasture site, and the project would have no effect on Hawaiian hoary bats.

With the exception of Hawaiian hoary bats, all terrestrial mammals, reptiles and amphibians in Hawai'i are alien. Horses (*Equus c. caballus*), domestic cattle (*Bos taurus*), donkeys (*Equus asinus*), feral but semi-domesticated sheep or mouflon (*Ovis aries* or *Ovis gmelini musimon*) and pigs (*Sus scrofa*) were seen in or near the pasture on DLNR land. Feral cats (*Felis catus*), pet dogs (*Canis f. familiaris*), small Indian mongooses (*Herpestes a. auropunctatus*), various species of rat (*Rattus* spp.) and European house mice (*Mus domesticus*) could also be present. No reptiles or amphibians were observed, although some may be present at times in this pasture. None of these animals is of conservation concern.

In a letter of March 24, 2014 in response to early consultation (see Appendix 1a for full text), the Hawai'i DLNR stated, among other concerns:

> "How will the PV array affect nesting or foraging Nēnē *(Branta sandwicensis),* or other endangered birds (such as the Hawaiian hawk, *Buteo solitarius);*
>
> How will the PV array affect the endangered Blackburn Sphinx moth *(Manduca blackburni),* are there host plants in the proposed space that will need to be removed (such as tree tobacco, *Nicotiana glauca*) [?]"

Nēnē nest in deep grass and there are several locations in the general Pu'u Wa'awa'a area where they may occasionally nest. They forage widely throughout the project area. The short grass of the pasture does not offer nesting habitat, and during the biological survey, no Nēnē nests were observed. The removal of 1.74 acres from pasture in an area with tens of thousands of acres of grass will not affect Nēnē foraging.

Hawaiian Hawks nest in tall trees, usually away from significant sources of disturbance. No tall trees are present in the area. The hawks forage widely on a variety of native and non-native birds as well as small, non-native mammals. The 1.74 acres of pasture does not represent valuable forage area for this hawk.

The endangered Blackburn's sphinx moth (*Manduca blackburnii*) may be present as eggs, pupae or larvae on annual or semi-perennial plants in the Puʻu Waʻawaʻa region, which is part of the area designated as critical habitat for this species. This close relative of the tomato hornworm of North America was formerly common on all Hawaiian Islands. Its populations were drastically reduced because of the decline of its principal natural host plant, the native tree *ʻaiea* (*Nothocestrum* spp.). Blackburn's sphinx moth has since been found to occasionally utilize non-native host plants including: *Nicotiana glauca* (tree tobacco), *N. tabacum* (commercial tobacco), *Solanum melongena* (eggplant), *Lycopersicon esculentum* (tomato), and possibly *Datura stramonium* (Jimson weed). According to the U.S. Fish and Wildlife Service, the full range of the taxa that Blackburn's sphinx moth larvae may feed on is not known. However, larvae of a close relative of Blackburn's sphinx moth, *Manduca sexta,* feed on a wide variety of taxa in the Solanaceae family including: *Capsicum* (sweet and chili pepper), *Cestrum* (ornamental plants), *Cymphomandra* (tomatillo), *Datura* (Jimson weed, loco weed), *Lycium* (ornamental plants used for Chinese herbal medicines), *Lycopersicum* (tomato), *Petunia* (petunia), *Physalis* (tomatillo and ground cherry), *Solandra* (ornamental vines) and *Solanum* (potato, eggplant, Christmas cherry, nightshade).

These weedy members of the Solanaceae family are found widely distributed throughout the Hawaiian Islands. None of these plants except for a few stubs of *Solanum sodomeum* are present in the pasture area. These plants are not suitable habitat and the action would not be expected to affect Blackburn's Sphinx moth. If large *Nicotiana glauca* plants emerge on the pasture prior to implementation of the project, DLNR and USFWS will be consulted to determine the appropriate protocol for inspecting the plants for eggs, pupae or larvae. In the unlikely event that they are found, larvae may be transferred to appropriate host plants in nearby areas that are unlikely to be removed. It may be necessary to await the hatching of eggs to determine the species and relocate or leave in place as appropriate. As pupae tend to be found underneath or directly adjacent to the tree tobacco plant the egg hatched on, it may be necessary to wait until the moth emerges and departs before construction.

3.1.4 Air Quality, Noise and Scenic Resources

Environmental Setting

Air pollution in Puʻu Waʻawaʻa is present much of the year from volcanic emissions of sulfur dioxide from Kilauea that convert into particulate sulfate and produce a volcanic haze (vog). This pollution drifts around the south side of Mauna Loa and become caught in the local land breeze-sea breeze circulation. Puu Waʻawaʻa is far enough north to remain free of haze many days each year, particularly during times when the island of Hawaiʻi is experiencing strong trade

winds. The occasional range fire also produces smoky, polluted conditions. Manmade air pollution is nearly absent.

The principal noise source in the project area is agricultural activity, which generates only minor levels of noise. The pump for the well is located 2,500 feet below the surface and does not generate noticeable noise.

The Hawai‘i County General Plan (Hawai‘i County 2005:7-12) notes regarding scenic resources in North Kona that:

> “North Kona, in the area called Kekaha, is characterized by a sense of openness created by expansive areas of lava flows. Vegetation on the lava is comprised of low pockets of grasses and scrub trees. From the coastline, the land climbs slowly to the distant saddle plateau between Mauna Kea and Mauna Loa. This long natural grade also contributes to the sense of openness and space. The rest of North Kona is dominated by Hualalai. Its steep slopes provide a green backdrop when viewed from the coast, or spectacular views of the coastline, ocean and horizon from higher elevations. Part of Kona's natural beauty is also due to the wide range of climatic conditions in a relatively short distance. Such variations extending from the coastal areas to the higher elevations are evidenced by changes in vegetation, producing a wide scope of different physical environments.”

The only specific scenic resource or viewplane called out in the General Plan in this area is the Pu‘u Wa‘awa‘a cinder cone itself. A public trail is available to the top of the cone, where several viewpoints that overlook the areas both *mauka* and *makai* are present, one of which is shown in Figure 3c.

Impacts and Mitigation Measures

The proposed project would not measurably affect air quality or noise levels, and it would not affect public views of scenic sites recognized in the Hawai‘i County General Plan or other important public views.

In a letter of March 24, 2014 in response to early consultation (see Appendix 1a for full text), the Hawai‘i DLNR stated, among other concerns:

> “What are the visual impacts from around or near the proposed project site, including from hiking trails, roads, nearby cabins/private property and the top of Puu Waawaa? How will this impact the visitor's experience? Will the PV need to be fenced?”

The project would insert into the rural landscape a 1.74-acre, quasi-industrial built element, including solar panels and a chain link fence. Although it would be adjacent to an existing facility, the attractively designed and landscaped Energy Lab, it has at least some potential to represent a disharmonious visual element. Of critical importance are the affected viewplanes,

which are discussed below.

The most important viewplane is from the summit and other publicly accessible areas of Puʻu Waʻawaʻa, where hikers who use the public trail on the back side of the cone (and perhaps participate in conservation activities) have expansive views of the landscape. As shown in Figure 3c, the viewpoint from the point closest to the project site (near the water tank and picnic area in the reforestation part of the western slope) does not include views of the Energy Lab and adjacent pasture. This is because of both the convex shape of the cinder cone and intervening trees. Views from the twin summit cones of Puʻu Waʻawaʻa have even less of a view of facilities at the western base of the cone. There will thus be no impact to views from public enjoying the trails on Puu Waʻawaʻa.

The most affected viewplane would be that from the private properties at Puʻu Waʻawaʻa Ranch, which would be slightly affected by adding on to the developed footprint of the Ranch's own Energy Lab, which is adjacent to the proposed solar facility. However, the owners of the private inholdings support the project and have expressed no objections.

The State cabins on the *mauka* side would also experience a visual impact, although the low profile of the structures and their alignment along a descending slope will tend minimize the view impacts. It is the applicant's understanding that the cabins are not intended to be structures that the State will continue to allow to be occupied and that they are currently not maintained by the State ~~and that the State collects no rent from them~~.

Public access on Puʻu Waʻawaʻa Ranch road ends *makai* of the pasture, according to signs posted by the State, past which the public road that is open to hunters turns south. The view from the bend of the road here does include the pasture that is the project site (see Figure 3b).

In summary, some visual impact will occur, but the location adjacent to an existing technology building that already contains solar panels is an appropriate context. The area is not visible from the summit of Puʻu Waʻawaʻa nor the trails that access it, and few members of the public would actually have the occasion to see the panels.

3.1.5 Hazardous Substances, Toxic Waste and Hazardous Conditions

Environmental Setting, Impacts and Mitigation Measures

No professional evaluation such as a Phase I Environmental Site Assessment was conducted for the proposed easement area, but the history of use of the site and its surroundings (see Section 3. 2) does not suggest the presence of hazardous materials. Visual surveys of the project site and its surroundings, which is a pasture, did not indicate the presence of structures, equipment or storage containers that might indicate hazardous material use. Therefore, based upon prior and present use, no hazardous substances, toxic wastes or hazardous conditions are expected to be present on the project site.

The proposed project would not involve any impacts related to production of, or exposure to, such substances or conditions. As discussed in Section 3.1.2, depending on technology, solar panels may contain certain hazardous materials, particularly metals. This is an issue faced by most solar installations, whether rooftop or ground-mounted, residential or commercial. The solar panels proposed for the NPI project at Puʻu Waʻawaʻa are BenQ monocrystalline panels. As opposed to thin-film systems, installed silicon-based cells pose minimal risks to human health or the environment according to reviews conducted by the Brookhaven National Lab and the Electric Power Research Institute (EPRI 2003). The fact that solar panels are encased in heavy-duty glass or plastic means that there is little risk that the small amounts of semiconductor material present can be released into the environment. In the event of a fire, it is theoretically possible for hazardous fumes to be released and inhalation of these fumes could pose a risk to human health. Generally, these risks can be minimized to almost zero by removing fuels such as dry brush during site preparation, since the glass and aluminum of a solar panel are not themselves flammable. Firefighters are trained to deal with building fires that can affect rooftop systems. The pasture site does not contain fuels that could cause an issue. The strength of electromagnetic fields produced by photovoltaic systems do not approach levels considered harmful to human health established by the International Commission on Non-Ionizing Radiation Protection. Moreover the small electromagnetic fields produced by photovoltaic systems rapidly diminish with distance and would be indistinguishable from normal background levels within several yards. (Oregon Department of Transportation: http://www.oregon.gov/ODOT/HWY/OIPP/docs/life-cyclehealthandsafetyconcerns.pdf). No sensitive uses are located directly adjacent to the panels.

At the end of their useful life, solar panels should be recycled to reduce the need for virgin raw materials and ensure that potentially harmful materials are not released into the environment. The solar industry has a trade association that promotes takeback by solar vendors, and according to the applicant, the manufacturer of the proposed cells for NWI participates in this program, as do most responsible vendors. It is relatively easy to recover the glass, aluminum frame, and solar cells. Following this process, the glass and aluminum frame are separated and typically sold to industrial recyclers. The solar cells are then reprocessed into silicon wafers with valuable metals recovered and sold. Depending on the condition, the wafer can then either be remade into a functioning cell or granulated to serve as feedstock for new polysilicon. If not properly decommissioned, the greatest end of life health risk from crystalline solar modules arises from lead containing solders. Under the right conditions it is possible for the lead to leach into landfill soils and eventually into water bodies. If takeback does not occur, then the system owner must be held responsible for proper disposal.

3.2 Socioeconomic and Cultural

3.2.1 Socioeconomic Characteristics

Environmental Setting

The project is located on State land adjacent to Puʻu Waʻawaʻa Ranch, a 28-acre private inholding. Another smaller private inholding is also present mauka of the well site, and the State land has three homes and three cabins in the area, most of which have residents.

The nearest residential community is Puʻu Anahulu, which is not measured by census records but perhaps has several hundred residents. This small community is centered around ranches that leased formerly large tracts of government land in and around Puʻu Waʻawaʻa and homesteads that date from more than a century ago. The homesteaders, many of whom worked on the large cattle ranches, were direct descendants of the native tenants of Puʻu Anahulu and Puʻu Waʻawaʻa, and the community has strongly traditional foundations. Subsequent owners and State land lessees have continued to ranch, with more intense grazing on a smaller land base. The late 20th century also saw the development of Big Island Country Club, a private golf course around which there are plans for a residential community, and the Puʻu Lani Ranch subdivision, a gated residential community.

All of the residents of Puʻu Waʻawaʻa and most of the residents of Puʻuanahulu, as well as three ranches, the Puʻuanahulu Community Center, the Puʻuanahulu Volunteer Fire Station, and DLNR (with five connections), depend on water from NWI.

Impacts and Mitigation Measures

The proposed action would reduce pumping costs for water by approximately half, savings which would be passed on to the non-profit utility's customers, who include most of the residents of the immediate area as well as Puʻuanahulu. In this sense, it would be a substantial benefit.

The proposed project would not involve any relocation of businesses or homes or any other social impacts. There would be no disruption of local traffic patterns or effects to neighborhood character or integrity.

3.2.2 Cultural Resources

The information in this section relies on historical research provided in the Archaeological Assessment Survey (AAS) by ASM Affiliates, Inc., contained in Appendix 2, various other published and unpublished sources, and consultation with Puʻu Waʻawaʻa and Puʻuanahulu residents and organization officials conducted for the EA and/or as part of the AAS.

Cultural Background for Era Prior to Western Contact

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

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

Over a period of several centuries, areas with the richest natural resources became populated and perhaps crowded, the population began expanding to the *kona* (leeward side) and upland areas such as Waimea (Kirch 2012). Over the generations, the ancient Hawaiians developed a sophisticated system of land and resources management. By the time ‘Umi-a-Līloa rose to rule the island of Hawai‘i in ca. 1525, the island (*mokupuni*) was divided into six districts or *moku-o-loko*. On Hawai‘i, the district of Kohala is one of six major *moku-o-loko* within the island. Kohala like other large districts on Hawai‘i, was subdivided into ‘*okana* or *kalana* (regions of land smaller than the *moku-o-loko*, yet comprising a number of smaller units of land). The *moku-o-loko* and ‘*okana* or *kalana* were further divided into manageable units of land, and were tended to by the *maka‘āinana* (people of the land). Of all the land divisions, perhaps the most significant management unit was the *ahupua‘a*. *Ahupua‘a* are generally wedge-shaped pieces of land that radiate out from the center of the island, extending to the ocean fisheries fronting the land unit. They were usually marked by an altar with an image or representation of a pig placed upon it (thus the name *ahu-pua‘a* or pig altar).

The *ahupua‘a* were also divided into smaller individual parcels of land (such as the *‘ili*, *kō‘ele*, *māla*, and *kīhāpai,* etc.), generally oriented in a *mauka-makai* direction, and often marked by stone alignments (*kuahiwi*). In these smaller land parcels the native tenants tended fields and cultivated crops necessary to sustain their families, and the chiefly communities with which they were associated. As long as sufficient tribute was offered and *kapu* (restrictions) were observed, the common people who lived in a given *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*.

Entire *ahupua'a*, or portions of the land 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 resources management planning. In this system, the land provided fruits and vegetables and some meat in the diet, and the ocean provided a wealth of protein resources.

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

Clark (1987) offered a regional settlement pattern model for the Pre-Western Contact use of nearby Waikoloa that included four elevationally delimited environmental zones: Coastal Zone, Intermediate Zone, Kula Zone, and Wilderness Zone. The Coastal Zone extends up to about 150 feet elevation, and was used for permanent and temporary habitation, coastal resource exploitation, and limited agriculture. The Intermediate Zone extends from the Coastal Zone to about 1,900 feet elevation. This zone was used primarily for seasonal agriculture with associated short-term occupation, typically situated near intermittent drainages. The Kula Zone extends from the Intermediate Zone to about 2,700 feet elevation (and to 3,200 feet in certain areas). This was the primary agricultural and residential area, with extensive formal fields and clustered residential complexes. The Wilderness Zone extends above the Kula Zone to the mountaintops, and was a locus for the collection of wild floral and faunal resources. Pu'uwa'awa'a crosses several environmental zones that are generally referred to as *wao* in the Hawaiian language. These environmental zones include the near-shore fisheries and shoreline strand (*kahakai*) and the *kula kai*/*kula uka* (shoreward/inland plains). These regional zones were greatly desired as places of residence by the natives of the land.

Continuing into the *kula uka* (inland slopes), the environment changes as elevation increases. The zones called the *wao kanaka* (region of man) and *wao nahele* (forest region) in Pu'u Wa'awa'a are generally situated between the 1,800 to 2,400 foot elevations, and are crossed by

the present-day Māmalahoa Highway. The highway is situated not far below the ancient *ala loa*, or foot trail, also known as Ke-alaʻehu, and was part of a regional trail system passing through Kona from Kaʻū to Kohala. Within the forest region, rainfall increases to 30 or 40 inches annually, and taller forest growth occurred. This region provided native residents with shelter for residential and agricultural uses, and a wide range of natural resources that were of importance for religious, domestic, and economic purposes.

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

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

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

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

reported “I went visiting from here to the lava bed and pond that lies along the length of the land.” He was told, “Kaniku is the lava bed and Kiholo, the pond” (Kamakau 1961:56).

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

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

In the series of articles entitled “*Na Hoonanea o ka Manawa, Kekahi mau Wahi Pana o Kekaha ma Kona*” (Pleasant Passing of Time [Stories] About Some of the Famous Places of Kekaha at Kona), Kihe presented detailed narratives of native traditions of Nāpuʻu and Kekaha (*Ka Hoku o Hawaii*; Dec. 6th 1923 to Feb. 21st 1924). Kihe described some of the famous places (*wahi pana*), and how they came to be named. He also identified some of the early residents of the region, and practices associated with water catchment and agriculture. The account of the priest Moemoe, and the shark-man, ʻĪwahaʻouʻou, from *Ka Hoku o Hawaii*; January 3, 1924 includes several important place names in the lowlands of Puʻu Waʻawaʻa. Significantly, there are named caves and sites, and descriptions of cultivating practices in the uplands of Nāpuʻu. The former residence of sharkman, ʻĪwahaʻouʻou, is situated near the Puʻu Waʻawaʻa-Puʻuanahulu boundary several miles from the project site, and overlooks the *kula* (plains). This site is still pointed out by elder *kamaʻāina* of the land.

Post-Western Contact Cultural and Historical Background

Captain James Cook and his crew first arrived in the Hawaiian Islands on January 18, 1778, on board the *H.M.S. Resolution* and *Discovery*, prior to sailing north and searching fruitlessly for the Northwest Passage. Returning a year later, he spent a month in Kealakekua Bay, where he was killed in February 1779 over a dispute involving one of the ship’s skiffs. With the arrival of foreigners in the islands, Hawaiʻi’s culture and economy underwent drastic changes. Demographic trends during the early part of the nineteenth century indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. At first there was a continued trend toward craft and status specialization,

intensification of agriculture, *ali‘i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history (Kent 1983). Later, as the Historic Period progressed, Kamehameha I died, the *kapu* system was abolished, Christianity established a firm foothold in the islands, and introduced diseases and global economic forces began to have a devastating impact on traditional life-ways. Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early Western visitors. Introduced foods often grown for trade with Westerners included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845). The arrival of foreigners in Hawai‘i signified the end of the Precontact Period, and the beginning of the Historic Period, and the end of an era of uniquely Hawaiian culture.

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

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

In 1848, the Hawaiian system of land tenure was radically altered by the *Māhele ‘Āina*. The *Māhele* (division) defined the land interests of Kamehameha III (the King), the high-ranking chiefs, and the *konohiki*. As a result of the *Māhele*, all land in the Kingdom of Hawai‘i came to be placed in one of three categories: (a) Crown Lands (for the occupant of the throne); (b) Government Lands; and (c) Konohiki Lands. Laws in the period of the *Māhele* record that ownership rights to all lands in the kingdom were “subject to the rights of the native tenants;” those individuals who lived on the land and worked it for their subsistence and the welfare of the chiefs.

The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). Claims for *kuleana* had to be submitted during a two year period that expired on February 14, 1848 to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more time than was prescribed by the two year term, and the deadline was extended several times, not

for new claims, but for the Land Commission to finish its work (Maly and Maly 2002). As the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenant's rights to the land and its resources, and also the process by which they could apply for, and be granted fee-simple interest in their *kuleana*. The volumes of native registry and testimony collected for the *kuleana* claims provide a snap-shot of life in Hawai'i during the middle part of the nineteenth century. Information recorded in the these volumes contains the names of smaller land divisions (*'ili*, *mo'o*, etc.) within the *ahupua'a*, ties individual claimants and their families to specific locations within those land divisions, provides background information about when, and from whom, the claimants received their lands, and gives accounts of the land use at that certain time and place.

Mikahela Kekauonohi (a granddaughter of Kamehameha I) claimed Pu'u Wa'awa'a Ahupua'a during the *Māhele*; however, the *ahupua'a* was relinquished to the government perhaps in lieu of commutations for other lands awarded. Five *kuleana* claims, all in the coastal portion of the *ahupua'a* near Kiholo Bay, were made, but none were granted (Maly and Maly 2006). As Pu'u Wa'awa'a was retained as crown land during the *Māhele*, it was not until 1873 that its boundaries were surveyed. The boundary testimonies and survey records provide a good summary of traditional knowledge of places, and identify localities ranging from the shore to the upper most boundaries of the *ahupua'a*. The narratives described trails and forest resources of Pu'uwa'awa'a; the occurrence of historical features, including residences and agricultural fields; the practice of salt making; and many place names. Appendix 2 contains several translated testimonies that provide interesting information on the area; none relate directly to the project site.

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

When the Hawaiian Kingdom began issuing homesteads in the late 1800s, those seeking lands began competing with Pu'u Wa'awa'a Ranch for desirable crop and grazing land. By 1914, Robert Hind began acquiring title to lots in Pu'u Anahulu from homesteaders who, according to terms of the homesteading application process, needed to prove they had jobs, and the only ones available in the area were those offered by the ranch. Hind's growing sociopolitical influence led

to his appointment in 1916 as Hawai‘i Territorial Senator, a position he held for several years. By this time the ranch’s primary residence had been built. The home became known as Pihanakalani, which translated as “gathering place [of] high supernatural beings,” and was visited by dignitaries from around the world. Over the next two decades the corporation “Robert Hind, Limited” was created to consolidate his interests, which by then consisted of 120,000 acres ranging up to 6,000 feet in elevation, with all but 300 acres involving leased government lands. They included 100,000 acres covered with lava flows, with only about 1,500 acres of the remainder considered good grazing land – mostly around the 5,000-foot elevation. Another 100 acres were planted in crops. In 1929 the ranch contained 30 miles of fences, half stone and half wire, and 2,000 head of cattle. It was at this time that efforts were undertaken to reduce the number of goats that were competing with the cattle for forage. In the mid-1930s, changes were made to the leases to exclude private parcels, including many along the coast. The leases for Pu‘u Anahulu and Pu‘u Wa‘awa‘a were again put up for auction in 1937 with Hind retaining them, but at a much higher cost. Robert Hind died in 1938 and his operations continued under a trust overseen by Trustee John K. Clarke until Clarke’s death in 1951.

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

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

Bohnett’s lease on the remaining property expired in 2000. In 2002 the BLNR transferred all State-managed lands in the *ahupua‘a* of Pu‘u Wa‘awa‘a from the Department of Land and Natural Resources’ Land Division to the Division of Forestry and Wildlife and State Parks (Giffin 2003). The agencies were directed to develop a management plan to provide for the restoration of native ecosystems and preservation of cultural resources, as discussed elsewhere in this document.

In 1993 the fee-simple parcel containing the ranch homes and HQ was sold by Bohnett to Pu‘u Wa‘awa‘a Ranch. In 2000 the ranch sold the property to Jerry R. King, who sold it on April 13, 2006 to Henk and Akemi Rogers, who still hold the property and reside there part-time.

Consultation

To gain any further possible insights about the project area and the specific project site of the proposed project, the AIS included consultation with a variety of individuals, as detailed in Appendix 2. On March 5, 2014 Robert B. Rechtman, Ph.D. and Genevieve L. Glennon, B.A. met separately with Miki Kato and Ralph Alapai. Miki Kato has lived in the *ahupua'a* since about 1962 and worked at the Pu'u Wa'awa'a Ranch since 1956; he currently lives about a half mile *makai* of the project area. Ralph Alapai's family has been resident in the Pu'u Wa'awa'a-Pu'uanahulu area for centuries, and the Alapai family has been associated with ranching in the area since the late 1880s. Ralph currently maintains cattle in the vicinity of the project area. Both individuals are familiar with and very knowledgeable about the general area and neither indicated that they knew of the presence of any archaeological or cultural sites or that any cultural practices have occurred within the project site. As part of the EA early consultation process, the Office of Hawaiian Affairs, the Pu'uanahulu Community Association, and the Pu'u Wa'awa'a Advisory Council were also contacted about the action (see Appendix 1a for responses). No specific cultural practices, resources or sites were identified.

Existing Cultural Resources or Practices

Inspection of the short-grass pasture project site by professional archaeologists and biologists (see Section 3.2.1 and 3.2.3) revealed no evidence of structures, unique natural features or activities that would be valuable for gathering, ceremonial, or access purposes. No agency or group identified any natural, cultural or historical resources or expressed concern about potential cultural impacts.

Impacts and Mitigation Measures

It is reasonable to conclude that, based upon the lack of resources on the easement, which has been used for pasture for over a century, the exercise of native Hawaiian rights related to gathering, access or other customary activities will not be affected, and there will be no adverse effect upon cultural practices or beliefs. This conclusion was reviewed based on additional input received during review of the Draft EA. No party reviewing the Draft EA supplied any cultural information.

3.2.3 Historic Properties and Archaeological Sites

Methods

Following background research described in Appendix 2, on March 5, 2014, Robert B. Rechtman, Ph.D. and Genevieve L. Glennon, B.A. conducted fieldwork at the project site. The archaeological surface survey involved the systematic inspection of the project area, with the field investigators walking north/south transects at a 20-meter spacing interval. As the vegetation consisted of heavily grazed pasture, ground visibility was excellent.

Existing Archaeological Resources

There were no archaeological features observed on the surface; given the nature of the substrate, there is virtually no likelihood of encountering subsurface remains.

Impacts and Mitigation Measures

Given the absence of findings of historic properties, the archaeologists concluded that the proposed solar photovoltaic project would not significantly impact any known historic properties. The archaeological survey has been submitted to the State Historic Preservation Division for review and concurrence. In a letter of November 26, 2014, SHPD concurred with the findings of the report (see Appendix 1b for letter).

As a precaution, the applicant proposes to include as a condition of the easement that in the unlikely event that any unanticipated archaeological resources are unearthed during development activities, in compliance with HAR 13§13-280 work in the immediate vicinity of the finds should be halted and DLNR-SHPD contacted.

3.3 Roadway, Utilities and Public Facilities and Services, and Energy

Roads and Access

The project site is accessed by Puʻu Waʻawaʻa Ranch Road, a partially paved one- to two-lane road. Construction will require intermittent use of the road during an approximately two-month period. Solar panels are lightweight and simple to install, and no major construction equipment requiring the use of heavy hauling trucks will be required. Some light excavation with a backhoe will be needed, but all equipment can easily be trailered onto the site with no need for road improvements or special traffic control. Maintenance of the facility will be minimal once equipment is installed and no traffic impacts are expected.

Electricity

Electricity is already available at the well site. Some electrical switchgear will have to be placed on site to connect to HELCO's pole through underground existing conduits.

Public Services and Facilities

The proposed project will not adversely affect or increase demand on public services or facilities, including police protection, recreational facilities, or social services. As discussed in Section 3.1.5, above, solar facilities are not highly flammable. Generally, fire risk can be minimized to almost zero by removing fuels such as dry brush during site preparation, since the glass and aluminum of a solar panel are not themselves flammable. Firefighters are trained for dealing with building fires that do occasionally affect rooftop systems. The pasture site does not contain fuels that could present an issue, and it will be maintained fuel-free. The nearest station for the

Hawai‘i Fire Department is on Palani Road in Kailua-Kona, about 17 miles away. A volunteer Fire Department is present in Pu‘uanahulu, and additional County stations are located in Waikoloa and Waimea.

Water Supply

As stated above, the project is intended to increase energy security and reduce costs and would not increase demand on the water system or yield additional water.

In a letter of March 24, 2014 in response to early consultation (see Appendix 1a for full text), the Hawai‘i DLNR-DOFAW made several inquiries about the ability of the project to provide DLNR with additional water and stated:

> "Would it be possible to get a stand pipe as well as the 3 water meters? This would greatly assist the State with fire-fighting capability [?];
> What is the status of the discussion with Na Puu Water Co., Inc. in regards to installation of a water storage tank for firefighting above Puu Lani Ranch Subdivision? This may have been a part of the initial discussions [?];"

Currently, NWI supplies DLNR-DOFAW with four connections. Two former DOFAW services were closed by mutual agreement in the past. All but one of these was obtained by legal agreement with NWI for residential use only, with restrictions on quantity of use:

- DOFAW "Party House" (residential)
- Caretaker's House (residential)
- DOFAW Lake Meter
- DOFAW #2 (State cabin) (residential)

The applicant recognizes that the State needs to acquire additional water to improve its management of Pu‘uwa‘awa‘a and to protect public resources. The NWI is a utility that must abide by its charter, and is thus not legally able to provide water services gratis or at less than rates set by the utility's rules. NWI must also ensure that the capacity of the system to serve existing and legally entitled ratepayers is not exceeded. NWI is currently working with DLNR to arrive at solutions that are in keeping the charter and amenable to all parties.

Energy

The energy policy of the State of Hawai‘i seeks to ensure dependable, efficient, and economical energy; increased energy self-sufficiency; greater energy security; and reduction of greenhouse gas emissions (Hawai‘i State DBEDT: http://hawaii.gov/dbedt/info/energy/Document.2010-03-01.1302). Lacking internal fossil fuel resources, Hawai‘i is highly dependent on imported energy. Currently, over 95 percent of Hawai‘i's primary energy is derived from imported fossil fuels such as petroleum and coal (Ibid). Hawai‘i's remote location, dispersed population and relatively small market leads to very high energy prices and makes the State vulnerable to energy

supply fluctuations. In response to this situation, the State passed legislation that requires Hawaii Electric Company and its affiliates, including HELCO, to generate renewable energy equivalent to 10 percent of their net electricity sales by 2010, 15 percent by 2015, 25 percent by 2020, and 40 percent by 2030. Act 234, Hawai‘i’s Global Warming Solutions Act of 2007, requires Hawai‘i to reduce its statewide greenhouse gas emissions to 1990 levels by January 1, 2020. Hawai‘i also signed the Hawai‘i Clean Energy Initiative, which involves a Memorandum of Understanding with the federal Department of Energy (DOE) for a roadmap to achieve 70 percent clean energy by 2030, with 30 percent to come from efficiency measures, and 40 percent from locally generated renewable sources.

HELCO currently derives about 40 percent of its energy from renewable sources, including solar, geothermal, wind and hydroelectricity, according to HECO (http://www.hawaiianelectric.com/heco/Clean-Energy/Latest-Clean-Energy-News/About-Our-Fuel-Mix). Although this is one of the highest rates in the state, it also means that the other 60 percent of the energy comes from fossil fuels. The proposed project would substitute up to 300 Megawatt hrs/yr of all renewable electrical energy that would otherwise be produced by HELCO, which is less than half renewable.

3.4 Secondary and Cumulative Impacts

The proposed project would not lead to any adverse secondary impacts, such as population changes or effects on public facilities. The project is intended to increase energy security and reduce costs and would not increase demand on the water system or yield additional water that would prompt growth. Success in implementing the proposed project may have the beneficial effect of providing a proven model for other private and public water systems to reduce their reliance on fossil fuels and adopt renewable energy for well pumping.

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. It is important to note that the adverse effects of the proposed solar facility are very limited in severity, nature and geographic scale. They are basically restricted to visual impacts that given the context next to an existing technology building covered with solar panels are minor. At the current time, there are no roadway, utility, development, land use or other projects being undertaken in the area that would tend to combine in such a way as to produce adverse cumulative effects. DLNR-DOFAW and the U.S. Forest Service are actively managing the more than 40,000 acres in Pu‘u Wa‘awa‘a for research and to conserve natural and cultural resources. Although these projects may occasionally involve built structures or other actions that alter the visual landscape, all such actions are generally located at a distance from the proposed project and would not create visual impacts that would accumulate with that of the proposed solar facility.

3.5 Required Permits and Approvals

The proposed project requires BLNR approval of the easement, review and approval of plans by the DLNR Engineering Division, Plan Approval by the Planning Department, and a building permit from the County of Hawai‘i. The applicant is working with DLNR to determine if any additional DLNR permits are necessary, including an annual Special Use Permit for work in a Forest Reserve.

3.6 Consistency With Government Plans and Policies

3. 6. 1 Hawai‘i State Plan

Adopted in 1978 and last revised in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended), the Plan establishes a set of themes, goals, objectives and policies that are meant to guide the State’s long-run growth and development activities. The three themes that express the basic purpose of the *Hawai‘i State Plan* are individual and family self-sufficiency, social and economic mobility and community or social well-being. The proposed project would not in any way be detrimental to these goals and would help fulfill goals related to the economy and well-being.

3.6.2 Hawai‘i State Land Use Law

All land in the State of Hawai‘i is classified into one of four land use categories – Urban, Rural, Agricultural or Conservation – by the State Land Use Commission, pursuant to Chapter 205, HRS. The property is in the State Land Use Agricultural District. The proposed project, which involves renewable energy use, is consistent with intended uses for this land use district and is a permissible use.

3.6.3 Hawai‘i County General Plan and Zoning

The *General Plan* for the County of Hawai‘i is a policy document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i. The plan was adopted by ordinance in 1989 and revised in 2005 (Hawai‘i County Department of Planning). 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 Hawai‘i. Most relevant to the proposed project are the following Goal, Policies, Standards and Courses of Action:

ENERGY GOALS

- Strive towards energy self-sufficiency.
- Establish the Big Island as a demonstration community for the development and use of natural energy resources.

ENERGY POLICIES

- Encourage the development of alternate energy resources.
- Ensure a proper balance between the development of alternative energy resources and the preservation of environmental fitness and ecologically significant areas.
- Strive to diversify the energy supply and minimize the environmental impacts associated with energy usage.

ECONOMIC GOALS

- Provide residents with opportunities to improve their quality of life through economic development that enhances the County's natural and social environments.

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.

ENVIRONMENTAL QUALITY STANDARDS

- Pollution shall be prevented, abated, and controlled at levels that will protect and preserve the public health and well being, through the enforcement of appropriate Federal, State and County standards.

HISTORIC SITES GOALS

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

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.

LAND USE GOALS

- Designate and allocate land uses in appropriate proportions and mix and in keeping with the social, cultural, and physical environments of the County.

LAND USE, AGRICULTURE, POLICIES

- Ensure that development of important agricultural land be primarily for agricultural use.
- Assist in the development of basic resources such as water, roads, transportation and distribution facilities for the agricultural industry.
- Encourage other compatible economic uses that complement existing agricultural and pastoral activities.

Discussion: The proposed project would utilize a small portion of non-economic pasture to substantially reduce the carbon footprint and the dependence of fossil fuels for a non-profit water utility that serves an agricultural community. It would protect the environment through avoiding areas that are sensitive from a biological, archaeological, cultural, hydrological or scenic perspective.

The *Hawai'i County General Plan Land Use Pattern Allocation Guide (LUPAG)*. The LUPAG map component of the *General Plan* is a graphic representation of the Plan's goals, policies, and standards as well as of the physical relationship between land uses. It also establishes the basic urban and non-urban form for areas within the planned public and cultural facilities, public utilities and safety features, and transportation corridors. The project site is designated as Extensive Agriculture in the LUPAG (see letter in Appendix 1a). The proposed project is consistent with this designation.

Hawai'i County Zoning and Special Management Area. The project site is zoned A20a (Agriculture, minimum lot size 20 acres). The proposed project is a permitted and intended use within this designation. The project site is outside the s Special Management Area (SMA).

3.6.4 Kona Community Development Plan

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

The General Plan now requires that a Community Development Plan shall be adopted by the County Council as an "ordinance," giving the CDP the force of law. This is in contrast to plans created over past years, adopted by "resolution" that served only as guidelines or reference documents to decision-makers. The Kona CDP was adopted in September 2008 by the County Council. The version referenced in this Environmental Assessment is at: http://www.hcrc.info/community-planning/north-and-south-kona-cdp/cdp-final-drafts/Final%20KCDP_Sept%202008_text.pdf

The purposes of the Kona CDP are to:

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

The draft CDP states that:

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

The proposed project preserves the rural character of the area by utilizing a marginal pasture area for energy production that is local and sustainable. It would not affect viewplanes, agricultural uses, or open space, and would not affect the rural ambience of this part of Kona.

The Plan has many elements and wide-ranging implications, but there are several major strategies that embody the guiding principles related to the economy, energy, environmental quality, flooding and other natural hazards, historic sites, natural beauty, natural resources and shoreline, housing, public facilities, public utilities, recreation, transportation and land use.

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

> *Protect Kona's natural resources and culture.*

It also conforms with item No. 7:

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

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

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

The project supports energy conservation and sustainable production as a viable business model for the non-profit water company.

The Kona CDP also notes that critical habitat designated by the U.S. Fish and Wildlife Service (see Section 3.1.3) is a sensitive resource, per Policy ENV-1.5. It is important to remember that critical habitat is a tool for recovery of endangered species on projects or land with a federal nexus, and not a mechanism to block utilization of land. No aspect of the project is in conflict with the recovery of endangered species at Puʻu Waʻawaʻa.

3.6.5 Local Puʻu Waʻawaʻa Plans: Puʻu Waʻawaʻa Management Plan and U.S. Forest Service Experimental Tropical Forest

Management Plan for the Ahupuaʻa of Puʻu Waʻawaʻa and the Makai Lands of Puʻu Anahulu

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

DOFAW initiatives led to the establishment and official designation of the Puʻu Waʻawaʻa Forest Bird Sanctuary. The plan also aspired to emulate the traditional concept of *ahupuaʻa* management in a contemporary context. This plan presented 62 unique objectives that were intended to support the complex array of resource management needs and community interests that applied. These set the framework for management of this area for a 10-year period beginning in July 2003. Accordingly to DOFAW, 26 of the objectives, which had a budget of over $26 million, were achieved the 10-year period, and some of the remaining 34 objectives are no longer relevant due to various changes. The plan recognized the need to actively seek additional resources through grants, cooperative agreements and partnerships. DLNR and Puʻu Waʻawaʻa Advisory Council continue to seek to implement the plan.

The following discussion of the consistency of the proposed action with the objectives of the Management Plan for the Ahupuaʻa of Puʻu Waʻawaʻa and the Makai Lands of Puʻu Anahulu is restricted to those applicable in some way to the proposed project.

Objective 6. Reduce fire hazard at Puʻu Waʻawaʻa using prevention measures.

The solar panels themselves are not flammable. The proposed project would assist NWI in pumping water, some of which is important for fire protection.

Objective 12. Protect isolated occurrences of rare and endangered species
Objective 16: Preserve and protect unique native invertebrate populations at Puʻu Waʻawaʻa and the makai lands of Puʻu Anahulu.
Objective 17: Protect and enhance native bird populations and their habitat

The proposed two-acre pasture site does not contain native plant species and does not represent habitat for native animal species. No adverse impact on native species will occur.

Objective 42. Survey and develop historic trails within and adjacent to the ahupuaʻa for public use

The proposed 1.74-acre pasture site does not make use of a historic trail or any other historic property and does not affect public access in any way.

Objective 48. Conduct a comprehensive cultural and archaeological survey of Puʻu Waʻawaʻa and the makai portion of Puʻu Anahulu
Objective 49. Protect and Restore Cultural Sites

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

Objective 56. Upgrade Cultural and Environmental Education facilities

Although not specifically called out in the plan, the Puʻu Waʻawaʻa Ranch Energy Lab represents a significant educational resource for instructing visitors, including students, on renewable energy including solar power, hydrogen fuel cells and battery technology. The solar energy and flywheel storage facility, which is adjacent, could offer an additional resource.

Puu Waawaa Dry Forest Unit of the U.S. Forest Service Hawaii Experimental Tropical Forest

The Hawaii Experimental Tropical Forest (HETF) was established in 2007 and includes two Units: the Laupahoehoe Wet Forest, totaling 12,343 acres, and the Puu Waawaa Dry Forest,

totaling 38,885 acres. The HETF is part of a network of USFS Experimental Forest and Range units across the United States (http://www.hetf.us/page/puu_waa_waa/).

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

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

The proposed solar facility involves 1.74 acres of degraded pastures adjacent to private land at ranch headquarters and does not adversely affect the HETF. The renewable energy infrastructure will provide an educational resource and a model for development of facilities at the HETF.

PART 4: DETERMINATION

The applicant expects that based on the findings of the EA, and after review of comments to the Draft EA, the State of Hawai‘i, Department of Land and Natural Resources will determine that the proposed project will not significantly alter the environment, as impacts will be minimal, and that this agency will accordingly issue a Finding of No Significant Impact (FONSI).

PART 5: FINDINGS AND REASONS

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

1. *The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.* Natural or cultural resources have been fully inventoried.

No threatened or endangered species or cultural sites are present, and none would be committed or lost.

2. *The proposed project will not curtail the range of beneficial uses of the environment.* The proposed project expands and in no way curtails beneficial uses of the environment. If ever desired, the solar panels and flywheel storage can be removed from the project site and the area can be re-used for pasture or other purposes.
3. *The proposed project will not conflict with the State's long-term environmental policies*. The State's long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The proposed project is environmentally benign and furthermore fulfills aspects of these policies calling for increased use of renewable energy. It is thus consistent with all elements of the State's long-term environmental policies.
4. *The proposed project will not substantially affect the economic or social welfare of the community or State.* The proposed project will not adversely affect the social welfare of the community in any adverse way. Construction and operation will have highly beneficial effects through reducing fossil fuel energy consumption and increasing energy security.
5. *The proposed project does not substantially affect public health in any detrimental way.* The proposed project will not affect public health in any way.
6. *The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities*. The proposed project would not lead to any adverse secondary impacts, such as population changes or effects on public facilities. The project is intended to increase energy security and reduce costs and would not increase demand on the water system or yield additional water that would prompt growth. Success in implementing the proposed project may have the beneficial effect of inducing other private and public water systems to similarly reduce their reliance on fossil fuels and adopt renewable energy for well pumping.
7. *The proposed project will not involve a substantial degradation of environmental quality*. The proposed project is minor and environmentally benign, and would thus not contribute to environmental degradation.
8. *The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.* The project site is pasture with non-native vegetation. No impacts to rare, threatened or endangered species of flora or fauna will occur.
9. *The proposed project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions.* The adverse effects of the proposed solar facility are very limited in severity, nature and geographic scale. They are basically restricted to visual impacts that given the context next to an existing technology building covered with solar panels are minor. At the current time, there are no roadway, utility, development, land use or other projects being undertaken in the area that would tend to combine in such a way as to produce adverse cumulative effects. DLNR-DOFAW and the U.S. Forest Service are actively managing the more than 40,000 acres in Pu‘u Wa‘awa‘a for research and to conserve natural and cultural resources. Although these projects may occasionally involve built structures or other actions that alter the visual landscape, all such actions are generally located at a distance from the proposed

project and would not create visual impacts that would accumulate with that of the proposed solar facility.

10. *The proposed project will not detrimentally affect air or water quality or ambient noise levels.* No adverse effects on these resources would occur, and global air quality will benefit from a net reduction in fossil fuel emissions.
11. *The project does not affect nor would it likely to be damaged as a result of being located in environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal area.* Although the project site is in an area with some volcanic and seismic risk, the entire Island of Hawai‘i shares this risk, and the proposed project is not imprudent to undertake.
12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* The proposed project would not affect public views of scenic sites recognized in the Hawai‘i County General Plan, or other important public views. It would insert into the rural landscape a roughly two-acre, quasi-industrial built element, including solar panels and a chain link fence. Some visual impact will occur, but the location adjacent to an existing technology building that already contains solar panels is an appropriate context. The area is not visible from the summit of Pu‘u Wa‘awa‘a nor the trails that access it, and few members of the public would actually have the occasion to see the panels. The most critical viewplanes from the public areas of the Pu‘u Wa‘awa‘a cinder cone are not affected.
13. *The project will not require substantial energy consumption*. The proposed project will reduce fossil-fuel energy use by a figure of up 300 Megawatt hrs per year.

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

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ENVIRONMENTAL ASSESSMENT

Na Pu‘u Water Inc.
Easement on State Land for Solar Photovoltaic Array

APPENDIX 1a
Comments in Response to Early Consultation

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William P. Kenoi
Mayor

Harry S. Kubojiri
Police Chief

Paul K. Ferreira
Deputy Police Chief

County of Hawai'i

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

March 19, 2014

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

RE: EARLY CONSULTATION ON ENVIRONMENTAL ASSESSMENT FOR NA PU'U WATER CO., INC., EASEMENT ON STATE LAND FOR SOLAR PHOTOVOLTAIC ARRAY, TMK (3) 7-1-001:006 (POR.), PU'U WA'AWA'A, NORTH KONA, ISLAND OF HAWAI'I

Dear Mr. Terry:

This is in response to your letter dated March 1, 2014, requesting for comments on the above-referenced project.

We have no comments or objections to offer at this time.

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

SINCERELY,

HARRY S. KUBOJIRI
POLICE CHIEF

PAUL H. KEALOHA, JR.
ASSISTANT POLICE CHIEF
AREA II OPERATIONS

RMI/jaj
RS140162

From: Jerry Norris [mailto:jerryn@oha.org]
Sent: Friday, March 21, 2014 2:08 PM
To: rterry@hawaii.rr.com
Subject: Re: Proposed EA - TMK (3) 7-1-001:006

Re: Easement on State Land for Solar Photovoltaic Array – The Office of Hawaiian Affairs does not have any concerns regarding this project.

Jerry B. Norris
Compliance Specialist
Office of Hawaiian Affairs
Na Lama Kukui
560 N. Nimitz Hwy. – Suite 200
Honolulu, HI 96817
Phone: (808) 594-0227
Fax: (808) 594-1825
Jerryn@oha.org
www.oha.org

William P. Kenoi
Mayor

Duane Kanuha
Director

Bobby Command
Deputy Director

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

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

March 25, 2014

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

Dear Dr. Terry:

Subject: **Pre-Consultation for Draft Environmental Assessment**
Project: Easement on State Land for Solar Photovoltaic Array
TMKs: (3) 7-1-001:006 (por) Pu'u Wa'awa'a; North Kona, Hawai'i

Thank you for your letter dated March 1, 2014, requesting comments from this office regarding the preparation of a Draft Environmental Assessment (DEA) for the subject project.

The subject parcel is owned by the State of Hawai'i, contains approximately 13,046.1 acres, is located within the State Land Use Agricultural and Conservation districts, zoned Agricultural (A-20a) and Open by the County, and designated Extensive Agriculture and Conservation by the Hawai'i County General Plan Land Use Pattern Allocation Guide (LUPAG) map. No portion of the project is within the Special Management Area (SMA).

We understand that Na Pu'u Water Company is requesting an easement of approximately two acres for installation of a solar photovoltaic array and flywheel energy storage system; the land is currently in use as pasture. We note that the majority of the parcel appears to be in an area of critical habitat as identified by the U.S. Fish & Wildlife Service, which is identified by the Kona Community Development Plan (KCDP) as a sensitive resource per Policy ENV-1.5. We recommend that the DEA include a discussion of the proposed project's alignment with the KCDP, copies of which can be found at the Planning Department.

We have no further comments to offer, at this time. However, please keep us informed and provide our department with a copy of the DEA for our review and comment. If you have any questions or if you need further assistance, please feel free to contact Lucas Mead of this office at (808) 961-8140.

Sincerely,

DUANE KANUHA
Planning Director

LM:
P:\wpwin60\Luke\dEA, EA, & EIS Comments\preconsultdraftea PV Easement at Pu'u Wa'aw'a.doc

From: Elliott Parsons [mailto:eparsons@hawaii.edu]
Sent: Friday, April 11, 2014 7:52 AM
To: Ron Terry
Cc: Blue Planet Research
Subject: Re: Na Puu WC Solar PV installation

Hi Ron,
Thank you, no problem. I don't have any comments in addition to the response you received from Steve Bergfeld/Hawaii DOFAW Branch. I will pass along to anyone I can think of that would be interested. Yes, I think a presentation to the PAC would be great. The next 3 PAC meetings are scheduled for:
Friday, June 20th, 3-5 PM at the Puuwaawaa Lake House
Friday, September 19th, 3-5 PM at the Puuwaawaa Lake House
Friday, December 12th, 3-5 PM at the Puuwaawaa Lake House.
Please let me know which of these days works for Paul and I will get it on the agenda.
Thank you!
Elliott

On 4/9/2014 10:07 AM, Ron Terry wrote:
Elliot, at the request of Paul Ponthieux and Steve Bergfeld, I wanted to share the early consultation letter I prepared a while ago for the project. Please review and pass along; we would welcome your comments. Sorry this took a while to get to you.

Also, Paul said he would be happy to provide a presentation on the project to the Puuwa`awa`a Advisory Council if desired.

If you have any questions or comments, please feel free to email me or call me at 969-7090.

Thanks

Ron Terry
rterry@hawaii.rr.com

--
Elliott Parsons, Ph.D.
Division of Forestry and Wildlife
Natural Area Reserves Specialist IV
Cell: (808) 333-0084
email: eparsons@hawaii.edu
http://www.puuwaawaa.org/index.html

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 28, 2014

Geometrician Associates
Attention: Mr. Ron Terry
P.O. Box 396
Hilo, Hawaii 96721

via email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Early Consultation on Environmental Assessment for Na Puu Water Co., Inc., Easement on State Land for Solar Photovoltaic Array, Geometrician Associates, LLC for Na Puu Water Co., Inc., Applicant, Puu Waawaa, North Kona, Hawaii, TMK: (3) 7-1-001:006 (por.)

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

At this time, enclosed are comments from the (i) Engineering Division, (ii) Hawaii District Land Office, (iii) Division of Forestry and Wildlife, and (iv) Office of Conservation and Coastal Lands on the subject matter. Should you have any questions, please feel free to call Kevin Moore at (808) 587-0426. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

2014 MAR 10 AM 10:36 ENGINEERING

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 7, 2014

MEMORANDUM

FR:

~~TO:~~

DLNR Agencies:
__Div. of Aquatic Resources
__Div. of Boating & Ocean Recreation
X Engineering Division
X Div. of Forestry & Wildlife
__Div. of State Parks
__Commission on Water Resource Management
X Office of Conservation & Coastal Lands
X Land Division – Hawaii District
X Historic Preservation

DEPT. OF LAND & NATURAL RESOURCES STATE OF HAWAII
2014 MAR 14 PM 3:50
RECEIVED LAND DIVISION

TO:

~~FROM:~~ Russell Y. Tsuji, Land Administrator
SUBJECT: Early Consultation on Environmental Assessment for Na Puu Water Co., Inc., Easement on State Land for Solar Photovoltaic Array
LOCATION: Puu Waawaa, North Kona, Hawaii, TMK: (3) 7-1-001:006 (por.)
APPLICANT: Geometrician Associates, LLC for Na Puu Water Co., Inc.

Transmitted for your review and comment is information on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 28, 2014.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Kevin Moore at 587-0426. Thank you.

Attachments

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

Signed: _____
Print name: Carty S. Chang, Chief Engineer
Date: 3/13/14

cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/ Russell Y. Tsuji
Ref.: Early Consultation on EA for Na Pu'u Water Co., Inc., Easement on State Land for Solar Photovoltaic Array, Pu'u Wa'awa'a, North Kona Hawaii.014

COMMENTS

( ) We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ___.

(X) Please take note that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Zone X. The National Flood Insurance Program (NFIP) does not regulate developments within Zone X.

( ) Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ___.

( ) Please note that the project site must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.

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

( ) Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.

( ) Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.

( ) Mr. Carolyn Cortez at (808) 270-7813 of the County of Maui, Department of Planning.

( ) Mr. Stanford Iwamoto at (808) 241-4884 of the County of Kauai, Department of Public Works.

( ) The applicant should include project water demands and infrastructure required to meet water demands. Please note that the implementation of any State-sponsored projects requiring water service from the Honolulu Board of Water Supply system must first obtain water allocation credits from the Engineering Division before it can receive a building permit and/or water meter.

( ) The applicant should provide the water demands and calculations to the Engineering Division so it can be included in the State Water Projects Plan Update.

( ) Additional Comments: _____

_____

( ) Other: _____

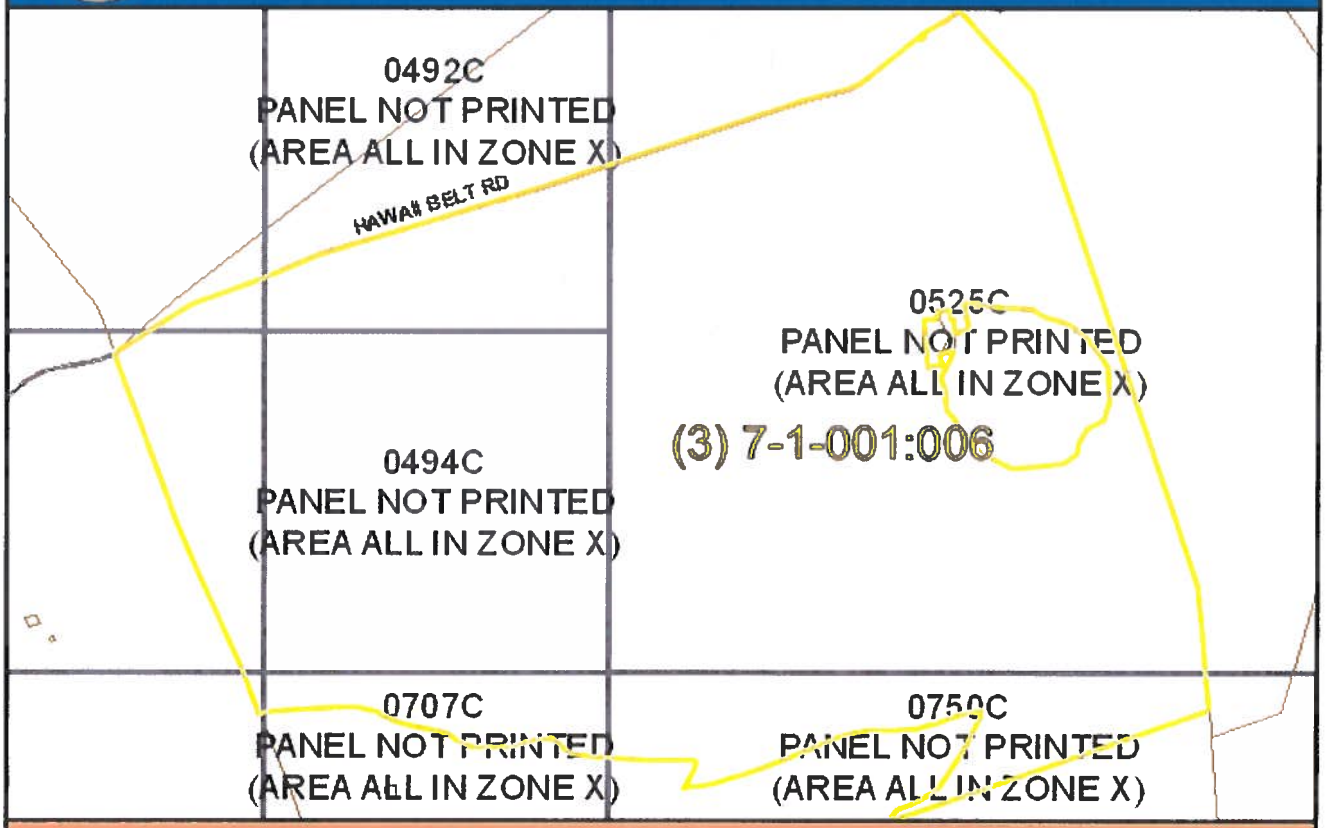
Should you have any questions, please call Mr. Dennis Imada of the Planning Branch at 587-0257.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 3/19/14

State of Hawaii

FLOOD HAZARD ASSESSMENT REPORT



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD ZONE DEFINITIONS

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

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

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

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

OTHER FLOOD AREAS

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

PROPERTY INFORMATION

COUNTY:	HAWAII
TMK NO:	(3) 7-1-001-006
PARCEL ADDRESS:	
FIRM INDEX DATE:	APRIL 02, 2004
LETTER OF MAP CHANGE(S):	NONE

FEMA FIRM PANEL(S):

1551660750C - PANEL NOT PRINTED 1551660525C - PANEL NOT PRINTED 1551660492C - PANEL NOT PRINTED 1551660491C - PANEL NOT PRINTED 1551660493C - PANEL NOT PRINTED 1551660494C - PANEL NOT PRINTED 1551660707C - PANEL NOT PRINTED 1551660706C - PANEL NOT PRINTED

PARCEL DATA FROM:	JUNE 2013
IMAGERY DATA FROM:	MAY 2005

IMPORTANT PHONE NUMBERS

County NFIP Coordinator	
County of Hawaii	
Frank DeMarco, CFM	(808) 961-8042
State NFIP Coordinator	
Carol Tyau-Beam, P.E., CFM	(808) 587-0267

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

2014 MAR 11 P 1:35

RECEIVED
LAND DIVISION
HILO, HAWAII

March 7, 2014

MEMORANDUM

TO: **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
_X_Engineering Division
_X_Div. of Forestry & Wildlife
___Div. of State Parks
___Commission on Water Resource Management
_X_Office of Conservation & Coastal Lands
_X_Land Division – Hawaii District
_X_Historic Preservation

RECEIVED
LAND DIVISION
2014 MAR 17 AM 10:52
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Early Consultation on Environmental Assessment for Na Puu Water Co., Inc., Easement on State Land for Solar Photovoltaic Array
LOCATION: Puu Waawaa, North Kona, Hawaii, TMK: (3) 7-1-001:006 (por.)
APPLICANT: Geometrician Associates, LLC for Na Puu Water Co., Inc.

Transmitted for your review and comment is information on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 28, 2014.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Kevin Moore at 587-0426. Thank you.

Attachments

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

Signed: _____

Print name: GORDON C. HEIT
Date: 3/14/14

cc: Central Files

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

75 Aupuni Street, Room 204
Hilo, Hawaii 96720
PHONE: (808) 961-9590
FAX: (808) 961-9599

March 14, 2014

MEMORANDUM

TO: Russell Y. Tsuji, Administrator

FROM: Gordon C. Heit, Hawaii District Land Agent

SUBJECT: Early Consultation on Environmental Assessment for Na Puu Water Co., Inc., Easement on State Land for Solar Photovoltaic Array.

LOCATION: Puu Waawaa, North Kona, Island of Hawaii, TMK: (3) 7-1-001:006 por.

APPLICANT: Geometrician Associates, LLC for Na Puu Water Co., Inc.

Pursuant to your request for comments on the above matter, we offer the following:

The property identified above is encumbered under E.O 4203 to the Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW). Any easement over this land will require the concurrence of DOFAW.

Please contact me should you have any questions.

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

March 7, 2014

MEMORANDUM

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

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Early Consultation on Environmental Assessment for Na Puu Water Co., Inc., Easement on State Land for Solar Photovoltaic Array
LOCATION: Puu Waawaa, North Kona, Hawaii, TMK: (3) 7-1-001:006 (por.)
APPLICANT: Geometrician Associates, LLC for Na Puu Water Co., Inc.

Transmitted for your review and comment is information on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 28, 2014.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Kevin Moore at 587-0426. Thank you.

Attachments

( ) We have no objections.
( ) We have no comments.
(X) Comments are attached.

Signed: [signature]

Print name: _____
Date: 3/24/14

RECEIVED
14 MAR 10 A11:07
STATE OF HAWAII

cc: Central Files

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

JESSE SOUKI
FIRST DEPUTY

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF FORESTRY AND WILDLIFE
19 EAST KAWILI STREET
HILO, HAWAII 96720
PH: (808)974-4221 FAX: 808)974-4226

March 24, 2014

TO: Russell Y. Tsuji, Land Administrator

FROM: Steven T. Bergfeld, Acting Branch Manager
Division of Forestry and Wildlife, Hawaii Island

SUBJECT: Early Consultation on Environmental Assessment for Na Puu Water Co., Inc., Easement on State Land for Solar Photovoltaic Array

We received your Memorandum re: Early Consultation on EA for Na Puu Water Co, on March 10th 2014. Thank you for the opportunity to provide comments on the upcoming Environmental Assessment for the proposed Solar Photovoltaic (PV) Array at Puu Waawaa, North Kona, Hawaii, TMK (3) 7-1-001:006 (por.), applicant: Geometrician Associates, LLC (for Na Puu Water Co., Inc.). We have a number of questions that should be addressed in the Environmental Assessment, as well as some general comments and questions regarding the request.

Puu Waawaa Forest Reserve, in North Kona, is a place that is biologically rich, culturally important, and is also important to the general public; Puu Waawaa is visited by many people, who engage in a variety of activities that include, but are not limited to: hiking, wildlife-watching, hunting, cultural gathering, and/or group activities. The EA should examine how the proposed project will affect native plants and animals as well as user groups that may utilize the proposed project space. Here are some specific questions that can also be addressed:

- How will the PV array affect the access road that leads up to the three state cabins? Will the access road be able to be easily re-routed around the PV array, will this affect access to cabin residents, the private inholding (Henk Rogers and Jerry King's properties), the public, DOFAW, or fire-fighting vehicles? Will creating a new access road also require an EA, or will this be completed concurrently with the proposed project EA?
- How will the PV array affect nesting or foraging Nēnē (*Branta sandwicensis*), or other endangered birds (such as the Hawaiian hawk, *Buteo solitarius*);
- How will the PV array affect the endangered Blackburn Sphinx moth (*Manduca blackburni*), are there host plants in the proposed space that will need to be removed (such as tree tobacco, *Nicotiana glauca*);
- What is the susceptibility of the proposed project site to land-slides originating on the Puu Waawaa cinder cone and how might the project affect erosion;
- What are the cultural impacts of placing this structure on/near the Puu Waawaa cinder cone? The Puu Waawaa cinder cone is culturally significant and the local residents of Puu Anahulu as well as the Puu Waawaa Advisory Council should be considered in the public consultation process.

- What are the visual impacts from around or near the proposed project site, including from hiking trails, roads, nearby cabins/private property and the top of Puu Waawaa? How will this impact the visitor's experience? Will the PV need to be fenced?

In addition to providing you with the above questions, we would like to continue our discussion with you regarding the public benefits of this project. Currently, Land Division and the Division of Forestry and Wildlife are requiring the completion of the EA along with providing at least 3 water meters including at the Puu Anahulu property managed by Land Division (where the old school house, teacher cabin, and baseyard building reside). The following are questions about whether additional public benefit could be secured for the proposed project, and questions about logistics:

- Will Na Puu Water Co., Inc. pay an annual rental fee for the State Forest Reserve land that will be tied up in the placement of PV panels? Will a long-term lease be required or annual Special Use Permits in addition to an Easement?
- Will any bond $ be set aside for the State (for administrative costs, maintenance, upkeep, or removal of the panels) by Na Puu Water Co., Inc. in case the company is unable to meet their obligations (e.g. lose their permit, the well stops functioning, bankruptcy, etc.)?
- Would it be possible to get a stand pipe as well as the 3 water meters? This would greatly assist the State with fire-fighting capability;
- What is the status of the discussion with Na Puu Water Co., Inc. in regards to installation of a water storage tank for firefighting above Puu Lani Ranch Subdivision? This may have been a part of the initial discussions;

Thank you for the opportunity to provide Early Consultation comments on the EA, as well as general comments/questions on the project as a whole. We look forward to working with Land Division on this matter to help ensure that Na Puu Water Co., Inc. is able to continue to provide water into the future for important work at Puu Waawaa, including fire-fighting and fire-fuels reduction, reforestation efforts, and management in general.

Acting Branch Manager
Division of Forestry and Wildlife

3/25/14
Date

HA-14-157

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

RECEIVED
OFFICE OF CONSERVATION
AND COASTAL LANDS
2014 MAR 10 A 10: 03

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

RECEIVED
DEPT OF LAND & NATURAL RESOURCES
STATE OF HAWAII

March 7, 2014

MEMORANDUM

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

RECEIVED
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII
2014 MAR 14 AM 10:49
LAND DIVISION

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Early Consultation on Environmental Assessment for Na Puu Water Co., Inc., Easement on State Land for Solar Photovoltaic Array
LOCATION: Puu Waawaa, North Kona, Hawaii, TMK: (3) 7-1-001:006 (por.)
APPLICANT: Geometrician Associates, LLC for Na Puu Water Co., Inc.

Transmitted for your review and comment is information on the above referenced document. We would appreciate your comments on this document. Please submit any comments by March 28, 2014.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Kevin Moore at 587-0426. Thank you.

Attachments

( ) We have no objections.
(X) We have no comments. Project area is not in the Conservation District.
( ) Comments are attached.

Signed: Michael C

Print name: MICHAEL CAIN
Date: 13 MARCH 14

cc: Central Files

ENVIRONMENTAL ASSESSMENT

Na Pu‘u Water Inc.
Easement on State Land for Solar Photovoltaic Array

APPENDIX 1B
Comments to Draft EA and Responses

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William P. Kenoi
Mayor

Duane Kanuha
Director

Bobby Command
Deputy Director

West Hawai'i Office
74-5044 Ane Keohokalole Hwy
Kailua-Kona, Hawai'i 96740
Phone (808) 323-4770
Fax (808) 327-3563

County of Hawai'i
PLANNING DEPARTMENT

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

December 23, 2014

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

Dear Mr. Terry:

SUBJECT: Draft Environmental Assessment
Applicant: Na Pu'u Water Inc.
Landowner: State of Hawaii
Project: Easement on State Land for Solar Photovoltaic Array
TMK: (3) 7-1-001:Por. of 006, North Kona, Hawai'i

This is to acknowledge receipt of the Draft Environmental Assessment for the aforementioned project.

We provided preliminary comments on the proposed project by letter dated March 25, 2014 and concur with the following:

> The subject parcel contains approximately 13,046.1 acres. The project area of 1.74 acres is designated Agricultural by the State Land Use Commission and zoned Agricultural (A-20a) by the County. According to the General Plan Land Use Pattern Allocation Guide Map, it is in an area designated Extensive Agriculture. It is also outside of the Special Management Area.

Further, consistency with the plans and strategies of the Kona Community Development Plan was acknowledged and assessed.

However, we inadvertently did not acknowledge that Final Plan Approval will be required. Hawai'i County Code §25-4-11(b) states that "*Any substation used by a public utility for the purpose of furnishing telephone, gas, electricity, water, radio, or television shall be a permitted use in any district provided that the use is not hazardous or dangerous to the surrounding area and the director has issued plan approval for such use.*" Therefore, Plan Approval will be required for the addition of the solar photovoltaic array.

If you have questions, please feel free to contact Esther Imamura of our office at (808) 961-8139.

Sincerely,

DUANE KANUHA
Planning Director

ETI:cs
P:\Wpwin60\ETI\Eadraftpre-Consul\Terry Puu Water Inc. Easement For PV Array 7-1-1-Por. Of 6.Rtf

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

phone: (808) 969-7090 PO Box 396 Hilo Hawaii 96721 rterry@hawaii.rr.com

January 16, 2015

Duane Kanuha, Director
Hawai‘i County Planning Dept.
101 Pauahi Street, Suite 3
Hilo HI 96720

Dear Mr. Kanuha:

Subject: **Subject: Comment to Draft Environmental Assessment for Na Pu‘u Water Inc. Easement on State Land for Solar Photovoltaic Array, TMK (3rd) 7-1-001:006 (por.), North Kona District, Hawai‘i Island, State of Hawai‘i**

Thank you for the comment letter dated December 23, 2014, concurring with the EA's statements concerning land use designation information and Kona Community Development Plan consistency, and also stating that Plan Approval will be required for the project. This approval has been added to the list of required permits and approvals in Section 3.5 of the Final EA.

We very much appreciate your review of the document. If you have any questions about the EA, please contact me at (808) 969-7090.

Sincerely,

Ron Terry

Ron Terry, Principal
Geometrician Associates

Cc: Paul Ponthieux and John Hodson, NWI
Wesley Matsunaga, DLNR Land Division

NEIL ABERCROMBIE
GOVERNOR OF HAWAII

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

JESSE SOUKI
First Deputy

WILLIAM M. TAM
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

DIVISION OF FORESTRY AND WILDLIFE
19 EAST KAWILI STREET
HILO, HAWAII 96720
PH: (808)974-4221 FAX: 808)974-4226

September 29, 2014

Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawaii 96721

TO: Mr. Ron Terry, Ph.D.

FROM: Steven T. Bergfeld, Branch Manager, Hawai'i Island
Division of Forestry and Wildlife

SUBJECT: Initial comments on Draft Environmental Assessment for Na Pu'u Water Inc. Easement on State Land for Solar Photovoltaic Array, TMK (3) 7-1-001:006 (por.), Pu'u Wa'awa'a, North Kona District, Hawai'i Island

Thank you for sending the Draft Environmental Assessment on Tuesday, September 9th, 2014 for the proposed Na Pu'u Water Inc. easement at Pu'u Wa'awa'a Forest Reserve for the solar photovoltaic (PV) array project. We have reviewed the document and have a few more questions/comments. Otherwise, the document overall looks good and should be ready soon to submit to OEQC after the following changes are incorporated.

First, the DEA refers to reduced costs to the community as being one of the main benefits of the proposed project (e.g. costs of electricity will be cut in half). It is unclear in the DEA how reduced costs to NWI will be transmitted to the community – reduced water user fees, reduced costs per unit of water used, or stabilization of long-term rates that are projected to increase are some of the many ways these savings could be passed on to water users in the project area. More details on this should be included in the DEA initially in the Purpose and Need section. Second, work by Paul Ponthieux and others have shown that there may be significantly fewer hours of sunlight near Pu'u Wa'awa'a hill as compared to other areas in the Forest Reserve (such as below the Māmalahoa Highway). Even though it may be cost prohibitive and out of the scope of this project, the DEA should mention whether installing PV below the highway, where there is substantially more sunlight, was considered in the alternatives and why it isn't a viable option for this project.

Third, we are wondering what the responses were from the Pu'u Wa'awa'a Advisory Council (PAC) regarding the proposed project as there were no letters or emails from individual

members or the PAC as a whole included in Appendix 1a (Comments in Response to Early Consultation). Paul Ponthieux asked to be put on the agenda of the Pu'u Wa'awa'a Advisory Council for the June 20th, 2014 PAC meeting to present to the council on the proposed project, but he was unable to attend to give the presentation. Details about consultation with the PAC should be included as well as any correspondence during the early consultation process. In addition, we recommend that additional consultation of some of the lineal descendants and cultural experts of the area is included in the DEA. We can provide names and contact information for these individuals.

Finally, a few individuals expressed concern that strong wind gusts could blow away or destroy solar panels in this area if not securely anchored and attached to the ground. There is a history of occasional strong wind gusts in this specific area near the proposed site (e.g. the roof on Henk Roger's mechanics shop blew off in an unusually strong wind gust not too long ago). Because of the potential harmful effects of heavy metals within PV contaminating the environment if they are damaged in a wind storm, the DEA should address how installation methods and procedures will mitigate this potential risk.

Thank you for the opportunity to comment on the initial DEA for the proposed project. Please contact us for more information or if you have any questions.

Steven T. Bergfeld, Hawai'i Branch Manager
Division of Forestry and Wildlife,
Department of Land and Natural Resources

9/29/14
Date

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

phone: (808) 969-7090 PO Box 396 Hilo Hawaii 96721 rterry@hawaii.rr.com

January 16, 2015

Steve Bergfeld and Elliot Parsons
Hawai‘i State DLNR
Division of Forestry and Wildlife, Hawaii Island Branch
19 E. Kawili Street
Hilo HI 96720

Dear Mr. Bergfeld and Mr. Parsons:

Subject: **Subject: Comment to Draft Environmental Assessment for Na Pu‘u Water Inc. Easement on State Land for Solar Photovoltaic Array, TMK (3rd) 7-1-001:006 (por.), North Kona District, Hawai‘i Island, State of Hawai‘i**

Thank you for the comment memo on the pre-Draft EA that was circulated within DOFAW from Mr. Bergfeld dated September 29, 2014, as well as the email with a pdf of the pre-Draft EA marked up by Mr. Parsons supplied in an October 1, 2014 email. First of all, we would like to sincerely thank your office for its diligent involvement in the EA process, which also included phone calls and emails and meetings with the proponent and their consultants onsite.

The following provides answers to your specific comments. Because these comments were supplied after the Draft EA had been prepared for submittal to the Land Division for publication in the OEQC Environmental Notice, it was agreed by all parties that the comments be treated in the context of Draft EA comments. Please note that because it would not be practical to reproduce the entire Draft EA pdf to provide context for the October 1 comments as part of the Final EA, the comments have been extracted and in some cases altered to provide context.

September 29, 2014 Memo:

1. *“It is unclear in the DEA how reduced costs to NWI will be transmitted to the community - reduced water user fees, reduced costs per unit of water used, or stabilization of long-term rates that are projected to increase are some of the many ways these savings could be passed on to water users in the project area. More details on this should be included in the DEA initially in the Purpose and Need section.*”

Response: According to the project proponents, at this time it is difficult to project exactly how much savings will be obtained, or just how much will translate into reduced costs per user. This

will be determined by experience in running the system and evaluating the difference between previous years, over a period of time since the system has been in operation. The savings may translate into reducing the escalation of fees as the cost of utility power rises, or actually into reduced costs from using less utility purchased power. This will also depend on the success of and efficiency of the proposed storage system, which will certainly add to the savings by allowing NWI to pump longer with solar power. NWI will be tracking the performance of the system and the cost-savings that it achieves.

Regardless of the quantity of monetary savings realized by the system, NWI considers the security in an emergency situation where there is no grid power available a critical benefit. This is especially true in a disaster scenario where even diesel fuel for a generator is not available. In a catastrophic scenario, NWI will still be able to provide water to the community for basic needs. An added benefit for the entire island population will be demonstration and testing of a successful energy security measure, which other communities may wish to adopt for their water systems.

This information has been added to the Final EA.

2. *"Work by Paul Ponthieux and others have shown that there may be significantly fewer hours of sunlight near Pu'u Wa'awa'a hill as compared to other areas in the Forest Reserve (such as below the Mamalahoa Highway). Even though it may be cost prohibitive and out of the scope of this project, the DEA should mention whether installing PY below the highway, where there is substantially more sunlight, was considered in the alternatives and why it isn't a viable option for this project."*

Response: While it is clear that there are fewer hours of usable sun at the proposed location than at locations makai of the Mamalahoa Highway (about 2 miles distant from the proposed site) or near Queen Kaʻahumanu Highway (about 7 miles away), the system is sized to utilize the available solar window at the site. The tradeoff between proximity to the well with less sunlight versus a distant location with more sunlight is an efficient use of resources. In addition, since NWI is planning to utilize storage for the system, it would be difficult to provide that additional benefit if it were located further away. The energy security aspect of the project would be nullified if it were connected to the utility grid just as a means for net metering, and a billing arrangement with the utility. By having it in close proximity with the point of use, it ensures that the system can be optimized, and completely off-grid if desired in the future. Furthermore, there is a distinct physical security advantage to having the solar panels located near the well, the Puʻu Waʻawaʻa Ranch Energy Lab, and occupied homes. Finally, wheeling of electricity (defined as "the movement of electricity, owned by a power supplier and sold to a retail consumer, over transmission and distribution lines owned by neither one - www.cepc.net/rewhl.htm") is currently not allowed by HELCO across TMK property lines, even if it is entirely within properties with the same owner. Although NWI believes this is an unreasonable condition, it adds yet another reason to remove a distant generation site from consideration.

This information has been added to the Final EA.

3. "*… we are wondering what the responses were from the Pu'u Wa'awa'a Advisory Council (PAC) regarding the proposed project as there were no letters or emails from individual members or the PAC as a whole included in Appendix la (Comments in Response to Early Consultation). Paul Ponthieux asked to be put on the agenda of the Pu'u Wa'awa'a Advisory Council for the June 20th, 2014 PAC meeting to present to the council on the proposed project, but he was unable to attend to give the presentation. Details about consultation with the PAC should be included as well as any correspondence during the early consultation process. In addition, we recommend that additional consultation of some of the lineal descendants and cultural experts of the area is included in the DEA. We can provide names and contact information for these individuals*."

Response: Our team has attempted to coordinate continuously and effectively with the PAC. NWI has shared information about the project from its inception in meetings and discussions. When the EA began, early consultation letters were sent on March 1, 2014, to various members of the PAC. Later, on July 21, 2014, the NWI Coordinator sent an email to members of the PAC to follow up on earlier efforts, which Dr. Elliot Parsons acknowledged receiving in an October 2, 2014 email. An onsite meeting was held on June 27, 2014, with you and Dr. Elliot Parsons, the Chair of the PAC. Although the dialogue we had throughout this process helped clarify concerns, the only written comments received were from DOFAW, and these were included in Appendix 1a; no comments were received by any member of the PAC. Please note that we also sent copies of the Draft EA in digital and hardcopy form to the PAC, and also notified a number of individuals by mail and email of the availability of the EA. We did not receive any comments from the PAC in response to the Draft EA. The early consultation and the cultural consultant for the project coordinated with cultural and lineal descendants for the area, several of whom were also notified about/provided with a copy of the EA.

4. "*Finally, a few individuals expressed concern that strong wind gusts could blow away or destroy solar panels in this area if not securely anchored and attached to the ground. There is a history of occasional strong wind gusts in this specific area near the proposed site (e.g. the roof on Henk Roger's mechanics shop blew off in an unusually strong wind gust not too long ago). Because of the potential harmful effects of heavy metals within PV contaminating the environment if they are damaged in a wind storm, the DEA should address how installation methods and procedures will mitigate this potential ri*sk."

Response: There is extremely little risk that wind will blow away or destroy the solar panels. While it is true that the roof of the Energy Lab was dislodged in very high winds, this was due entirely to the fact that the structure, which was built in the 1950s, was not build to current code standards and was heavily damaged by termites. Modern code compliance dictates that new structures must withstand wind loading and uplift forces determined for the specific site location.

The PV Tracker Array will be anchored to the ground using screw piles that will provide the code-compliant uplift resistance. These piles have auger like properties that resist uplift forces in excess of the historical wind gusts data for this area. This was a requirement that NWI stipulated to the company providing the PPA in lieu of pouring concrete footings into excavated earth, which NWI avoided in order to minimize disturbance to the ground surface.

This information has been added to the Final EA.

October 1, 2014 email:

1. Section 1.1. "*The system is being funded through an arrangement in which Sunwize, an independent third party that will operate the system, will provide energy through a Purchase Power Agreement (PPA) in to NWI at a rate half of current HELCO… What permits would need to be in place for this to be able to happen?*"

Response: According to NWI officials, NWI was formed as a member owned non-profit corporation and does not operate as a public utility. As such, no approvals from the PUC are required. The only permits and approvals required are from DLNR and the County of Hawai'i, through the Building Permit and Plan Approval processes, as outlined in the EA.

2. Section 1.1. *Grazing Plan. "A grazing plan has been under development for a few years, but is still a little ways off from being finalized and adopted*."

Response: This additional information has been added to the Final EA.

3. Section 2.2. "*A number of folks have suggested that photovoltaic panels be put up makai of the Highway because there is often more sunlight there - could this be addressed.....? I.e. why this isn't feasible or not as cost effective - e.g. if the power has to be sent a long distance to the well this increases the footprint of the project, increases cost, reduces efficiency, etc*."

Response: Please see response to Item No. 2 from memo of September 29, 2014, above.

4. Section 3.1.1. "*…concern that a wind storm will damage PV that is placed there. What steps will be taken to prevent unusually high wind gusts from destroying the PV?"*

Response: Please see response to Item No. 4 from memo of September 29, 2014, above.

5. Section 3.1.2. "*Is a grading and grubbing permit required?"*

Response: No grading or grubbing permit will be required, as the project involves grading or excavation only at the flywheel storage site, which takes up about 300 square feet.

6. Section 3.1.3. *Concerning mitigation for pupae of Blackburn's Sphinx Moth. Pupae would tend to be found underneath or directly adjacent to the tree tobacco plant the egg hatched on. If it was an egg DOFAW would have to wait until it hatched as a larvae and then could potentially move the larvae if needed, depending on constraints from the ESA and USFWS.*

Response: This section summarized language based on recent protocol from the USFWS. Your amplifications and clarifications have been added to the Final EA.

7. Section 3.1.4. *The long term the plan is that the referenced State cabins will not be unoccupied, and the State is currently not maintaining them, but rent has been collected. This*

discussion, however, is beside the point, in that in the long-term, the visual impacts from those state cabins won't matter.

Response: The reference to rent has been removed.

8. Section 3.2.1. *How would savings realized by project be passed on? 1) reduced water use fees after installation? 2) stabilization of fees that are otherwise projected to increase (if so by how much)? Or other ways?*

Response: Please see response to Item No. 1 from memo of September 29, 2014, above.

9. Section 3.6.5. *Concerning progress in meeting Objectives of Pu‘uwa‘awa‘a Plan. “By my read, we have either achieved or made major progress on 28 of the 62 objectives... and some of the remaining 34 objectives are no longer relevant since the creation of the Forest Reserve, decision to not have a shooting range here, etc.”*

Response: The Final EA has been amended to provide this information.

Again, we very much appreciate your review of the document and your involvement in the EA process. If you have any questions about the EA, please contact me at (808) 969-7090.

Sincerely,

Ron Terry, Principal
Geometrician Associates

Cc: Paul Ponthieux and John Hodson, NWI
Wesley Matsunaga, DLNR Land Division

ENVIRONMENTAL ASSESSMENT

Na Pu‘u Water Inc.
Easement on State Land for Solar Photovoltaic Array

APPENDIX 2
Archaeological Assessment Survey

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Archaeological Assessment of Roughly 2 Acres of State Land Adjacent to Puʻuwaʻawaʻa Ranch

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

Puʻuwaʻawaʻa Ahupuaʻa
North Kona District
Island of Hawaiʻi

DRAFT VERSION

Prepared By:

Robert B. Rechtman, Ph.D.

Prepared For:

Nāpuʻu Water, Inc.
P.O. Box 2217
Kamuela, HI 96743

May 2014

ASM affiliates
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ASM Project Number 21750

Archaeological Assessment of Roughly 2 Acres of State Land Adjacent to Pu‘uwa‘awa‘a Ranch

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

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

ASM affiliates

EXECUTIVE SUMMARY

At the request of Nāpuʻu Water, Inc (NWI)., ASM Affiliates, Inc. conducted an archaeological study of a roughly 2 acre portion of state land (TMK: (3) 7-1-001:006 [por.]) located adjacent to Puʻuwaʻawaʻa Ranch in Puʻuwaʻawaʻa Ahupuaʻa, North Kona District, Island of Hawaiʻi. NWI intends to install a ground-mounted solar photovoltaic field of panels. This action on state land requires the production of an Environmental Assessment (EA) in compliance with HRS Chapter 343, thus necessitating the current study as a support document to the EA. The current study was undertaken in accordance with Hawaiʻi Administrative Rules 13§13–275, and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawaiʻi Administrative Rules 13§13–276. According to 13§13-275-5(b)(5)(A) when no archaeological resources are discovered during an archaeological survey the production of an Archaeological Assessment report is appropriate. Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawaiʻi Planning Department.

On March 5, 2014 Robert B. Rechtman, Ph.D. and Genevieve L. Glennon, B.A. conducted limited consultation with two knowledgeable individuals before conducting a thorough surface survey of the entire roughly 2-acre project area, Neither of the consulted indicated that they knew of the presence of any archaeological or cultural sites or that any cultural practices have occurred within the current project area. As a result of a systematic surface survey of the project area there were no archaeological features observed, and given the nature of the substrate there is virtually no likelihood of encountering subsurface remains.

Given the negative findings of a prior archaeological reconnaissance (McGerty and Spear 2000) that included the current project area and the concurrence with those findings as a result of the current study, it is concluded that the proposed solar photovoltaic project will not significantly impact any known historic properties. In the unlikely event that any unanticipated archaeological resources are unearthed during development activities, in compliance with HAR 13§13-280 work in the immediate vicinity of the finds should be halted and DLNR-SHPD contacted.

CHAPTERS

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1. INTRODUCTION

At the request of Nāpuʻu Water, Inc (NWI)., ASM Affiliates, Inc. conducted an archaeological study of a roughly 2 acre portion of state land (TMK: (3) 7-1-001:006 [por.]) located adjacent to Puʻuwaʻawaʻa Ranch in Puʻuwaʻawaʻa Ahupuaʻa, North Kona District, Island of Hawaiʻi (Figures 1, 2 and 3). NWI intends to install a ground-mounted solar photovoltaic field of panels to provide power to off-set the cost of operating their water wells, which service a combined community population of 330 people with 147 connections, including 132 residential connections, 3 cattle ranchers with 7 connections, 4 active (formerly 6) DLNR, Division of Forestry and Wildlife connections including the 5 MG Puʻuwaʻawaʻa reservoir, the Big Island Country Club, the HELCO Puʻuanahulu substation, and the Puʻuanahulu Volunteer Fire Station. This action on state land requires the production of an Environmental Assessment (EA) in compliance with HRS Chapter 343, thus necessitating the current study as a support document to the EA.

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

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

PROJECT AREA DESCRIPTION

The current project area is rectangular section of gently sloping pasture adjacent to the recently constructed Puʻuwaʻawaʻa energy laboratory (Figure 4). Elevation within the roughly 2 acre project area ranges from about 2,500 to 2,540 feet above sea level. Soil within the project area is classified as rock land (rRO), which can possess a thin (6 to 8 inches) soil (Sato et al. 1973) layer formed over slightly weathered *pāhoehoe* that originating from Hualālai between 1,500 to 3,000 years ago (Wolfe and Morris 1996). Precipitation recorded at the Puʻuwaʻawaʻa Weather Station located at an elevation of 2,326 feet has recorded an annual average rainfall of 28 inches. There is minimal vegetation within the current project area, and what is there is dominated by pasture grasses (Figures 5, 6 and 7).

Figure 1. Project area location.

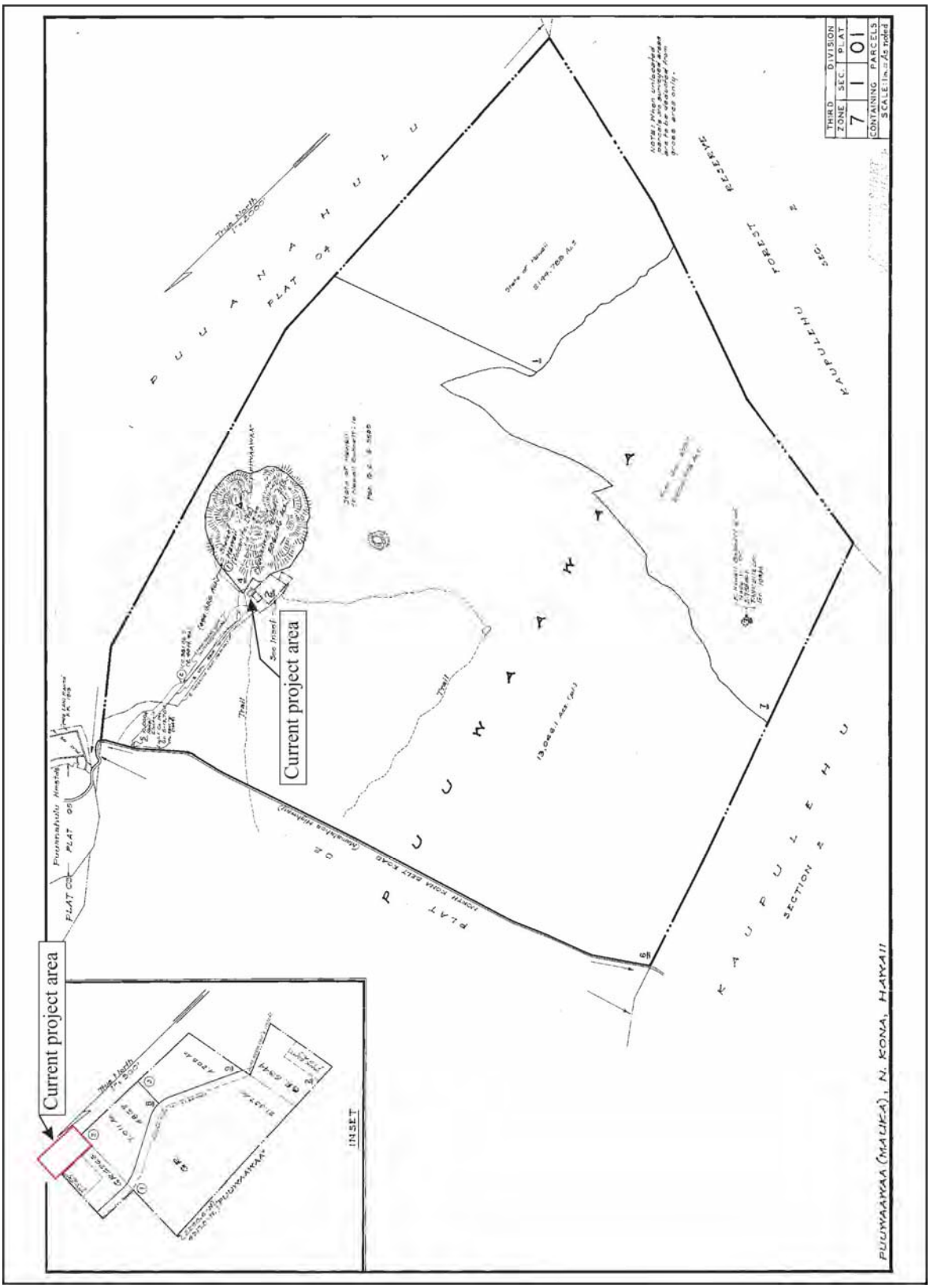

Figure 2. Tax Map Key(s): (3) 7-1-001 showing the current project area within Parcel 006.

Figure 3. Current Google Satellite™ image showing the current project area outlined in red.

Figure 4. Project area in foreground and Puʻuwaʻawaʻa Ranch Energy Laboratory in background, view to the southwest.

Figure 5. Project area, view to the north.

Figure 6. Project area, view to the southwest.

Figure 7. Project area, view to the east.

2. BACKGROUND

To generate a set of expectations regarding the nature of the archaeological resources that might be encountered within the project area, and to establish an environment within which to access the significance of any such resources, a presentation of previous archaeological studies conducted in the vicinity of the project area follows a discussion of the cultural-historical background for the region. An effort is made to provide a comprehensive and holistic understanding of the entire Puʻuwaʻawaʻa Ahupuaʻa. This section of the report examines the *ahupuaʻa* and its relationship to neighboring lands. In 2006, Kumu Pono Associates prepared a *Collection of Cultural and Historical Accounts of Puʻu Waʻawaʻa and the Nāpuʻu Region* (Maly and Maly 2006). Extensive research for that study included a review of archival-historical literature from both Hawaiian and English language sources, survey records of the Kingdom and Territory of Hawaiʻi; and historical texts authored or compiled by Malo (1951), Iʻi (1959), Kamakau (1961, 1964, 1976, and 1991), Ellis (1963), Fornander (1916-1919 and 1996), Thrum (1908), Beckwith (1970), Reinecke (n.d.); and Handy et al. (1972). That study also included several native accounts from Hawaiian language newspapers (compiled and translated from Hawaiian to English, by Kepā Maly), and historical narratives authored by eighteenth and nineteenth century visitors to the region. The information was presented within thematic categories and ordered chronological by the date of publication.

Over the last ten years, Kepā Maly of Kumu Pono Associates has researched and prepared several detailed studies in the form of review and translation of accounts from Hawaiian language newspapers, historical accounts recorded by Hawaiian and non-Hawaiian residents, and government land use records for lands in the Kekaha region of which Puʻu Waʻawaʻa is a part. Kepā Maly has also conducted a number of detailed oral history interviews with elder *kamaʻāina* documenting their knowledge of the Kekaha region (including Puʻuwaʻawaʻa).

As the information collected by Kumu Pono Associates (Maly and Maly 2006) was so complete, this report presents a condensed and only a slightly modified version of the cultural and historical background for Puʻuwaʻawaʻa Ahupuaʻa and the Kekaha region that was previously prepared. It is a comprehension of this background information that facilitates a more complete understanding of the potential significance of the resources that exist within the current study area.

CULTURE-HISTORICAL CONTEXT

The project area is located on the Island of Hawaiʻi within the District of North Kona in the *ahupuaʻa* of Puʻuwaʻawaʻa (Figure 8). Kona is one of six major *moku-o-loko* (districts), and extends from the shore across the entire volcanic mountain of Hualālai, and continues to the summit of Mauna Loa. Like other large districts on Hawaiʻi, Kona was further divided into *ʻokana* or *kalana* (regions of land smaller than the *moku-o-loko*, yet comprising a number of smaller units of land). In the region now known as Kona *ʻakau* (North Kona), there are several ancient regions (*kalana*) as well. The southern portion of North Kona was known as "Kona *kai ʻōpua*" (interpretively translated as: Kona of the distant horizon clouds above the ocean), and included the area extending from Lanihau (the present-day vicinity of Kailua Town) to Puʻuohau (now known as Red Hill). The northern-most portion of North Kona was called "Kekaha" (descriptive of an arid coastal place). Native residents of the region affectionately referred to their home as *Kekaha-wai-ʻole o nā Kona* (Waterless Kekaha of the Kona District), or simply as the *āina kaha*. Puʻuwaʻawaʻa Ahupuaʻa is located within a smaller district of Kekaha known as Nāpuʻu, literally translated as "the hills" (Pukui et al. 1974).

With respect to the Precontact use of the general project area, Clark (1987) offered a regional settlement pattern model that includes four elevationally delimited environmental zones: Coastal Zone, Intermediate Zone, Kula Zone, and Wilderness Zone. The Coastal Zone extends up to about 150 feet elevation, and was used for permanent and temporary habitation, coastal resource exploitation, and limited agriculture. The Intermediate Zone extends from the Coastal Zone to about 1,900 feet elevation. This zone was used primarily for seasonal agriculture with associated short-term occupation, typically situated near intermittent drainages. The Kula Zone extends from the Intermediate Zone to about 2,700 feet elevation (and to 3,200 feet in certain areas). This was the primary agricultural and residential area, with extensive formal fields and clustered residential complexes. The Wilderness Zone extends above the Kula Zone to the mountaintops, and was a locus for the collection of wild floral and faunal resources. Puʻuwaʻawaʻa crosses several environmental zones that are generally referred to as *wao* in the Hawaiian language. These environmental zones include the near-shore fisheries and shoreline strand (*kahakai*) and the *kula kai*/*kula uka* (shoreward/inland plains). These regional zones were greatly desired as places of residence by the natives of the land.

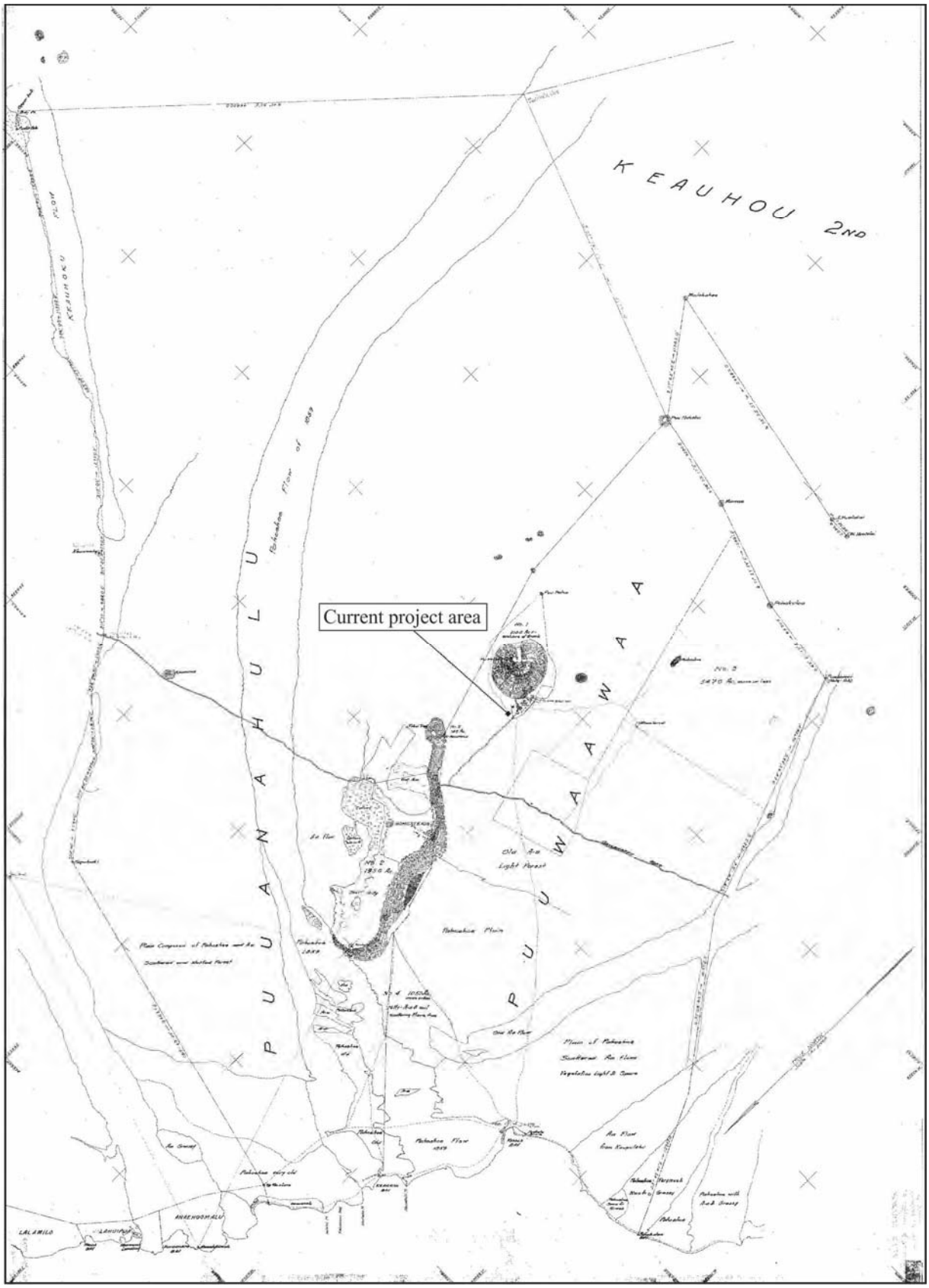

Figure 8. Hawai‘i Registered Map No. 2633 (showing Pu‘uwa‘awa‘a Ahupua‘a).

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

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

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

The *lehua* blossoms are likened to canoes returning to the sea. The coastal area of Pu‘uwa‘awa‘a contains the protected bay at Kīholo and was the location of a significant fishpond; as well as numerous springs and water caves. The land provided sheltered canoe landings, deepsea and near-shore fisheries, and important salt making resources. The inland agricultural field systems and diverse forest and mountain resources, also attracted native residents to the area. Through these diverse resources, the native families were sustained on the land.

It is within the context of both *kula* regions of Pu‘uwa‘awa‘a and the political divisions of the District of North Kona that the following discussion of the history and culture of the study area is framed. The chronological summary presented below begins with the peopling of the Hawaiian Islands and the presentation of a generalized model of Hawaiian Prehistory that includes legendary references to the study area lands and a discussion of the widely accepted settlement patterns for North Kona. The discussion of Prehistory is followed by a summary of Historic events in the islands that begins with the arrival of foreigners and then presents a history of land use after contact. The summary includes a discussion of the changing life ways and population decline of the early Historic Period, a review of land tenure in the study *ahupua‘a* during the *Māhele ‘Āina* of 1848 and the subsequent division of Land Grants. A synthesis of the Precontact settlement patterns and the Historic documentation of land use will then be used to predict the type, location, and likelihood of Historic properties that may be present within the project area.

A Generalized Model of Hawaiian Prehistory

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

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

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

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

The Expansion Period is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period. It was during the Expansion Period that a second major migration settled in Hawai‘i, this time from Tahiti in the Society Islands. According to Kamakau (1976), the *kahuna* Pā‘ao settled in the islands during the 13th century. Pā‘ao was the keeper of the god Kū‘kā‘ilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pā‘ao was expelled from his homeland by Lonopele. He prepared for a long voyage, and set out across the ocean in search of a new land. On board Pā‘ao’s canoes were thirty-eight men (*kānaka*), two stewards (*kānaka ‘ā‘īpu‘upu‘u*), the chief Pilika‘aiea (Pili) and his wife Hina‘aukekele, Nāmau‘u o Malaia, the sister of Pā‘ao, and the prophet Makuaka‘ūmana (Kamakau 1991). In 1866, Kamakau told the following story of their arrival in Hawai‘i:

> Puna on Hawai‘i Island was the first land reached by Pā‘ao, and here in Puna he built his first *heiau* for his god Aha‘ula and named it Aha‘ula [Waha‘ula]. It was a *luakini*. From Puna, Pā‘ao went on to land in Kohala, at Pu‘uepa. He built a *heiau* there called Mo‘okini, a *luakini*.
>
> It is thought that Pā‘ao came to Hawai‘i in the time of the *ali‘i* La‘au because Pili ruled as *mo‘i* after La‘au. You will see Pili there in the line of succession, the *mo‘o kū‘auhau*, of Hanala‘anui. It was said that Hawai‘i Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawai‘i Island had been without a chief for a long time, and the chiefs of Hawai‘i were *ali‘i maka‘āinana* or just commoners, *maka‘āinana*, during this time.
>
> . . . There were seventeen generations during which Hawai‘i 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 Hawai‘i. He was a chief from Kahiki and became the ancestor of chiefs and people of Hawai‘i Island. (1991:100–102)

There are several versions of this story that are discussed by Beckwith (1970), including the version where Mo‘okini and Kaluawilinau, two *kāhuna* of Moikeha, decide to stay on at Kohala. The bones of the *kahuna* Pā‘ao are said to be deposited in a burial cave in Kohala in Pu‘uwepa [possibly Pu‘uepa?] (Kamakau 1964:41). The Pili line’s initial ruling center was likely in Kohala too, but Cartwright (1933) suggests that Pili later resided in and ruled from Waipi‘o Valley in the Hāmākua District.

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

According to Kirch’s (1985) model, the concept of the *ahupua‘a* was established sometime during the A.D. 1400s, adding another component to a then 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* were usually wedge or pie-shaped, incorporating 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). 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 name of an *ahupua'a* sometimes indicates its importance, records its history, or reveals something about its resources or population. The *ahupua'a* of Pu'uwa'awa'a is one of some twenty ancient *ahupua'a* within the *'okana* of Kekaha-wai-'ole. The place name Pu'uwa'awa'a can be literally translated as "furrowed hill" (Pukui et al 1974). Pu'uwa'awa'a is located in the region that was commonly known as Nāpu'u; and it wasn't until the priestess/chiefess Anahulu, her husband Wa'awa'a, and their family moved to the area from Pū'āla'a, a hill near the Ka'ū and Puna border, that Pu'u Wa'awa'a was so named (Kihe in Maly and Maly 2006).

The *ali'i* and the *maka'āinana* (commoners) were not confined to the boundaries of the *ahupua'a*; when there was a perceived need, they also shared with their neighbor *ahupua'a ohana* (Hono-ko-hau 1974). The *ahupua'a* were further divided into smaller sections such as the *'ili, mo'o'aina, pauku'aina, kihapai, koele, hakuone,* and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mo'i* (king). *Heiau* building flourished during this 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 there is evidence that suggests that there were substantial changes to the political system as well (Griffin et al. 1971).

By the seventeenth century, large areas of Hawai'i Island (*moku 'aina* – 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. The legend of Kapunohu (set about A.D. 1600), relates that in North Kohala, the chiefs of Kukuipahu ruled the leeward *ahupua'a* of the district, and the chiefs of Niuli'i ruled the windward *ahupua'a* of the district, and that Wainaia Gulch was the boundary between the two domains (Erkelens and Athens 1994). In about A.D. 1600, the armies of the two polities met on the battlefield of Hinakahua at Kapa'au (east of the present day town of Kapa'au), and the forces of Kukuipahu were defeated, thus control of the district was united under the chiefs of Niuli'i (Fornander 1916:215-220).

'Umi-a-Līloa was a renowned Pili line *ali'i* who ruled from Waipi'o Valley, son of high ranking *ali'i* Līloa. 'Umi's fame stemmed from his successful unification of all the districts of Hawai'i Island (Kamakau 1992), and his reign lasted until around ca. A.D. 1620 (Cordy 1994). 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). Near the end of 'Umi's rule, he relocated to Kona where the weather was more favorable (Kamakau 1992).

One of 'Umi-a-Līloa's heirs to the Hawaiian kingdom was his son, Keawe-nui-a-'Umi, who presided over Hilo. Lono-i-ka-makahiki was Keawe-nui-a-'Umi's son, and was a ruler of Ka'ū and Puna (Kamakau 1992). Following the death of his father, Lono-i-ka-makahiki waged a war for the supremacy of Hawai'i Island against rebel forces in Kohala. After a battle in leeward North Kohala, Lono-i-ka-makahiki pursued his rivals to Hinakahua at Kapa'au, where they prepared to fight once again before retreating to the east and being defeated at Pololū Valley in windward North Kohala (Erkelens and Athens 1994). Upon achieving this final victory, Lono-i-ka-makahiki celebrated at the *heiau* of Mulei'ula at Apuakaohau (Fornander 1916:324). Neither of Lono-i-ka-makahiki's two sons were heirs to the government, and in the wake of his death, rule of Kohala, Kona, and Ka'ū was instead split between the descendants of his brother, Kanaloa-kua'ana.

The Proto-Historic Period was marked by both political intensification and stress. Wars occurred regularly between intra-island and inter-island polities, and this period was one of continual conquest by the reigning *ali'i*. At the beginning of this period, Hawai'i Island was not united under one rule, but was split amongst the chiefs of Kona and Hilo (Kamakau 1992). Keawe, the son of Kanaloakapulehu, was the ruler of Kohala, Kona, and Ka'ū. When Keawe died he split the rule of his lands between two of his sons; 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.

After Keawe's death, Alapa'inui, the son of former Kona war chief Kauauanui a Mahi, a former war chief of Kona, desired to wrest control of Hawai'i Island from the other chiefs (Kamakau 1992). Alapa'inui, who had been living on Maui since the death of his father, returned to Hawai'i Island and waged war against the chiefs of Kona and Kohala. Alapa'inui was eventually victorious and took the chiefs of those districts captive, proclaiming Kona and

Kohala his own. Kekaulike, the ruler of Maui, however, preferred the former chiefs and wished to help them reclaim their lands. The Maui forces attacked Alapaʻinui, but were unable to defeat him. Although Alapaʻinui's forces were never beaten, the frequent attacks by Kekaulike did prevent him from taking the chiefs of Hilo and Kaʻū captive (Alapaʻinui did eventually take control of these districts however). Alapaʻinui later fought and defeated the forces of Oʻahu on Molokaʻi, and after Kekaulike's death he fought Kauhi, his rival's oldest son, on Maui where he was also victorious. Alapaʻinui ruled for many years, but at the end of his reign, after moving to Kikiakoʻi in Kawaihae, he became seriously ill, and there at the *heiau* of Mailekini, he appointed his son Keaweʻopala ruler of the island (Kamakau 1992).

It was during this time of warfare, following the death of Keawe, that Kamehameha was born in North Kohala in the *ahupuaʻa* of Kokoiki, near the Moʻokini Heiau (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, and probably nearer to the later date. The birth event is said to have occurred on a stormy night of rain, thunder, and lightning, signified the night before by a very bright, ominous star, thought by some to be Halley's Comet (this is also controversial). Kamehameha's ancestral homeland was in Halawa, North Kohala (Williams 1919).

It was in 1754 that Keaweʻopala became the ruler of Hawaiʻi, but many of the chiefs who were deprived of their lands fought against him. Keaweʻopala was soon defeated in South Kona by Kalaniʻōpuʻu, who then became the ruler of Hawaiʻi Island (Kamakau 1992). Kalani'ōpuʻu was a clever and able chief, and a famous athlete in all games of strength, but according to Kamakau (1992), he possessed one great fault: he loved war and had no regard for others' land rights. Although Kalaniʻōpuʻu would maintain his rule over the island for nearly thirty years, his reign was not free of turmoil and strife.

About A.D. 1759, Kalaniʻōpuʻu conquered East Maui, defeating his wife's brother, the Maui king Kamehamehanui, by using Hāna's prominent Puʻu Kauʻiki as his fortress. He appointed one of his Hawaiʻi chiefs, Puna, as governor of Hāna and Kīpahulu. Following this victory, Keʻeaumoku, the son of Keawepoepoe who had originally supported Kalaniʻōpuʻu against Keaweʻopala, rebelled against the Hawaiʻi chief. He set up a fort on a hill between Pololū and Honokāne Valleys in windward North Kohala, but Kalaniʻōpuʻu attacked him there and was victorious. Using ropes, Keʻeaumoku escaped to the sea and fled in a canoe to Maui where he lived under the protection of the Maui chiefs.

In A.D. 1766, Kamehamehanui, the king of Maui, died following an illness and Kahekili became the new ruler of that island. Keʻeaumoku took Kamehamehanui's widow, Namahana, a cousin of Kamehameha I, as his wife, and their daughter, Kaʻahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Puʻu Kauʻiki, Hāna, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775, Kalaniʻōpuʻu and his Hāna forces raided and destroyed the neighboring district of Kaupō in Maui, and then launched several more raids on Molokaʻi, Lānaʻi, Kahoʻolawe, and parts of West Maui. It was at the battle of Kalaeokaʻilio that Kamehameha, a favorite of Kalaniʻōpuʻu, was first recognized as a great warrior and given the name of Paiʻea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniʻōpuʻu and Kahekili (1777–1779), Kaʻahumanu and her parents left Maui to live on the island of Hawaiʻi (Kamakau 1992). Kalaniʻōpuʻu was fighting on Maui when the British explorer Captain James Cook first arrived in the islands.

With the arrival of foreigners in the islands, Hawaiʻi's culture and economy underwent drastic changes. Demographic trends during the early part of the nineteenth century indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. At first there was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history (Kirch 1985; Kent 1983). Later, as the Historic Period progressed, Kamehameha I died, the *kapu* system was abolished, Christianity established a firm foothold in the islands, and introduced diseases and global economic forces had a devastating impact on traditional life-ways. Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early Western visitors. Introduced foods often grown for trade with Westerners included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845). The arrival of foreigners in Hawaiʻi signified the end of the Precontact Period, and the beginning of the Historic Period.

History After Contact

Captain James Cook and his crew on board the ships the H.M.S. *Resolution* and *Discovery* first arrived in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalani‘ōpu‘u, who was still at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. Kamehameha observed this meeting, but chose not to participate. It was during this visit to the islands that Lt. King of the Cook expedition explored the North Kohala countryside and reported:

> As far as the eye could reach, seemed fruitful and well inhabited. [Three and four miles inland, plantations of taro and potatoes and *wauke*] neatly set out in rows. The walls that separate them are made of the loose burnt stone, which are got in clearing the ground; and being entirely concealed by sugar-canes planted close on each side, make the most beautiful fences that can be conceived. [The exploring party stopped six or seven miles from the sea.] To the left a continuous range of villages, interspersed with groves of coconut trees spreading along the sea-shore; a thick wood behind this; and to the right, an extent of ground laid out in regular and well-cultivated plantations . . . as they passed, they did not observe a single foot of ground, that was capable of improvement, left unplanted. (Handy and Handy 1972:528)

In January [1779], Cook and Kalani‘ōpu‘u met again at Kealakekua Bay and exchanged gifts. The following month, Cook set sail for Maui; however, a severe storm off the coast of Kohala damaged a mast of one of the ships and they were forced to return to Kealakekua Bay. While back at the bay a skirmish broke out on the shores of Ka‘awaloa over a stolen skiff and Captain Cook was killed (Kuykendall and Day 1976; Sahlins 1985).

After the death of Captain Cook and the departure of H.M.S. *Resolution* and *Discovery*, Kalani‘ōpu‘u 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. Kalani‘ōpu‘u ordered that all the cultivated products of that district be seized, before setting out on a circuit of the island. Kalani‘ōpu‘u then went to Hinakahua in Kapa‘au where he amused himself with “sports and games such as hula dancing, *kilu* spinning, *maika* rolling, and sliding sticks” (Kamakau 1991:106). During his stay in Kohala, Kalani‘ōpu‘u proclaimed that his son Kiwala‘ō would be his successor, and he gave the guardianship of the war god Kūka‘ilimoku to Kamehameha. However, Kamehameha and a few other chiefs were concerned about their land claims, which Kiwala‘ō did not seem to honor (Fornander 1996; Kamakau 1992). The *heiau* of Moa‘ula was erected in Waipi‘o at this time (ca. A.D. 1781), and after its dedication, Kalani‘ōpu‘u set out for Hilo to quell a rebellion by a Puna chief named Imakakolo‘a.

Imakakolo‘a was defeated in Puna by Kalani‘ōpu‘u’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, Kalani‘ōpu‘u “went to Ka-‘u and stayed first at Punalu‘u, then at Waiohinu, then at Kama‘oa in the southern part of Ka-‘u, and erected a heiau called Pakini, or Halauwailua, near Kama‘oa” (Kamakau 1992:108). Imakakolo‘a was eventually captured and brought to the *heiau*, where Kiwala‘ō was to sacrifice him as an offering. “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 Kiwala‘ō could finish the first offerings, Kamehameha, “grasped the body of Imakakolo‘a 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 Hawai‘i. After usurping Kiwalao’s authority with a sacrificial ritual in Ka‘ū, Kamehameha retreated to his home district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). Kalani‘ōpu‘u died in April of 1782 and was succeeded by his son Kiwala‘ō.

The Rule of Kamehameha I (1782-1819)

After Kalani‘ōpu‘u died, several chiefs were unhappy with Kiwala‘ō’s division of the island’s lands, and civil war broke out. Kiwala‘ō, Kalani‘ōpu‘u’s son and appointed heir, was killed at the battle of Moku‘ōhai, South Kona in July of 1782. Supporters of Kiwala‘ō, including his half-brother Keōua and his uncle Keawemauhili, escaped the battle of Moku‘ōhai with their lives and laid claim to the Hilo, Puna, and Ka‘ū Districts. According to I‘i (1963), nearly ten years of almost continuous warfare followed the death of Kiwala‘ō, as Kamehameha endeavored to unite the island of Hawai‘i under one 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). Keawemauhili would eventually give his support to Kamehameha, but Keōua never stopped resisting. Around 1790, in an effort to secure his rule, Kamehameha began building the *heiau* of Pu‘ukohola in Kawaihae, which was to be dedicated to the war god Kūka‘ilimoku (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 by A.D. 1792 (Greene 1993).

In 1790, two Western ships, the *Eleanora* and *Fair American*, were trading in Hawaiian waters. As retribution for the theft of a skiff and the murder of one of the sailors, the crew of the *Eleanora* massacred more than 100 natives at Olowalu [Maui]. The *Eleanora* then sailed to Hawaiʻi Island, and one of its crew, John Young, went ashore where he was detained by Kamehameha. The other vessel, the *Fair American,* was captured by the forces of Kamehameha off the Kekaha coast and its crew was killed except for one member, Isaac Davis. Guns, and a cannon later named "Lopaka," were recovered from the *Fair American*, which Kamehameha kept as part of his fleet (Kamakau 1992). Kamehameha made Young and Davis his advisors, and aided by them and his newly acquired ships and foreign arms, had succeeded in conquering all the island kingdoms except Kauaʻi by 1796. It wasn't until 1810, when Kaumualiʻi of Kauaʻi gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. 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 (Kirch 1985; Kent 1983). Foreigners had 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.

Hawaiʻi's culture and economy continued to change drastically as capitalism and industry established a firm foothold. 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 Oʻahu at this time, did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Upon returning to Kailua in 1812, Kamehameha ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *tapa* 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, ʻAmaʻu, or Hapuʻu, from the wild plants resorted to" (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" (ibid.:204). In the uplands of Kailua, a vast plantation named Kuahewa was established where Kamehameha himself worked as a farmer. Kamehameha enacted the law that anyone who took one taro or one stalk of sugarcane must plant one cutting of the same in its place (Handy and Handy 1991). While in Kailua, Kamehameha resided at Kamakahonu, from where he continued to rule the islands for another nine years. He and his high chiefs participated in foreign trade, but also continued to enforce the rigid *kapu* system.

The Death of Kamehameha I and the Abolition of the Kapu System

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 remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death, a period of *ʻai noa* (free eating) was observed, along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs were altered:

> 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, 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 the purification ceremonies, Liholiho returned to Kamakahonu:

> 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-aliʻi consented to the free eating and it was accepted on Kauai (Kamakau 1992: 225).

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstituted the eating *kapu* but others appear to have thought otherwise. Kekuaokalani, caretaker of the war god Kū-Kaʻilimoku, 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 *ʻaumakua* worship, to continue (Oliver 1961; Kamakau 1992).

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 grown for trade included yams, coffee, melons, Irish potatoes, corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845).

Native Traditions and Historical Accounts of Puʻuwaʻawaʻa and the Nāpuʻu Region

This section of the study presents *moʻolelo*—native traditions and historical accounts (some translated from the original Hawaiian by Kepā Maly)—of the Kekaha region that span several centuries. Puʻuwaʻawaʻa was a favorable place to live in North Kona because of the freshwater springs and brackish pools along the coast and the more favorable agricultural land in the uplands. There are numerous native and historical accounts that mention Puʻuwaʻawaʻa specifically, and even more that encompass the greater Kehaha region.

Perhaps one of the earliest datable traditions that reference the Nāpuʻu-Kekaha region was collected by Abraham Fornander (1916-1917) titled "*The Legend of Kaulanapokii*". The legend speaks of traveling through the uplands, viewing Kīholo and Kapalaoa from Huʻehuʻe, and describes the practice of salt making at Puakō (a practice that was also very important in the coastal lands of Puʻuwaʻawaʻa). By association with Hīkapōloa, chief of Kohala at the time of the events described in this story, the *moʻolelo* dates to around the thirteenth century.

Native historian, Samuel Kamakau (1961) recorded that during the reign of Lono-i-ka-makahiki, Kamalālāwalu (the king of Maui), made plans to invade the island of Hawai‘i. Kamalālāwalu (Kama) sent spies to determine how many people lived on the island. The spies “landed at Kawaihae,” and one of them, Ka-uhi-o-ka-lani, traveled the trail between Kawaihae to Kanikū (Kamakau 1961:56). Returning to his companions, Ka-uhi-o-ka-lani reported “I went visiting from here to the lava bed and pond that lies along the length of the land.” He was told, “Kaniku is the lava bed and Kiholo, the pond” (Kamakau 1961:56).

In another historical account, Kamakau describes eighteenth century events in the Kekaha region, with particular emphasis on the lands of Pu‘uwa‘awa‘a and Ka‘ūpūlehu. When Alapa‘i-nui—ruler of Hawai‘i—died in 1754, and his son Keawe‘ōpala was chosen as his successor (Kamakau 1961:78). In the years preceding that time, the young chief Kalani‘ōpu‘u, had been challenging Alapa‘i’s rule. The challenge continued after Alapa‘i’s death, and following a short reign, Kalani‘ōpu‘u killed Keawe‘ōpala and secured his rule over Hawai‘i. Kamakau also reports that in ca. 1780, as a result of their valor and counsel Kalani‘ōpu‘u granted “estate lands” in Kekaha to the twin chiefs Kame‘eiamoku and Kamanawa (ibid. 310). Kamakau also records, that at the time of Kalani‘ōpu‘u’s death, Kame‘eiamoku was living at Ka‘ūpūlehu, and his twin, Kamanawa was living at Kīholo, Pu‘uwa‘awa‘a (ibid. 118). Kamakau also states, “the land of Kekaha was held by the *kahuna* [priestly] class of Ka-uahi and Nahulu” (ibid. 231); to which the twin chiefs are believed to have belonged.

Shortly after Kalani‘ōpu‘u’s death, Kamehameha I came into power. During his conquest of Kauai Island, he commissioned the building of war canoes. Waipa, a lesser chief of Hawai‘i island, built Kamehameha I a ship that was described as:

> The ribs were *koa* and *hau* wood, the flooring *wiliwili* wood, the nails of *kauila* wood from Napu‘u [near Pu‘uwa‘awa‘a] (Kamakau 1961:187).

David Malo (born ca. 1793), a native historian and prolific writer of tradition Hawaiian customs and lore wrote that the wood of the *kauila* tree was prized because it “is a hard wood, excellent for spears, *tapa* beaters and a variety of other similar purposes” and was made into spears for the army of Kamehameha I (Malo 1951:21 and 25). Kamehameha I retained Pu‘uwa‘awa‘a Ahupua‘a, among other reasons because it was “a wise thing for the king to keep as his own the *ahupua‘a* or districts in which the *kauila*, the *aala*, or the *auau* is plentiful…” (ibid.:194)

One of the most significant natural events on the island of Hawai’i, which occurred during the reign of Kamehameha I, was the eruption of Hualālai in 1800-1801. Kamakau (1961) provides a written description of the eruptions and their affect on the land and impact on the people of the region between Kīholo and Kalaoa:

> One of the amazing things that happened after the battle called Kaipalaoa, in the fourth year of Kamehameha’s rule, was the lava flow which started at Hu‘ehu‘e in North Kona and flowed to Mahai‘ula, Ka‘upulehu, and Kiholo. The people believed that this earthconsuming flame came because of Pele’s desire for *awa* fish from the fishponds of Kiholo and Ka‘upulehu and *aku* fish from Ka‘elehuluhulu; or because of her jealousy of Kamehameha’s assuming wealth and honor for himself and giving her only those things which were worthless; or because of his refusing her the *tabu* breadfruit (*‘ulu*) of Kameha‘ikana which grew in the uplands of Hu‘ehu‘e where the flow started . . . The reasons given for the flow may be summed up as: first, Pele’s wanting the *aku* of Hale‘ohi‘u and the *awa* fish of Kiholo; second, her anger at being denied the *‘ulu* (breadfruit) of Kameha‘ikana in upper Hu‘ehu‘e; third, her wrath because Kamehameha was devoting himself to Ka-heihei-malie and neglecting Ka-‘ahu-manu. [Kamakau in *Kuokoa*, July 13-20, 1867 and 1961:184-186]

There is no information pertaining to the original date of the Kīholo fishpond construction, but Kamehameha I was responsible for having it rebuilt between the mid 1790s and 1810 (Kelly 1996).

John Papa I‘i, a native historian and companion to the Kamehameha family, adds to the historical record of the fishpond Pa‘aiea that extended from the Mahai‘ula vicinity to Kalaoa, and was destroyed by the 1801 lava flows. I‘i reports that in the 1790s, as a result of his exceptional abilities at canoe racing, Kepa‘alani “became a favorite of the king, and it was thus that he received [stewardship of] the whole of Puuwaawaa and the fishponds Paaiea in Makaula and Kaulana in Kekaha” (I‘i 1959:132). In 1853, I‘I traveled to the Island of Hawai‘i to escape the smallpox epidemic spreading on O‘ahu. During his sail around Hawai‘i Island he stopped at Luahinewai (at the south end of Kīholo Bay in Pu‘u Wa‘awa‘a) to “bathe and visit that strange water in the lava” (1959:171).

Hawaiian traditions document land use practices and features of the cultural landscape. The narratives also convey values and expressions of the relationship between ancient Hawaiians and their environment. One of the most prolific native writers of the late nineteenth and early twentieth centuries, lived on the island of Hawai‘i at Pu‘uanahulu. His name was John Whalley Hermosa Isaac Kihe, who also wrote under the penname Ka‘ohuha‘aheoināKuahiwi‘ekolu

(The proud mist on the three mountains). Born in 1853, Kihe's parents came from Honokōhau and Kaloko. During his life, Kihe taught at various schools in the Kekaha region, served as legal counsel to native residents applying for homestead lands, and worked as a translator on the Hawaiian Antiquities collections of A. Fornander. In the later years of his life, Kihe lived at Puʻuanahulu with his wife, Kaimu (Puʻu Anahulu Homestead Grant No. 7540), and served as the postman of Nāpuʻu. Kihe, who died in 1929, was also one of the primary informants to Eliza Maguire, who translated some of Kihe's writings, publishing them in abbreviated form in her book "*Kona Legends*" (Maguire 1926).

During his career, Kihe collaborated with several other noted Hawaiian authors, among them were John Kaʻelemakule of Mahaiʻula, John Wise (who also worked with Kihe on translations of the Fornander Collection), and Reverend Steven Desha, Sr., editor of the Hawaiian newspaper, *Ka Hoku o Hawaii*. Kihe was the preeminent historian of Nāpuʻu and Kekaha, and from his pen (with contributions from his peers), came a rich collection of native traditions. His narratives ranged from native traditions to historical commentary and include historical accounts that were place-based. Readers are directed to Maly and Maly (2006) for translations of some of Kihe's contributions to the history, traditions, beliefs, customs, and practices of Nāpuʻu and the Kekaha region.

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

Later in 1924, Kihe, described the changes which had occurred in the Kekaha region since his youth. In the article titled *Na Hoʻomanao o ka Manawa* (in *Ka Hōkū o Hawaiʻi* June 5th & 12th 1924), Kihe wrote about the villages that were once inhabited throughout Kekaha, identifying families, practices, and schools of the Historic Period (ca. 1860-1924). In this two part series he also shared his personal feelings about the changes that had occurred, including the demise of the families and the abandonment of the coastal lands of Kekaha.

Kekaha and Nāpuʻu Described in the Missionary and Explorer Journals

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

The Journal of William Ellis (1823)

Less than a year after Kamehameha's death in 1819, Protestant missionaries arrived from America (cf. Iʻi 1959 and Kamakau 1961). In 1823, British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Hawaiʻi seeking out communities in which to establish church centers and schools for the Calvinist mission. Ellis' writings (1963) offer important glimpses into the nature of native communities and history as spoken at the time. Following his last visit to Kawaihae, Ellis visited several of the coastal villages along the way. In coastal Puʻuwaʻawaʻa, Ellis stopped at Kapalaoa, Wainānāliʻi, and Kīholo.

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

The Journals of Lorenzo Lyons and Cochran Forbes (ca. 1835-1859)

On July 16 1832, Lorenzo Lyons (*Makua Laiana*), replaced Reverend Dwight Baldwin as minister at Waimea, Hawai‘i. Lyons’ “Church Field” was centered in Waimea, at what is now the historic church ‘Imiola and included both Kohala and Hāmākua (Doyle 1953:40 & 57).

Lyons described his walk on the *ala loa* (main trail) along the coast from Kohala through Pu‘uwa‘awa‘a, and described Kīholo Fishpond, while on his way to Kailua:

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

During the time that Lyons was tending to his mission in South Kohala, Cochran Forbes (his South Kona counterpart), visited him and reports having walked to Kīholo from Kailua where he stayed a short while prior to continuing on to Wainānāli‘i and Kohala. Forbes (1984) described the 1841 journey with the following narratives:

> Jany. 1. On the 29th left home for Kohala… [On Dec. 31] …had a long & tedious journey by land to Kiholo. Arrived there at dark. Our canoe with baggage had not got along in the bad sea & head wind, *mumuku* & *hoolua* blowing. Spent the night at Kiholo & preached. Next morning our canoe got along as far as Wainanalii where we took breakfast and leaving the canoe, a strong *mumuku* blowing, we came by land over the lava to Puako, arrived there about 3 oclock and encamped with Daniela (Loli) one of Bro Lyons’ deacons. Here we spent the night and early this morng. The men returned for the baggage & brought it by land as the sea is rough & strong winds blowing… [Forbes 1984:91]

The Wilkes Expedition (1840-41)

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

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

The practice of inter-regional trade of salt and other articles described by Wilkes above, was based on traditional customs (cf. Malo 1951 & Kamakau 1961), and remained important to the livelihood of residents in the Nāpu‘u-Kekaha region through the ca. 1930s (see oral history interviews in Maly and Maly (2006).

Land Tenure in Pu‘uwa‘awa‘a Ahupua‘a and Vicinity

Through the traditions and early historical accounts cited above, we see that there are descriptions of early residences and practices of the native families on the lands of Pu‘uwa‘awa‘a and within greater Kekaha. Kalani‘ōpu‘u gave Kame‘eiamoku and Kamanawa various lands of the Kekaha region, as their personal properties (Kamakau 1961). Kamehameha I rose to power with the help of Kame‘eiamoku and Kamanawa, and their rights to the lands were retained, and handed down to their descendants (ibid. 1961). Among the best government records documenting residency in Pu‘uwa‘awa‘a are those of the *Māhele ‘Āina*, the Boundary Commission, the Government Survey Division, and the Government lease and homesteading programs.

The Māhele ‘Āina

By the middle of the nineteenth century the ever-growing population of Westerners forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership in Hawai‘i, and the *Māhele* became the vehicle for determining ownership of native lands. During the *Māhele*, land interests of the King (Kamehameha III), the high-ranking chiefs, and the low-ranking chiefs, the *konohiki*, were defined. 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. This process expedited the work of the Land Commission (Chinen 1961).

During the *Māhele* all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands. All three types of land were subject to the rights of the native tenants therein. In 1862, the Commission of Boundaries (Boundary Commission) was established to legally set the boundaries of all the *ahupuaʻa* that had been awarded as a part of the *Māhele*. 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 A.D. 1873 and 1885 and was usually given in Hawaiian and transcribed in English as they occurred. Boundary descriptions were not collected for all *ahupuaʻa*.

Mikahela Kekauonohi (a granddaughter of Kamehameha I) claimed Puʻuwaʻawaʻa Ahupuaʻa during the *Māhele*; however, the *ahupuaʻa* was relinquished to the government perhaps in lieu of commutations for other lands awarded. Five *kuleana* claims, all in the coastal portion of the *ahupuaʻa* near Kiholo Bay, were made, but none were granted (Maly and Maly 2006).

Boundary Commission Proceedings

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

Volume B
Puawaa [Puʻu Waʻawaʻa]
August 13, 1873
Aoa K. Sworn:

> I was born at Puawaa North Kona Hawaii at the time of Keoua 1st [ca. 1791] lived there till a few months ago when I moved to the adjoining land of Puanahulu [Puuanahulu]. I am kamaaina and know the boundaries. Lono an older cousin of mine, now dead, pointed out the boundaries to me; as the different lands had different Konohiki and different Koele [agricultural fields] &c. The land of Puawaa is bounded on the south side by Kaupulehu and mauka by the same. On the North by the land of Puanahulu, and makai by the sea. The ancient fishing rights of the land extend out to sea.
>
> The boundary at sea shore between this land and Kaupulehu, is at Pohakuokahai, a rocky point in the aa on the lava flow of 1801; the flow from Hualalai to sea. I think it is the third point from Kiholo, in the flow as you go toward Kona. Thence the boundary between these lands runs mauka on aa to Keahupuaa, a pile of stones, a short distance makai of the Government road, on a spot of old lava in the new flow. Thence mauka to Oweowe, a hill covered with trees said hill being surrounded by the flow, the kipuka pili [an area of pili grass growth] to the south is on Kaupulehu. Thence mauka to mawae [fissure] on a narrow strip of aa in the middle of the flow with smaller branches of the flow on each side of this strip, thence [page 253] mauka to where the aa turns toward Kona, as you go up Hualalai; thence the boundary follows up the East side of the flow to Puuako [Puuakowai], a water hole in the Pukiiawe trees on the old trail from Kainaliu to Puanahulu above the woods.
>
> There the boundary of these lands turns toward Kohala, along the old trail to Waikulukulu, a cave with water dripping from the sides, a little above the woods. Thence along the trail to Punahaha, a hill with cracks running along the top; this is above the large hill at the base of Hualalai; mauka of here, it can be seen from here when the mountain is clear. This hill is the corner of Puawaa where Kaupulehu and Puanahulu unite and cut it off. From this boundary point the boundary between Puawaa and Puanahulu runs makai to Iana o Maui [Ana-o-Maui], a large cave in the Pahoehoe, thence makai along the edge of the aa (the pahoehoe being on Puanahulu, to Kapohakahiuli a large cave with water in it). Thence makai and running along edge of aa, on south side of Haahaa, a place with old cultivating ground at the foot, thence to Kaluakauwila, a pali running towards the sea and along the Northern edge of the aa near the foot of the pali. Thence the boundary runs to Kukuihakau, a place where people used to live, along the edge of aa. Thence to Kalanikamoa and along an old iwi aina [boundary or planting field wall] through this place. Thence the boundary runs to Ahuakamalii; a pile of stones, built in olden times on soil. Thence along old trail to Ahinahina running through the middle of the old cultivating ground; thence makai along the road to Uliulihiaka,

a Kahawai [stream channel] now covered by lava flow of 1859; thence makai on the flow of 1859 to Kuanahu, an ahua in lava; thence makai to Mimiokauahi, an *ahua* covered by flow of 1859. Thence *makai* between Puuoa Lonoakai on Puawaa, and Puuoa Kaualii on Puanahulu, now covered with lava, except small portions of the one on this land. Thence to Kalaiokekai a point on old lava, on the edge of the flow of 1859 near Keawaiki. *I used to go on the mountain after sandal wood, and know these boundaries*. C.X.d. A hill called Mailihahei is the corner of Keauhou and Kaupulehu. I do not know the boundaries of Keauhou beyond this point. Keauhou does not reach Puawaa. [page 254]

Nahinalii K. Sworn:

I was born here [Pu‘u Wa‘awa‘a] at the time of the building of Kiholo [ca. 1810], and lived here till 1865 when I moved to Kawaihae. Keopu an old Kamaaina, now dead, told me some of the boundaries, and afterwards I went and saw them. Pohakuokahai is the boundary on the shore, between this land and Kaupulehu. From this point the boundaries between these two lands, runs mauka to Keahukaupuaa. Paniau is the name of the place where the ahu stands, thence mauka to Oweowe; which is as far as I know the boundaries on that side.

The kamaaina of this land told me that the boundary at shore between Puawaa and Puanahulu, is between Lonokai on Puawaa and Puuokaualii on Puanahulu, they are very close to the shore.

The kamaaina of Puanahulu, told me that the boundary is at Laeokaaukai, on the Kona side of the house at Kaawaiki.

I do not know the boundaries mauka of this point, until you come to Ahuaokamalii, an ahua on the Kona side of the pali some distance from the base; from thence the boundary runs mauka to Puuloa, a pali in the woods which runs mauka toward Hualalai. Thence the boundary runs mauka to Kaluakauila, a long iwi aina [usually a boundary- or planting field-wall] through a cultivating ground

This is as far as I know the boundaries and have not heard what the other boundaries are. Have heard that Kaupulehu cuts Puawaa off, above the woods and joins Puanahulu C.X.d. [page 255]

Volume B:428
Puawaa, No. Kona, Hawaii. June 14, 1876
D.H. Hitchcock filed a map & notes of survey.
D.H. Hitchcock K. Sworn:

I surveyed Puawaa taking Aoa for my Kamaaina. I found no dispute as to boundary between Puawaa and Puanahulu. On the boundary between Kaupulehu and Puawaa there is a dispute. The witness Kahueai of Kaupulehu, I found was dead. Commencing on the beach at place called Laemano, old salt works, I took it at an old wall with sand at each side, and old salt works on the south side, and salt works some distance off on the north side. Thence, we surveyed to Ahu at Mawae a short distance below road, as Aoa pointed out to me. The other kamaaina pointed out towards Kona, taking old cultivating ground Oweowe, that Aoa said always belonged to Kaupulehu. The Ahu Aoa pointed out is near a cave. Thence I ran mauka to a point of aa running down into a kipuka, thence I ran a straight line to Puuakowai. I found the witness of Puawaa & Kaupulehu all meet at Puuakowai, but Keliihanapule’s evidence cropped the land of Puawaa to Puuiki and then back to Puuakowai.

From Puuakowai I ran a straight line to Pohakunahaha. It is a prominent mark on the side of mountain, an old crater with three divisions in it, middle division belongs to this land. One of the other divisions belongs to Kaupulehu and another to Puuanahulu. Punihaole was with me when I surveyed Puawaa on the Puuanahulu side, and said he was satisfied with the survey. He is the lessee of Puawaa. C.X.d… [page 428]

Hawaiian Government Survey Records

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

Another unique facet of the Emerson's field notebooks is that his assistant, J. Perryman, was a talented artist. While in the field, Perryman prepared detailed sketches that now help to bring the landscape of that period to life. In a letter to W.D. Alexander, Surveyor General, Emerson described his methods and wrote that he took readings off of:

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

In his field communications (letter series to W.D. Alexander), Emerson comments on, and identifies some of his native informants and field guides. While describing the process of setting up triangulation stations from Puakō to Kaloko, Emerson reported that the "two native men are extra good. I could not have found two better men by searching the island a year." (State Archives, HGS DAGS 6, Box 1; February 15, 1882). We learn later, that the primary native guides were Iakopa and Kaʻilihiwa—*kūpuna* of the Keākealani family of Nāpuʻu (State Archives, HGS DAGS 6, Box 1; May 5, and August 30, 1882). Selected sketches, cited in the following section of the study, provide readers with a glimpse of the countryside of Puʻuwaʻawaʻa and vicinity, of more than 125 years ago.

J.S. Emerson Field Notebook Vol. 1 Reg. No. 251
West Hawaii Primary Triangulation, Kona District
Nohonaohae; March 23 & 29,1882 (Figure 9)

Site # and Comment (Map Section 2)
1 – Lae o Mano.
2 – Kiholo Bay.
3 – Lae Hou.
4 – Lae o Kaiwi.
5 – Keawaiki Bay.
6 – Lae o Leleiwi.
7 – Kapalaoa Sch. H.

Site # and Comment (Map Section 1)
1 – Lae o Kawaihae.
2 – Lae o Honokoa.
3 – Lae o Waiakailio.
4 – Lae o Puulaula.
5 – Lae o Waima. [Book 251:93]

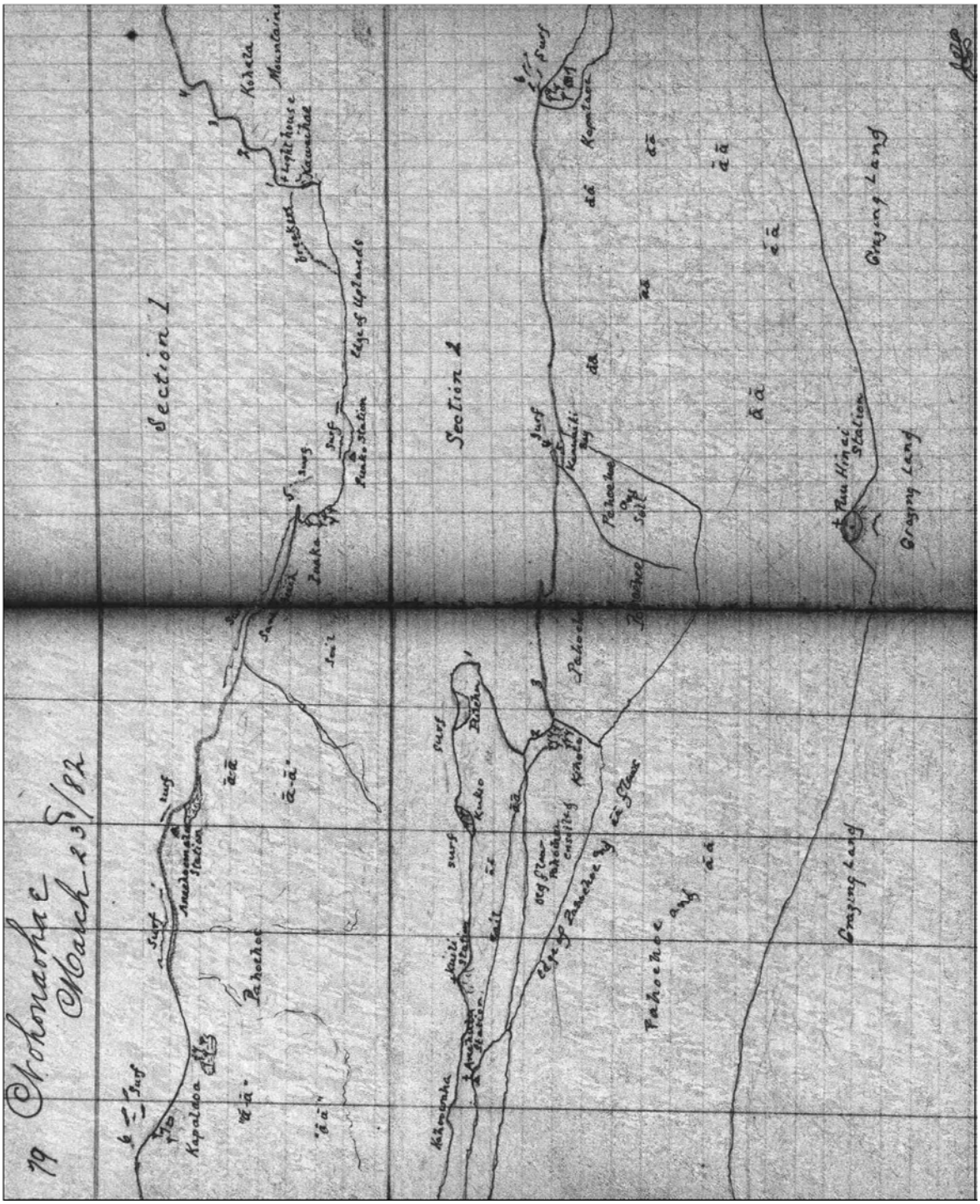

Figure 9. J.S. Emerson, Field Note Book Map – Book 251:79 (State Survey Division).

J.S. Emerson Field Notebook Vol. II Reg. No. 252
West Hawaii Primary Triangulation, Kona District
Puu Anahulu; April 29-30,1882 (Figure 10)

Site # and Comment:
1– Lae o Kawili. In Makalawena.
2 – Lae o Awakee. In Kukio.
3 – Bay this side of cape.
4 – Lae o Kukio iki.
5 – Large rock in sea.
6 – Kukio iki Bay.
7 – Lae o Kukio nui.
8 – End of reef
9 – Kukio nui Bay.
10 – Kaoahu's house in Kaupulehu Village.
11 – " " this side of house.
12 – Bay; tangent to head.
13 – Lae o Kolomuo (extremity in Kaupulehu).
14 – Nukumeomeo rock (opposite cape).
15 – Pohakuokahae. By authority of Kailihiwa – Boundary point between the ilis of Kaupulehu and Kiholo.
16 – small inlet.
17 – small cape.
18 – small bay.
19 – Lae o Nawaikulua.
20 – Small inlet.
21 – Keawawamano.
22 – Waiaelepi.
23 – *Lauhala* Grove.
24 – Keanini's Grass house.
25 – Kauai's Grass house.
26 – Kiholo meeting house. [church and school house]

Puu Waawaa.
27 – Lae o Keawaiki.
28 – Honuakaha.
29 – Lae Iliili.
30 – inside bay [Book 252:69-71]

While conducting the Pu‘uanahulu survey, Perryman prepared a sketch of the region depicting the area from Pu‘uanahulu upland to Pu‘uwa‘awa‘a and the southeastern slope of Hualālai. Though Perryman's sketch is not keyed, it includes important visual references and is included here as Figure 11.

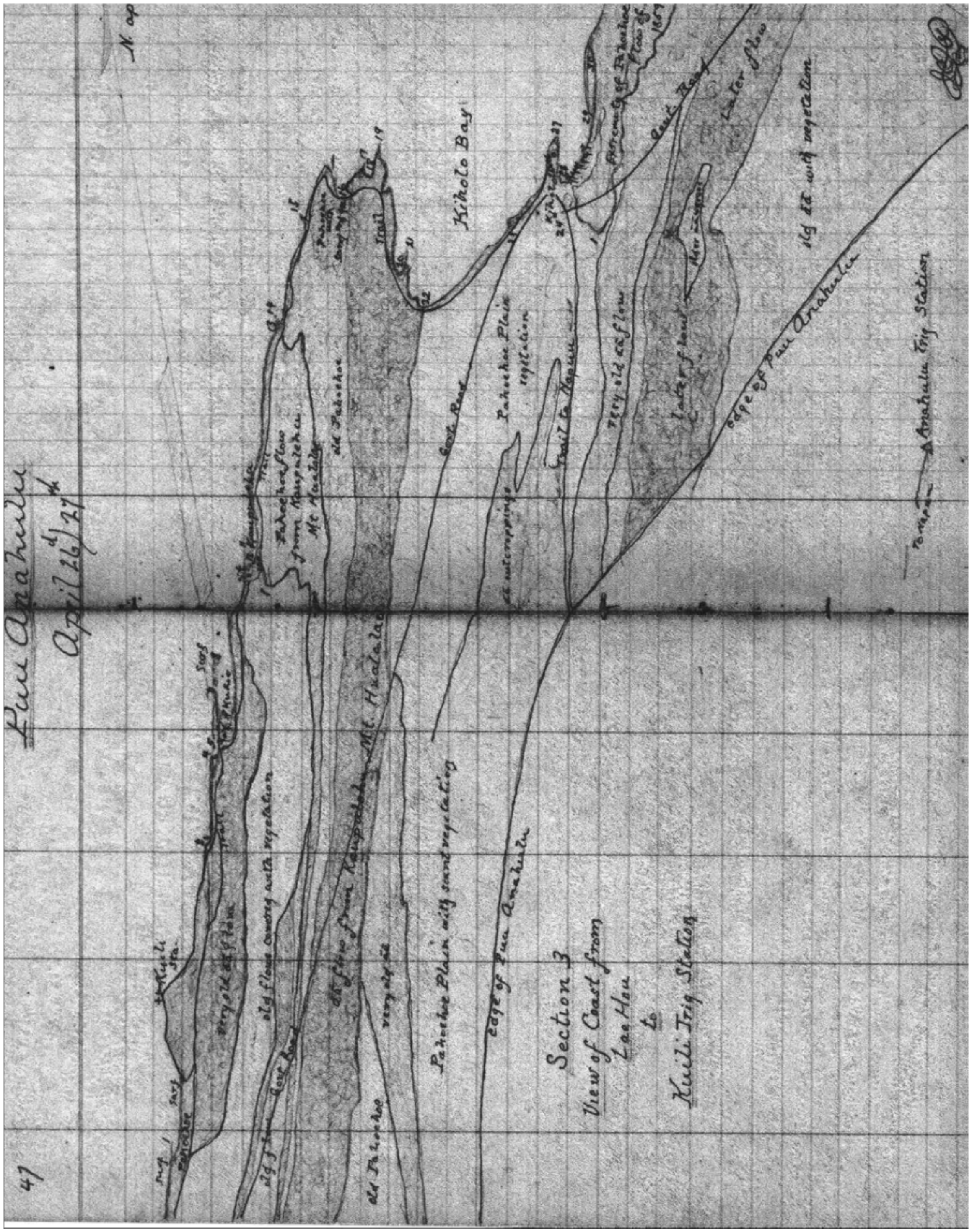

Figure 10. J.S. Emerson, Field Note Book Map – Book 252:47 (State Survey Division).

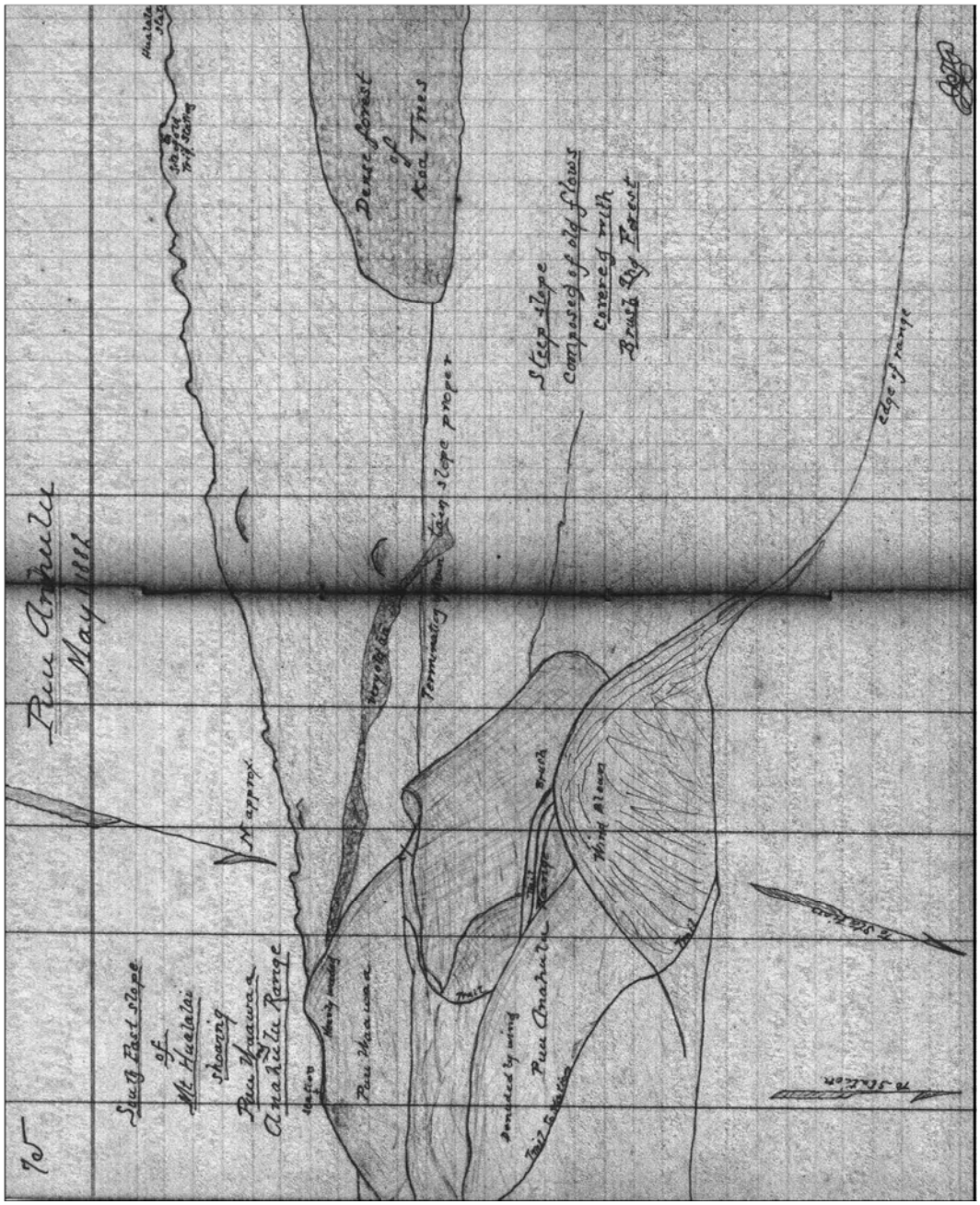

Figure 11. J.S. Emerson, Field Note Book Map – Book 252:75 (State Survey Division).

J.S. Emerson Field Notebook Vol. II Reg. No. 252
West Hawaii Primary Triangulation, Kona District
Puu Waawaa; May 16th, 1882 (Figure 12)

Site # and Comment:

Puu Waawaa.
1 – Aea's grass house. On Puu Huluhulu.
2 – School house, framed. On Kaipohaku.
3 – Jacob's [Iakopa's] house, grass. On Pawaa. Kapalaoa Sch. House.
4 – Puu Kuahiku. Anahulu range.
5 – Puu Pohakau.
6 – Puu o Lili.
7 – Kumua o iwi Kau.
8 – Mauiloa
9 – Puu Anahulu.
•Puu Iki. In Puu Anahulu – Boundary of P.A. and Waawaa Ahupuaa, half way between this station and Puu Iki according to the "boy."
Ana o Maui. In Anahulu covered with rock. [Book 252:116]

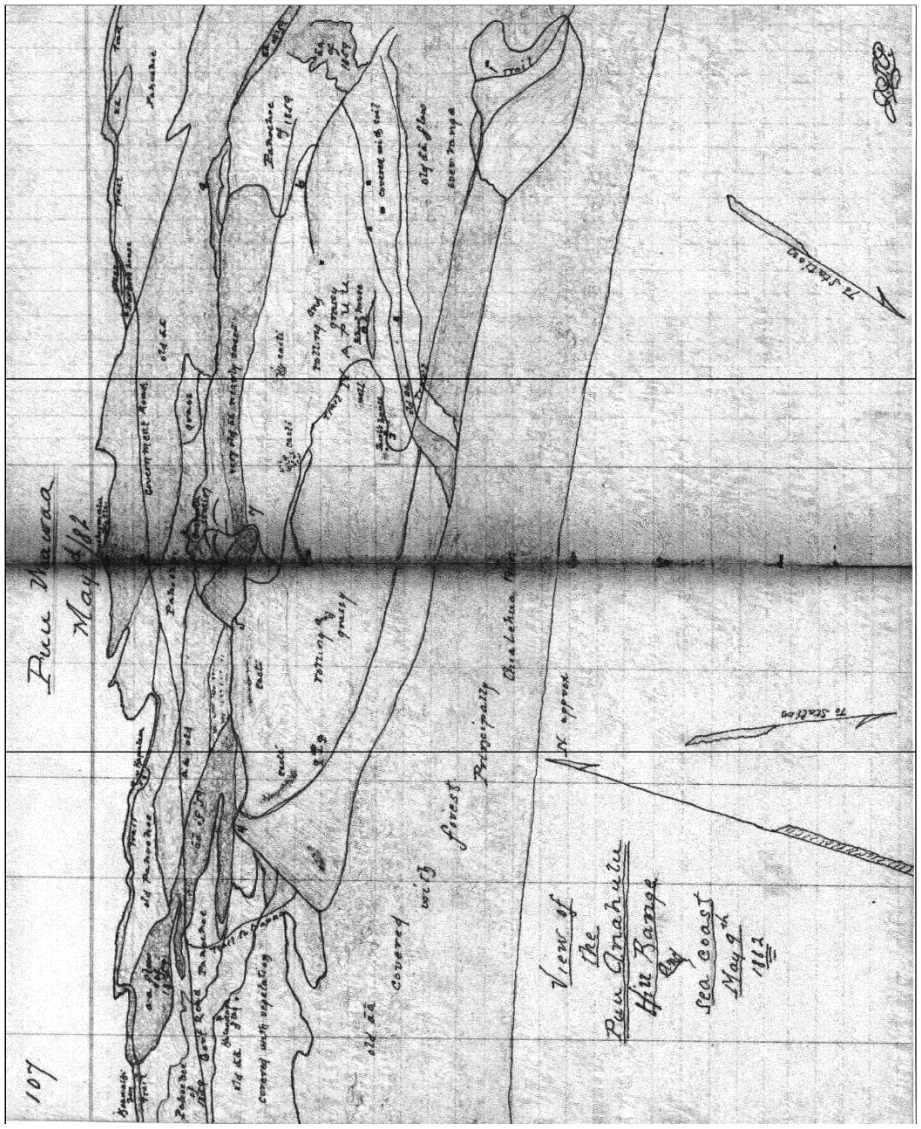

Figure 12. J.S. Emerson, Field Note Book Map – Book 252:107 (State Survey Division).

J.S. Emerson Field Notebook Vol. II Reg. No. 252
West Hawaii Primary Triangulation, Kona District
Kuili Station; May 19-20,1882 (Figure 13)

Site # and Comment:

34 – Keonenui Bay; long black sand beach.
35 – Lae o Nukumeomeo.
36 – Kiholo Bay; site on surf – indefinite.
37 – Lae Hou – extremity.
38 – Ohiki Bay.
39 – Lae o Kaiwi, needle shaped.
40 – Akina kahi Bay.
41 – Lae o Naubaka, Puu Anahulu.
42 – Kahamoi Bay. "Ha" = outlet to fishpond. "Moi" = a choice fish.
43 – Pohakuloa rock. On cape of same name, P. Anahulu.
44 – Lae o Pohakuloa.
45 – Akahukaumu. Indefinite, head of bay.
The lighting – "Akahu" of the oven "Kaumu."
[now written as Akahu Kaimu]
46 – Lae o Leleiwi, bone cape on a/c of sharpness.
47 – Kapalaoa bay.
Anaehoomalu Station
48 – Kuaiwa rock. Name from "Kuaiwa" chief of Anahulu Ahupuaa who in the time of Kaahumanu raised a revolt in favor of heathenism and being bound hand and foot, was thrown into the sea at Kailua.

Lae Makaha. Outlet of fishpond [Book 252:131-132]
Hale o Mihi rock. Mihi an ancient demigod or *Kupua*.
Koukealii Bay, sight on surf at head.
Lae o ka Auau. Anaehoomalu.
Waiulua inlet, abounding in "*ulua*" fish.
Waiulua Cape, nearly on level with sea.
Anaehoomalu Bay. Head of bay. [Book 252:131]

J.S. Emerson Field Notebook Vol. 111 Reg. No. 253
West Hawaii Primary Triangulation, Kona District
Akahipuu; May 29,1882 (Figure 14)

Site # and Comment:

1 – Kiholo meeting house. Puu Waawaa.
2 – Kauai's frame house. Puu Waawaa, Kiholo village.
3 – Keanini's frame house. Puu Waawaa, Kiholo village.
4 – Honuakaha Bay. Puu Waawaa.
5 – Keawaiki Cape. Puu Waawaa.
6 – Kiholo Bay. Puu Waawaa.
7 – Lae Iliili. Cape of lava stones.
8 – Inside bay.
9 – Lae Hou. [Book 253:39]

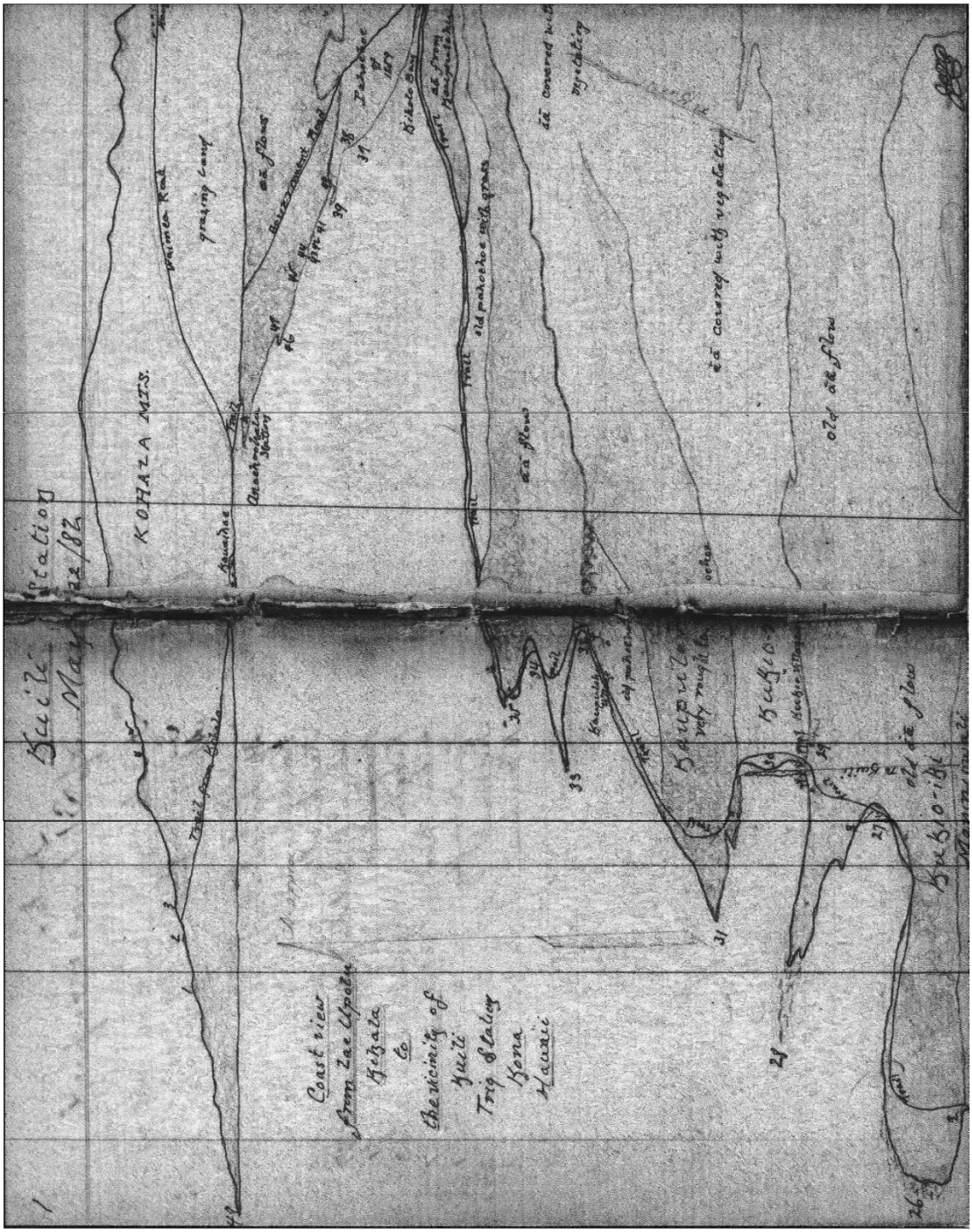

Figure 13. J.S. Emerson, Field Note Book Map – Book 253:1 (State Survey Division).

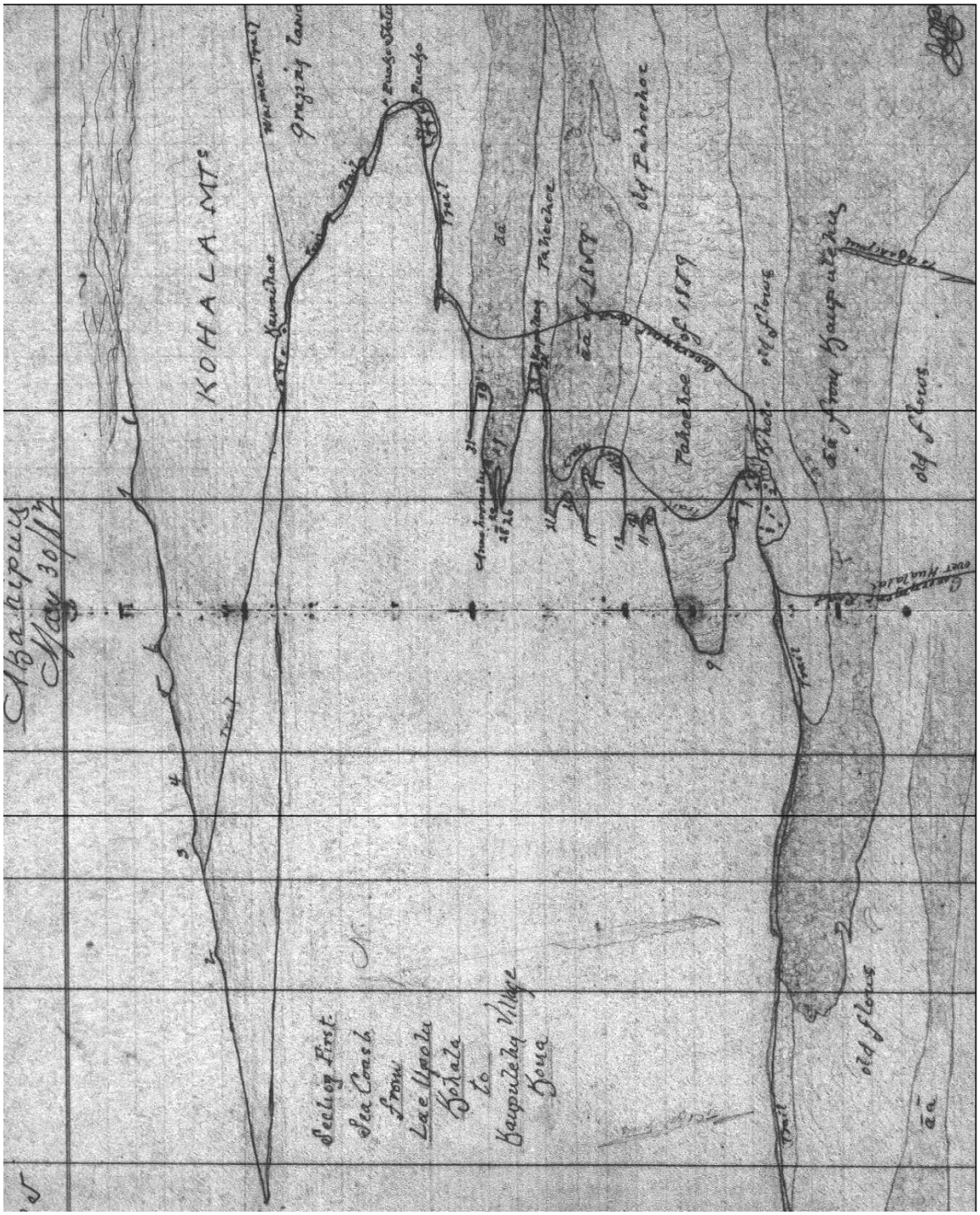

Figure 14. J.S. Emerson, Field Note Book Map – Book 253:25 (State Survey Division).

Akahipuu – May 31, 1882
10 – Ohiki Bay. In Puu Waawaa.
11 – Lae Ohiki. "
12 – Koholapilau bay. "
13 – Konalimu. "
14 – Keawakeekee bay. "
15 – Keawakeekee cape. "
16 – Keawaiki bay. "
17 – Lae Akinakahi. In Puu Waawaa.
18 – Akinakahi Bay. [Book 253:49]
19 – Lae o Naubaka. In Puu Anahulu.
20 – Kaluaouou Bay. "
21 – Lae o Namahana... " [Book 253:51]

J.S. Emerson Field Notebook Vol. 4 Reg. No. 254
Primary Triangulation, West Hawaii, Kona District
Station Descriptions – August 1882

Puu Waawaa

Is too prominent not to be easily found without a description.

A copper triangle and marked stone show the position of the point under ground. The stones above ground are close to the signal. There is a quantity of the cans underground also.

The rocks for the marking purposes had to be brought from the plains below on jackasses as there were none to be found on the hill. *The soil is very soft and rich, and the summit is covered with a dense forest.* [Field Book 254:123]

Government Leases and the Homesteading Program

It appears that the first formal lease (issued in 1863) for lands in the Nāpuʻu region was for ranching operations. On March 20, 1863, the entire *ahupuaʻa* of Puʻuanahulu ("*with the exception of the land rights of the native tenants upon the land*") was leased to three Hawaiian lessees—G. Kaukuna, M. Maeha, and S. Kanakaole, listed as residents of Honolulu, Oʻahu (State Archives files – General Lease No. 106; DLNR2- Vol. 15). Two years after Kaukuna, Maeha and Kanakaʻole acquired the lease, they sold their interest to Francis Spencer for incorporation into the holdings of the Waimea Grazing and Agricultural Company. From the 1860s until the 1970s, ranching was the primary, large-scale land use operation in the region. Over time, the land area under lease, ranged from approximately 4,000 acres to more than 120,000 acres of Puʻuwaʻawaʻa and Puʻuanahulu. A 1902 map of the Puʻuwaʻawaʻa-Puʻuanahulu lease lands depicts the lands described in various lease documents (Figure 15).

In 1893, with the lease of Puʻuanahulu (Government Land) and Puʻuwaʻawaʻa (Crown Land), held by Francis Spencer drawing to a close, new applications for the lands were tendered by native residents, Francis Spencer, and the party of Eben Low and Robert Hind. The Crown Land of Puʻuwaʻawaʻa, was brought before the Commissioners of Crown Lands, where discussion ensued. On June 27, 1893, it was noted that the native Hawaiian residents had applied for an interest in the land, but that the land agent had determined the land was inadequate for residency needs (though the families had resided there for generations). Governor Sanford Dole (also the father-in-law of Eben Low), observed that the forest on the land was an "important matter;" and also that a lease of the land should go to a "reliable tenant". What follows are communications regarding the lease agreement of Puʻuwaʻawaʻa Ahupuaʻa.

> Executive Building
>
> Honolulu June 27, 1893
> Meeting of the Commissioners of Crown Lands:
>
> …The special matter for consideration was an application from Mr. Low for the lease of the Crown Land known as Puuwaawaa in Kona Hawaii.
>
> Mr. Dole in referring to the general land policy of the Government, stated that special care be taken, when leasing lands, to reserve all such as may be adapted for settlement and homestead purposes. When any land is available for lease, he would favor leasing the same to a good and reliable tenant who will make extensive improvements and could be relied upon to carry out certain requisite conditions more especially that in reference to the care of the forest, now a most important matter.

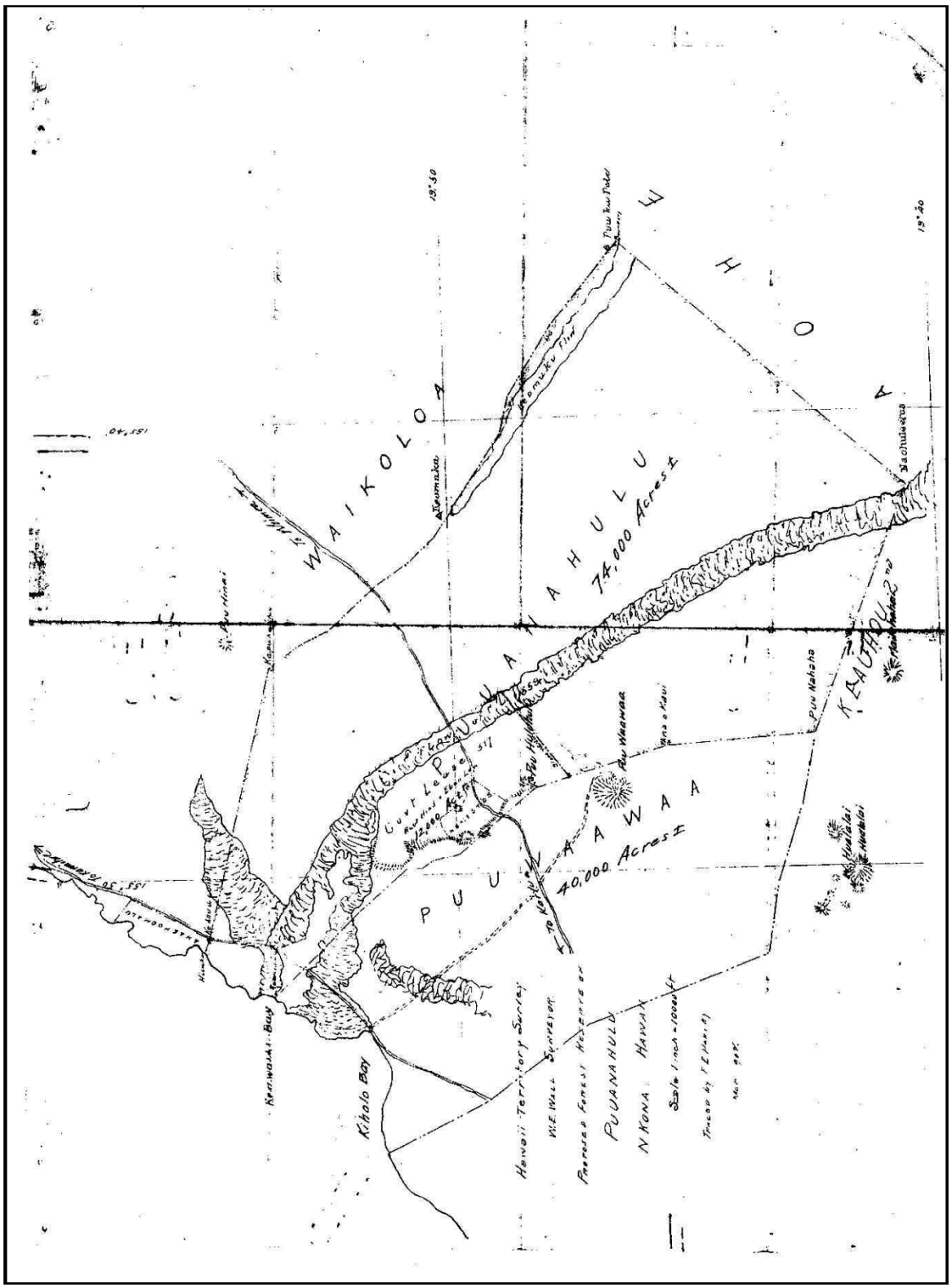

Figure 15. Pu‘uanahulu and Pu‘uwa‘awa‘a Lease lands (1902). (Lease 971) State Survey Division.

The Agent states that the land of Puuwaawaa, though covering a very large area, between 30 and 40 thousand acres, is mostly comprised of *aa* and *pahoehoe*. At the request of certain native Hawaiians who claimed to be residents, he had visited Kiholo where they were living, and found that the land was not suitable for homesteading. In support of his observations, the Agent read the report of the Special Commission appointed at the Extra Session of the Legislature of 1887, which stated that this land offered no inducements to settlers.

The application of Mr. Low was then read, making the following propositions, viz.

> together with free liberty of ingress, egress and regress, to and for the said parties of the first part [i.e., the Commissioners of Crown Lands] and their successors in office… …For and during the term of Twenty five (25) YEARS, to commence from the fifteenth day of August A.D. 1893…paying…the yearly rent of Twelve Hundred & Ten Dollars…
>
> [handwritten amendments]:
>
> Provided that they may take such timber and other trees for their own use as fire wood or for mechanical, fencing or building purposes, to be used only on the demised premises… **And also** that they will and shall during the term of the present demised keep up and maintain the forest substantially according to the description hereinafter set forth; **And also** keep the Lantana from spreading or making any further headway on said demised premises; And further that they will within three years from commencement of the terms hereof, put and erect upon the premises hereby demised substantial improvements of a permanent character to the value of three thousand ($3000.) dollars, and the same to keep and maintain in good repair during the full term hereof…
>
> Signed J.A. King
> William O. Smith Interior Department
> C.P. Iaukea
> Robert Hind, Jr.
> Eben P. Low Lessees
>
> Kohala, July 20/94
> Messrs. P.C. Jones, C.P. Iaukea,
> Commissioners of Crown Lands:
>
> Dear Sirs;
> We respectfully beg to make application for a reduction of $710.00 on the rental of the land of Puuwaawaa, making the rental to $500.00 per annum. We find it strictly necessary to ask for the reduction so that we will be in a position to keep up the strict conditions that are stipulated in the lease.
>
> The writer goes to Honolulu by the "*Kinau*" and will give every detail, in person, to you, and will also be happy to give any information that you may require.
>
> We remain, Dear Sirs,
> Your obedient servants,
> Eben P. Low,
> Robert Hind, Jr.
>
> (Attachment)
> Statement of a few facts in regards to Improvements, Situation, Roads etc. etc., on the Land of *Puuwaawaa*, North Kona, Island of Hawaii.
>
> Improvements. There are on the Premises, improvements in the way of Buildings, fences to the extent of $3000--- viz. Watersheds, Dairy Building, Stables, Dwelling quarters Six—5000 Gal. Tanks, 1—1200 gal. tank and over 30,000 gal. Cistern not quite completed.
>
> Roads and Trails. The land of Puuwaawaa has only 4 outlet or trails, one by way of the mountain, one by land of Puuanahulu, one by Kapalaoa and one by Kiholo, none of these are Government trails, it is impossible to go by any other way without inconvenience and trouble. The distance of road from Kohala via Waimea to Puuwaawaa is 47 miles. The distance via Kawaihae is 36 miles.

It takes an average going with cattle from P'waa [Puuwaawaa] to Waimea 12 hours, Waimea to Kohala 9 hours, Puuwaawaa to Kawaihae, distance of twenty-one miles 13 hours. No way of making a wagon road under a cost of $1,000.00 per mile.

Land. There are 40,000 Acres in this piece of property to be divided namely:
20,000 Acres Worthless
10,000 Acres Good for only 6 mos. in the year or when it rains.
1,000 Acres Very rich soil suitable for cultivation.
9,000 Acres Good for grazing only.

Rainfall. October to March plentiful.
March to May very slight, drizzily.
May to October hardly any, very dry.

No water holes or springs of any nature on the land.

Trees and Plants.
- Out of 1200 *kiawe* trees planted, about 209 growing.
- 50 Ironwood, none growing.
- 300 Eucalyptus, 2 growing.
- 100 Coffee Trees (for experiment), none growing.
- 150 Silk Oak, all growing.
- 50 Peach Trees, all growing.
- 50 Cheramois Trees, all growing.
- 12 Mangoes, Apricots, Lemons, all growing.

The great portion of the trees that died was from want of moisture, we could not save them, for no water could be spared.

We have rooted up every lantana visible, this will be our worst enemy on a count of the numerous quails that carry the berries from John Maguire's property [Kaupulehu], adjoining ours which is largely covered with this weed.

The cactus or the *Papipi* is also spreading fast, and so is the Scotch Thistle; We are trying to keep them from spreading any further.

Hawaiian trees and shrubs of numerous kinds abound luxuriantly on this land. Viz; the koa, pua, mamane, koko, naio, iliahi, opiko, kolea, kou, kukui, lama & etc. etc.

Stock. Cattle, Hind & Low, 1,000 head.
Horses 7, mules, Hind & Low 135 head.
Cattle & Horses, Spencer, 400 head.
Cattle & Horses, Natives, 150 head.

We have lost 3 mules and 2 horses from packing lumber from Kiholo, 70 head of cattle from want of water during summer of last year, and equivalent of 7% of our herd of 1,000.

Expenses. The expense of looking after this place is very large, our shoeing account alone is $37.50 per month, and that is done right on the ranch by our men.

It takes 5 men, and no less, to look after this property, 10 miles of fences, and also fighting against lantana, cactus, thistle and keeping sundry trails in order – $1500.00.

We pay freight per ton per S.S. to Kawaihae, $5.00. We pay freight per ton per sloop to Kiholo, $5.00. From Kiholo to P'waa Hill a distance of 9 miles by road, by pack mules and horses ½ cent per lb., on ordinary mds, as rice, flour & etc.-- $10.00. 1 ½ cents per foot on lumber, $15.00. My personal overseeing is not counted.

We intend to put in a large area under coffee, but we cannot see our way to it on account of the heavy rent we are bound under, especially when you have to lay out money besides rent and then wait for 3 years to get any returns.

Honolulu, July 24, 1894.
Eben P. Low.
General Lease No. 1039
(Replacing previous Lease Agreements)
Commissioner of Public Lands to Robert Hind
Sept. 27, 1917

Puuwaawaa – Lease of 40,000 acres for the period of 21 years, commencing August 15th, 1918. (Hawaii State Land Division Files)

April 5th and 8th, 1919
Governor McCarthy; to Commissioner Bailey:

Communications noting the request of Mr. Muller for a lease of a portion of the Puuwaawaa Beach Lots from the lease of Robert Hind, to be used as a salt works. Commissioner urged Governor to have Muller develop lease arrangement personally with Hind23. (Hawaii State Archives – Ex. & C.P.L. Files)

In the 1880s, the Hawaiian Kingdom undertook a program to form Homestead lots on Government lands as a way to get more Hawaiian tenants in possession of fee-simple property (Homestead Act of 1884). On Hawai‘i, several lands in the Kekaha region of North Kona were selected, and a surveying program initiated to open up the lands. Because it was the intent of the Homestead Act to provide residents with land upon which they could cultivate crops or graze animals, most of the lots were situated near the *mauka* road that ran through North Kona. Native tenants of Nāpu‘u requested Homestead lands as early as 1894, but the granting process was slow, and homesteaders competed for land that was also desirable for grazing use by Pu‘u Wa‘awa‘a Ranch. Indeed, the first applicants and recipients of fee simple title to land in Pu‘uanahulu were James Hind (brother of the primary lessee), Eben Parker Low, Elizabeth Napoleon-Low (wife of Eben P. Low), and Sanford Dole (the adoptive father of Elizabeth Napoleon-Low). Subsequently, by 1914, only a short time after native families began receiving title to their homestead lots in Pu‘uanahulu, Robert Hind began acquiring title to homestead lots from the native residents (Maly and Maly 2006). Generally speaking, the people who applied for homestead lots in a given land were long-time residents of the *ahupua‘a* or of neighboring lands. The documentation associated with the applications, also reveals that as a result of the conditions of the homesteading application process, the applicants had to live on the land requested, and had to prove that they had jobs and a secure income. Pu‘u Wa‘awa‘a Ranch (Maly and Maly 2006) offered the only available jobs in the remote Nāpu‘u Region. Because of this the native tenants had to maintain good relations with the ranch.

Robert Hind was clearly a significant individual with respect to the emerging sociopolitical economy of Hawai‘i and in 1916 became a significant political figure both regionally and nationally as he was appointed Hawai‘i Territorial Senator. A position he held for several years. It was during this tenure the Pu‘u Wa‘awa‘a Ranch, and the primary residence that was built there between 1905-1910 (named Pihanakalani), was visited by dignitaries from around the world. Pukui and Elbert (1986: 326) translate Pihanakalani as “gathering place [of] high supernatural beings.”

By the late 1920s, Hind began consolidating his interests in Pu‘uwa‘awa‘a Ranch (including the lease lands of Pu‘uanahulu and Pu‘uwa‘awa‘a and the various homestead parcels he acquired) under the corporation name “Robert Hind, Limited.” The following transaction was recorded in the Bureau of Conveyances Liber No. 911:1-4—

Mortgage – Robert Hind To Robert Hind, Limited, a Hawaiian Corporation Transferring General Leases of Puuanahulu and Puuwaawaa, and Grant No.’s — 4862 to Robert Hind, 25.38 acres; 5344 to Robert Hind, 4.16 acres; 6266 to Robert Hind, 3 acres; 6498 to Robert Hind, 3 acres; 6748 to Robert Hind, 3 acres; 5038 to Nipoa Pahia, 18.8 acres; 4594 to Eben P. Lowe, 116.1 acres, except 8.16 acres sold by the grantor to Margaret Mitchell by deed dated May 10, 1927; 5914 to Kinihaa Amona, 13.5 acres; 6147 to Kalani Nakupuna, 23.74 acres; 6148 to Kailihiwa Kuehu, Jr., 13.67 acres; 6156 to Keakealani Kuehu, 31.93 acres; 6159 to J.P. Cundell, Administrator of the Estate of J.W. Kaumelelau, 15.16 acres; 6149 to Joe Keoho, 7.30 acres, except for 2.33 acres sold by the grantor to D.H. Kahuila by deed dated May 31, 1927; and all livestock, improvements and equipment thereon comprising the PUUWAAWAA RANCH. (October 20, 1927)

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

> Puuwaawaa Ranch in North Kona, with the ranch headquarters beautifully located three miles above the government road, consists of a total of about 128,000 acres, but about 100,000 are waste lands covered with lava flows. Of the remaining 28,000 acres only 1,500 are really good grazing lands. About 100 acres are planted to cultivated crops. All but 300 acres held in fee simple are government leased lands. These lands run from sea level to an elevation of 6,000 feet. Some of the best grazing lands are found at 5,000 feet elevation.
>
> For many years there was practically no water on the ranch other than what the cattle could get from the dew and succulent vegetation. However, as the vegetation became scarcer water was required in all but a few paddocks well supplied with cactus where the cattle still grow to maturity without ever having access to free water. The limited water now available is secured from roofs, and a pipe line from Huehue Ranch.
>
> A total of about thirty miles of fences, half stone and half wire, are found on the ranch. At present, the ranch carries about 2,000 Herefords. All the bulls and thirty of the females are purebred. About 500 head, ranging between two and three years of age and dressing out at 500 pounds are marketed annually,—practically all are sent to Honolulu, being loaded on the steamers at Kailua.
>
> Only rarely are the bulls left with the breeding herd throughout the year. Usually they are turned out only during the seasons when grazing conditions are good, for the owner does not like to risk losing valuable bulls during adverse seasons. The good and bad seasons do not follow the same schedule year after year, so a definite pre-arranged breeding schedule, which would be preferable to get calves at the same time, is impossible.
>
> Calves are weaned at about six months of age, depending on the season. In bad seasons they are weaned earlier and taken to the best paddocks, which helps both the calf and the cow. An 85% calf crop was secured in 1928, but such a good percentage is not always secured.
>
> When bulls range with the cows throughout the year they average about one bull to thirty cows. For restricted breeding seasons more bulls are needed. The ranch carries about sixty light horses and raises about ten mules per year. Practically no swine and no sheep are kept.
>
> About two hundred dairy cattle of the Holstein and Guernsey breeds, ranging in age from four months to about two years can be found on the ranch at all times. These are the young calves from the Hind-Clarke dairy in Honolulu which are carried to the calving age at Puuwaawaa Ranch and then sent back to the dairy in Honolulu again.
>
> Bermuda grass (*Cynodon dactylon*) is considered one of the best grasses. Other grasses that do well are *Kukaipuaa* or crab grass (*Panicum pruriens*), Kentucky blue grass (*Poa priatensis*), Spanish needles (*Bidens pilosa*), Rhodes grass (*Chloris gayana*), Mesquite or Yorkshire fog (*Holcus lanatus*) on high elevations, orchard grass or cocksfoot (*Dactylis glomerata*), *Paspalum compressum*, bur clover (*Medicago denticulata*) and red top (*Agrostis stolonifera*). Native weeds supply some forage and in droughty seasons the cactus (*Opuntia* spp.) is a great asset for the cattle eat not only the young leaves but also manage to break off the spines with their feet and survive. Rat tail or New Zealand Timothy (*Sporobolus elongatus*) has also been introduced and seems to be spreading.
>
> The real beginning of Puuwaawaa Ranch was about 1892 when Robert Hind and Eben Low leased about 45,000 acres from the government and purchased about 2,000 head of cattle, —a mixture of Shorthorned, Angus and Devon breeds, from Frank Spencer, who had previously leased the lands of Puuanahulu, consisting of approximately 83,000 acres from the government. In 1893 Hind and Low acquired the lease on 12,000 acres of this area and in about 1917 Hind acquired the lease on the other 71,000 acres formerly in the Spencer lease. No cattle were carried on these 71,000 acres during the period 1893- 1917, but the land was pretty well overrun with goats… Since 1902 Robert Hind has been the sole owner of Puuwaawaa Ranch and he is still general manager of the ranch. (Henke 1929:43-44)

One of the significant problems faced by Hind in his ranching operation was competition that his herd faced from wild goats. By the turn of the century, the impact of goats on Hawaiian forests and lands valued by ranchers for economic purposes was causing alarm among land officials. On October 12, 1922, Charles Judd, Superintendent of Forestry in the Territory of Hawaii forwarded a communication to Governor Farrington describing conditions in the Nāpuʻu – Kekaha region. He observed:

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

It was estimated in the 1920s that there was one goat on every five acres of land, and Judd reported that in the ranch lands of Puʻuwaʻawaʻa and Puʻuanahulu, which comprised 105,000 acres, there were 21,000 wild goats. The lands of Kaʻūpūlehu and Kealakekua were combined, totaling 40,000 acres, meaning the goat population was estimated at 8,000 head (Hawaii State Archives Territorial Fish and Game Commission; Com-2, Box 15).

Following the development of the Puʻuwaʻawaʻa Ranch leases and operations, Robert Hind and several business associates applied for, and were granted fee simple title to parcels of land on the coast of Puʻuanahulu and Puʻuwaʻawaʻa. Those include the following parcels:

Land Patent Grant No. 6498 to Robert Hind; Nov. 26, 1915.
Kiholo Beach Lot 1 – 3.0 acres; Puuwaawaa.
Land Patent Grant No. 6748 to Robert Hind; Jan. 4, 1917.
Kiholo Beach Lot 2 – 3.0 acres; Puuwaawaa.
Land Patent Grants No.'s 9943, 9944, and 9945 to Robert Hind; Dec. 22, 1930.
Kiholo Beach Lots 8, 7 and 9 – three parcels at 3.0 acres each; Puuwaawaa.
Land Patent Grant No. 10,433 to Dorothy Von Holt; Aug. 28, 1936.
Weliweli Beach Lot 13 – 2.70 acres; Puuanahulu-Puuwaawaa Beach Lots.
Land Patent Grant No. 10,431 to Robert Hind; Aug. 19, 1936.
Kiholo Beach Lot 11 – 0.71 acres; Puuwaawaa.
Land Patent Grant No. 10,432 to R. Leighton Hind; Aug. 15, 1936.
Kiholo Beach Lot 12 – 3.0 acres; Puuwaawaa.
Land Patent Grant No. 9071 to Frances H.I. Brown; July 15, 1926.
Keawaiki Beach Lot 4 – 3.0 acres; Puuwaawaa-Puuanahulu.
S.S.A. 1612 to Sanji Abe; February 24, 1937.
Kiholo Beach Lot 14 (Luahinewai Lot) – 2.65 acres; Puuwaawaa.
(Transferred to Marjorie C. Hind, March 16, 1937)

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

In the same time period, the Commissioner announced that bidding for the leases would be opened, and for the first time, there was active competition against Hind's interests. On October 12, 1937, the bidding closed with Hind retaining the lease, paying almost three times the original asking price, for the period of twenty-one years (effective August 15, 1939). The Commissioner of Public lands subsequently issued a new General Lease, No. 2621 (boundaries described in C.S.F. 8592), with descriptions of the boundaries and consolidation of all lands from General Lease No.'s

971, 1038 and 1039. (see General Leases in Land Division and State Survey Division Files; and Honolulu Advertiser and Star Bulletin articles of October 12 & 13, 1937).

C.S.F. 8592 (Figure 16) dated March 24, 1938, provides the survey coordinates for the revised and combined lease, containing a total area of 125,000 acres. The lease excluded the following —

Puuanahulu Homesteads (Lots 1 to 40 inclusive and roads	853.41 Acres
Puuanahulu-Puuwaawaa Beach Lots 1 to 14 inclusive	39.06 "
Grant 4862 to Robert H. Hind	25.28 "
Grant 5344 to Robert H. Hind	4.16 "
Grant 6266 to Robert H. Hind	3.00 "
Grant 9513 to S.L. Desha, Sr.	1.22 "
Grant 10286 to A.W. Carter, Trustee	25.09 "
Grant 10290 to A.W. Carter Trustee	20.72 "
North Kona Belt Road (F.A.P. 10-A and F.A.P. E-10-B)	79.67 "
	1051.71 Acres

Leaving a Net Area of 123,948.29 Acres.

> …Also excepting and reserving there from all existing roads and trails within this tract and such other roads, trails and other rights-of-way that may be required for public purposes, said rights-of-way to be designated by the Commissioner of Public Lands. (C.S.F. 8592)

Robert Hind died in December 1938. Robert Hind, Limited, under the direction of Trustee John K. Clarke (who oversaw the trust until his death in 1951), continued operation of the Puʻuwaʻawaʻa Ranch holdings, and various interests both on Hawaiʻi (Puʻuwaʻawaʻa, Captain Cook, and Honomalino) and Oʻahu (Aina Haina). Paddocks of the ranch (both older walled pastures and newer fenced pastures) as they exist in the present-day were basically in place by the 1940s. The paddocks range from approximately the 1,000 foot elevation, through the forest lands, to the upper boundary of Puʻuwaʻawaʻa, and also take in the rich *kula* lands of Puʻuanahulu (that surround the historic homestead lots). In 1948, the ranch contracted surveyor, Charles Murray to prepare a map of the ranch paddocks and fencing projects that were underway. The map (Figure 17) also identifies the names of the paddocks, as they were remembered by the *kamaʻāina* cowboys. The current project area falls within the "Ohia Paddock."

In 1955, the Commissioner of Public Lands proposed to Robert Hind, Limited (R. Hind, Ltd.), removing approximately 500 acres of land—consisting of the area made up by Puʻu Waʻawaʻa—from General Lease No. 2621. The goal being to lease it out to a firm interested in mining rights. The proposal was accepted by R. Hind, Ltd., with the provision that measures would be taken to protect Hinds' private and remaining leasehold interests. The Puuwaawaa Quarry Site was auctioned on November 8, 1955, and the lease (No. 3528) sold to Volcanite, Limited (also known as Hawaiian Ornamental Concrete Products, Ltd.), for the period of 21 years (Land Division File – Lease No. 3528). The survey description and map of the Puuwaawaa Quarry Site is recorded in C.S.F. 12,205 (in the collection of the State Survey Division). The lease allowed Volcanite, Ltd.:

a. to dig, excavate, blast and quarry trachyte-pumice, for the primary purpose of utilizing or selling the same for concrete aggregate or for the manufacture of clay products…but not for the primary purpose of extracting mineral of any sort except trachyte-pumice.

b. to construct, maintain and operate a plant (together with camps and other structures appurtenant thereto) for the purpose of crushing materials; and

c. to remove, use and sell trachyte-pumice, pursuant to the provisions of paragraph (a) above, and also soil and quarry waste incidentally derived from digging, excavating, blasting and quarrying… (General Lease No. 3528)

The lease included a number of conditions, among which were two conditions regarding protection of "the triangulation stations located on Puuwaawaa Hill" and:

9. That the Licensee shall in no way deface the northwest half or rim of said Puuwaawaa Hill, and shall not unduly deface any of the remainder of said Hill…above the Rim, which Rim, for the purposes herein is that irregular line ranging from the 3350-foot to 3600-foot contours… Further, the Licensee shall level and fill all pits and other excavated areas to the end that there will be a slope to enable the proper drainage of water and to prevent the stagnation of water… (General Lease No. 3528)

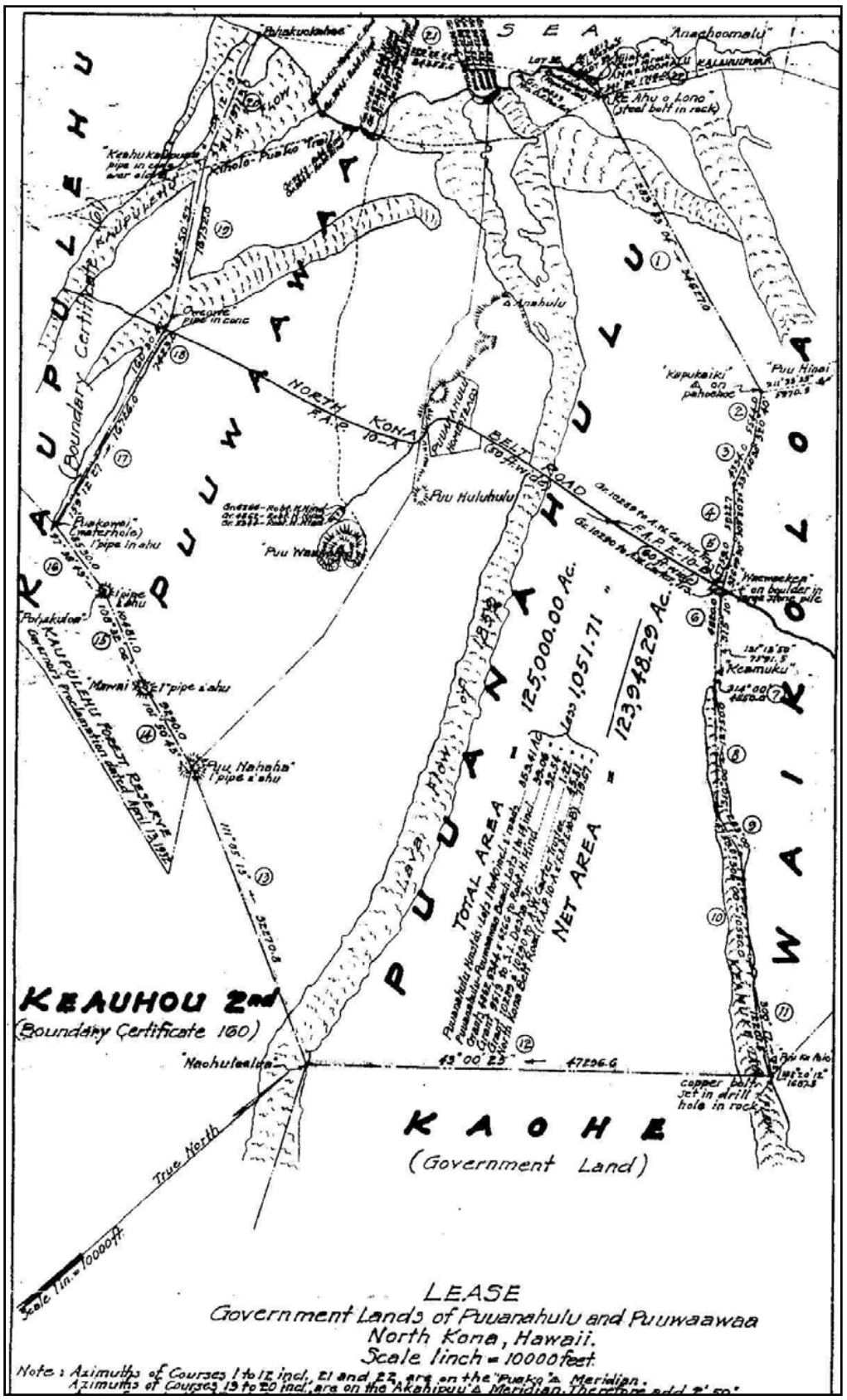

Figure 16. Pu‘uanahulu and Pu‘uwa‘awa‘a (C.S.F. 8592), Feb. 25, 1938.

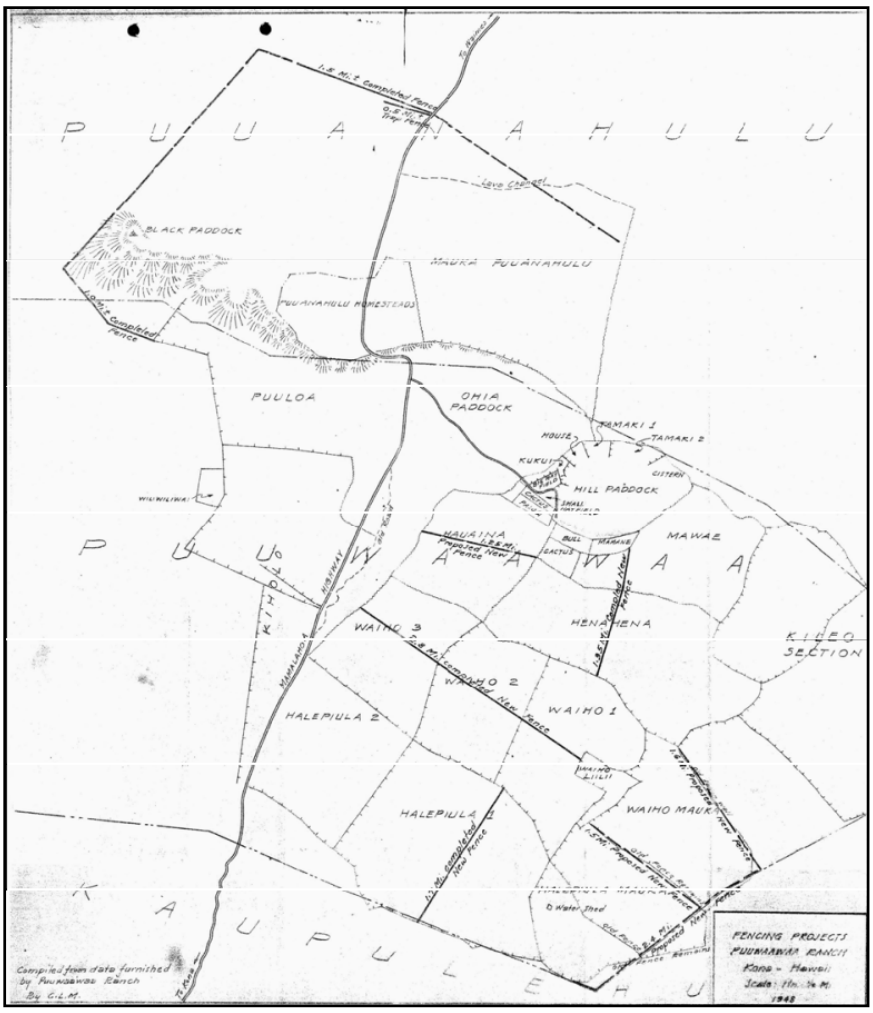

Figure 17. Paddocks of Pu‘uwa‘awa‘a Ranch (reduction of map compiled by Chas. L. Murray, 1948).

A review of communications in the packet of General Lease No. 3528, reveals that several complaints were made in the 1950s and 1960s regarding infractions by the lessee, of the aforementioned cited lease agreement. Volcanite Ltd. voluntarily surrendered its lease on October 13, 1967, and applied for a land license that was issued as Revocable Permit No. 2-4134. Revocable Permit No. 2-4134 remained in effect from April 1, 1968 to October 31, 1972, and was then covered under Land License No. S-99, which expired on March 31, 1988.

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

> Robert Hind, Limited, the lessee of these lands up to June 30, 1958, was able to operate a reasonably successful cattle operation on the Puuanahulu and Puuwaawaa lands prior to and including 1949. Due to periodic drought to which the area is subject and to increased operating costs the company suffered losses on cattle operations each year thereafter. Recognitions that only by greater beef production could the company meet increased operating costs and only by a large investment in water systems and range improvements could a greater production be achieved, were compelling factors in Robert Hind, Limited’s decision to sell its Kona interests to Dillingham Investment Corporation and its wholly owned subsidiaries.

> Robert Hind, Limited was not in financial position to undertake the heavy investments necessary to effect more intensive use of its Kona lands. There being no prospect of either the County of Hawaii or the Territory of Hawaii being able to provide water supply for the widespread grazing areas, the only out for the owners of Robert Hind, Limited was sale to companies better able to finance extensive improvements. (G.L. No. 2621; State of Hawaii Land Division)

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

PREVIOUS ARCHAEOLOGICAL STUDIES

John Reinecke (n.d.) conducted the first archaeological survey of Hawaiian sites in the Kekaha region in 1929-1930 on behalf of the Bishop Museum. Reinecke's recorded six sites along the Puʻuwaʻawaʻa shoreline:

> **Site 129**. Luahinawai [Luahinewai] is a pond behind a black sand beach; no ruins. Waiaelepi is a shallow pond of practically fresh water. From the Kaupulehu Flow on is a grove of *kiawe* and the cattle pasturing under it have undoubtedly destroyed several sites. There is a pen behind Waiaelepi, where there has been a house or a cowboys' camp. Then come concrete salt pans and a fine terraced platform of stones [Muller's salt works]. There are traces of shelters at the foot of the dune of black pebbles. Remains of a pen with very thick, low walls on three sides. From here on is a continuous row of traces at the foot of the beach and under the *kiawe*. Especially noticeable are the large boulders at the back of the platforms, pens, or enclosed house sites—now it cannot be said which. Toward the north end of this area is a pen and a recent house site.
>
> **Site 130**. Many shelters on the reddish lava block of the *kiawe*.
>
> **Site 131**. Large cave [Keanalele] with three feet of almost fresh water.
>
> **Site 132**. Two narrow pens extend north, enclosing the *kiawe* and stagnant pools. Behind them are two yards, with three house sites between them. Between the cave and the pens is a lot containing a house platform. There are two other very ruinous platforms outside, and a bordered, coral-strewn path running a short distance *mauka* through a few shelters. Back of the pens a considerable distance are many small hut sites or shelters. They may have been temporary structures. There is also a hollow fenced on all but the perpendicular side, recent. Several waterholes, one walled up.
>
> **Site 133**. Ruins of five modern houses at the south end of Kiholo Bay. There are many walls in this area. The area back of the ponds is difficult to penetrate due to the *kiawe*. I found only two ruins, a platform c. 75x25x0-1 and a rough heap that had been a medium-sized platform.
>
> **Site 134**. Excellent stone platform at the south-end of the long lagoon, probably quite modern.

There have been several, more recent archaeological studies conducted within Puʻuwaʻawaʻa Ahupuaʻa (Ching 1971; Rosendahl 1973; Ahlo 1982; Rechtman and Wolforth 1999; McGerty and Spear 2000; Ketner et al. 2008) (Table 1 and Figure 18). The report by McGerty and Spear (2000) is the only one that encompassed the current project area. Additional archaeological reports prepared for the neighboring *ahupuaʻa* of Puʻuanahulu (Barrera 1997; Dye et al. 2002; Walker et al. 1990) provide additional information on the existence of archaeological resources of the Nāpuʻu region. Relevant findings from these archaeological studies are presented in chronological order below.

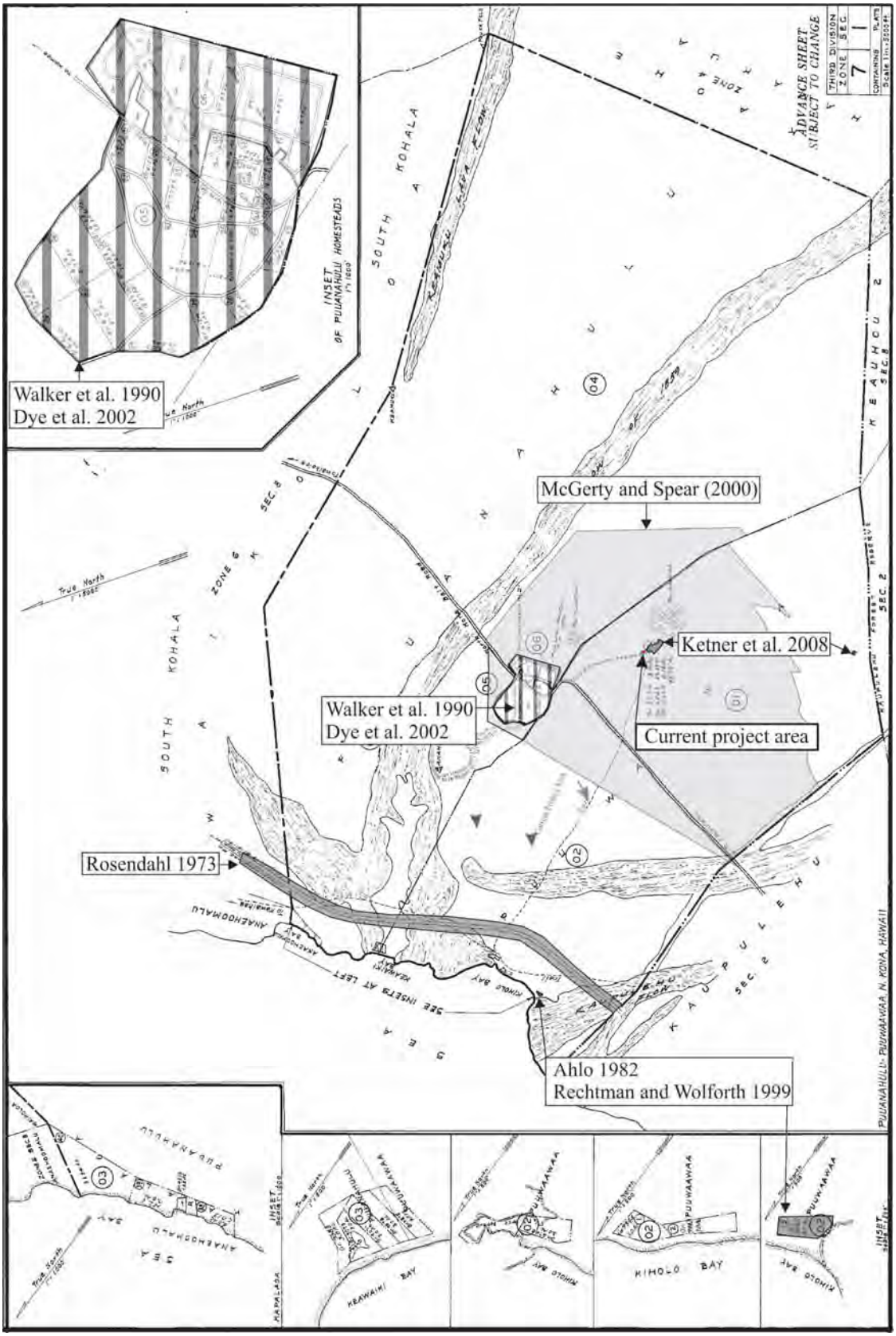

Figure 18. Previous archaeolocial studies conduted in the vicinity of the current project area.

Table 1. Previous archaeological studies conducted within the vicinity of the project area.

Year	*Author*	*Area*	*Type of Study*
n.d	Reinecke	Various	Survey
1971	Ching	Lalamilo to Hamanamana	Survey and Testing
1973	Rosendahl	Keāhole-Anaehoʻomalu	Salvage Operations
1982	Ahlo	Puʻuwaʻawaʻa	Reconnaissance Survey
1990	Walker et al.	Puʻuahahulu	Inventory Survey
1997	Barrera	Puʻuanahulu	Inventory Survey
1999	Rechtman and Wolforth	Puʻuwaʻawaʻa	Inventory Survey
2000	McGerty and Spear	Puʻuanahulu/Puʻuwaʻawaʻa	Reconnaissance Survey
2002	Dye et al.	Puʻuanahulu	Supplemental Inventory Survey
2008	Ketner et al.	Puʻuwaʻawaʻa	Inventory Survey

As part of the planning of the Queen Kaʻahumanu Highway, extensive archeological survey and testing work (Ching 1971) was conducted in the right-of-way corridor of the then-proposed highway (see Figure 18). The road corridor crosses lava fields that contain little to no soil. Within the section of road corridor that contained Puʻuwaʻawaʻa Ahupuaʻa, many features that span from Precontact times to the Historic Period were recorded, and include a portion of the Kīholo-Kaʻūpūlehu trail, enclosures, caves (burials, habitation, shelter, or refuge), cairns, petroglyphs, walls and areas containing surface midden. All of these features are similar to those found at other places along the road corridor and provide important information to the overall use of barren lava landscapes and the relationship of these places to the coastal and upland portions of the *ahupuaʻa*. In 1972, archaeologists from the Bishop Museum performed archaeological salvage operations (Rosendahl 1973) within and adjacent to the Keāhole-Anaehoʻomalu section of the highway corridor. A total of 284 features were slated for salvage investigations within the Keāhole-ʻAnaehoʻomalu section of the alignment corridor, none of which were within Puʻuwaʻawaʻa.

In 1982, Science Management, Inc. conducted an archaeological reconnaissance survey of a three-acre parcel at Kīholo Bay in Puʻuwaʻawaʻa Ahupuaʻa (Ahlo 1982), north of the current project area (see Figure 18). Their study area extended northeasterly from the Kaʻūpūlehu lava flow (1800-1801) approximately 600 feet, paralleling the shore on the southwestern end of Kīholo Bay. The entire study parcel appeared to have been previously bulldozed. As a result of their survey, two sites were recoded; a cattle enclosure and evaporating ponds used for salt making during the 1920s and 1930s with associated cobble platforms. The platforms were interpreted as supporting either a sleeping house for the caretaker of the salt ponds or possibly as a shed used to store salt or tools.

In 1990, Paul H. Rosendahl, Ph.D., Inc. (PHRI) conducted an archaeological inventory survey of approximately 400 acres within Puʻuanahulu Ahupuaʻa (Walker et al. 1990), east of the current project area (see Figure 18). As a result of their survey, eleven sites were identified, and included feature types such as; terraces, mounds, enclosures, modified outcrops, cairns, c-shapes, alignments, cultural deposits and a possible cistern. No Precontact features were identified during the survey and many of the features were interpreted as related to Historic ranching or homesteading.

In 1999, PHRI conducted an archaeological survey of a nine-acre area at Kīholo Bay in Puʻuwaʻawaʻa Ahupuaʻa (Rechtman and Wolforth 1999), north of the current survey corridor (see Figure 21). As a result of that survey, thirteen sites were recorded, seven of which were within their study parcel and six were off. The six that were off were recorded in an effort to mitigate the re-routing of the access road. All of the sites encountered were interpreted as temporary habitations that were used during the procurement of coastal resources. The sites contained fifty-one features comprised of; c-shapes, u-shapes, enclosures, possible quarries, rock piles, shelters (blister and/or lava tubes), and a habitation platform.

In 1999, Scientific Consultant Services, Inc. conducted a reconnaissance of 22,000 acres within both Puʻuanahulu and Puʻuwaʻawaʻa Ahupuaʻa, a portion of which included the current project area (McGerty and Spear 2000) (see Figure 18). As a result of the reconnaissance four previously recorded sites and thirty-two new sites were encountered. Site types included temporary habitation caves, burial caves, agricultural sites (mounds, terraces, and enclosures), cairns, and nineteenth and early twentieth century ranching features (enclosures, rock and mortar building with water tank). McGerty and Spear (2000) did not report any sites within the current project area.

In 2002, International Archaeological Research Institute, Inc. produced supplemental research to support an archaeological inventory survey done by William Barrera in 1997 of approximately 150 acres at Puu Lani Ranch within Puʻuanahulu Ahupuaʻa (Dye et al. 2002), east of the current project area (see Figure 18). This supplemental report was conducted in order to bring the original inventory report up to State Historic Preservation Division (SHPD)

archaeological inventory survey standards. As a result, most of the twenty-two sites originally recorded by Barrera (1997) were relocated. In addition to the twenty-two previously recorded sites, International Archaeological Research Institute, Inc. identified and recorded eleven new sites and many additional features present at Barrera's previously recorded sites. The sites consisted of Historic Period features comprised mainly of core-filled walls, agricultural mounds, house platforms, burials (platform, mound, and soil), overhang shelters, temporary habitation caves, modified outcrops, Historic petroglyphs, enclosures, and a road bed. All of the features were interpreted as relating to Historic ranching or homesteading.

In 2008, Rechtman Consulting, LLC conducted an archaeological inventory survey of TMK: (3) 7-1-01:002 por. and 006 por. comprising roughly 32.5 acres and TMK: (3) 7-1-001:003 which was comprised of roughly 2.7 acres, located in Pu'uwa'awa'a Ahupua'a, adjacent to and *mauka* of the current survey corridor (Ketner et al. 2008) (see Figure 19). As a result of their inventory survey two historic properties were identified: SIHP Site 26170, the historic Pu'uwa'awa'a Ranch; and SIHP Site 26171, the Hale Piula water catchment area. Both of these resources date from no earlier than the late nineteenth century and contain mostly architectural elements. There were no Precontact resources observed during that study.

3. PROJECT AREA EXPECTATIONS

Based on a review of historical information previously collected by Maly and Maly (2006), the findings of previous archaeological research within the current project area (McGerty and Spear 2000) and immediately adjacent to it (Ketner et al 2008), historical documentary research, and settlement patterns for the North Kona District, the archaeological expectations for the current project area are extremely limited. This area was actively used as pasture beginning in the late nineteenth century until the present. There may be some ranching features such as wall and fence lines present, and there is a remote possibility of lava blister features being present reflective of early Historic/late Precontact habitation and burial activities.

4. CONSULTATION AND CURRENT FIELD INVESTIGATION

On March 5, 2014 Robert B. Rechtman, Ph.D. and Genevieve L. Glennon, B.A. met separately with Miki Kato and Ralph Alapai before conducting a thorough surface survey of the entire roughly 2-acre project area, the boundaries of which were evident in the field. Miki Kato has lived in the *ahupua'a* since about 1962 and worked at the Pu'uwa'awa'a Ranch since 1956; he currently lives about ½ mile *makai* of the project area. Ralph Alapai's family has been resident in the Pu'uwa'awa'a/Pu'uanahulu area for centuries, and Alapai family have been associated with ranching in the area since the late 1880s. Ralph currently maintains cattle in the vicinity of the project area. Both individual are familiar with and very knowledgeable about the general area and neither indicated that they knew of the presence of any archaeological or cultural sites or that any cultural practices have occurred within the current project area.

The archaeological surface survey involved the systematic inspection of the project area, with the field investigators walking north/south transects at a 20 meter spacing interval. As the vegetation consisted primarily of grazed pasture grasses ground visibility was excellent**.** There were no archaeological features observed on the surface and given the nature of the substrate, there is virtually no likelihood of encountering subsurface remains.

5. CONCLUSION AND RECOMMENDATIONS

Given the negative findings of the prior archaeological reconnaissance (McGerty and Spear 2000) and concurrence with those findings as a result of the current study, it is concluded that the proposed solar photovoltaic project will not significantly impact any known historic properties. In the unlikely event that any unanticipated archaeological resources are unearthed during development activities, in compliance with HAR 13§13-280 work in the immediate vicinity of the finds should be halted and DLNR-SHPD contacted.

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