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STATE OF HAWAI'I
DEPARTMENT OF LAND AND NATURAL RESOURCES

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HONOLULU, HAWAI'I 96809

Ref: OCCL:LY

CDUA: HA-3797

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OFC. OF ENVIRONMENTAL QUALITY CONTROL
AUG 08 2017

To: Scott Glenn, Director
Office of Environmental Quality Control

From: Suzanne D. Case, Chairperson
Department of Land and Natural Resources

Subject: Final Environmental Assessment (FEA) for Conservation District Use Application (CDUA) HA-3797 for the Dearing Single Family Residence (SFR) and Agriculture Farm, located at Keonepoko Iki, Puna, Hawai'i
Tax Map Keys (TMK): (3) 1-5-009:055

The Department of Land and Natural Resources has reviewed the FEA for the subject project and has determined a Finding of No Significant Impact (FONSI). Please be advised, however, that this finding does not constitute approval of the proposal.

The Draft EA was published in the May 23, 2017 edition of *The Environmental Notice*. Comments on the Draft EA were sought from relevant agencies and the public, and were included in the Final EA. The FEA has been prepared pursuant to Chapter 343, Hawai'i Revised Statutes and Chapter 11-200, Hawai'i Administrative Rules. Please publish this notice in OEQC's upcoming August 23, 2017 edition of *The Environmental Notice.*

We have enclosed one (1) hard copy of the DEA and OEQC publication form, as well as one (1) CD with a pdf file of the Final EA/FONSI. A separate e-mail shall be sent with the OEQC publication form in word document format for publication purposes.

Please contact Lauren Yasaka of the Office of Conservation and Coastal Lands staff at 587-0386 should you have any questions.

Attachments: *FEA, OEQC Pub Form, 1 CD*

18-055

APPLICANT
PUBLICATION FORM

Project Name:	Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko
Project Short Name:	Dearing Residence and Farm
HRS §343-5 Trigger(s):	Use of Land in Conservation District
Island(s):	Hawai'i
Judicial District(s):	Puna
TMK(s):	3-1-5-009-055
Permit(s)/Approval(s):	County of Hawai'i: Special Management Area Permit or Exemption Plan Approval and Grubbing, Grading, and Building Permits State of Hawai'i: Conservation District Use Permit Wastewater System Approval Water Well Permit
Approving Agency:	Hawai'i State Department of Land and Natural Resources
Contact Name, Email, Telephone, Address	Lauren Yasaka, Staff Planner, DLNR-OCCL 808-587-0386, lauren.e.yasaka@hawaii.gov DLNR- Office of Conservation and Coastal Lands 1151 Punchbowl Street, Room 131 Honolulu HI 96813
Applicant:	
Contact Name, Email, Telephone, Address	Garrett B. Dearing 801 Kakala St. #42, Kapolei, Hawai'i 96707 C/O James Leonard 808-896-3459; jmleonard.mac.com
Consultant:	
Contact Name, Email, Telephone, Address	Ron Terry, Geometrician Associates LLC 808-969-7090 rterry@hawaii.rr.com P.O. Box 396 Hilo, Hawai'i 96721

Status (select one)	**Submittal Requirements**
___ DEA-AFNSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.
_x_ FEA-FONSI	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.
____ FEA-EISPN	Submit 1) the approving agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.
____ Act 172-12 EISPN ("Direct to EIS")	Submit 1) the approving agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.
____ DEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.
____ FEIS	Submit 1) a transmittal letter to the OEQC and to the approving agency, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.

____ FEIS Acceptance Determination	The approving agency simultaneously transmits to both the OEQC and the applicant a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
____ FEIS Statutory Acceptance	The approving agency simultaneously transmits to both the OEQC and the applicant a notice that it did not make a timely determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and therefore the applicant's FEIS is deemed accepted as a matter of law.
____ Supplemental EIS Determination	The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.
____ Withdrawal	Identify the specific document(s) to withdraw and explain in the project summary section.
____ Other	Contact the OEQC if your action is not one of the above items.

Project Summary

Provide a description of the proposed action and purpose and need in 200 words or less.

Garrett Dearing plans a single-family residence and fruit-tree farm on his 6.79-acre Conservation District property near the Hawaiian Shores subdivision in the Puna District, Island of Hawaii. The one-story, 20-foot tall home would be setback 100 feet from the shoreline. Associated features include a swimming pool, lanais, wells, a drainage retention/irrigation pond, a barn, an IWS, and a driveway. The home would not be visible from the Government Beach Road and barely visible from offshore. The property was almost fully bulldozed decades ago during previous farming, which left many ornamental and fruit trees. A primarily alien forest with some hala trees is now present, and the Dearings have planted fruit trees and ornamentals near the driveway. Hala trees would be preserved as much as feasible and integrated into the farm. Banana, mango, coconut, durian, and lychee would be planted in holes with minimal ground disturbance. Landclearing that would occur over less than an acre would produce short-term impacts to noise, air and water quality, and scenery, mitigated by Best Management Practices associated with the Farm Management Plan. One endangered plant, *Ischaemum byrone,* is being preserved and managed. These grass clumps' survival is primarily due to the Dearings' ongoing care. Impacts to the islandwide-ranging endangered Hawaiian hoary bats and Hawaiian hawks will be avoided through vegetation removal timing. Archaeological survey found one site, a mid-20th century wall used as a camping windbreak, which has been sufficiently studied and will be removed. There will be no interference with shoreline access or traditional cliff fishing and opihi picking.

Final Environmental Assessment

Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko

August 2017

TMK (3rd): 1-5-009-055
Keonepoko Iki, Puna, County of Hawai‘i, State of Hawai‘i

APPLICANT:

Garrett Dearing
801 Kakala St. #42,
Kapolei, Hawai‘i 96707

DETERMINING AGENCY:

State of Hawai‘i
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
1151 Punchbowl Street, Room 131
Honolulu, Hawai‘i 96813

CONSULTANT:

Geometrician Associates LLC
P.O. Box 396
Hilo, Hawai‘i 96721

Final Environmental Assessment

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CONSULTANT:

Geometrician Associates LLC
P.O. Box 396
Hilo, Hawai‘i 96721

CLASS OF ACTION:

Use of Land in Conservation District

This document is prepared pursuant to:
The Hawai‘i Environmental Protection Act,
Chapter 343, Hawai‘i Revised Statutes (HRS), and
Title 11, Chapter 200, Hawai‘i Department of Health Administrative Rules (HAR).

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APPENDIX 2 Archaeological Inventory Survey
APPENDIX 3 Cultural Impact Assessment
APPENDIX 4 Farm Management Plan
APPENDIX 5 Coastal Erosion Study

SUMMARY OF PROJECT, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Garrett Dearing (the applicant) seeks a Conservation District Use Permit (CDUP) to build a single-family residence and farm on his 6.79-acre property located *makai* of the Government Beach Road in Keonepoko Iki, northwest of the Hawaiian Shores subdivision, in the Lower Puna area of the Island of Hawai‘i. In addition to the home, he is seeking to permit development of a fruit tree farm with a water well and backup well, a barn, a water tank with capacity for on-demand water supply, and a pond for storing irrigation water, capturing excess runoff and supplying fire flow. A Farm Management Plan specifying Best Management Practices has been developed.

The one-story, 20-foot tall home would have three bedrooms, three baths, a kitchen, a study, a dining room, a living room, a laundry room, a garage, and various lanais, porches and decks. The total interior space would be 2,412 square feet (sf), with a 616-sf garage, 1,044 sf of lanai and porches, and 850-sf of swimming pool and pool decking, for a total footprint of 4,922 sf. The home and all related improvements would be set back from the edge of the cliff a minimum of 100 feet, about 120 to 130 feet from the actual edge of the water. An Individual Wastewater System in compliance with State Department of Health regulations will be built. The home would not be visible from the Government Beach Road and only subtly visible from offshore waters.

The property was almost fully bulldozed in the mid-20th century as part of a former coconut farm. Since then, a primarily alien forest with some hala has grown up. The Dearings have added to the existing ornamental and fruit trees and shrubs around the driveway. Hala trees would be preserved as much as feasible and integrated into the landscaping and farm. The farm would feature banana, mango, coconut, durian, lychee and other fruit trees, planted in holes with minimal disturbance of the ground. A 713-sf, 13-foot tall “barn” would be built about 200 feet from the Government Beach Road to accommodate tractor-parking, a fertilizer/pesticide storage room, a small bathroom necessary for hygiene and worker use, and tool storage.

Landclearing and construction activities would occur over less than an acre, with very minor short-term impacts to noise, air and water quality and scenery. These would be mitigated by Best Management Practices associated with the CDUP, grading permit and a Farm Management Plan. The applicant will ensure that all earthwork and grading conforms to applicable laws, regulations and standards. The site has been surveyed for threatened and endangered plants and the one species present (*Ischaemum byrone*) is being preserved and managed. Impacts to the island wide-ranging endangered Hawaiian hoary bat and Hawaiian hawk will be avoided through timing of vegetation removal and/or hawk nest survey. Archaeological survey has determined that only one site is present – a mid-20th century wall used as a camping windbreak. This site has been studied and will be removed. In the unlikely event that additional undocumented archaeological resources, including shell, bones, midden deposits, lava tubes, or similar finds, are encountered during construction within the project site, work in the immediate area of the discovery will be halted and the State Historic Preservation Division will be contacted to determine the appropriate actions. The proposed residential use will not interfere in any way with use of the boulder shoreline below the cliff for fishing or opihi picking.

PART 1: PROJECT DESCRIPTION AND E.A. PROCESS

1.1 Project Description and Location

Garrett Dearing (the applicant) seeks a Conservation District Use Permit (CDUP) to build a single-family residence and farm on his 6.79-acre property (TMK 3rd: 1-5-009:055) located *makai* of the Government Beach Road in Keonepoko Iki, northwest of the Hawaiian Shores subdivision, in the Lower Puna area of the Island of Hawai‘i (see Figures 1-2). In addition to the home, he is seeking to establish a fruit tree farm with a water well and backup well, a barn, a water tank with capacity for on-demand water supply, and a pond for storing irrigation water, capturing excess runoff and supplying fire flow.

The one-story, 20-foot tall home would have three bedrooms, three baths, a kitchen, a study, a dining room, a living room, a laundry room, a garage, and various lanais, porches and decks. The total interior space would be 2,412 square feet (sf), with a 616-sf garage, 1,044 sf of lanai and porches, and 850-sf of swimming pool and pool decking, for a total footprint of 4,922 sf. The home and all related improvements would be set back from the edge of the cliff a minimum of 100 feet, about 120 to 130 feet from the edge of the water. An Individual Wastewater System in compliance with State Department of Health regulations will be built. The home would not be visible from the Government Beach Road and only subtly visible from offshore waters. The Site Plan in Figure 3 provides an overall plan view of the property, the residence floor plan and elevations, the barn plans, and a landscape plan. A 610-foot long, 12-foot wide driveway (mostly already existing) would lead to a 2,800-sf turnaround area near the home. A 50-foot long, 12-foot wide driveway would lead to a 2,100-sf turnaround area near the barn. All driveways and turnaround areas would be paved.

The property was almost entirely bulldozed in the mid-20th century in association with a former coconut farm. Since then, a primarily alien forest has grown up. Some hala trees, which readily resprout after bulldozing, are also present. Hala trees are planned to be preserved as much as feasible and integrated into the landscaping and farm. In addition to ornamentals that were planted prior to their ownership of the property, the Dearing Family has planted some ornamentals and fruit trees around the driveway, as shown in Figure 3. The application for the CDUP requests that these plants be included in the permitted use. The plantings in the area of the driveway would thus include a continuation of the existing plantings and incorporation into the farm landscape, except for those particular plants where there may be an indication of having invasive or weedy characteristics, including jasmine, mock orange, gingers, heliconia, and certain orchids, as indicated by the USFS Pacific Island Ecosystem at Risk (PIER) (http://hear.org/pier/) and University of Hawai‘i, College of Tropical Agriculture and Human Resources (UH-CTAHR), *Weeds of Hawai‘i* site (https://www.ctahr.hawaii.edu/invweed/weedsHi.html).

The house site was placed 100 feet *mauka* of the cliffed shoreline in order to avoid disturbance to native shoreline vegetation. This consists of hala trees, naupaka shrubs, and several patches of the endangered grass *Ischaemum byrone*, which the Dearing family has repeatedly protected from destruction by ironwood needle shedding (see photos in Figure 2, and Landscape Plan at the end of Figure 3 for typical locations). The house site is partially within an existing clearing, but all trees in the area, including about six hala trees and several dozen non-native trees, would be removed to make room for the home. The

Figure 1 Project Location Map

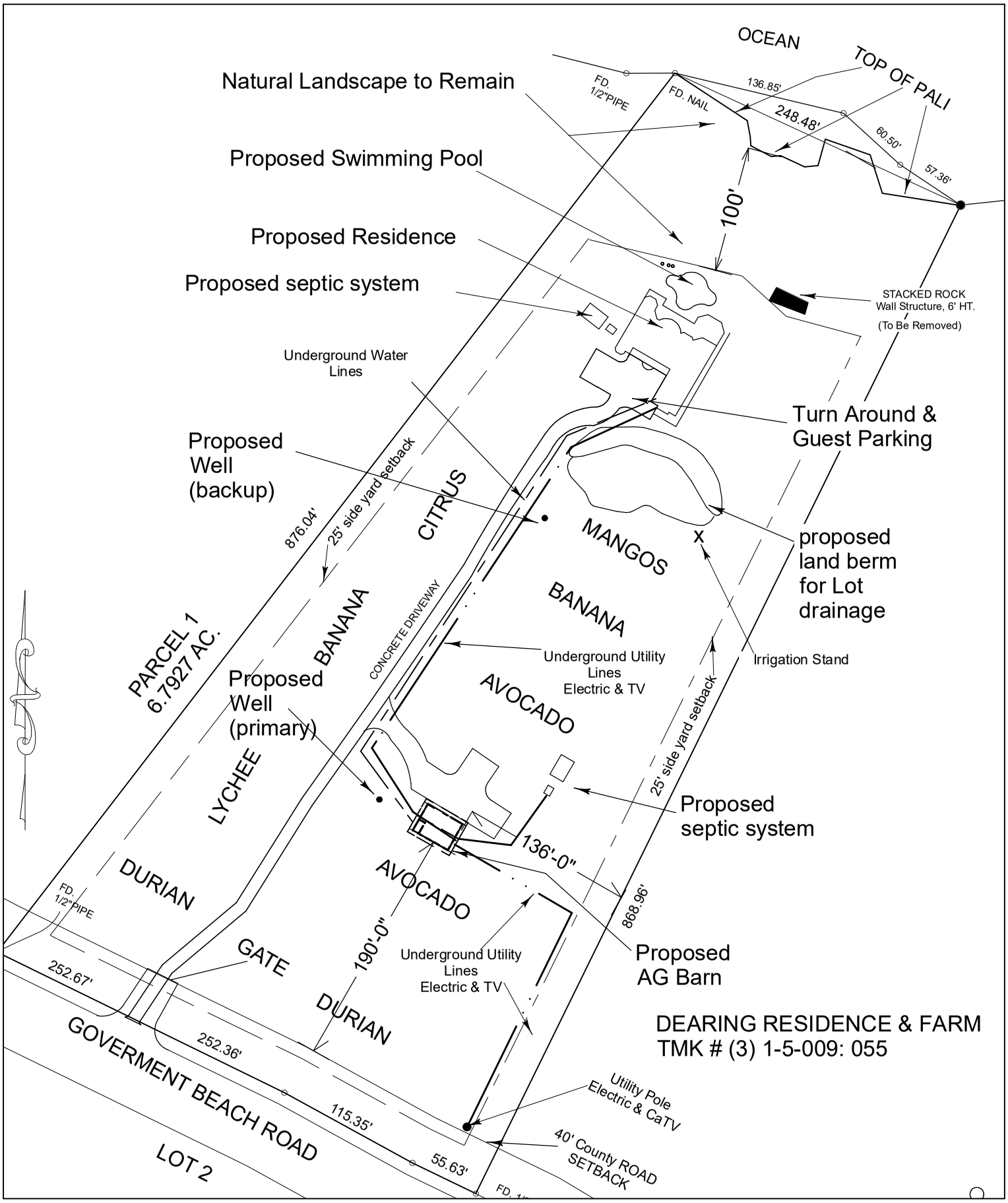
young, vigorous hala trees would be relocated towards the periphery of the site, as part of a total of ten hala trees that would be planted or relocated there. The ironwoods between the proposed residence site and the sea cliff would be thinned and trimmed for a view and breeze corridor, which will also avoid having tall, shallow-rooted ironwood trees that could potentially damage the home during high winds. As shown in the landscape plan in Figure 3, about 20 ironwood trees would be removed between the home and the cliff. Most of the cut debris and logs would be chipped, composted and used onsite for mulch as part of the farm operation. Following the pruning, thinning, and removal of the ironwoods in the *makai* area, this area will be replanted with hala. It is expected that, with the removal of the ironwoods, the native naupaka found primarily along the top of the cliff face will gradually extend into this area so that the vegetation will eventually include a mix of native species similar to that found in remainder of the *makai* area. It is important to reiterate that the great majority of hala trees in this area and elsewhere on the property would be retained, and additional hala and other native and Polynesian vegetation would be planted.

Figure 2. Site Photos

2a, Above, Proposed home site, with windbreak rock structure. 2b, Below: Shoreline area *mauka* of cliff

Figure 2. Site Photos

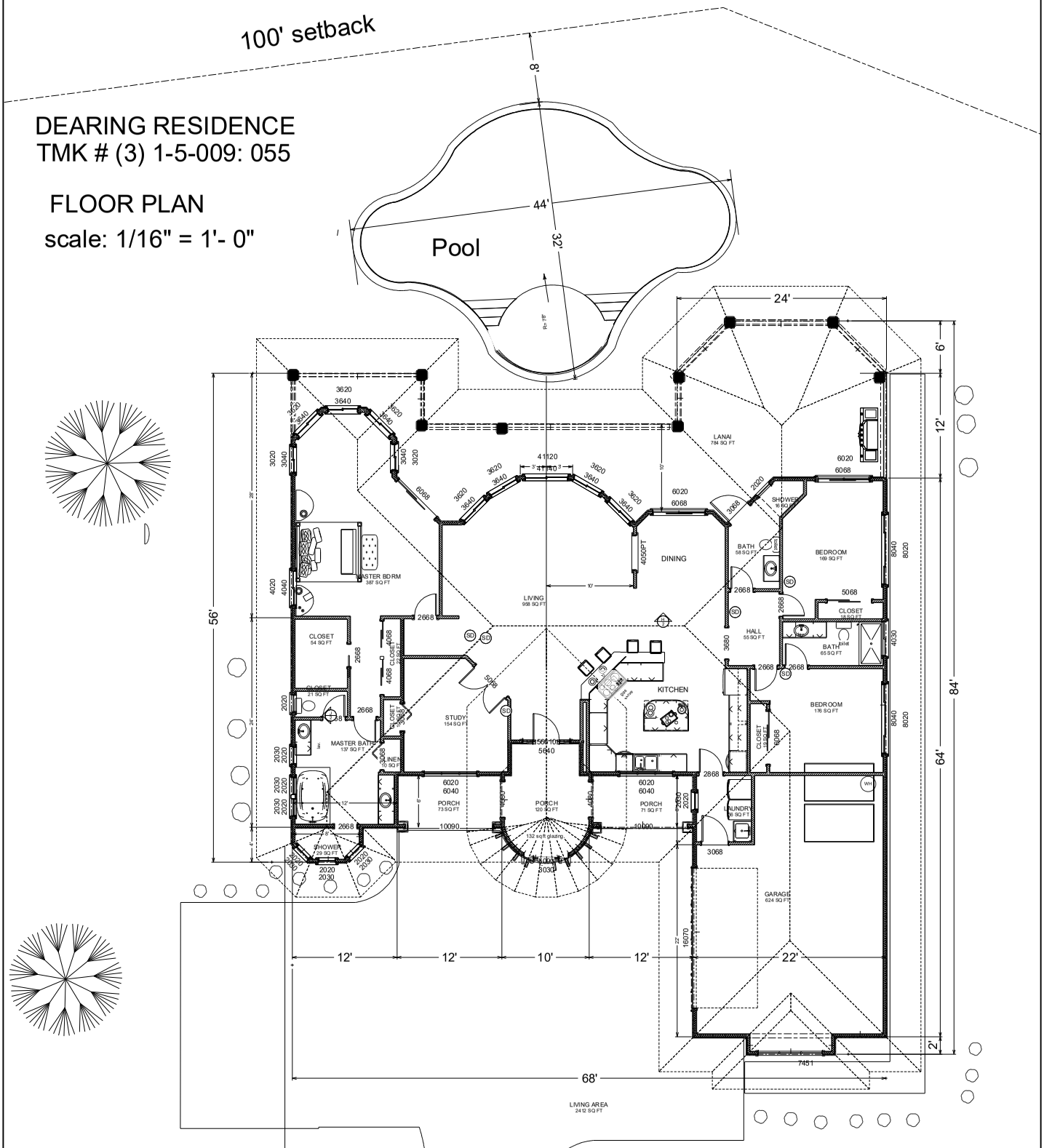
2c, Above: Existing driveway and landscaping. 2d, Below: *Ischaemum byrone* patch


OCEAN
TOP OF PALI
Natural Landscape to Remain
FD. 1/2"PIPE
FD. NAIL
136.85'
248.48'
60.50'
57.36'
Proposed Swimming Pool
100'
Proposed Residence
Proposed septic system
STACKED ROCK Wall Structure, 6' HT.
(To Be Removed)
Underground Water Lines
Turn Around & Guest Parking
Proposed Well (backup)
25' side yard setback
876.04'
CITRUS
MANGOS
X
proposed land berm for Lot drainage
BANANA
CONCRETE DRIVEWAY
PARCEL 1
6.7927 AC.
BANANA
Underground Utility Lines Electric & TV
Irrigation Stand
Proposed Well (primary)
AVOCADO
25' side yard setback
LYCHEE
Proposed septic system
136'-0"
DURIAN
AVOCADO
868.96'
FD. 1/2"PIPE
190'-0"
Underground Utility Lines Electric & TV
Proposed AG Barn
GATE
252.67'
DURIAN
DEARING RESIDENCE & FARM
TMK # (3) 1-5-009: 055
252.36'
GOVERMENT BEACH ROAD
Utility Pole Electric & CaTV
115.35'
40' County ROAD SETBACK
55.63'
LOT 2

1" = 100'

DEARING RESIDENCE
TMK # (3) 1-5-009: 055

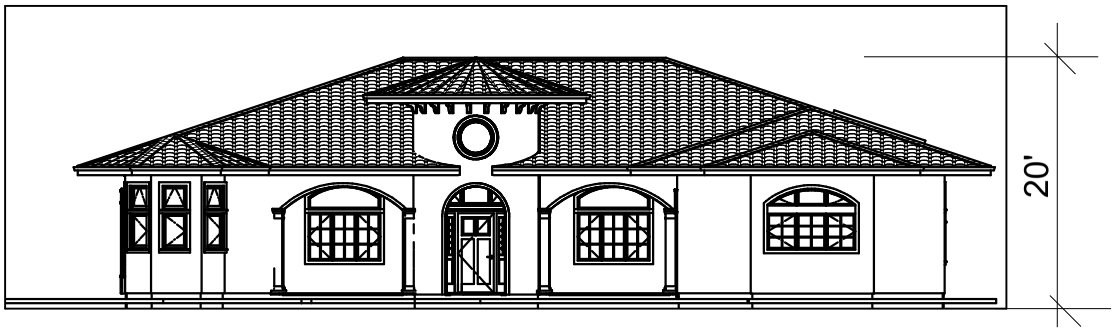
FLOOR PLAN
scale: 1/16" = 1'- 0"



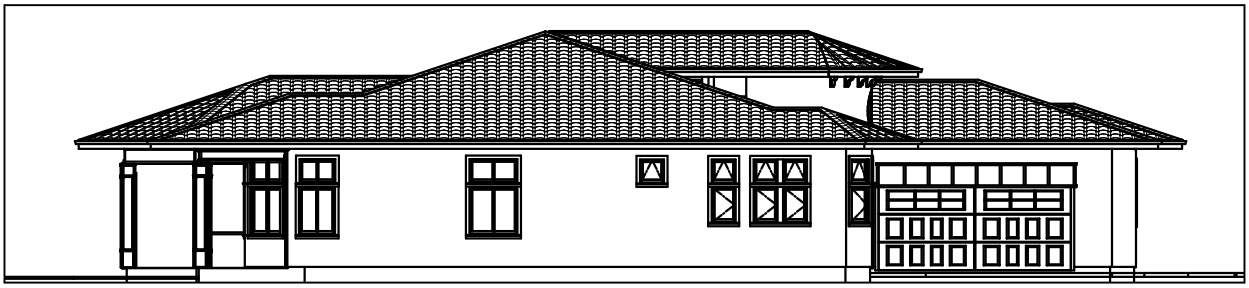
Area Tabulation:
2,412 sq. ft. Interior
784 sq. ft. Lanai
260 sq. ft. Porches
616 sq. ft. Garage
850 sq. ft. Pool & Surround
4,922 sq. ft. Total

DEARING RESIDENCE
TMK # (3) 1-5-009: 055

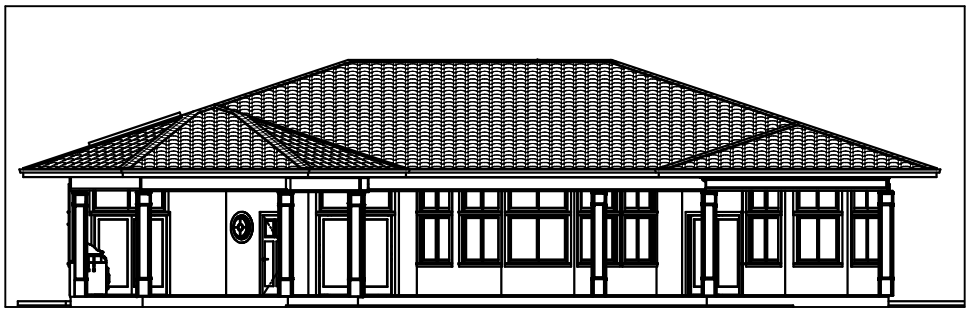
scale: 1/16" = 1'- 0"



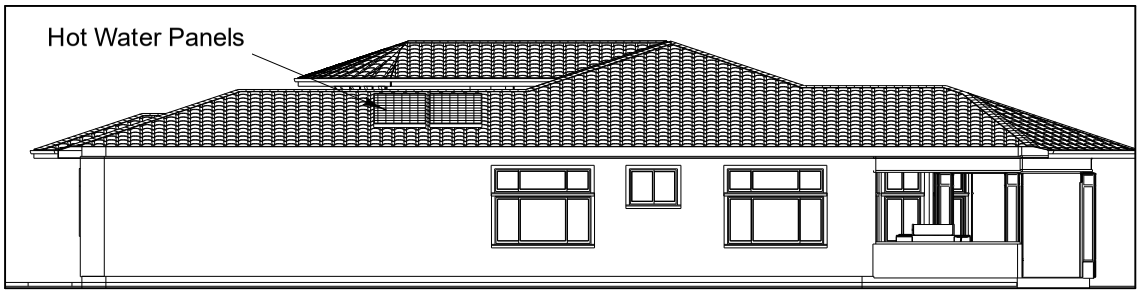
SOUTH WEST ELEVATION



NORTH WEST ELEVATION

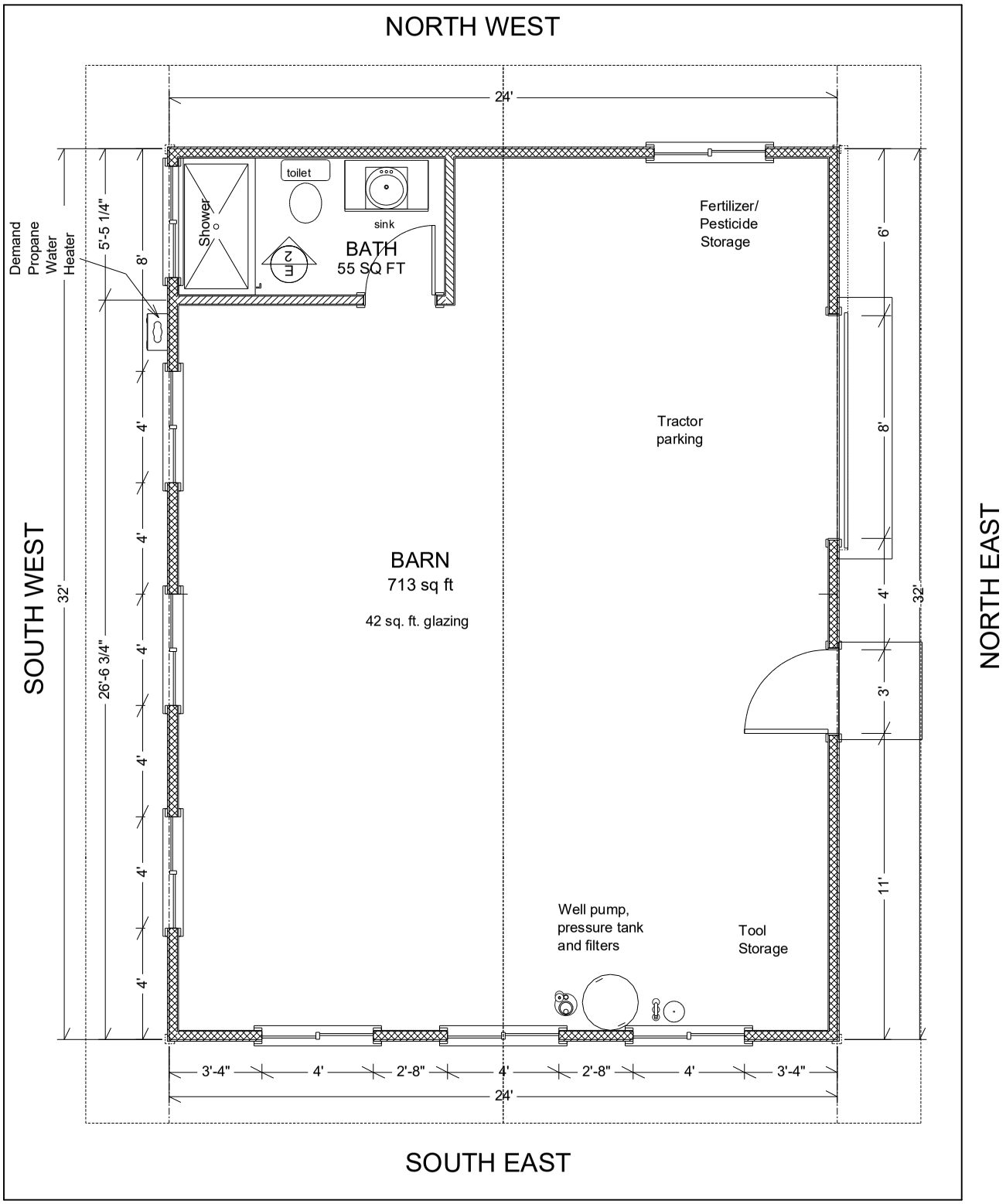


NORTH EAST ELEVATION



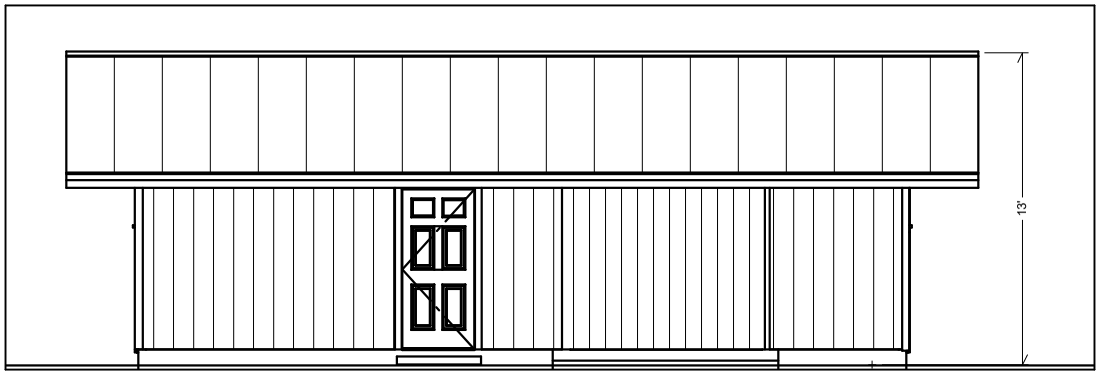
SOUTH EAST ELEVATION

DEARING BARN
TMK # (3) 1-5-009: 055
scale: 3/16" = 1'- 0"

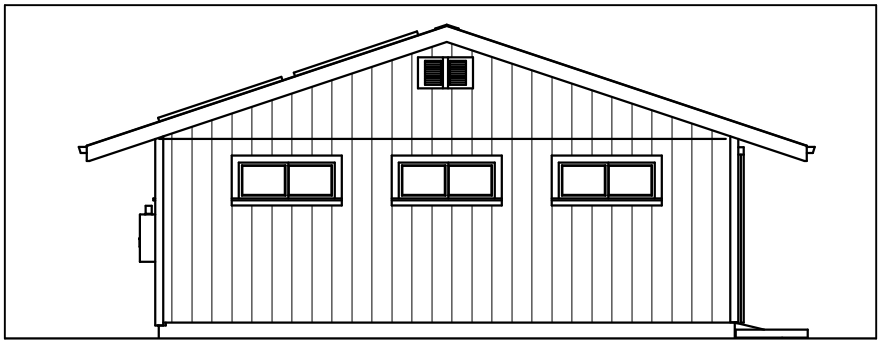


FLOOR PLAN

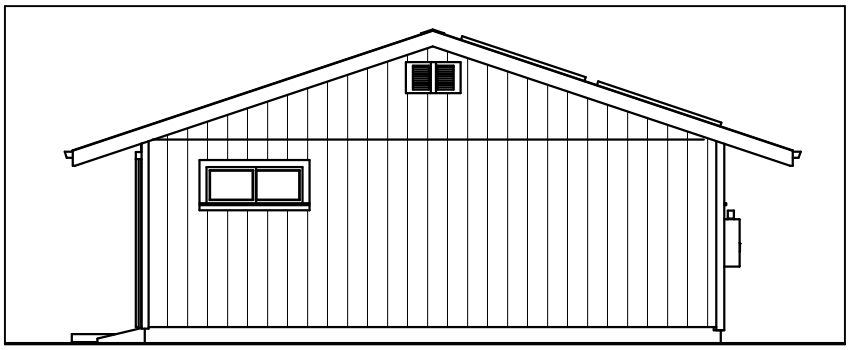
DEARING BARN
TMK # (3) 1-5-009: 055
scale: 1/8" = 1'- 0"



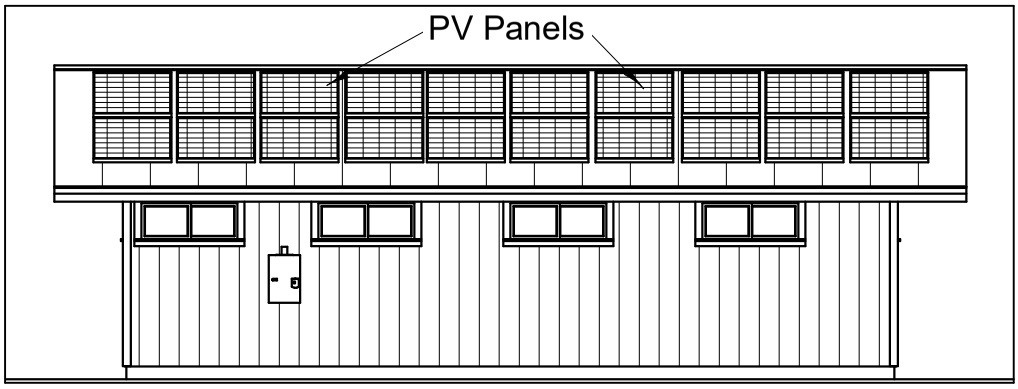
NORTH EAST ELEVATION



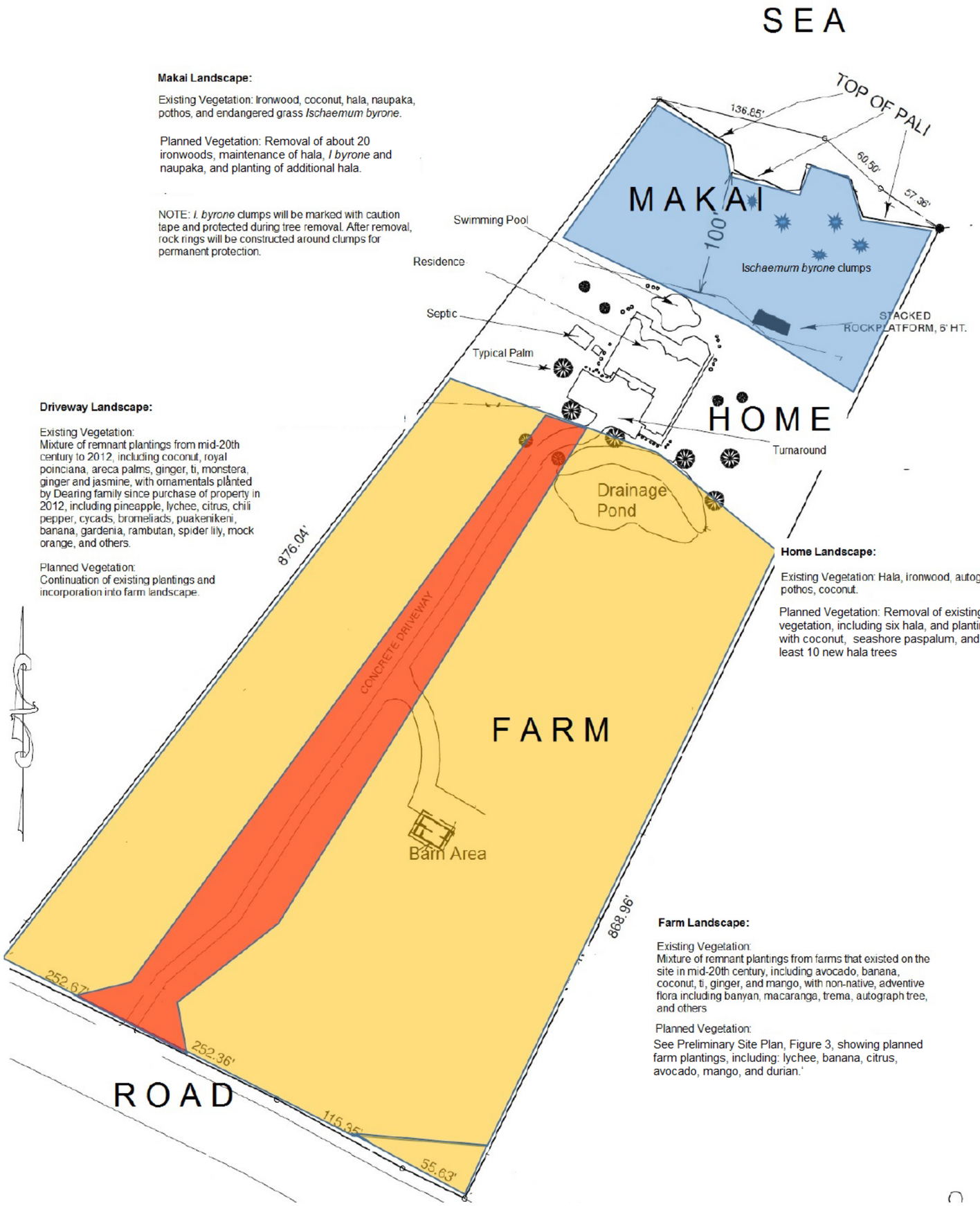
SOUTH EAST ELEVATION



NORTH WEST ELEVATION



SOUTH WEST ELEVATION



Makai Landscape:

Existing Vegetation: Ironwood, coconut, hala, naupaka, pothos, and endangered grass *Ischaemum byrone*.

Planned Vegetation: Removal of about 20 ironwoods, maintenance of hala, *I byrone* and naupaka, and planting of additional hala.

NOTE: *I. byrone* clumps will be marked with caution tape and protected during tree removal. After removal, rock rings will be constructed around clumps for permanent protection.

Driveway Landscape:

Existing Vegetation:
Mixture of remnant plantings from mid-20th century to 2012, including coconut, royal poinciana, areca palms, ginger, ti, monstera, ginger and jasmine, with ornamentals planted by Dearing family since purchase of property in 2012, including pineapple, lychee, citrus, chili pepper, cycads, bromeliads, puakenikeni, banana, gardenia, rambutan, spider lily, mock orange, and others.

Planned Vegetation:
Continuation of existing plantings and incorporation into farm landscape.

Home Landscape:

Existing Vegetation: Hala, ironwood, autograph tree, pothos, coconut.

Planned Vegetation: Removal of existing vegetation, including six hala, and planting with coconut, seashore paspalum, and at least 10 new hala trees

Farm Landscape:

Existing Vegetation:
Mixture of remnant plantings from farms that existed on the site in mid-20th century, including avocado, banana, coconut, ti, ginger, and mango, with non-native, adventive flora including banyan, macaranga, trema, autograph tree, and others

Planned Vegetation:
See Preliminary Site Plan, Figure 3, showing planned farm plantings, including: lychee, banana, citrus, avocado, mango, and durian.'

The farm would occupy about 5 acres of the property and feature banana, mango, citrus, durian, avocado, lychee and coconut trees, planted in holes with minimal disturbance of the ground. A 713-sf, 13-foot tall "barn" would be built about 200 feet from the Government Beach Road to accommodate tractor parking, a fertilizer/pesticide storage room, a bathroom necessary for hygiene and worker use, and tool storage. Two-inch PVC irrigation lines with sprinklers and smaller lines will extend through the cultivated areas.

A farm management plan (FMP) has been prepared for the CDUP application and is attached as Appendix 4. In summary, the FMP is meant to ensure that the environmental impacts of farming are minimized to the extent feasible, in keeping with the values of the Conservation District. To meet this goal, improvements to the property and farm operation and management will meet the following objectives:

- Siting improvements in previously disturbed areas, taking advantage of the existing topography so as to minimize the amount of grading required.
- Maintaining a protective buffer area along the coast that will be left in its natural state and undisturbed for the protection of the native species and the marine environment.
- Providing drainage related improvements in concert with a drainage plan to prevent any farm runoff from the site to the ocean.
- Implementing a program for Best Management Practices collectively aimed at maximizing crop production while minimizing potential environmental or health impacts from farm activities.
- Implementing a program for the systematic removal of invasive species that cover much of the property and monitoring for their ongoing control.

BMPs have been formulated through consultation of the University of Hawai‘i-Manoa, College of Tropical Agriculture and Human Resource's *Best Management Practices to Manage Non-Point Pollution in Agriculture* (Abbas and Fares 2009). These include short-term practices meant to control erosion and sedimentation related to the relatively small amount of ground disturbing activities.

There will also be long-term practices related to soil management and other farm practices. The emphasis is placed on cultivation practices that minimize tillage, add organic material to the soils and establish ground covers. As proposed at the farm, these objectives would be achieved by creating holes for the tree plantings rather than grading or tilling the area for cultivation; maintaining the existing ground cover; and adding mulch from onsite composting and green-waste. Existing ground conditions in the farm are typically rocky with only a thin layer of organic soils. The fractured lava rock substrate makes for well-draining soil conditions with low potential for ponding or soil erosion. Any soil that is present or added at the tree plantings will be retained in place by berming soil around individual plantings. Water will be managed through effective irrigation, also referred to as "right time-right amount" irrigation, to ensure that the specific crop water requirements are met, without overwatering and excessive soil, nutrient, or chemical movement. BMPs for nutrient management will monitor and regulate the application of nutrients to the soil according to the specific crop nutrient requirements. Nutrient management also includes selecting and using the appropriate organic manure amendments, which can help build and stabilize soils while reducing the need for chemical nutrients. Pests will be managed through integrated pest management stressing pest-resistant crops, biological control, removal and eradication of pests, and, only where necessary, safe and effective storage, handling and application of pesticides.

Finally, there will be regular and ongoing monitoring of the farm soil, water and plant conditions in order to identify potential environmental or biological threats early on; insure the effective use of available resources; and maintain optimum growing conditions for the selected crops. The Dearing family is experienced in growing fruit trees and expects to be fully capable of establishing and managing the farm in conformance with the Farm Management Plan.

1.2 Environmental Assessment Process

This Environmental Assessment (EA) process is being conducted in accordance with Chapter 343 of the Hawai‘i Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200, of the Hawai‘i Administrative Rules (HAR), is the basis for the environmental impact assessment 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, based on the preliminary findings for each criterion made by the consultant in consultation with the Hawai‘i State Department of Land and Natural Resources, the determining agency. If, after considering comments to the Draft EA, DLNR 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 to other necessary permits. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, then an Environmental Impact Statement (EIS) will be prepared.

1.3 Public Involvement and Agency Coordination

The following agencies, organizations and individuals have been consulted during the Environmental Assessment Process:

County:

Planning Department	County Council	Civil Defense Agency
Fire Department	Department of Public Works	Police Department

State:

Department of Health
Department of Land and Natural Resource (DLNR)
Office of Hawaiian Affairs

Private:

Sierra Club	Malama O Puna
Three Adjacent Property Owners	

Copies of communications received during early consultation are contained in Appendix 1a. Notice of the availability of the Draft EA was published in the May 23, 2017 *OEQC Environmental Notice*. Appendix1b contains written comments on the Draft EA and the responses to these comments. Various places in the EA have been modified to reflect input received in the comment letters; additional or modified non-procedural text is denoted by double underlines, as in this paragraph.

PART 2: ALTERNATIVES

2.1 Proposed Project, Alternative House Sites and Alternative Uses

The proposed project and its location are described in Section 1.1 above and illustrated in Figures 1-3. The location of the home site, at a minimum of 100 feet from the sea cliff that represents the shoreline, was chosen in order to enjoy coastal breezes and views on the property. In its inland section, the property is heavily vegetated with non-native trees that will be largely replaced with a fruit tree farm and associated facilities, including a barn, a well, and a drainage basin/irrigation pond.

A number of other locations on the property could also serve as the site for a residence, but none have the advantages of the proposed site in terms of breezes and views, while both avoiding impacts to native shoreline vegetation (which is restricted to about 80 feet inland) and offering a location for the farm and its infrastructure. There is no known environmental or other reason for seriously considering other sites on the property.

No other alternative uses for the property that are identified in the Conservation District Rules, such as a commercial tourist nature park, are desired by the applicant, and thus none are addressed in this EA.

2.2 No Action

Under the No Action Alternative, the residence would not be built and the farm would not be established. The lot would remain unused, except for temporary camping and picnicking by the owner. This EA considers the No Action Alternative as the baseline by which to compare environmental effects from the project.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION

The 6.79-acre property is located between the Government Beach Road on the south side and the shoreline of the Pacific Ocean on the north side, flanked by similarly sized private parcels that currently have no active land uses (see Fig. 1). The shoreline in this area is neatly defined by the edge of a seacliff, in front of which is a sloping field of angular and rounded boulders that is about 50 feet wide. *Mauka* of the seacliff the ground is gently sloping, with natural lava undulations in the first 100 feet, *mauka* of which the lot has been bulldozed and slopes gently and evenly up toward the Government Beach Road (see photos in Figure 2 for each of these zones). The ground in the inland area is fairly flat and densely vegetated with primarily alien trees and shrubs (see Figure 2). U.S. Geological Survey maps and Google Earth images indicate that elevations on the property vary from about 25 to 75 feet above sea level.

3.1 Physical Environment

3.1.1 Climate, Geology, Soils and Geologic Hazards

Environmental Setting

The property is located on the flank of Kilauea, an active volcano, in the District of Puna, in the *ahupuaʻa* of Keonepoko Iki. This area receives an average of about 120 inches of rain annually, with a mean annual temperature of approximately 75 degrees Fahrenheit (Giambelluca et al 2014; UH Hilo-Geography 1998:57). The lava flows of this area are all derived from eruptive vents on Kilauea volcano's East Rift Zone, located as close as four miles east of the project site. The specific lava flows that underlie the project site erupted between 200 and 750 years by Moore and Trusdell (1991). Two primary stratigraphic units underlie the area. Although vegetation and soil cover largely obscure rocks *mauka* of the shoreline, coastal exposures reveal them. The lower 10 to 15 feet of shoreline bluff consists of a complex of ʻaʻā flow lobes erupted sometime in the interval between 400 and 750 years ago. Whether each of these lobes is a product of an individual eruption or they all pertain to a single multi-phase outpouring over a long period of time cannot be determined. Northwestward, the flow core slants toward sea level and there is a buildup of 10 feet of angular fragments or rock that are cemented together, called breccia. Capping this flow is a much thinner "veneer" of pahoehoe that may have erupted 360 years ago. The flow ranges in thickness from one to three feet.

Soil in the area is classified within the Malama series, which is characterized as deep, well drained soils consisting of organic material over fragmental ʻaʻā lava substrata at a shallow depth. The specific soil is Malama extremely cobbly highly decomposed plant material. It has a soil subclass of VIIs, which means it has limitations that make it unsuitable for cultivation and restrict its use to pasture, range, woodland or wildlife. (U.S. Soil Conservation Service 1973).

The entire Big Island is subject to geologic hazards, especially lava flows and earthquakes. Volcanic hazard as assessed by the U.S. Geological Survey in this area of Puna is Zone 2 on a scale of ascending risk 9 to 1 (Heliker 1990:23). The relatively high hazard risk is because Kilauea is an active volcano. Zone 2 includes areas adjacent to and downslope of active rift zones. About 15 to 25 percent of the area

has been covered by lava since 1800, and about 25 to 75 percent has been covered in the last 750 years. As such, there is some risk of lava inundation over a 50-year span. Several towns and villages in Puna, including Pāhoa, Kalapana and Kapoho, are within Zone 2.

The Island of Hawai‘i experiences high seismic activity and is at risk from major earthquake damage (USGS 2000), especially to structures that are poorly designed or built, as the 6.7-magnitude quake of October 15, 2006 demonstrated. The portion of the property site proposed for improvement has been graded and is flat to low-sloping. There are appropriate setbacks to surrounding steeper slopes, with a minimum of 100 feet to the low (20 to 30-foot tall) sea cliffs. There does not appear to be a substantial risk at the site from subsidence, landslides or other forms of mass wasting.

Impacts and Mitigation Measures

In general, geologic conditions do not impose undue constraints on the proposed action, as much of the Puna District faces similar volcanic and seismic hazard and yet continues to be the fastest growing region of the State. The applicant understands that there are hazards associated with homes in this geologic setting, and has made the decision that a residence is not imprudent to construct or inhabit.

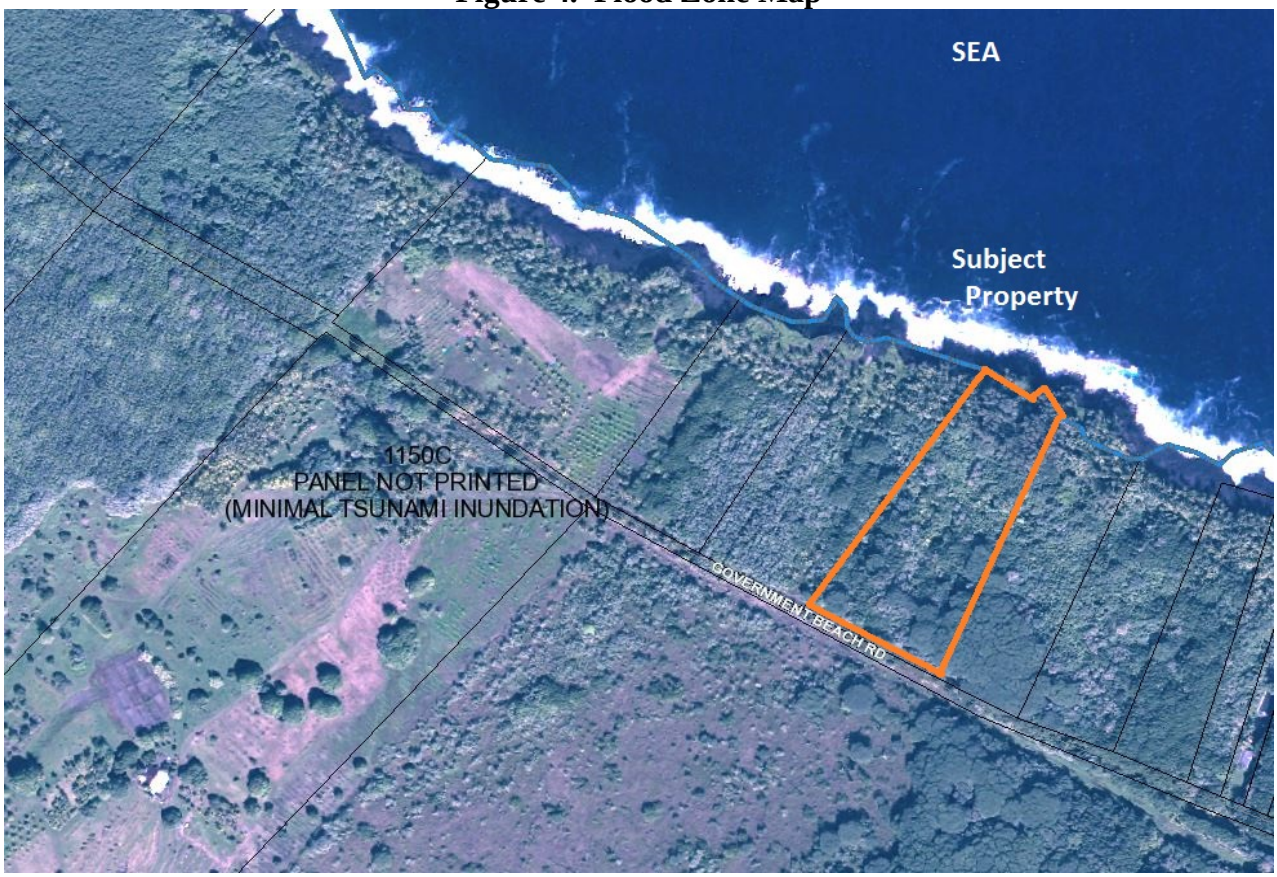
3.1.2 Flood Zones and Shoreline Setting

Floodplain Environmental Setting, Impacts and Mitigation Measures

Floodplain status for many areas of the island of Hawai‘i has been determined by the Federal Emergency Management Agency (FEMA), which produces the National Flood Insurance Program’s Flood Insurance Rate Maps (FIRM). No flood map for the project area has been printed. The home building site is classified in Flood Zone X, areas outside the mapped 500-year floodplain, with minimal tsunami inundation (Figure 4).

The home would be located at least 25 feet above sea level, 100 feet back from the top of the 12 to 20-foot tall sea cliff that marks the shoreline here (and a minimum of about 120 to 130 feet from open water), with no evidence of tsunami inundation, out of the flood zone. Other than mega-tsunami of the type that would inundate all of Hilo and Honolulu, the site is not at risk of tsunami. The proposed site for the residence is also completely out of the area affected by high waves. During Tropical Storm Iselle, which hit the Puna coastline on August 8, 2014, Mr. Dearing and his family carefully monitored the wave activity. The storm did cause several invasive trees to topple, which emphasizes the need for removal or thinning of these hazards. They chose to locate the home a minimum of 100 feet from the cliff in order to completely avoid wave damage and minimize spray from waves.

Figure 4. Flood Zone Map



Source: Hawai‘i DLNR: http://gis.hawaiinfip.org/fhat/

Coastal Erosion Issues: Background

Property near the shoreline is subject to natural coastal processes including erosion and accretion, which can be affected by human actions such as removal of sand or shoreline hardening. Erosion may adversely affect not only a lot owner's improvements but also State land and waters, along with the recreational and ecosystem values they support. Development of shoreline properties also exposes residents and visitors to increased risk of hazardous high waves and tsunami.

Single Family Residential permitting in Conservation Districts in the State of Hawai‘i is regulated by State of Hawai'i Administrative Rules governing Conservation Districts (Title 13, Subtitle 1 Chapter 5, adopted August 12, 2011). Applications to permit shoreline residential construction in the Conservation Districts must consider rates of coastal erosion. The State DLNR requires an estimate of annual erosion rate for any property for which construction is proposed in the form of a "Coastal Erosion Study". Such a study integrates on-site quantitative measurements by a credentialed specialist or specialists, inspection of available aerial and satellite imagery taken over a period of time, and a review of relevant geological literature.

A Coastal Erosion Study was prepared for the property by Geohazards Consultants International, Inc. The full report is attached as Appendix 5 and summarized below.

Coastal Erosion: Physical Setting

As discussed in Section 3.1.1, two primary geologic stratigraphic units underlie the area, which are well exposed along the cliff in front of the property. The lower 10 to 15 feet is a complex of ʻaʻā flow lobes erupted sometime in the interval between 400 and 750 years ago. A single massive flow core (Figure 5a) and its related breccia dominates the bluff along this length of the shore, presenting a somewhat simple impression of the significantly more involved eruptive sequence observed elsewhere. Northwestward, the flow core slants toward sea level as associated superjacent breccia attains its greatest thickness on-site, approximately 10 feet (Figure 5b). This is also the area in which the erosion on the property is most evident. Capping the ʻaʻā is a much thinner "veneer" of pahoehoe, which ranges in thickness from about one to three feet. The flow does not entirely overlie the older ʻaʻā within the property, and is absent at the site of the breccia accumulation.

The terrain on the Dearing property slopes gently (less than 4.1% grade) from its frontage on Government Beach Road to the rim of a littoral bluff or low sea cliff that rises from 12 to 20 feet above mean sea level. This cliff is in turn separated from the water by a natural buffer zone of eroded rocky debris ranging from 30 to 80 feet wide, depending upon specific location, tidal, and sea conditions (see Figure 5a). The shoreline is not linear, but rather is gently scalloped with a maximum point-to-head of inlet distance of approximately 80 feet

The coast of this part of the Puna District faces the open ocean with no barrier of offshore reefs or bars. The submarine slope is approximately 1,300 feet/mile for a distance of roughly 6 miles, descending into the deepwater Puna Canyon. Large waves reaching the coast are predominantly related to trade wind conditions, though the shoreline is also exposed in part to North Pacific swells. Some storm-related breakers reported by the property owner have sent frothy water over the 12 to 20-foot high bluff line at least several meters inland. The total range of tidal change is about 2.4 feet.

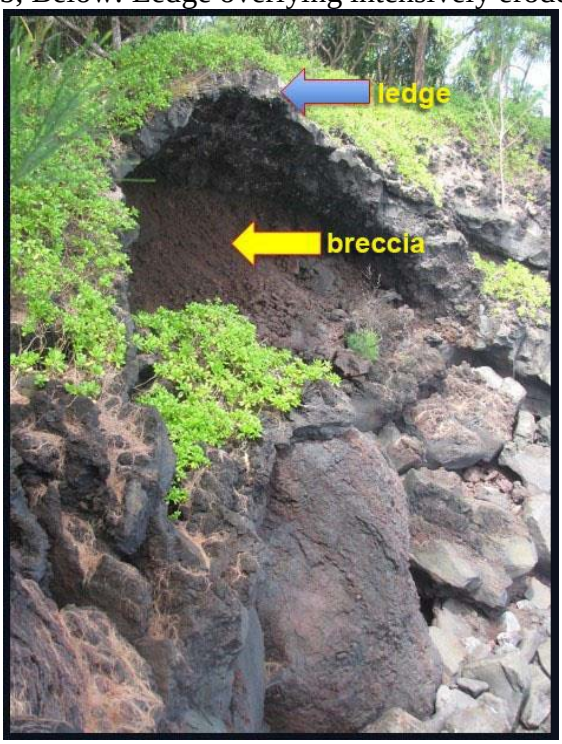
Coastal Erosion: Evidence of Erosion on Site

In general, the property shoreline is massively rocky and "hard" as opposed to unconsolidated and "soft", and by nature it resists erosion far more effectively than Hawaiʻi's beaches and bars. Nevertheless, clear signs of gradual erosion may be seen here. These include numerous large blocks mostly of massive ʻaʻā rubble ranging from a few tens of inches to six feet in diameter, concentrated primarily at the points of land along the shore (as shown in the photos in Figure 5). The characteristic massiveness, low density of vesicles, fracturing, and positions of these big pieces of lava show that most derive from the adjacent ʻaʻā flow core within the bluff face. Not simply the core itself breaks to yield these blocks, however. Overlying breccia and where present the capping pāhoehoe flow layer, also contribute debris. The arching

Figure 5. Coastal Erosion Study Photos

5a, Above: Face of massive core of an ʻaʻā flow (blue arrow), with yellow arrow marking tidal "buffer zone" of rocky debris

5b, Below: Ledge overlying intensively eroded breccia



ledge of lava overlying the breccia extends as much as 12 feet out over free air space that formerly must have been packed with breccia fragments, as shown in Figure 5b. In this exposure, some breccia pieces appear to be embedded in the overlying lava.

Within the inlets, too, large blocks, and more distinctively, smaller cobbles and boulders form a crudely-developed "beach". Many of these coarse, water-worn fragments are notably sub-rounded, in contrast to the larger, angular blocks at the points. This indicates abrasion which may be localized by repeated rolling and knocking together of fragments confined within the inlets during periods of rough wave activity. In addition to this material, oxidized breccia clasts, at least some of which may tumble downslope from poorly consolidated faces due simply to gravity, occur scattered around the heads of inlets.

Several key processes are at work contributing to erosion of this and all typical hard coasts. Wave energy impacting the bluff loosens masses of rock by compressing air within fractures, while the drag of moving water abrasively grinds smaller fragments at the shore. Wind and gravity can loosen free pieces of breccia that have dried out beneath overhangs. Storm seas perhaps timed with periodic high tides can be especially erosive. And, on a larger scale – though not evident here – the coastline may suddenly drop because of undersea sliding that extends right up into neighboring land. There is no way to definitively quantify the relative contributions of these processes, though it is reasonable to say that the energy released by wave action is probably the main cause of shoreline retreat at this locality.

Coastal Erosion: Rate of Erosion

Geologists analyzed aerial imagery to search for evidence of major changes in shoreline profile during historic times. Two sets of black-and-white photos from 1965 and 1977 allowed a comparison of shoreline position for these dates and the present. Likewise, both GoogleEarth © and Bing © imagery registered in color over a period of years show no evident changes. Analysis revealed no evident change in shoreline configuration, though vegetative cover, variable tidal and sea conditions, shading and resolution differences can easily obscure important smaller-scale details such as the shifting of a boulder here or modest collapse of a ledge there.

Most shoreline studies in Hawai‘i and elsewhere focus on erosion of "soft" coasts, for the obvious reasons that erosion rates are faster and thus more observable and consequential for human occupation. Andriati and Walsh (2007) studied the erosion of carbonate (limestone and low-grade marble) hard coast near Bari, Italy, and documented the important observation that the finer the crystallinity of the rock, the slower the rate of retreat. They established shoreline shift rates of 0.03-0.3 feet/year – as much as 4 inches/year. Of course, the conditions of the present study are considerably different – not simply in terms of the relative crystallinity of the rock, but its degree of fracturing, marine dynamics, climate, and a host of other factors. Nevertheless, their work reinforces the observation that hard coasts are significantly more resistant to erosion.

A conservative estimate of shoreline retreat rate intended to protect future improvements on the subject property can be obtained by measuring at a right angle to the general coast the length from the furthermost point (seen at low tide) to the location of shoreline erosion lying farthest inland, then dividing this

distance (approximately 130 feet) by the 360-year age of the youngest lava making up the bluff. While this estimate – 0.36 ft/year – discounts the possibility of erosion having removed land that once extended even farther out to sea than is presently observed, it also is positively biased simply because of the use of the youngest lava in the area to establish the rate. More gradual coastal shoreline retreat rates – from 0.33 to as low as 0.17 ft/yr – are determined by factoring in the full possible 750-year age range of the lava making up most of the shoreline. These estimates fall within range, perhaps coincidentally, of hard coast erosion rates determined by Andriati and Walsh in their 2007 Italian study. These numbers indicate a shoreline retreat of 8.5 to 18 feet over the coming half-century.

These rates need to be considered in the context of the environment. The shoreline is not retreating everywhere uniformly, nor is it doing so continuously. Erosion is episodic and principally storm-related. In addition, the estimates presented above do not reflect three facts that need to be taken into long-term consideration: (1) the island is sinking isostatically; (2) eustatic sea level change is taking place in response to climate change, and (3) wave and storm conditions also appear to be changing in the central and eastern Pacific, also in response to climate change.

A worst-case scenario incorporating all aspects of potential sea level flux related to warming global climate forecasts a rise of as much as 6.5 feet by the end of this century (Pfeffer 2008), with 3.25 feet a more conservative estimate (Solomon 2007). This change should be added to an annual estimated crustal subsidence rate for easternmost Puna in the range of 0.4 to 0.7 inches/year (Hwang and Brooks 2007), which gives a relative SLR of 6 to 12 feet by the year 2100 along the Dearing shoreline. The greatest rate of SLR will take place during the second half of this century according to recent modelling (e.g., Cazenave and Le Cozannet 2014). Anderson and others (2015) studied this phenomenon in the context of soft coasts throughout the Hawaiian Islands and concluded that average rates of shoreline recession would double by the year 2050, and increase to 2.5 times present and historically measured values by 2100, with shoreline retreats of as great as 190 feet possible in some places. The relevancy of this study to the current subject property is slight, however, given the elevated rockiness at this location.

In a worst-case scenario where sea level rise (SLR) by the year 2100 reduces the height above sea level of the Dearing property's coastal shelf to just a couple of meters at most, run-up from extreme waves breaking ashore will be significantly greater than at present. Estimating future wave run-ups requires the application of detailed engineering and mathematical models and the collection of data however, that are beyond the capacity of this study. Parameters for consideration include surface friction, nearshore bathymetry, shoreline motion trajectories, wave dispersion effects, wave breaking characteristics, and hydrodynamic relationship of multiple parallel land profiles. Most of these are not accurately knowable under highly irregular natural conditions. Post SLR run-up is a question for the distant future though, and the investigator does not consider it relevant to the present case.

A final factor for consideration is the potential role of seismicity in raising relative sea level at this site. Infrequent (once or twice-a-century) severe seismic activity has accompanied significant subsidence along the south coast of the Puna District. During the M7.5-7.7 November 1975 earthquake the coast at Kaimu Bay dropped roughly three feet; while at Kapoho 6 miles to the northeast the land settled 0.75 feet. The area of the Dearing property, however, lies in a footwall position north of the zone of active normal

faulting associated with the southern flank of Kīlauea Volcano (Owen and Bürgmann 2006), and may be regarded as tectonically stable. Future tsunamis related to large, local earthquakes, however, would certainly impact the coast here. Compared to the potential of storm-driven waves, however, tsunamis represent a trivial concern in terms of erosion.

Considering all these factors together, geologists arrived at a cautiously estimated average coastal retreat rate of 0.36 feet/year. Applying the DLNR formula of 70 times the annual erosion rate plus 40 feet, the appropriate setback distance would be at least 65.2 feet. With a setback of 100 feet, the proposed home improvements are located well back from this setback.

Coastal Erosion: Climate Change and Sea Level Rise

There is a scientific consensus that the earth is warming due to manmade increases in greenhouse gases in the atmosphere, according to the United Nations' Intergovernmental Panel on Climate Change (UH Manoa Sea Grant 2014). Global mean air temperatures are projected to increase by at least 2.7°F by the end of the century. This will be accompanied by the warming of ocean waters, expected to be highest in tropical and subtropical seas of the Northern Hemisphere. Wet and dry season contrasts will increase, and wet tropical areas in particular are likely to experience more frequent and extreme precipitation. For Hawai‘i, where warming air temperatures are already quite apparent, not only is the equable climate at risk but also agriculture, ecosystems, the visitor industry and public health. As discussed above, sea level rise will flood coasts, degrade coastal ecosystems, erode beaches, and ruin infrastructure in low-lying areas.

Guidance to federal agencies for addressing climate change issues in environmental reviews was released in August 2016 by the Council on Environmental Quality (US CEQ 2016). The guidance urged that when addressing climate change, agencies should consider: 1) the potential effects of a proposed action on climate change as indicated by assessing greenhouse gas emissions in a qualitative, or if reasonable, quantitative way; and, 2) the effects of climate change on a proposed action and its environmental impacts. It recommends that agencies consider the short- and long-term effects and benefits in the alternatives and mitigation analysis in terms of climate change effects and resiliency to the effects of a changing climate. The State of Hawai‘i in Hawai‘i Revised Statutes §226-109 encourages a similar analysis.

As discussed above, the minimum shoreline setback to residence related improvements has taken sea level rise into consideration. Although a scenario of modest sea level rise would likely not substantially affect the integrity or use of the proposed residence and particularly the farm, which is located on the *mauka* side of the lot, substantially larger increases, particularly in a case of sudden onset, could perhaps eventually affect them. If so, the Dearing property would be among thousands, or perhaps tens of thousands, to be affected in what would be the largest disaster to affect the Hawaiian Islands since human settlement. As sea level rise is gradual, there would probably be an opportunity for the owner to consider relocating or scrapping all structures for re-use of its valuable materials should sea level rise sufficiently to endanger the structure.

The owner would agree to a CDUP and/or deed condition that would prevent any future request for shoreline hardening to protect the residence, regardless of hardship, and a condition requiring moving or dismantling the home if sea level rise eventually threatens the integrity of the structure.

In addition to sea level rise, more frequent and more violent storms could result from climate change. It is critical for private and public structures to be set sufficiently far back from the shoreline that damage from such events is minimized. In the case of this property and proposal, the project does not involve any shoreline hardening or use of areas subject to beach processes. Access to the home will be by a driveway from the Government Beach Road at the *mauka* end of the property. As discussed above, the proposed home would be outside the flood zone, at an elevation of about 25 feet above sea level, at a minimum distance of 100 feet from the shoreline, well away from the expected effects of current and future storms.

3.1.3 Water Quality

The portion of the property to be used for the residence is adjacent to the sea but the house would be set back a minimum of 100 feet from the shoreline, and no grading activities would occur *makai* of this area. No natural water features such as streams, springs, or anchialine ponds are found on or near the property.

Landclearing and construction activities would occur within an area of less than an acre. The grading work required for the residence and farm would be limited to the home site and barn and their related driveway/parking and construction staging areas; the area of the drainage basin/irrigation pond; and the trenching work needed for the supporting utilities, including the potable water lines, underground power lines, and septic systems. No grubbing or grading is planned in the farm area in preparation for the tree plantings, as the trees will be planted in individual holes to minimize the need for ground disturbance. Both the barn and residence would be located in previously disturbed and relatively level portions of the property, and the drainage basin/irrigation pond is strategically located in an area which has an existing depression and raised portion along the *makai* edge that provides an ideal location and topography so as to lessen the amount of overall grading required for this feature. There will also be a balance of cut and fill material between the areas of the house site, barn, utilities, and drainage basin/irrigation pond to avoid the need to import or export of soils from the site. Some crushed rock material will be needed at the house and barn sites to prepare a level area and provide a base course for the house and barn foundations and driveway areas.

The majority of the grading required for the residence and farm will be for construction of the drainage basin/irrigation pond, which would encompass approximately 9,600 square feet and have an average depth of four feet. Following the required grading of this site, a sand lining will be emplaced followed by a 20-gauge, vinyl-beaded liner to create an impervious base. For the trenching required for the septic system and underground utilities, extracted materials (spoils) will be used to refill the trenched areas and to blend the areas with the surrounding topography.

A County grading permit will be required. After actual grading plans are developed, the applicant and engineer will determine whether the area of disturbance is sufficiently large to require a National Pollutant Discharge Elimination System permit. Grading for the driveway and house lot will include

practices to minimize the potential for sedimentation, erosion and pollution of coastal waters. The applicant will ensure that their contractor shall perform all earthwork and grading in conformance with:

(a) "Storm Drainage Standards," County of Hawai‘i, October, 1970, and as revised.
(b) Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawai‘i County Code.
(c) Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).
(d) Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control," of the Hawai‘i County Code.
(e) Conditions of an NPDES permit, if required, and any additional best management practices required by the Board of Land and Natural Resources.

In addition, as part of construction, the applicant will be implementing Best Management Practices as part of the Farm Management Plan (see Appendix 4). The applicant will require that the construction contractor implement the following practices:

- The total amount of land disturbance will be minimized. The construction contractor will be limited to the delineated construction work areas within the lot.
- The contractor will not allow any sediment to leave the site, particularly towards the ocean.
- Construction activities with the potential to produce polluted runoff will not be allowed during unusually heavy rains or storm conditions that might generate storm water runoff.
- Cleared areas will be replanted or otherwise stabilized as soon as possible.
- On a permanent, operational basis, the drainage basin/irrigation pond will minimize the flow of sediment after rainfall to the shoreline and ocean.

Use and maintenance of the swimming pool would have no effect on coastal water quality. The swimming pool would use a cartridge-filter/saltwater system that does not require any back-washing. The advantage of using a cartridge filter/saltwater pool system is that the system avoids the formation of chloramines, which typically produce the stinging eyes and chlorine smell associated with conventional pools, and the water is not harmful to the environment. The pool would require draining only very infrequently. The pool water will be drained into a lava sump that will be specified on the engineered plans for the building permit for the pool, in conformance with all State and County of Hawai‘i laws and regulations. The lava sump would also be located *mauka* of the pool site so as to be well removed from the shoreline area.

The general area already supports several homes and is utilized by residents and property owners to park vehicles and fish, and there are no reported water quality problems from these uses. Upon their completion, the home and fruit tree farm would be similar to the homes on shoreline lots in the area, and they would be not expected to contribute to sedimentation, erosion, and pollution of coastal waters.

3.1.4 Flora and Fauna

Environmental Setting: Flora

Prior to the use for agriculture, ranching, and lot subdivision, the natural vegetation of this part of the Puna shoreline (the site of a less than 400-year-old lava flow) was mostly coastal forest and strand vegetation, dominated by naupaka (*Scaevola taccada*), hala (*Pandanus tectorius*), ʻōhiʻa (*Metrosideros polymorpha*), nanea (*Vigna marina*) and various ferns, sedges and grasses (Gagne and Cuddihy 1990). The site was systematically inspected for plants by Dr. Ron Terry in June 2016. Previous visits to this general area had identified several clusters of *Ischaemum byrone*, a State and federally listed endangered grass known to grow on pahoehoe close the edge of sea cliffs, where salt spray may limit other plants.

As discussed above, all of the lot *mauka* of a narrow coastal strip was bulldozed many decades ago. This was followed by growth of an alien-dominated forest, although some hala also grew back. Aside from scattered hala and one remnant ʻōhiʻa tree near Government Beach Road, all trees found on the project site are non-native. The shoreline vegetation is dominated by hala, naupaka and especially the invasive tree ironwood (*Casuarina equisetifolia*). Interestingly, several short, shrubby native hapuʻu (*Cibotium glaucum*) and amaʻu (*Sadleria cyatheoides*) tree ferns are also present intermingled in the naupaka.

Several clusters of *Ischaemum byrone* were found, all within 60 feet of the shoreline, out of the footprint of any development, but within the area planned for tree thinning and removal. As mentioned previously, the Dearing family has carefully protected the largest grass clump (Figure 2d) from harm by removing the ironwood needles that at times have completely covered it. Without this intervention, this clump would likely have perished, as have several others on the shoreline northwest of Hawaiian Beaches (pers. observation). No other rare, threatened or endangered plant species appear to be present, either in the shoreline strip (which is to be protected) or in any other part of the property.

The interior of the property is covered by tree species that typically dominate disturbed areas of Puna: Chinese banyan (*Ficus microcarpa*), cecropia (*Cecropia obtusifolia*), autograph three (*Clusia rosea*), macaranga (*Macaranga mappa*), albizia (*Falcataria moluccana*), gunpowder tree (*Trema orientalis*) and ironwood. Non-native pilau maile (*Paederia foetida*) and pothos (*Epipremnum aureum*) vines festoon the trees and, in some areas, the ground. Except for the *hala* trees that dot this forest, there is little of value for biological conservation in this flora. A list of species detected on the property itself is found in Table 1.

Table 1. Plant Species Observed on Dearing Property

Scientific Name	Family	Common Name	Life Form	Status*
Odontonema sp.	Acanthaceae	Odontonema	Shrub	A
Thunbergia fragrans	Acanthaceae	White Thunbergia	Vine	A
Agave sp.	Agavaceae	Agave	Herb	A
Cordyline fruticosa	Agavaceae	Ti	Shrub	PI
Dracena cults.	Agavaceae	Dracena	Shrub	A
Mangifera indica	Anacardiaceae	Mango	Tree	A
Schinus terebinthifolius	Anacardiaceae	Christmas Berry	Tree	A
Centella asiatica	Apiaceae	Asiatic Pennywort	Herb	A
Plumeria sp.	Apocynaceae	Plumeria	Shrub	A
Epipremnum pinnatum	Araceae	Pothos	Vine	A
Monstera deliciosa	Araceae	Monstera	Shrub	A
Philodendron spp.	Araceae	Philodendron	Vine	A
Schefflera actinophylla	Araliaceae	Octopus Tree	Tree	A
Araucaria columnaris	Araucariaceae	Cook Pine	Tree	A
Cocos nucifera	Arecaceae	Coconut	Tree	PI
Marsdenia floribunda	Asclepiadaceae	Stephanotis	Vine	A
Ageratum houstonianum	Asteraceae	Ageratum	Herb	A
Conyza bonariensis	Asteraceae	Conyza	Herb	A
Emilia fosbergii	Asteraceae	Lilac Pualele	Herb	A
Emilia sonchifolia	Asteraceae	Flora’s Paintbrush	Herb	A
Erechtites hieracifolia	Asteraceae	Erechtites	Herb	A
Erechtites valerianifolia	Asteraceae	Erechtites	Herb	A
Pluchea symphytifolia	Asteraceae	Sourbush	Shrub	A
Wedelia trilobata	Asteraceae	Wedelia	Herb	A
Begonia sp.	Begoniaceae	Begonia	Herb	A
Sadleria cyatheoides	Blechnaceae	Ama‘u	Fern	E
Ananas comosus	Bromeliaceae	Pineapple	Herb	A
Undetermined genera	Bromeliaceae	Bromelia	Herb	A
Carica papaya	Caricaceae	Papaya	Shrub	A
Drymaria cordata	Caryophyllaceae	Drymaria	Herb	A
Casuarina equisetifolia	Casuarinaceae	Ironwood	Tree	A
Cecropia obtusifolia	Cecropiaceae	Cecropia	Tree	A
Clusia rosea	Clusiaceae	Autograph Tree	Tree	A
Terminalia catappa	Combretaceae	False Kamani	Tree	A
Commelina diffusa	Commelinaceae	Honohono	Herb	A
Momoridica charantia	Cucurbitaceae	Bitter Melon	Vine	A
Cycas revoluta	Cycadaceae	Cycad	Shrub	A
Zamia furfuracea	Cycadaceae	Zamia	Shrub	A
Cyperus polystachyos	Cyperaceae	Pycreus	Herb	I
Kyllinga brevifolia	Cyperaceae	Kyllinga	Herb	A

Table 1, continued				
Scientific Name	**Family**	**Common Name**	**Life Form**	**Status***
Scleria testacea	Cyperaceae	Scleria	Herb	I
Cibotium glaucum	Dicksoniaceae	Hapu‘u	Fern	E
Dioscorea sp.	Dioscoreaceae	Bitter Yam	Vine	PI
Chamaesyce hirta	Euphorbiaceae	Garden Spurge	Herb	A
Chamaesyce hypericifolia	Euphorbiaceae	Graceful Spurge	Herb	A
Chamaesyce prostrata	Euphorbiaceae	Prostrate Spurge	Herb	A
Codiaeum variegatum	Euphorbiaceae	Croton	Shrub	A
Macaranga mappa	Euphorbiaceae	Macaranga	Shrub	A
Phyllanthus debilis	Euphorbiaceae	Niruri	Herb	A
Chamaecrista nictitans	Fabaceae	Partridge Pea	Herb	A
Crotalaria sp.	Fabaceae	Crotalaria	Herb	A
Delonix regia	Fabaceae	Royal Poinciana	Tree	A
Desmodium sandwicense	Fabaceae	Desmodium	Herb	A
Falcataria moluccana	Fabaceae	Albizia	Tree	A
Mimosa pudica	Fabaceae	Sleeping Grass	Herb	A
Scaevola taccada	Goodeniaceae	Beach Naupaka	Shrub	I
Heliconia spp.	Heliconiaceae	Heliconia	Herb	A
Persea americana	Lauraceae	Avocado	Tree	A
Agapanthus sp.	Liliaceae	Agapanthus	Herb	A
Crinum ap.	Liliaceae	Crinum	Herb	A
Cuphea carthagenensis	Lythraceae	Cuphea	Herb	A
Hibiscus tiliaceus	Malvaceae	Hau	Tree	I
Dissotis rotundifolia	Melastomataceae	Dissotis	Herb	A
Pterolepis glomerata	Melastomataceae	Pterolepis	Herb	A
Ficus microcarpa	Moraceae	Banyan	Tree	A
Musa sp.	Musaceae	Banana	Shrub	A
Metrosideros polymorpha	Myrtaceae	Ōhi’a	Tree	E
Psidium cattleianum	Myrtaceae	Strawberry Guava	Tree	A
Psidium guajava	Myrtaceae	Guava	Tree	A
Nephrolepis exaltata	Nephrolepidaceae	Sword Fern	Fern	I
Nephrolepis multiflora	Nephrolepidaceae	Sword Fern	Fern	A
Jasminum sp.	Oleaceae	Jasmine	Herb	A
Undetermined orchid genera	Orchidaceae	Orchid	Herb	A
Spathoglottis plicata	Orchidaceae	Philippine Ground Orchid	Herb	A
Oxalis corniculata	Oxalidaceae	Yellow Wood Sorrel	Herb	I
Pandanus tectorius	Pandanaceae	Hala	Tree	I
Passiflora edulis	Passifloraceae	Passion Fruit	Vine	A
Paspalum sp.	Poaceae	Paspalum	Herb	A

Table 1, continued				
Scientific Name	**Family**	**Common Name**	**Life Form**	**Status***
Digitaria ciliaris	Poaceae	Digitaria	Herb	A
Digitaria sp.	Poaceae	Digitaria	Herb	A
Ischaemum byrone	Poaceae	Hilo Ischaemum	Herb	END
Oplismenus sp.	Poaceae	Basketgrass	Herb	A
Paspalum conjugatum	Poaceae	Hilo Grass	Herb	A
Paspalum urvillei	Poaceae	Paspalum	Herb	A
Sacciolepis indica	Poaceae	Glenwood Grass	Herb	A
Polygala paniculata	Polygalaceae	Milkwort	Herb	A
Coccoloba uvifera	Polygonaceae	Sea Grape	Tree	A
Microsorum scolopendria	Polypodiaceae	Maile Scented Fern	Fern	A
Pityrogramma calomelanos	Pteridaceae	Silver Fern	Fern	A
Gardenia sp.	Rubiaceae	Gardenia	Shrub	A
Kadua corymbosa	Rubiaceae	Hedyotis	Herb	A
Morinda citrifolia	Rubiaceae	Noni	Shrub	PI
Paederia scandens	Rubiaceae	Maile Pilau	Vine	A
Spermacoce sp.	Rubiaceae	Spermacoce	Herb	A
Citrus spp.	Rutaceae	Citrus	Shrub	A
Murraya paniculata	Rutaceae	Mock Orange	Shrub	A
Capsicum annuum	Solanaceae	Chili Pepper	Shrub	A
Cestrum nocturnum	Solanaceae	Night Jasmine	Shrub	A
Melochia umbellata	Sterculiaceae	Melochia	Tree	A
Christella dentata	Thelypteridaceae	Cyclosorus	Fern	A
Christella cyatheoides	Thelypteridaceae	Cyclosorus	Fern	E
Trema orientalis	Ulmaceae	Gunpowder Tree	Tree	A
Pilea microphylla	Urticaceae	Artillery Plant	Herb	A
Stachytarpheta jamaicensis	Verbenaceae	Jamaican Vervain	Herb	A
Alpinia purpurata	Zingiberaceae	Red Ginger	Herb	A
Unknown genus	Zingiberaceae	Ornamental Ginger	Herb	A
Zingiber zerumbet	Zingiberaceae	‘Awapuhi	Herb	PI

A=Alien E=Endemic I=Indigenous END=Federal and State Listed Endangered

Environmental Setting: Fauna

During May and June 2016 site visits, we observed common mynas (*Acridotheres tristis*), northern cardinals (*Cardinalis cardinalis*), spotted doves (*Streptopelia chinensis*), striped doves (*Geopilia striata*), Kalij pheasants (*Lophura leucomelanos*) Japanese white-eyes (*Zosterops japonicus*), and house finches (*Carpodacus mexicanus*). No native birds were identified, and it is unlikely that many native forest birds would be expected to use the project site due to its low elevation, alien vegetation and lack of adequate forest resources. However, it is likely that Hawai’i ‘amakihi (*Hemignathus virens*) are sometimes present, as some populations of this native honeycreeper appear to have adapted to the mosquito borne diseases of the Hawaiian lowlands. Common shorebirds, such as Pacific golden-plover (*Pluvialis fulva*), ruddy

turnstone (*Arenaria interpres*), and wandering tattler (*Heteroscelus incanus*), are often seen on the Puna coastline feeding on shoreline resources. These were not observed during site visits (very few of these migratory birds are present during the summer months), but they undoubtedly visit occasionally, despite the minimal habitat offer by the cliffy coast. They would be unlikely to make much use of the property itself, which is densely vegetated and offers no habitat for them. The seabird black noddy (*Anous minutus melanogenys*) was observed flying near the cliffs and over the nearshore waters, as it frequently does in cliffed coasts of the main Hawaiian Islands. It nests in crevices and caves in lava (especially pahoehoe) seacliffs; no black noddy nests were observed on the cliffs in front of the property.

As with all of East Hawai‘i, several endangered native terrestrial vertebrates may be present in the general area and may overfly, roost, nest, or utilize resources of the property. These include the endangered Hawaiian hawk (*Buteo solitarius*), the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), the endangered Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell’s shearwater (*Puffinus newelli*).

Other mammals in the project area are all introduced species, including feral cats (*Felis catus*), feral pigs (*Sus scrofa*), small Indian mongooses (*Herpestes a. auropunctatus*) and various species of rats (*Rattus* spp.). None are of conservation concern and all are deleterious to native flora and fauna.

The coastal and marine fauna and flora are typical of the high-energy coasts of Puna, which are young ecosystems with limited coral growth but a variety of algae, fish and invertebrates. Marine mammals and reptiles, some of them endangered, also visit the Puna coastal waters.

Impacts and Mitigation Measures

The project site is dominated by alien vegetation, with the only sensitive ecosystem on the property being the shoreline vegetation, where common native plants are present as well as several clumps of the endangered grass *Ischaemum byrone*. Development completely avoids the shoreline area, but a number of ironwoods will be removed and others will be trimmed. No adverse impact upon vegetation or endangered species should occur. The endangered grass clumps have been marked with flagging and protected from trampling for the time being. They will be marked again prior to any tree-trimming or tree removal activity in the area and monitored to ensure that the clusters are not impacted during these activities. After this, each clump will be surrounded with a ring of local rocks to prevent inadvertent trampling in the future. It bears repetition that the survival of the largest clump is directly attributable to the ongoing actions of the landowner, who has cared for the grass ever since discovering it.

Because of the location and nature of the project relative to sensitive vegetation and species, construction and use of the single-family residence as well as establishment of a farm are not likely to cause adverse biological impacts. The removal of the majority of the existing ironwood in the coastal area will not only help protect the endangered grass but will also allow existing native species found in the area to re-establish, reclaiming the area from domination by the invasive ironwood tree.

The precautions for preventing effects to water quality during construction listed above in Sections 3.1.1 and 3.1.6 will reduce adverse impact on aquatic biological resources in coastal waters to negligible levels.

In order to avoid impacts to the endangered but regionally widespread terrestrial vertebrates listed above, the applicant will commit to conditions that are proposed for the CDUP. Specifically, construction will commit to refrain from activities that disturb or remove the vegetation between June 1 and September 15, when Hawaiian hoary bats may be sensitive to disturbance. If landclearing occurs between the months of March and September, inclusive, a pre-construction hawk nest search by a qualified ornithologist using standard methods will be conducted. If Hawaiian hawk nests are present, no land clearing will be allowed until October, when hawk nestlings will have fledged. Finally, the applicant agrees to shield any exterior lighting from shining upward, in conformance with Hawai‘i County Code § 14 – 50 et seq., to minimize the potential for disorientation of seabirds.

3.1.5 Air Quality, Noise, and Scenic Resources

Environmental Setting

Air quality in the area is generally excellent, due to its rural nature and minimal degree of human activity, although vog from Kilauea volcano is occasionally blown into this part of Puna. Noise on the site is low, and is derived from natural sources (such as surf, birds and wind) due to the very rural nature of the area.

The area shares the quality of scenic beauty along with most of the Puna coastline. The County of Hawai‘i General Plan contains Goals, Policies and Standards intended to preserve areas of natural beauty and scenic vistas from encroachment. The General Plan discusses the black sand beaches and tidal ponds as noted features of natural beauty in Puna, but among specific examples of natural beauty does not identify any features or views in the *ahupua‘a* of Keonepoko Iki, in Plat 1-5-009, or any other location near the project site. Shoreline views from the Government Beach Road are completely blocked by over 600 feet thick of existing heavy vegetation.

Impacts and Mitigation Measures

The project would not affect air quality or noise levels in any substantial ways. Brief and minor adverse effects would occur during construction. However, there are virtually no sensitive noise receptors in the vicinity – with no houses or other structures within 1,000 feet. Given the small scale and short duration of any noise impacts, coupled with the lack of sensitive receptors, noise mitigation would not be necessary.

Because all grading and construction would occur, at the closest, 100 feet from the sea cliff, and over 500 feet of the *mauka* edge of the property, with dense intervening vegetation on all sides, construction and occupation of the single-family home would have virtually no visual impacts. The fruit tree farm would be visible from the road but is in harmony with the rural landscape of Puna.

3.1.6 Hazardous Substances, Toxic Waste and Hazardous Conditions

Based on onsite inspection and the lack of any known former and current uses on the property, it appears that the site contains no hazardous or toxic substances and exhibits no other hazardous conditions. In addition to the measures related to water quality detailed in Section 3.1.3, in order to ensure to minimize the possibility for spills of hazardous materials, the applicant proposes the following:

- Unused materials and excess fill will be disposed of at an authorized waste disposal site.
- During construction, emergency spill treatment, storage, and disposal of all hazardous materials, will be explicitly required to meet all State and County requirements, and the contractor will adhere to "Good Housekeeping" for all appropriate substances, with the following instructions:
    - Onsite storage of the minimum practical quantity of hazardous materials necessary to complete the job;
    - Fuel storage and use will be conducted to prevent leaks, spills or fires;
    - Products will be kept in their original containers unless unresealable, and original labels and safety data will be retained;
    - Disposal of surplus will follow manufacturer's recommendation and all regulations;
    - Manufacturers' instructions for proper use and disposal will be strictly followed;
    - Regular inspection by contractor to ensure proper use and disposal;
    - Onsite vehicles and machinery will be monitored for leaks and receive regular maintenance to minimize leakage;
    - Construction materials, petroleum products, wastes, debris, and landscaping substances (herbicides, pesticides, and fertilizers) will be prevented from blowing, falling, flowing, washing or leaching into the ocean
    - All spills will be cleaned up immediately after discovery, using proper materials that will be properly disposed of;
    - Regardless of size, spills or toxic or hazardous materials will be reported to the appropriate government agency;
    - Should spills occur, the spill prevention plan will be adjusted to include measures to prevent spills from re-occurring and for modified clean-up procedures.

3.2 Socioeconomic and Cultural

3.2.1 Land Use, Socioeconomic Characteristics and Recreation

Existing Environment

Because of the gradual occupation of lots developed during widespread land subdivision about fifty years ago, the Puna District has been the Big Island's fastest-growing district over the last thirty years. Population as measured in the 2010 U.S. Census was 45,326, a 66 percent increase over the 2000 count of 27,232. Despite a lack of basic infrastructure such as paved roads and water in most subdivisions, the relatively inexpensive lots, which typically range in size from one to three acres, have attracted residents

from the U.S. mainland and other parts of the State of Hawai‘i who seek affordable property. The basis of the economy of Puna has evolved from cattle ranching and sugar to diversified agriculture, various services for the growing populations, commuting to Hilo, and tourism, which has been stimulated by being home to Kilauea, one of the world’s most active volcanoes.

Some Puna subdivisions between Pahoa and Hilo (including Hawaiian Beaches and Hawaiian Shores, near the project site), are now partially bedroom communities for Hilo’s workforce, as evidenced by the heavy flow of Hilo-bound traffic during the AM rush hour.

The Dearing property is bordered by the shoreline to the north, by the Government Beach Road to the south, and by vacant lots to the east and west. Across the Government Beach Road is a 365-acre agricultural property used at least partially for cattle ranching.

Puna experiences a high demand for coastal recreation, especially in calmer shorelines areas near populations centers. Despite the long coastline, there are few beaches in Puna, and none in the vicinity of the project site. In most location in Puna, ocean recreation consists primarily of fishing from the cliffs. There is relatively little use of the rough and irregular shoreline in this area. Maps of public accesses produced by the County of Hawai‘i do not indicate any nearby official *mauka-makai* shoreline public accesses from the Government Beach Road (http://www.hawaiicounty.gov/pl-shoreline-access-big-island). However, from informal access trails to the west that connect the road to the shoreline, fisherman and *opihi* pickers access fishing and gathering spots. The project site does not have an official or unofficial trail either above or below the sea cliff. The area above the cliff is topographically difficult and heavily vegetated with natural shoreline vegetation, with no artificial management of any kind (Figure 2b). The Dearings have observed fisherman traversing the shoreline below the cliff (see photos in Figure 5), which although quite hazardous and irregular, is the site for *opihi* gathering and offers perches on which to cast a line, unlike the sea cliff itself.

Impacts and Mitigation Measures

No adverse socioeconomic impacts are expected to result from the project. The project will have a very small positive economic impact for the County of Hawai‘i. The residence and associated improvements will not adversely affect recreation, as access along the shoreline will not be affected. The proposed residential and farming uses will not interfere with this continuing use. Mr. Dearing has been informed of the rights of the public to utilize these areas and the cultural and subsistence importance of these practices, and expects that conditions ensuring continued public access along the front of the property will be codified within the Conservation District Use Permit to make the access situation explicit.

3.2.2 Cultural and Historic Resources

An archaeological inventory survey and a cultural impact assessment were prepared for the property and are attached as Appendices 2 and 3, respectively. Research for this report included primary fieldwork, consultation of archaeological and ethnographical studies and primary documents including maps and Mahele testimony, and consultation of informants. In the interest of readability, the summary below does

not include all scholarly references; readers interested in extended discussion and sources may consult these appendices. Separately, the Office of Hawaiian Affairs, Councilmember Greggor Ilagan, the Sierra Club and Malama O Puna were also consulted as part of the EA to determine whether they had any information on natural or cultural resources that might be present or affected, and additional research on cultural resources and impacts was conducted.

Historical and Cultural Background

The first inhabitants of Hawai‘i were believed to be settlers who had undertaken difficult voyages 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, although recent work suggests that Polynesians may not have arrived in Hawai‘i until at least A. D. 1000 (Kirch 2012).

The initial inhabitants of Hawai‘i are believed to have come from the southern Marquesas Islands and settled initially on the windward side, eventually expanding to leeward areas. Early Hawaiian farmers developed new strategies and tools for their new environment (Kirch 2012; Pogue 1978). Societal order was maintained by their traditional philosophies and by the conical clan principle of genealogical seniority (Kirch 2012). Universal Polynesian customs brought from their homeland included the observance of major gods *Kane*, *Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge, various beliefs, and the concepts of *mana* and the *‘aumakua* (Fornander 1969).

The Development Period, believed under Kirch’s new concept to have occurred from A. D. 1100 to 1350, brought an evolution of traditional tools, including a variation of the adze (*ko‘i*), and some new Hawaiian inventions such as the two-piece fishhook and the octopus-lure breadloaf sinker. That was followed by the Expansion Period (A. D. 1350 to 1650) which saw greater social stratification, intensive land modification, and population growth. This period was also the setting for the second major migration to Hawai‘i, this time from Tahiti. Also established during this period was the *ahupua‘a*, a land-use concept that incorporated all of the eco-zones from the mountains to the shore and beyond. The usually wedge-shaped *ahupua‘a* provided a diverse subsistence resource base (Hommon 1986) and added another component to what was already becoming a well-stratified society (Kirch 2012).

Ahupua‘a were ruled by *ali‘i ‘ai ahupua‘a* or lesser chiefs and managed by a *konohiki*. *Ali‘i* and *maka‘ainana*, or commoners, were not confined to the boundaries of *ahupua‘a* as resources were shared when a need was identified. *Ahupua‘a* were further divided into smaller sections such as *‘ili, mo‘o‘aina, pauku‘aina, kihapai, koele, hakuone* and *kuakua*. The chiefs of these land units have their allegiance to a territorial chief or *mo‘i* (literally translated as king) (Hommon 1986). The project site is located within Keonepoko Iki Ahupua‘a, a land unit of the District of Puna, one of six major districts on the island of Hawai‘i.

As population grew during the following centuries so did the reach of inland cultivation in the upland environmental zones and consequent political and social stresses. During the Proto-Historic Period (A. D. 1650-1795), wars reflective of a complex and competitive social environment are evidenced by *heiau*

building. During this period, sometime during the reign of Kalaniopuʻu (A. D. 1736-1758), Kamehameha I was born in North Kohala.

As McGregor stated, "Puna is where new land is created and new growth and new life sprout. The new land is sacred, fresh, clean, and untouched. After vegetation begins to grow upon it, it is ready for human use." (2007:145). In Pre-Western contact and early Historic times the people lived in a small number of small settlements along the coast where they subsisted on marine resources and agricultural products. Each of the villages, McEldowney noted:

> "…seems to have comprised the same complex of huts, gardens, windbreaking shrubs, and utilized groves, although the form and overall size of each appear to differ. The major differences between this portion of the coast and Hilo occurred in the type of agriculture practiced and structural forms reflecting the uneven nature of the young terrain. Platforms and walls were built to include and abut outcrops, crevices were filled and paved for burials, and the large numbers of loose surface stones were arranged into terraces. To supplement the limited and often spotty deposits of soil, mounds were built of gathered soil, mulch, sorted sizes of stones, and in many circumstances, from burnt brush and surrounding the gardens. Although all major cultigens appear to have been present in these gardens, sweet potatoes, ti (*Cordyline terminalis*), *noni (Morinda citrifolia*), and gourds (*Lagenaria siceraria*) seem to have been more conspicuous. Breadfruit, pandanus, and mountain apple (*Eugenia malaccensis*) were the more significant components of the groves that grew in more disjunct patterns than those in Hilo Bay" [1979:17].

Puna was a region famed in legendary history for its associations with the goddess Pele and god Kāne. Because of the relatively young geological history and persistent volcanic activity, the region has a strong association with Pele. However, the connection to Kāne is perhaps more ancient. Kāne, ancestor to both chiefs and commoners, is the god of sunlight, fresh water, verdant growth, and forests. It is said that before Pele migrated to Hawaiʻi from Kahiki, Puna was esteemed the most beautiful place in the islands by many. Contributing to that beauty were the groves of fragrant hala and forests of *ʻōhiʻa lehua* for which Puna was famous. The inhabitants of Puna were likewise famous for their expertise and skill in *lauhala* weaving.

A traditional *moʻolelo*, "The Heart Stirring Story of Ka-Miki" (*Kaao Hooniua Puuwai no Ka-Miki*), originally appeared in *Ka Hoku o Hawaiʻi* (a Hawaiian language newspaper) between 1914 and 1917. The story tells of two supernatural brothers, Ka-Miki and Maka-ʻiole, who were skilled *ʻōlohe* (competitors/ fighters) and their travels around Hawaiʻi Island by way of the ancient trails and paths (*ala loa* and *ala hele*), seeking competition with other *ʻōlohe*. In the legend of Ka-Miki, the land of Keoneopokoiki was named for an *ʻolohe* master of Puna, who was the *mokomoko* (rough hand fighting) instructor of the chief Puʻula (Maly 1992). According to the story Keoneopokoiki was a traditional training grounds for *ʻolohe* of Puna, were masters skilled in hand to hand combat and other martial arts techniques. In the story Ka-Miki quickly defeats the Puna master, Keoneopokoiki, in an *ʻolohe* contest. Ka-Miki then threatened to kill Keoneopokoiki, who seeing that there was no one who could defeat Ka-Miki, gave his complete surrender and returned to his home. According to the story, Keoneopokoiki lived on the upland side of the

alaloa (the around the island coastal trail). At his compound was an altar dedicated to his gods (Maly 1998).

Traditional life in Hawai‘i’ took a sharp turn on January 18, 1778 with the arrival of British Capt. James Cook in the islands. On a return trip to Hawai‘i ten months later, Kamehameha visited Cook aboard his ship the *Resolution* off the east coast of Maui and helped Cook navigate his way to Hawai‘i Island. Cook exchanged gifts with Kalaniopu‘u at Kealakekua Bay the following January, and Cook left Hawai‘i in February. However, Cook’s ship then sustained damage to a mast in a severe storm off Kohala and returned to Kealakekua, setting the stage for his death on the shores of the bay.

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

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

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

In 1823, British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Hawai‘i scouting communities in which to establish church centers for the growing Calvinist mission. Ellis recorded observations made during this tour in a journal (Ellis 1963). His writings contain descriptions of residences and practices elsewhere in Puna that are applicable to the general study area:

> The population in this part of Puna, though somewhat numerous, did not appear to possess the means of subsistence in any great variety or abundance; and we have often been surprised to find desolate coasts more thickly inhabited than some of the fertile tracts in the interior; a circumstance we can only account for, by supposing that the facilities which the former afford for fishing, induce the natives to prefer them as places of abode; for they find that where the coast is low, the adjacent water is usually shallow.
>
> We saw several fowls and a few hogs here, but a tolerable number of dogs, and quantities of dried salt fish, principally albacores and bonitos. This latter article, with their *poë* [*poi*] and sweet

> potatoes, constitutes nearly the entire support of the inhabitants, not only in this vicinity, but on the sea coasts of the north and south parts of the island.
>
> Besides what is reserved for their own subsistence, they cure large quantities as an article of commerce, which they exchange for the vegetable productions of Hilo and Mamakua [Hāmākua], or the mamake and other tapas of Ora [‘Ōla‘a] and the more fertile districts of Hawaii.

Ellis and the ABCFM missionaries travelled along the coast of Kauwai, Wa‘awa‘a, and Nānāwale Ahupua‘a and then turned *mauka* toward a village in Honolulu Ahupua‘a (Ellis 2004:294). On August 8, 1823, the Ellis and the ABCFM missionaries left Honolulu and visited the village of Waiakahiula to the southeast of the project site. Ellis’ journal provides a brief first-hand description of the village’s location relative to the coast:

> We arose early on the 8th, and Mr. Thurston held morning worship with the friendly people of the place [Honolulu]. Although I had been much indisposed through the night, we left Honoruru [sic] soon after six a.m. and, travelling slowly towards the sea-shore, reached Waiakeheula [sic] about eight, where I was obliged to stop, and lie down under the shade of a canoe-house near the shore. Messrs. Thurston and Bishop walked up to the settlement about half a mile inland, where the former preached to the people…(Ellis 2004:295)

After preaching, Bishop continued on alone toward Waiakea, while Thurston returned to fetch Ellis from the canoe shed. Upon reaching the village, Ellis found its residences to be interspersed among the agricultural fields rather than in a single, nucleated settlement:

> The country was populous, but the houses stood singly, or in small clusters, generally on the plantations, which were scattered over the whole country. Grass and herbage were abundant, vegetation in many places luxuriant, and the soil, though shallow, was light and fertile. (Ellis 2004:296)

A year after Ellis’ visit, in 1824, the ABCFM established a base church in Hilo. From that church (Haili), the missionaries traveled to the more remote areas of the Hilo and Puna Districts. David Lyman, who came to Hawai‘i in 1832, and Titus Coan, who arrived in 1835, were two of the most influential Congregational missionaries in Puna and Hilo. As part of their duties they conducted a census of the areas within their missions. In 1835, 4,800 individuals were recorded as residing in the district of Puna; the smallest total district population on the island of Hawai‘i. In 1841, Titus Coan stated that most of the 4,371 recorded residents of Puna lived near the shore, though hundreds also lived inland.

The *Mahele ‘Aina* took place in 1848, placing all land in Hawai‘i into three categories: Crown Lands, Government Lands and Konohiki Lands. Ownership rights were “subject to the rights of the native tenants,” or those individuals who lived on the land and worked it for their subsistence and for their chiefs. As a result of the Māhele, Keonepoko Ahupua‘a (assumed to be Keonepoko Nui, but not specified) was returned by Lunalilo and retained as Government Land (Soehren 2005). Keonepoko Iki

Ahupuaʻa is not listed in the Māhele Book, but it too became Government Land, as did Kaʻohe Ahupuaʻa (returned by Ulumaheihei) adjacent to the southeastern coastal boundary of Keonepoko Iki. Kaʻohe was claimed by Ulumaheihei as portion of LCAw. 5207H, a claim that was not awarded. The partial boundaries of Kaʻohe (near the coast) are shown on only one of the historic maps reviewed for the work in Appendix 2 (Hawaiʻi Registered Map No. 2258; Figure 15). On most maps the coastal lands of Kaʻohe have been lumped together with those of Keonepoko Iki (the Kaʻohe Homesteads, located within a detached piece of the *ahupuaʻa* above Pāhoa town, still retain the Kaʻohe name, however). The project site is located in Keonepoko Iki Ahupuaʻa near its indefinite boundary with Kaʻohe Ahupuaʻa, between two coastal points labeled "Kawaiki" and "Keahu". No LCAw. claims were made for *kuleana* within either Keonepoko Iki or Kaʻohe Ahupuaʻa during the Māhele (Waihona ʻĀina database).

In conjunction with the Māheleʻ Āina of 1848, the King authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the Māhele should be set aside and sold as grants. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the Māhele, to purchase lands of their own. Despite this goal, many of the Government Lands were eventually sold or leased to foreigners. The project site is a portion of a 277.8-acre grant parcel purchased by Kekoa in 1855 as Grant No. 1533. The record is silent regarding Kekoa's use of the grant lands.

Land use in the Puna District changed quickly in the late 19th century. In 1868 volcanic activity emanating from Mauna Loa volcano devastated Hawaiʻi Island with lava flows, earthquakes and a tsunami. This transformed the landscape of the southern part of island forever, and further contributed to the depopulation of the District of Puna. Even with this disaster, however, transportation infrastructure in the project area continued to improve in order to serve the growing commercial sugar, timber and coffee operations in Puna. The current alignment of the Government Beach Road, which evolved from earlier trail routes, was under construction by the 1840s. The road remained the preferred route of travel between Hilo and the outlying areas of Puna until 1895, when the Keaʻau-Pāhoa Road (now Highway 130) was established to access the growing inland population centers and agricultural areas (Maly 1999:6).

By 1900 Puna was on the verge of major economic growth, spurred by the sugar and lumber industries. The rise and fall of these industries can be traced along the rusted railroad tracks that litter the landscape *mauka* of the study area. In 1899, the ʻŌlaʻa Sugar Company began operating in the Keaʻau area. The directors of the company realized early that the lack of cargo transportation facilities would hinder their success. As a result, they organized the Hilo Railroad Company and, on April 8, 1899, were granted a 50-year charter (Best 1978). The railroad's infrastructure developed quickly. Rail service to ʻŌlaʻa (Keaʻau) from Hilo began on June 18, 1900. Puna Sugar Company, located near the village of Kapoho, had been organized within the Puna District on March 2 of that same year. Puna Sugar had cane fields scattered all over lower Puna from Kapoho to Pāhoa Town itself. Coastal Keonepoko Iki's thin, sticky, acidic soils, however, did not allow sugar cane cultivation. The scattered geography of suitable agricultural lands in Puna also hindered the growth of the sugar industry. As with ʻŌlaʻa Sugar's early Keaʻau operations, the lack of a reliable transportation system made it expensive to collect and transport the cane from the

scattered fields to the mill. So, when Hilo Railroad proposed to lay four miles of track from Kapoho to Pāhoa, the Puna Sugar Company paid for half the cost. By March 1, 1902, the Hilo Railroad was making regular stops at the ʻŌlaʻa Sugar Mill, the town of Pāhoa, and in lower Puna.

The route of the railroad across Keonepoko Iki can be seen on Hawaiʻi Registered Map No. 2258 prepared by J.H. Morange in September of 1903 (see Figure 15 of Appendix 2). On that map a "Section House" and a "Switch" at Pāhoa Junction are shown in Keonepoko Iki Ahupuaʻa, several miles *mauka* of the project site. Two "Old Trails" are shown extending *makai* from near the section house to the coast (and a short distance *mauka* as well). One of the trails terminates at the coast of Keonepoko Iki to the northwest of the project site. Beginning in 1903 *mauka* portions of Keonepoko Nui and Keonepoko Iki *ahupuaʻa* (in the vicinity of the town of Pāhoa) were subdivided into twenty-three homestead lots collectively called the Keonepoko Homesteads (Figure 17). Soon after that the sixteen lot Kaʻohe Homesteads were created in the area above the town of Pāhoa, *mauka* and east of Keonepoko Iki Ahupuaʻa. All of these parcels were sold as grants. By 1905 the harvests of the Puna Sugar Co. were being ground at the ʻŌlaʻa Mill, and the Puna Sugar Co. was operating as a division of the ʻŌlaʻa Sugar Co. (Dorrance and Morgan 2000).

The *makai* lands of Keonepoko Iki (and neighboring Government Lands) became part of the Shipman Ranch during the early twentieth century. Hawaiʻi Territory Survey Plat Map No. 811 (prepared in 1915) shows that W.H. Shipman, Ltd. held a lease for roughly 7,400 acres of Keonepoko Nui and Keonepoko Iki (General Lease No. 1025) at an annual rental of $300.00. The lease ran from July 1918 through July 1928. It excluded the 277.8-acre Grant No. 1533 to Kekoa, of which the project site was then a part.

Throughout this period of industrial growth and decline in Puna, the coastal portion of Keonepoko Iki Ahupuaʻa remained largely undeveloped. The 1924 U.S.G.S. Makuʻu quadrangle (Figure 21 of Appendix 2) shows a single structure located in the coastal portion of Keonepoko Iki, situated inland and west of the Dearing property (interestingly this map does not show the Government Beach Road along the *mauka* boundary of the property). Farrell and Dega (2013:8) indicate the lands in the general vicinity of the project site were planted in coconuts in 1942 (these were later harvested and sold as mature trees). The Dearing property was created in 1961 when Grant No. 1533 was subdivided (Farrell and Dega 2013). During the mid-1960s, the lands to the southeast and northwest of the study area were subdivided into the Hawaiian Beaches, Hawaiian Parks, and Hawaiian Shores subdivisions. In recent years several residences have been constructed along the coast of Keonepoko Iki within the subdivided parcels of the former grant property.

A constant through all these eras of history is that the well-developed Hawaiian traditions of fishing and collecting food from the ocean continue to be practiced. This orientation to the shoreline and the traditional practices developed in Hawaiʻi are still passed down from generation to generation. Many fishermen catch *pūhi* to fish for *ʻulua* along the cliffs of Puna. Whether they use a hand-line or rod and reel, they use knowledge and techniques of past fishermen to select fishing locations, proper bait, and technique. Fishermen throw net, fish by rod and reel, or spear fish at different locations along the shoreline including the Keonepoko area to catch specific fish such as *āholehole*, *ʻāweoweo*, *kala*, *kole*, *kūmū*, *manini*, *mamo*, *moana* and many other types of fish. In addition, the traditional collection of *ʻōpihi*,

ʻaʻama, and *limu* along the rocky shoreline is still practiced. Others fish by boat out of Hilo or Pohoiki for *akule*, *kaweleʻā*, *mahimahi*, *ono*, *ʻōpakapaka*, and other species. Traditional Hawaiian fishing practices, shoreline gathering practices, and ocean access are protected by State law.

Archaeological Investigations and Resources

Previous archaeological studies conducted in the project study area provided a working model for the types and density of features that the archaeologists could expect on the project site. These studies are reviewed in Appendix 2, and they identified mounds, feature complexes, platforms, walls, trails, *ahu*, C-shaped rock structures, stone alignments, faced depressions, pits and ravines. These features were interpreted as having been used for habitation, burial, ceremonial, and agricultural purposes. One site, a faced depression designated Site A4-21, described as "a partially stone-faced natural depression" (Ewart and Luscomb 1974:34), was identified within the mauka portion of the Dearing property. This site, likely utilized for agricultural purposes, was not re-identified during an August 10, 2012, State Historic Preservation Division field inspection of the property. Given its location, Site A4-21 was likely destroyed during the grubbing and creation of an access driveway across the property, sometime between 1974 and 2000, prior to Mr. Dearing's ownership of the property. Farrell and Dega (2013) and Knapp (2003) described similar agricultural features to the southeast of the project site, suggesting that opportunistic agriculture may have been common in mulched depressions along the coast of Keonepoko Iki during the late Precontact and Early Historic Periods.

The Government Beach Road (Site 21273), which runs along the *mauka* edge of the property, is considered a historic property. Also referred to as the Puna Trail, it was studied by Lass (1997) and Maly (1999) within the *ahupuaʻa* of Keaʻau. The road is outside the area of effect of the proposed single-family residence and farm undertaking. A core-filled wall occupies the edge of the road in various places, but not at or in the vicinity of the Dearing property, where it may have been destroyed by previous road-building, coconut farming, illegal dumping or other activities.

On August 10, 2012, State Historic Preservation Division (SHPD) staff, in response to a Special Management Area application for a proposed coconut farm, conducted a field inspection of the property. They did not identify any historic resources in the previously grubbed and graded, *mauka* portion, but they did note a Historic-era wall feature near the coast, *makai* of the bulldozed coastal road. In order to protect this Historic-era site, which was outside of the development area proposed at that time, without requiring any additional archaeological research, former SHPD branch chief Theresa Donham recommended that a construction barrier be erected along the *makai* edge of the coastal road prior to any development activities. Furthermore, she required that no development associated activities be conducted *makai* of the construction barrier. As part of the current proposal, an additional archaeological survey has been undertaken because of the change of proposed land use for the parcel and the presence of this known site.

Fieldwork for the current study of the Dearing property included a visual inspection of the surface of the entire area and detailed site recordation. Researchers walked transects perpendicular to the Government Beach Road (oriented roughly northwest-southeast) spaced at 15-meter intervals. The entire area was

accessible and the corners of the property were clearly indicated tape. Ground surface visibility was excellent, as the weedy vegetation consisted primarily of tall trees with very little ground cover, and the ground was fairly flat, as it had been previously impacted by mechanical land clearing. A single archaeological site was found: the Historic-era wall previously identified by SHPD in the coastal portion of the property (see Figures 24-39 of Appendix 2 for maps, photos and illustrations of the wall, designated Site 30571). This wall was cleared of vegetation and mapped in detail using a measuring tape and compass. The site was photographed and then described using a standardized site record form. A 1 x 1 meter test unit was hand excavated at the identified site following natural stratigraphic layers. The recovered soil matrix was passed through 1/8-inch mesh screen, and all recovered cultural material was collected. A glass jug dated from 1948 was found, along with some shells and a *kukui* nut fragment. The orientation of the wall suggests that it was built to block the often strong, prevailing trade winds from blowing across the area in its lee. This area may have been used for short-term camping by fishermen accessing the adjacent coastline. The wall may have also supported a lean-to structure that sheltered the area in its lee from the rain and sun. Details of the survey methods and findings are contained in Appendix 2.

Evaluation of Significance and Assessment of Impacts to Archaeological Resources

Site 30571 was evaluated by the archaeologists as significant for the information it has yielded relative to the mid-twentieth century use of the property for short-term habitation (recurrent camping) purposes and the associated exploitation of marine resources. Site 30571 was fully documented during the archaeological survey, and the archaeologists propose that the site documentation has served to mitigate any potential impacts from the future development of a single-family residence. As the significance of the archaeological resource derives from information already collected from Site 30571, and the likelihood of encountering additional significant subsurface archaeological resources is remote, no further historic preservation work is recommended. In the unlikely event that any unanticipated archaeological resources are unearthed within the project site during the proposed development activities, work in the immediate vicinity of those resources should be halted and SHPD should be contacted in compliance with Hawai‘i Administrative Rules 13§13-280. The survey was provided to SHPD for their review and comment on August 1, 2016. By letter of May 26, 2017, SHPD concurred with the findings and accepted the report, determining that it provided adequate discussion of the project, physical environment, cultural and historical background, previous archaeological studies, methods and field findings, and met the requirements specified in HAR §13-276-5 (see Appendix 1b for letter).

Cultural Resources and Practices

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

As stated in the OEQC Guidelines for Assessing Cultural Impacts, the goal of the oral interview process is to identify and help determine the significance of potential cultural resources, practices, and beliefs associated with the affected project area, along with potential cultural impacts and appropriate mitigation as necessary. A notice describing the action and location and inviting consultation was published in the Office of Hawaiian Affairs (OHA) newspaper *Ka Wai Ola* (Vol. 33, No. 11 page 27), and a complete copy of the cultural impact assessment was shared with OHA.

As part of consultation, Dr. Rechtman met with Wayland Lum, the current manager of the remaining lands that were formerly a part of the Kekoa grant, discussed above. The Kekoa grant property in its entirety (of which the Dearing property is a part) had belonged to Wayland Lum's family as early as the 1920s, when his maternal grandfather (Erik Mydell [Mejdell], of mixed Norwegian/Hawaiian ancestry) and grandmother (Mary Kiawe [Kaiewe] Mydell, of Hawaiian ancestry) either purchased or inherited the property. According to Wayland, the property was used for cattle ranching, and as part of that activity, the observed coastal road was created by his grandfather. Wayland was born in 1954 and his personal experiences on the property continue to this day. He was not familiar with the rock construction (Site 30571), and he related that when his was growing up the property was very remote to the folks then living in Puna. He was not aware of anybody using their land or the immediate shoreline area for cultural practices. When asked what he thought about the proposed development of the Dearing property, Wayland related that he had no concerns as long as the proposed development was "tasteful" and "fit the environment."

The investigations of the property and its history did not reveal any cultural resources or practices aside from shoreline resources. No consulted individuals with ties to and history with the area had any specific information concerning the property, although one neighboring property owner stated that cultural practitioners utilized the stone camping windbreak (see emails in Appendix 1a). Subsequent research did not determine any evidence of this. However, traditional gathering and fishing are known to still be practiced on the shoreline *makai* of the property. While some users are newcomers simply engaging in recreation and/or collecting food, others have deeper ties and are undertaking cultural practices as well. The Dearing property does not contain any springs, *pu'u*, or caves that might be important cultural sites. No gathering of plant material is noted from the property, and aside from a shoreline strip that includes a native portion that will not be disturbed in any way, all vegetation on is either non-native weeds or ornamental plantings. There are no cultural values or associations related to this vegetation.

Impacts and Mitigation Measures for Cultural Resources

Shoreline access and the cultural activities this affords will not be affected. It is reasonable to conclude, based upon the limited range of resources and the proposed mitigation to all affected resources, that the exercise of native Hawaiian rights related to gathering, access or other customary activities will not be affected, and there will be no adverse effect upon cultural practices or beliefs. The Draft EA was distributed to agencies and groups who might have knowledge in order to confirm this finding. <u>No party reviewing the Draft EA supplied any cultural information.</u>

3.3 Public Roads, Services and Utilities

3.3.1 Roads and Access

Existing Environment, Impacts and Mitigation Measures

The sole road access to the project site is via an existing driveway from the Government Beach Road, (see Figure 1 and 2d). The existing gravel driveway that currently extends to proposed house site would be paved, along with the parking and turn-around area near the residence.

3.3.2 Public Utilities and Services

Environmental Setting, Impacts and Mitigation Measures

Electrical power and CATV connection will be provided from the existing HELCO and CATV lines that run along the Government Beach Road and would be extended to a single power pole located near the *mauka* property boundary and then run underground to the barn and house sites. The power system will be supplemented with a photovoltaic (PV) system located at the barn and with the PV panels mounted on the barn roof top.

Domestic water supply would be provided from an onsite water well located in the center of the property, near the barn, about 200 feet makai of the Government Beach Road. It would have a 1.5 HP pump capable of delivering up to 50 gallons per minute at maximum use. An additional back-up well, to be used in case of a mechanical failure at the primary well, is planned in the area directly *mauka* of the propose drainage/irrigation basin, about 250 feet *makai* of the primary well. A 2,000-gallon storage tank will be located within the barn, with an additional 1,500-gallon storage tank located within the garage at the residence. The proposed storage is expected to be more than adequate to meet the expected demand, based on the family's prior monitored use of less than 120 gallons per day.

Wastewater would be treated with two septic systems (one for the residence and one for the barn) in conformance with requirements of the State Department of Health (see Figure 3 for location). No parks, schools or other public facilities are present nearby.

Police, fire and emergency medical service are available about seven road miles away at new facilities on Highway 130 in Pahoa. For fire protection, the applicant proposes use of the water tanks.

There will be no adverse impact to any public or private utilities. The addition of one single-family home will have no measurable adverse impact to or additional demand on public facilities such as schools, police or fire services, or recreational areas. Mr. Dearing acknowledges and understand that this lot, along with almost all other residences in the Puna District, is not located within a mile of emergency services.

3.4 Secondary and Cumulative Impacts

Due to its small scale, the proposed project would not produce any major secondary impacts, such as population changes or effects on public facilities.

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. No substantial government or private projects such as roadways, schools, businesses, or subdivisions, are known to be occurring or in planning for this portion of Puna. There are several dozen private lots on the three-mile stretch of the narrow and unpaved Government Beach Road between the Hawaiian Paradise Park and Hawaiian Shores subdivisions. At any given time, a home may be under construction, and occasionally there are two or more homes under construction simultaneously. The adverse effects of building a single-family residence in this context are very minor and involve temporary disturbances to air quality, noise, traffic and visual quality during construction. It should again be noted that the proposed home and farm are in a somewhat isolated, sparsely populated area, and no accumulation of adverse construction effects would be expected. Other than the precautions for preventing adverse impacts during construction listed above in Sections 3.1.3 and 3.1.6, no special mitigation measures should be required to counteract the small adverse cumulative effect.

3.5 Required Permits and Approvals

County of Hawai‘i:

Special Management Area Permit or Exemption
Plan Approval and Grubbing, Grading, and Building Permits

State of Hawai‘i:

Conservation District Use Permit
Wastewater System Approval
Water Well Permit

3.6 Consistency with Government Plans and Policies

3.6.1 Hawai‘i County General Plan

The *General Plan* for the County of Hawai‘i is the document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i. The plan was adopted by ordinance in 1989 and revised in 2005. The General Plan’s Land Use Allocation Guide Map designates the property as Open. The *General Plan* is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai‘i. Below are pertinent sections followed by a discussion of conformance.

ECONOMIC GOALS

(a) Provide residents with opportunities to improve their quality of life through economic development that enhances the County's natural and social environments.
(b) Economic development and improvement shall be in balance with the physical, social, and cultural environments of the island of Hawaii.
(d) Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County's cultural, natural, and social environment.

Discussion: The proposed construction and occupation of a single-family home and the establishment of a farm are in balance with the natural, cultural and social environment of the County, would create temporary construction jobs for local residents and permanent jobs for the occupant and any required farm hands, and would indirectly boost the economy through construction industry purchases from local suppliers. A multiplier effect takes place when these employees spend their income for food, housing, and other living expenses in the retail sector of the economy. Such activities are in keeping with the overall economic development of the island.

ENVIRONMENTAL QUALITY GOALS

(a) 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.
(b) Maintain and, if feasible, improve the existing environmental quality of the island.
(c) Control pollution.

ENVIRONMENTAL QUALITY POLICIES

(a) Take positive action to further maintain the quality of the environment.

ENVIRONMENTAL QUALITY STANDARDS

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

Discussion: The proposed construction and occupation of a single-family home and the establishment of a farm would not have a substantial adverse effect on the environment and would not diminish the valuable natural resources of the region. The home and associated improvements would be compatible with the existing rural single-family homes and recreational uses in the area. Pertinent environmental regulations would be followed, including those for mitigation of water quality impacts.

HISTORIC SITES GOALS

(a) Protect, restore, and enhance the sites, buildings, and objects of significant historical and cultural importance to Hawaii.
(b) Appropriate access to significant historic sites, buildings, and objects of public interest should be made available.

HISTORIC SITES POLICIES

(a) Agencies and organizations, either public or private, pursuing knowledge about historic sites should keep the public apprised of projects.
(b) Amend appropriate ordinances to incorporate the stewardship and protection of historic sites, buildings and objects.
(c) Require both public and private developers of land to provide historical and archaeological surveys and cultural assessments, where appropriate, prior to the clearing or development of land when there are indications that the land under consideration has historical significance.
(d) Public access to significant historic sites and objects shall be acquired, where appropriate.

Discussion: An archaeological inventory survey properly documented the one historic site present on the property, a mid-20th century wall likely used as a camping shelter. The archaeologists have proposed that the wall is no longer significant and it is proposed for removal in association with the construction of the residence. There are no known cultural resources or known or expected cultural uses on the lot; traditional fishing and shellfish gathering occur *makai* of the lot, which will not be affected.

FLOOD CONTROL AND DRAINAGE GOALS

(a) Protect human life.
(b) Prevent damage to man-made improvements.
(c) Control pollution.
(d) Prevent damage from inundation.
(e) Reduce surface water and sediment runoff.
(f) Maximize soil and water conservation.

FLOOD CONTROL AND DRAINAGE POLICIES

(a) Enact restrictive land use and building structure regulations in areas vulnerable to severe damage due to the impact of wave action. Only uses that cannot be located elsewhere due to public necessity and character, such as maritime activities and the necessary public facilities and utilities, shall be allowed in these areas.
(g) Development-generated runoff shall be disposed of in a manner acceptable to the Department of Public Works and in compliance with all State and Federal laws.

FLOOD CONTROL AND DRAINAGE STANDARDS

(a) "Storm Drainage Standards," County of Hawaii, October, 1970, and as revised.
(b) Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawaii County Code.
(c) Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).
(d) Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control," of the Hawaii County Code.
(e) Applicable standards and regulations of the Natural Resources Conservation Service and the Soil and Water Conservation Districts.

Discussion: The property is within Zone X, or areas outside of the 500-year floodplain as determined by detailed methods in the Flood Insurance Rate Maps (FIRM). The project will conform to applicable drainage regulations and policies of the County of Hawai‘i.

NATURAL BEAUTY GOALS

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

NATURAL BEAUTY POLICIES

(a) Increase public pedestrian access opportunities to scenic places and vistas.
(b) Develop and establish view plane regulations to preserve and enhance views of scenic or prominent landscapes from specific locations, and coastal aesthetic values.

Discussion: The improvements are minor and consistent with traditional uses of the land and will not cause scenic impacts or impede access.

NATURAL RESOURCES AND SHORELINES GOALS

(a) Protect and conserve the natural resources from undue exploitation, encroachment and damage.
(b) Provide opportunities for recreational, economic, and educational needs without despoiling or endangering natural resources.
(c) Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.
(d) Protect rare or endangered species and habitats native to Hawaii.
(e) Protect and effectively manage Hawaii's open space, watersheds, shoreline, and natural areas.
(f) Ensure that alterations to existing land forms, vegetation, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of an earthquake.

NATURAL RESOURCES AND SHORELINES POLICIES

(a) Require users of natural resources to conduct their activities in a manner that avoids or minimizes adverse effects on the environment.
(c) Maintain the shoreline for recreational, cultural, educational, and/or scientific uses in a manner that is protective of resources and is of the maximum benefit to the general public.
(d) Protect the shoreline from the encroachment of man-made improvements and structures.
(h) Encourage public and private agencies to manage the natural resources in a manner that avoids or minimizes adverse effects on the environment and depletion of energy and natural resources to the fullest extent.
(p) Encourage the use of native plants for screening and landscaping.
(r) Ensure public access is provided to the shoreline, public trails and hunting areas, including free public parking where appropriate.
(u) Ensure that activities authorized or funded by the County do not damage important natural resources.

Discussion: The home would be set back a minimum of 100 feet from the shoreline at an elevation of about 25 feet above sea level, and would not affect shoreline resources or be damaged by waves or tides.

PUNA COMMUNITY DEVELOPMENT PLAN

The Puna Community Development Plan (CDP) encompasses the judicial district of Puna, 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 Puna CDP does not specify land use in the project area, but contains the following Goals for Managing Growth that are relevant to the action.

> 3.1.1 Goals (for Managing Growth)
> a. Puna retains a rural character while it protects its native natural and cultural resources.
> b. The quality of life improves and economic opportunity expands for Puna’s residents.
> d. Exposure to high risk from natural hazards situations is reduced.
> f. Native vegetation, coastal and historic resources are provided new forms of protection.

Discussion: The proposed single-family home and the establishment of a farm help the area retain a rural character. Through provision of housing and production of fruit, it improves the quality of life and economy. The lot shares the same volcanic and seismic hazard as all of Puna, the by virtue of the home’s proposed location on the lot, coastal hazard is avoided. No native vegetation, rare species, coastal resources or historic sites will be adversely affected, and an endangered grass will continue to undergo care and protection by the landowner that has heretofore allowed it to persist. The construction of a of a single-family home and farm is not inconsistent with the Puna CDP.

3.6.2 Hawai‘i County Zoning and Special Management Area

The State Land Use District for property is Conservation. The entire property is zoned by the County of Hawai‘i as within the Agricultural District, minimum lot size of one acre (A-1a), although County zoning per se does not apply in the Conservation District. No aspect of the project appears to be inconsistent with County zoning.

The entire property is within the Special Management Area. Single-family residences may be determined to be an exempt action under the County’s Special Management Area (SMA) guidelines. The County of Hawai‘i Planning Department requires preparation of an SMA Assessment Application, in which SMA issues are expressly dealt with. A summary of consistency is provided below.

The proposed land use complies with provisions and guidelines contained in Chapter 205A, Hawai‘i Revised Statutes (HRS), entitled *Coastal Zone Management*. Single-family residences and the agricultural uses associated with the planned fruit tree farm may be determined to be an exempt action under the County’s Special Management Area (SMA) guidelines. The proposed use would be consistent with Chapter 205A because it would not affect public access to recreational areas, historic resources, scenic and open space resources, coastal ecosystems, economic uses, or coastal hazards.

The proposed improvements are not likely to result in any substantial adverse impact on the surrounding environment. The house site is set back from the shoreline and will not restrict any shoreline uses such as hiking, fishing or water sports. Lateral pedestrian use of the shoreline area will not be impacted and there will be no effect on the public’s access to or enjoyment of this shoreline area. Furthermore, viewplanes towards the project site will not be adversely impacted in any substantial way, as views from the Government Beach Road are totally blocked by trees. It is expected that the project will not result in any impact on the biological or economic aspects of the coastal ecosystem. The project site is not situated over any natural drainage system or water feature that would flow into the nearby coastal system. The property contains mostly non-native and a few common native plants. No floodplains are present in the area. In terms of beach protection, construction is set back from the shoreline and would not affect any beaches nor adversely affect public use and recreation of the shoreline in this area. With implementation of Best Management Practices associated with grading permits and the Farm Management Plan, there should be no impacts on marine resources. The one historic site, a mid-20th century wall, has been properly documented and there will be no impact to significant historic sites. There are no known cultural resources or practices.

The Planning Director will be asked to make the determination that the proposed development of a single-family home and agricultural uses planned as part of the farm are not considered a “development” under Special Management Area Rules and Regulations of the County of Hawai‘i, Section 9-4 (10) (B) and is otherwise not subject to an SMA Major Permit.

3.6.3 Conservation District

The State Land Use District for the Dearing property is Conservation. Its subzone is Resource, for which, according to Hawai‘i Administrative Rules (HAR) §13-5-15, both a single-family residence and a farm are identified uses. Any proposed use must undergo an examination for its consistency with the goals and rules of this district and subzone. The applicant has concurrently prepared a Conservation District Use Application (CDUA), to which this EA is an appendix. The CDUA includes a detailed evaluation of the consistency of the project with the criteria of the Conservation District permit process. Briefly, the following individual consistency criteria should be noted:

1. The proposed land use is consistent with the purpose of the Conservation District;

The development of the single-family residence and the establishment of a farm are in conformance with the purpose of the Conservation District. Both are identified uses within the Conservation District, requiring a Board Permit for such use. A commitment by the applicant to management of the site as reflected in the Farm Management Plan will conserve, protect and preserve the natural features on the subject property. The proposed use will not impact the lateral public access or the public’s ability to utilize the coastal resources that front this property. Additionally, due to the careful and limited nature of the proposed development, there would be no significant impacts to the natural or cultural resources of the area.

2. The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;

The objective of the Resource subzone “*…is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas.”* These identified uses, which conform to the design standards in 13-5-41, will ensure the sustained use of the natural resources in the project area by mitigating potential impacts as outlined in this document. Single-family residences are an identified use in the Resource subzone under HAR 13-5-24, R-8, and agriculture in an area greater than one acre is an identified use under HAR 13-5-23, L-1, requiring a management plan.

3. The proposed land use complies with provisions and guidelines contained in Chapter 205A, Hawaii Revised Statutes (HRS), entitled "Coastal Zone Management," where applicable;

The proposed land uses comply with provisions and guidelines contained in Chapter 205A, Hawai‘i Revised Statutes (HRS), entitled *Coastal Zone Management*, as discussed above in Section 3.6.2.

4. The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region;

Because of the relatively minor nature of the project and the lack of native terrestrial ecosystems and threatened or endangered plant species (other than the endangered grass, which has been and will continue to be protected by the applicant), the proposed single-family residence and the establishment of a farm are

not likely to cause adverse biological impacts. Impacts to the island wide-ranging endangered Hawaiian hoary bat and Hawaiian Hawk will be avoided through timing of vegetation removal and/or hawk nest survey. No effect on any coastal ecosystem will occur, because of the extensive, 100-foot wide shoreline vegetated strip that will be left almost completely untouched except for removal and thinning of some invasive trees, the careful preservation of two patches of an endangered grass, and the planned precautions for preventing soil runoff during construction and later during farming operations. The proposed action will also have no impact on the public's current access to or use of the shoreline area.

5. The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels;

The proposed use is consistent with single-family residential use in the area. The proposed one-story home will be 20 feet high, 4,922 square feet in size (including pool, decking, lanais and porches and garage) and will be set back a minimum of 100 feet from a *pali* that marks the shoreline, approximately 25 feet above sea level, outside the flood zone. It will be in area not visible to the public. This identified use, which conforms to the design standards in HAR 13-5-41, will ensure the sustained use of the natural resources in the project area by mitigating impacts. The use will not adversely affect the surrounding properties or how these properties are utilized. The proposed farm will be established in an area that currently supports a non-native weed forest on long-ago bulldozed land formerly utilized for farming and ranching. This land use will be attractive and compatible with the area, as across Government Beach Road there is an existing ranch.

6. The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable;

The proposed continued use of the subject property for a single-family residence and the establishment of a farm will help conserve, protect and preserve the natural features of the area.

7. Subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District;

The proposed action does not involve or depend upon subdivision and will not lead to any increase in intensity of use beyond the requested single-family residence.

8. The proposed land use will not be materially detrimental to the public health, safety and welfare.

The general area is already in use for recreation by the public and the proposed single-family residence and the establishment of a farm will not be detrimental to the public health, safety, and welfare.

PART 4: DETERMINATION, FINDINGS AND REASONS

4.1 Determination

Based on the findings below, and upon consideration of comments to the Draft EA, the applicant expects that the State of Hawai‘i, Department of Land and Natural Resources, will determine that the proposed action 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).

4.2 Findings and Supporting Reasons

1. *The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.* No valuable natural or cultural resource would be committed or lost. Common native plants are present but native ecosystems would not be adversely affected. The project site is dominated by alien vegetation, with the only sensitive ecosystem on the property being the shoreline vegetation, where common native plants are present as well as several clumps of the endangered grass *Ischaemum byron*e. Development completely avoids this area, but some ironwoods will be removed and others will be trimmed. No adverse impact upon vegetation or endangered species should occur. The endangered grass clumps will be marked and protected from trampling and tree removal/trimming. The survival of the largest clump is directly attributable to the ongoing actions of the landowner, who has cared for the grass ever since discovering it. Because of the location and nature of the project relative to sensitive vegetation and species, construction and use of the single-family residence as well as establishment of a farm are not likely to cause adverse biological impacts. An archaeological inventory survey properly documented the one historic site present on the property, a mid-20th century wall likely used as a camping shelter. The archaeologists have proposed that the wall is no longer significant and it is proposed for removal in association with the construction of the residence. No valuable cultural resources and practices such as coastal access, fishing, gathering, hunting, or access to ceremonial sites would be affected in any way.

2. *The proposed project will not curtail the range of beneficial uses of the environment.* No restriction of beneficial uses would occur by residential and farming use on this lot.

3. *The proposed project will not conflict with the State’s long-term environmental* policies. The State’s long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The project is minor and basically environmentally benign, and it is thus consistent with all elements of the State’s long-term environmental policies.

4. *The proposed project will not substantially affect the economic or social welfare of the community or State.* The project would not have any substantial effect on the economic or social welfare of the Big Island community or the State of Hawai‘i.

5. *The proposed project does not substantially affect public health in any detrimental way.* The

project would not affect public health and safety in any way. Wastewater will be disposed of in conformance with State Department of Health regulations.

6. *The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities*. The small scale of the proposed project would not produce any major secondary impacts, such as population changes or effects on public facilities.

7. *The proposed project will not involve a substantial degradation of environmental quality*. The project is minor and environmentally benign, and thus it would 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.* Thorough survey has determined that no endangered plant species are present, with the exception of an endangered grass that has been and will continue to be protected. Other than Hawaiian hoary bats and Hawaiian hawks, island wide-ranging species that will experience no adverse impacts due to mitigation in the form of timing of vegetation removal and/or hawk nest survey, no rare, threatened or endangered species of fauna are known to exist on or near the project site, and none would be affected by any project activities.

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 building a single-family residence are very minor and temporary disturbance to traffic, air quality, noise, and visual quality during construction. This area is fairly isolated from sensitive receptors other than similar single-family residences. There are no substantial government or private projects in construction or planning, and no accumulation of adverse construction effects would be expected. Other than the precautions for preventing adverse effects during construction listed above, no special mitigation measures should be required to counteract the small adverse cumulative effect.

10. *The proposed project will not detrimentally affect air or water quality or ambient noise levels.* No substantial effects to air, water, or ambient noise would occur. Brief, temporary effects would occur during construction and would be mitigated. Some noise would also occur during farming activities, particularly during initial hole preparation, but the context of the proposed farm's location, with no residences, parks, or other sensitive uses nearby, will help avoid noise impacts. Water quality impacts from the proposed farming methods would be minimal, and a drainage basin/irrigation pond and other practices outlined in a formal Farm Management Plan will assist in mitigating sedimentation impacts to essentially zero.

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.* The proposed home is not located in a flood zone. The proposed home site is 100 feet from the shoreline at an elevation of about 25 feet from the shoreline, outside the area historically affected by tsunami. In general, geologic conditions do not impose undue constraints on the proposed action, as much of the Puna District faces similar volcanic and seismic hazard

and yet continues to be the fastest growing region of the State. The applicant understands that there are hazards associated with homes in this geologic setting, and has made the decision that a residence is not imprudent to construct or inhabit.

12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* No scenic views are located nearby or would be affected in any way. Coastal views from the Government Beach Road are totally obstructed by 600 feet of dense vegetation. The attractive design of the home, given the existing context in which the home would not be visible from public vantage points, would not materially degrade the scenery of the project area. The fruit trees would replace a tangled, weedy forest of invasive trees and would offer pleasant scenery to passing motorists.

13. *The project will not require substantial energy consumption*. Negligible amounts of energy input would be required for construction of the facilities and operation of the farm.

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Environmental Assessment

Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko

APPENDIX 1a
Comments in Response to Early Consultation

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DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

EPO 16-256

July 21, 2016

Mr. Ron Terry, Principal
Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawaii 96721
Email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Environmental Assessment for Early Consultation (EA EC) for Proposed Single-Family Residence and Farm in the Conservation District, Puna District, Hawaii
TMK: (3rd) 1-5-009: 055

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your EA EC to our office on July 15, 2016

In the development and implementation of all projects, EPO strongly recommends regular review of State and Federal environmental health land use guidance. State standard comments and available strategies to support sustainable and healthy design are provided at: http://health.hawaii.gov/epo/landuse. Projects are required to adhere to all applicable standard comments. EPO has recently updated the environmental Geographic Information System (GIS) website page. It now compiles various maps and viewers from our environmental health programs. The eGIS website page is continually updated so please visit it regularly at: http://health.hawaii.gov/epo/egis.

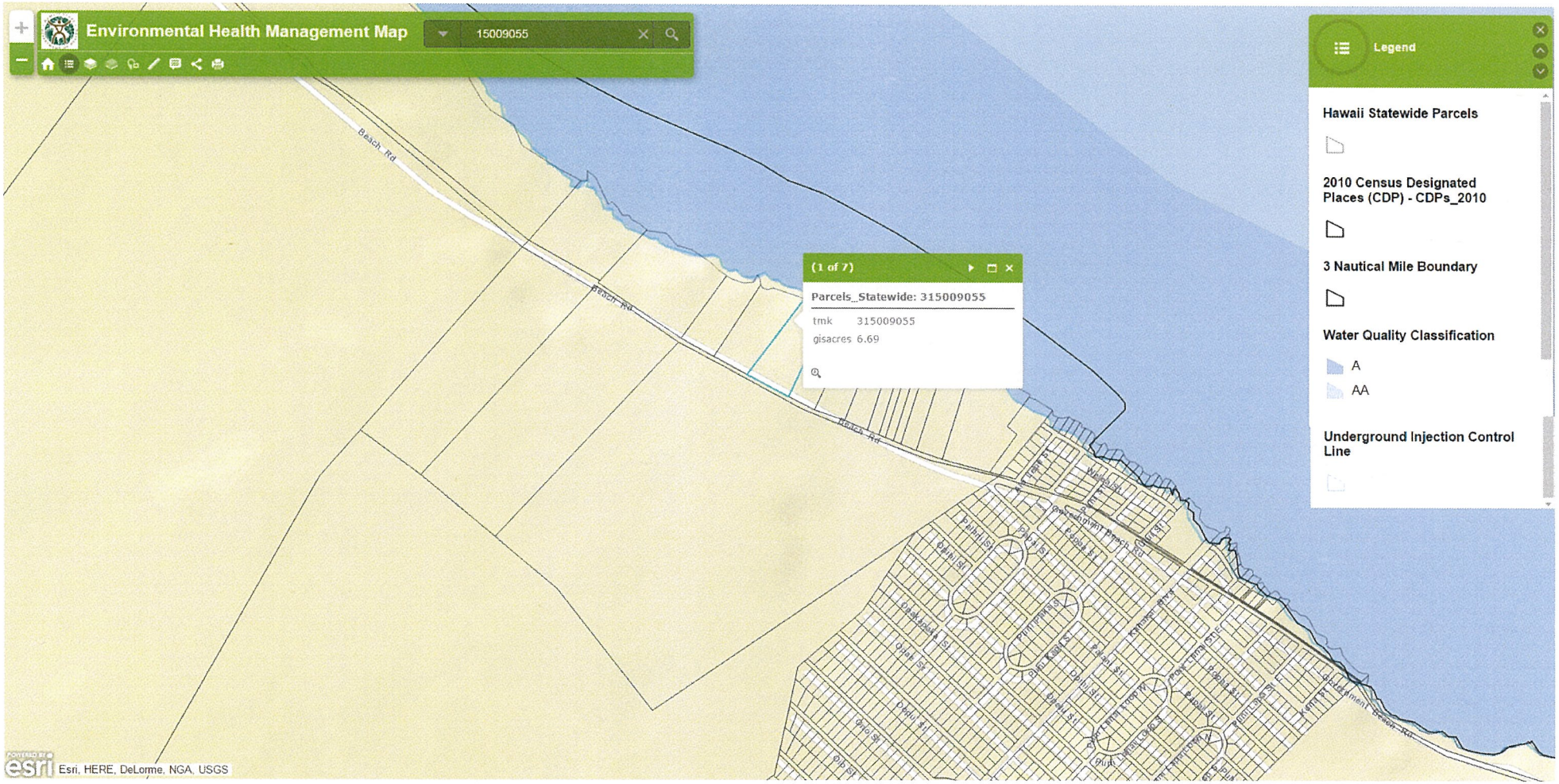
EPO also encourages you to examine and utilize the Hawaii Environmental Health Portal at: https://eha-cloud.doh.hawaii.gov. This site provides links to our e-Permitting Portal, Environmental Health Warehouse, Groundwater Contamination Viewer, Hawaii Emergency Response Exchange, Hawaii State and Local Emission Inventory System, Water Pollution Control Viewer, Water Quality Data, Warnings, Advisories and Postings.

We suggest you review the requirements of the CWB (HAR, Section 11-54-1.1, -3, 4-8) and/or the National Pollutant Discharge Elimination System (NPDES) permit (HAR, Chapter 11-55) at: http://health.hawaii.gov/cwb. If you have any questions, please contact the Clean Water Branch, Engineering Section at (808) 586-4309 or cleanwaterbranch@doh.hawaii.gov. If your project involves waters of the U.S., it is highly recommended that you contact the Army Corps of Engineers, Regulatory Branch at: (808) 835-4303.

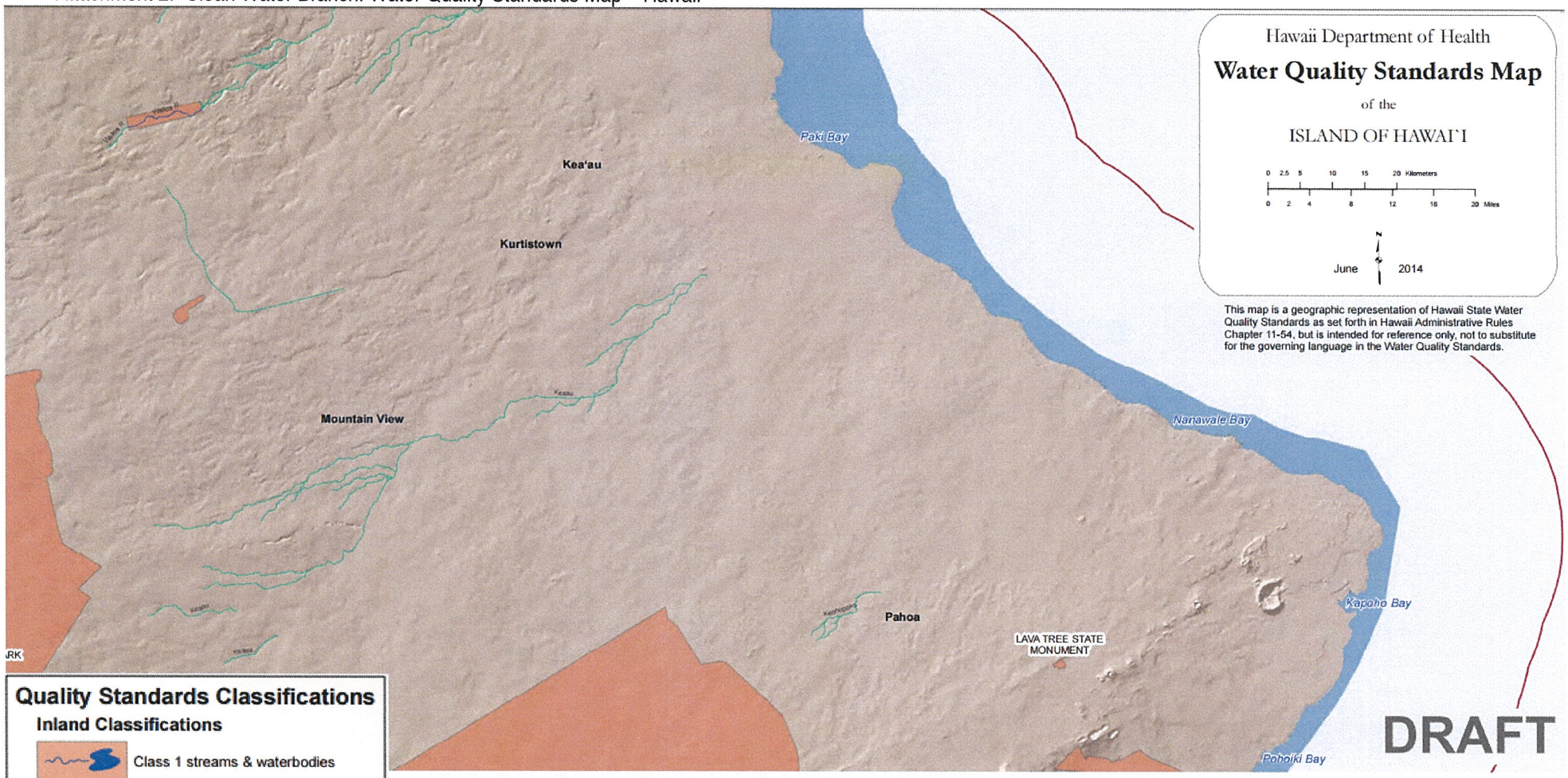
Please note that all wastewater plans must conform to applicable provisions of the Department of Health's Administrative Rules, Chapter 11-62, "Wastewater Systems". We reserve the right to review the detailed wastewater plans for conformance to applicable rules. Should you have any questions, please review online guidance at: http://health.hawaii.gov/wastewater and contact the Planning and Design Section of the Wastewater Branch at (808) 586-4294.

You may also wish to review the draft Office of Environmental Quality Control (OEQC) viewer at: http://eha-web.doh.hawaii.gov/oeqc-viewer. This viewer geographically shows where some previous Hawaii Environmental Policy Act (HEPA) {Hawaii Revised Statutes, Chapter 343} documents have been prepared.

Attachment 1: Environmental Health Management Web App Snipit of Project Area: http://health.hawaii.gov/epo/egis



Attachment 2: Clean Water Branch: Water Quality Standards Map – Hawaii



Quality Standards Classifications

Inland Classifications

Class 1 streams & waterbodies

Class 2 streams & waterbodies

Marine Classifications

A
AA
Bounded by 100-fathom contour

3 Mile Boundary Line: Areas situated within this line but outside of the 100-fathom contour are subject to Hawaii State Oceanic Water Quality Standards.

Attachment 3: Wastewater Branch: Recycled Water Use Map of Project Area

Attachment 4: OEQC Viewer Map of Project Area

DAVID Y. IGE
GOVERNOR OF
HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
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

OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF: OCCL: AJR

COR: HA-17-02

JUL 21 2016

J M Leonard Planning, LLC
P.O. Box 11321
Hilo, HI 96721

SUBJECT: **REQUEST FOR INFORMATION REGARDING LAND USES IN THE STATE LAND USE CONSERVATION DISTRICT**
Puna District, Island of Hawaii
TMK: (3) 1-5-009:055

Dear Mr. Leonard,

The Office of Conservation and Coastal Lands is in receipt of your correspondence requesting information on the permitting and approval process for a proposed family farm (Farm) and Single Family Residence (SFR). For reference the subject parcel is located within the State Land Use (SLU) Conservation District *Resource* Subzone.

According to the information provided to this office it appears the landowner is proposing to construct a SFR of less than 5000 square feet, establish and plant a tropical fruit tree farm of approximately five (5) acres, and construct a "barn" that is less than 400 sq. ft. in size. Additional improvements include one or two on-site drill wells, and a drainage basin/irrigation reservoir located near the SFR for storm water management and Farm use.

It was stated in the letter that: "the farm is envisioned to serve as a family farm consisting of a variety of tropical fruit trees, the produce from which is intended for family use". Additionally, the letter also states that: "if at some point in the future, the family decides to process a portion of the fruit for sale; the fruit would be processed, packaged and sold off-site". **Please note that the OCCL will still consider this use to be commercial, and therefore will require a public hearing prior to any final determination.**

The landowner is proposing to begin with the installation of the farm related improvements including the well, barn, drainage/irrigation improvements, and tree plantings; all of which are proposed to be completed in the first three (3) years after permits are issued and approval is granted. Three (3) to five (5) years later, if permits are issued and approval is granted for the Farm, the landowner proposes to construct a SFR.

The letter requested information on "phasing" the proposed land uses under one (1) Conservation District Use Application (CDUA), rather than submitting two (2) CDUAs – one for the SFR and one for the Farm. Similarly, the landowner wishes to submit one (1) Environmental Assessment (EA) to cover both "phases" (i.e., SFR and Farm) of the proposed project.

At this time the OCCL is prepared to accept for review one (1) Environmental Assessment (EA) that covers the proposed development of the entire parcel (i.e., Farm and SFR). However, in order to apply for this project in "phases", the landowner will be required to submit one (1) CDUA for the Farm and one (1) CDUA for the SFR when the landowner is prepared to construct the SFR. Please note that the acceptance of an EA that covers the two (2) projects (i.e., Farm and SFR) is contingent upon current State rules and regulations. Should Hawaii Revised Statutes Chapter 343 or Hawaii Administrative Rules §11-200-8 be amended, there is a potential the EA may no longer be acceptable for the second phase (i.e., SFR) of the proposed project.

You have also requested information regarding the need for a Shoreline Certification; based on preliminary plans submitted to this office it is unclear if it is required for this proposed project. Once the application is submitted, or more detailed plans are proposed, the requirement to obtain a Shoreline Certification will be determined. Additionally, the County of Hawaii may request a Shoreline Certification for any Special Management Area (SMA) review and permitting.

1) The proposal to establish a commercial tropical fruit farm on the subject parcel is an identified land use within the Conservation District General Subzone pursuant to HAR §13-5-23, L-1 **AGRICULTURE** (D-1), *Agriculture, within an area of more than one acre, defined as the planting, cultivating, and harvesting of horticultural crops, floricultural crops, or forest products, or animal husbandry. A management plan approved simultaneously with the permit is also required.* In order to apply for this proposed land use the landowner will be required to submit to this office a complete Conservation District Use Application (CDUA) and all required documentation;

and

2) The proposal to construct a Single Family Residence (SFR) and associated appurtenances on the subject parcel is an identified land use in the Conservation District Resource Subzone pursuant to HAR §13-5-24, R-7 **SINGLE FAMILY RESIDENCE** (D-1), *A single family residence that conforms to design standards as outlined in this chapter.* In order to apply for these proposed land uses the applicant will be required to submit to this office a complete Conservation District Use Application (CDUA) and all required documentation;

3) Both of these proposed land uses would require a Board permit. To apply, modify, or deny either of the applications would be at the discretion of the Board of Land and Natural Resources;

4) In conformance with §343, Hawaii Revised Statutes (HRS), as amended, and HAR, §11-200-8 the development of the subject parcel will require the filing of an Environmental Assessment (EA);

5) Pursuant to HAR §13-5-40 Hearings, (a) Public hearings shall be held: (1) *On all applications for a proposed use of land for commercial purposes.* Therefore this project will require a public hearing; and

6) Please be informed that, the applicant's responsibility includes complying with the provisions of Hawaii's Coastal Zone Management law (Chapter 205A, Hawaii Revised Statures) that pertain to the Special Management Area (SMA) requirements administered by the various counties. Negative action by the Chair of the BLNR on this application can be expected should you fail to obtain and provide us, at least thirty (30) days prior to Chairpersons action, one of the following from the appropriate county:

    1. An official determination that the proposal is exempt from the provisions of the county rules relating to the SMA;

    2. An official determination that the proposed development is outside the SMA; or

    3. An SMA Use Permit for the proposed development.

If you have any questions related to this correspondence, or on our rules and regulations, please contact Alex J. Roy, M.Sc., of our Office of Conservation and Coastal Lands staff at 808-587-0316

Sincerely,

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

CC: DLNR Land – Attn: Lydia Morikawa
County of Hawaii – Planning Department
Geometrician Assoc. Inc., PO Box 396, Hilo, HI, 96721

William P. Kenoi
Mayor

Darren J. Rosario
Fire Chief

Renwick J. Victorino
Deputy Fire Chief

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

July 25, 2016

Ron Terry, Principal
Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawai'i 96721

Dear Mr. Ron Terry:

SUBJECT: Environmental Assessment Early Consultation for Proposed Single-Family Residence and Farm in the Conservation District, Puna District, Island of Hawai'i, TMK (3) 1-5-009:005

In regards to the above-mentioned Environmental Assessment Early Consultation application, the following shall be in accordance:

NFPA 1, UNIFORM FIRE CODE, 2006 EDITION
Note: Hawai'i State Fire Code, National Fire Protection Association 2006 version, with County of Hawai'i amendments. County amendments are identified with a preceding "C~" of the reference code.

Chapter 18 Fire Department Access and Water Supply

18.1 General. Fire department access and water supplies shall comply with this chapter.

For occupancies of an especially hazardous nature, or where special hazards exist in addition to the normal hazard of the occupancy, or where access for fire apparatus is unduly difficult, or areas where there is an inadequate fire flow, or inadequate fire hydrant spacing, and the AHJ may require additional safeguards including, but not limited to, additional fire appliance units, more than one type of appliance, or special systems suitable for the protection of the hazard involved.

18.1.1 Plans.

18.1.1.1 Fire Apparatus Access. Plans for fire apparatus access roads shall be submitted to the fire department for review and approval prior to construction.

18.1.1.2 Fire Hydrant Systems. Plans and specifications for fire hydrant systems shall be submitted to the fire department for review and approval prior to construction.

C~ 18.1.1.2.1 Fire Hydrant use and Restrictions. No unauthorized person shall use or operate any Fire hydrant unless such person first secures permission or a permit from the owner or representative of the department, or company that owns or governs that water supply or system. Exception: Fire Department personnel conducting firefighting operations, hydrant testing, and/or maintenance, and the flushing and acceptance of hydrants witnessed by Fire Prevention Bureau personnel.

18.2 Fire Department Access.

18.2.1 Fire department access and fire department access roads shall be provided and maintained in accordance with Section 18.2.

18.2.2* Access to Structures or Areas.

18.2.2.1 Access Box(es). The AHJ shall have the authority to require an access box(es) to be installed in an accessible location where access to or within a structure or area is difficult because of security.

18.2.2.2 Access to Gated Subdivisions or Developments. The AHJ shall have the authority to require fire department access be provided to gated subdivisions or developments through the use of an approved device or system.

18.2.2.3 Access Maintenance. The owner or occupant of a structure or area, with required fire department access as specified in 18.2.2.1 or 18.2.2.2, shall notify the AHJ when the access is modified in a manner that could prevent fire department access.

18.2.3 Fire Department Access Roads. (*may be referred as FDAR)

18.2.3.1 Required Access.

18.2.3.1.1 Approved fire department access roads shall be provided for every facility, building, or portion of a building hereafter constructed or relocated.

18.2.3.1.2 Fire Department access roads shall consist of roadways, fire lanes, parking lots lanes, or a combination thereof.

18.2.3.1.3* When not more than two one- and two-family dwellings or private garages, carports, sheds, agricultural buildings, and detached buildings or structures 400ft^2 (37 m^2) or less are present, the requirements of 18.2.3.1 through 18.2.3.2.1 shall be permitted to be modified by the AHJ.

18.2.3.1.4 When fire department access roads cannot be installed due to location on property, topography, waterways, nonnegotiable grades, or other similar conditions, the AHJ shall be authorized to require additional fire protection features.

18.2.3.2 Access to Building.

18.2.3.2.1 A fire department access road shall extend to within in 50 ft (15 m) of at least one exterior door that can be opened from the outside that provides access to the interior of the building. Exception: 1 and 2 single-family dwellings.

18.2.3.2.1.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.1 shall be permitted to be increased to 300 feet.

18.2.3.2.2 Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 ft (46 m) from fire department access roads as measured by an approved route around the exterior of the building or facility.

18.2.3.2.2.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.2 shall be permitted to be increased to 450 ft (137 m).

18.2.3.3 Multiple Access Roads. More than one fire department access road shall be provided when it is determined by the AHJ that access by a single road could be impaired by vehicle congestion, condition of terrain, climatic conditions, or other factors that could limit access.

18.2.3.4 Specifications.

18.2.3.4.1 Dimensions.

C~ 18.2.3.4.1.1 FDAR shall have an unobstructed width of not less than 20ft with an approved turn around area if the FDAR exceeds 150 feet. **Exception:** FDAR for one and two family dwellings shall have an unobstructed width of not less than 15 feet, with an area of not less than 20 feet wide within 150 feet of the structure being protected. An approved turn around area shall be provided if the FDAR exceeds 250 feet.

C~ 18.2.3.4.1.2 FDAR shall have an unobstructed vertical clearance of not less then 13ft 6 in.

C~ 18.2.3.4.1.2.1 Vertical clearances may be increased or reduced by the AHJ, provided such increase or reduction does not impair access by the fire apparatus, and approved signs are installed and maintained indicating such approved changes.

18.2.3.4.1.2.2 Vertical clearances shall be increased when vertical clearances or widths are not adequate to accommodate fire apparatus.

C~ 18.2.3.4.2 Surface. Fire department access roads and bridges shall be designed and maintained to support the imposed loads (25 Tons) of the fire apparatus. Such FDAR and shall be comprised of an all-weather driving surface.

18.2.3.4.3 Turning Radius.

C~ 18.2.3.4.3.1 Fire department access roads shall have a minimum inside turning radius of 30 feet, and a minimum outside turning radius of 60 feet.

18.2.3.4.3.2 Turns in fire department access road shall maintain the minimum road width.

18.2.3.4.4 Dead Ends. Dead-end fire department access roads in excess of 150 ft (46 m) in length shall be provided with approved provisions for the fire apparatus to turn around.

18.2.3.4.5 Bridges.

18.2.3.4.5.1 When a bridge is required to be used as part of a fire department access road, it shall be constructed and maintained in accordance with county requirements.

18.2.3.4.5.2 The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus.

18.2.3.4.5.3 Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ.

18.2.3.4.6 Grade.

C~ 18.2.3.4.6.1 The maximum gradient of a Fire department access road shall not exceed 12 percent for unpaved surfaces and 15 percent for paved surfaces. In areas of the FDAR where a Fire apparatus would connect to a Fire hydrant or Fire Department Connection, the maximum gradient of such area(s) shall not exceed 10 percent.

18.2.3.4.6.2* The angle of approach and departure for any means of fire department access road shall not exceed 1 ft drop in 20 ft (0.3 m drop in 6 m) or the design limitations of the fire apparatus of the fire department, and shall be subject to approval by the AHJ.

18.2.3.4.6.3 Fire department access roads connecting to roadways shall be provided with curb cuts extending at least 2 ft (0.61 m) beyond each edge of the fire lane.

18.2.3.4.7 Traffic Calming Devices. The design and use of traffic calming devices shall be approved the AHJ.

18.2.3.5 Marking of Fire Apparatus Access Road.

18.2.3.5.1 Where required by the AHJ, approved signs or other approved notices shall be provided and maintained to identify fire department access roads or to prohibit the obstruction thereof of both.

18.2.3.5.2 A marked fire apparatus access road shall also be known as a fire lane.

18.2.4* Obstruction and Control of Fire Department Access Road.

18.2.4.1 General.

18.2.4.1.1 The required width of a fire department access road shall not be obstructed in any manner, including by the parking of vehicles.

18.2.4.1.2 Minimum required widths and clearances established under 18.2.3.4 shall be maintained at all times.

18.2.4.1.3* Facilities and structures shall be maintained in a manner that does not impair or impede accessibility for fire department operations.

18.2.4.1.4 Entrances to fire departments access roads that have been closed with gates and barriers in accordance with 18.2.4.2.1 shall not be obstructed by parked vehicles.

18.2.4.2 Closure of Accessways.

18.2.4.2.1 The AHJ shall be authorized to require the installation and maintenance of gates or other approved barricades across roads, trails, or other accessways not including public streets, alleys, or highways.

18.2.4.2.2 Where required, gates and barricades shall be secured in an approved manner.

18.2.4.2.3 Roads, trails, and other access ways that have been closed and obstructed in the manner prescribed by 18.2.4.2.1 shall not be trespassed upon or used unless authorized by the owner and the AHJ.

18.2.4.2.4 Public officers acting within their scope of duty shall be permitted to access restricted property identified in 18.2.4.2.1.

18.2.4.2.5 Locks, gates, doors, barricades, chains, enclosures, signs, tags, or seals that have been installed by the fire department or by its order or under its control shall not be removed, unlocked, destroyed, tampered with, or otherwise vandalized in any manner.

18.3 Water Supplies and Fire Hydrants

18.3.1* A water supply approved by the county, capable of supplying the required fire flow for fire protection shall be provided to all premises upon which facilities or buildings, or portions thereof, are hereafter constructed, or moved into or within the county. When any portion of the facility or building is in excess of 150 feet (45 720 mm) from a water supply on a fire apparatus access road, as measured by an approved route around the exterior of the facility or building, on-site fire hydrants and mains capable of supplying the required fire flow shall be provided when required by the AHJ. For on-site fire hydrant requirements see section 18.3.3.

EXCEPTIONS:

1. When facilities or buildings, or portions thereof, are completely protected with an approved automatic fire sprinkler system the provisions of section 18.3.1 may be modified by the AHJ.
2. When water supply requirements cannot be installed due to topography or other conditions, the AHJ may require additional fire protection as specified in section 18.3.2 as amended in the code.
3. When there are not more than two dwellings, or two private garage, carports, sheds and agricultural. Occupancies, the requirements of section 18.3.1 may be modified by AHJ.

18.3.2* Where no adequate or reliable water distribution system exists, approved reservoirs, pressure tanks, elevated tanks, fire department tanker shuttles, or other approved systems capable of providing the required fire flow shall be permitted.

18.3.3* The location, number and type of fire hydrants connected to a water supply capable of delivering the required fire flow shall be provided on a fire apparatus access road on the site of the premises or both, in accordance with the appropriate county water requirements.

18.3.4 Fire Hydrants and connections to other approved water supplies shall be accessible to the fire department.

18.3.5 Private water supply systems shall be tested and maintained in accordance with NFPA 25 or county requirements as determined by the AHJ.

18.3.6 Where required by the AHJ, fire hydrants subject to vehicular damage shall be protected unless located within a public right of way.

18.3.7 The AHJ shall be notified whenever any fire hydrant is placed out of service or returned to service. Owners of private property required to have hydrants shall maintain hydrant records of approval, testing, and maintenance, in accordance with the respective county water requirements. Records shall be made available for review by the AHJ upon request.

C~ 18.3.8 Minimum water supply for buildings that do not meet the minimum County water standards:

Buildings up to 2000 square feet, shall have a minimum of 3,000 gallons of water available for Firefighting.

Buildings 2001- 3000 square feet, shall have a minimum of 6,000 gallons of water available for Firefighting.

Buildings, 3001- 6000 square feet, shall have a minimum of 12,000 gallons of water available for Firefighting.

Buildings, greater than 6000 square feet, shall meet the minimum County water and fire flow requirements.

Multiple story buildings shall multiply the square feet by the amount of stories when determining the minimum water supply.

Commercial buildings requiring a minimum fire flow of 2000gpm per the Department of Water standards shall double the minimum water supply reserved for firefighting.

Fire Department Connections (FDC) to alternative water supplies shall comply with 18.3.8 (1)-(6) of *this code.*

NOTE: In that water catchment systems are being used as a means of water supply for firefighting, such systems shall meet the following requirements:

1) In that a single water tank is used for both domestic and firefighting water, the water for domestic use shall not be capable of being drawn from the water reserved for firefighting;

2) Minimum pipe diameter sizes from the water supply to the Fire Department Connection (FDC) shall be as follows:
   a) 4" for C900 PVC pipe;
   b) 4" for C906 PE pipe;
   c) 3" for ductile Iron;
   d) 3' for galvanized steel.

3) The Fire Department Connection (FDC) shall:
   a) be made of galvanized steel;
   b) have a gated valve with 2-1/2 inch, National Standard Thread male fitting and cap;
   c) be located between 8 ft and 16 ft from the Fire department access. The location shall be approved by the AHJ;
   d) not be located less than 24 inches, and no higher than 36 inches from finish grade, as measured from the center of the FDC orifice;
   e) be secure and capable of withstanding drafting operations. Engineered stamped plans may be required;
   f) not be located more than 150 feet of the most remote part, but not less than 20 feet, of the structure being protected;
   g) also comply with section 13.1.3 and 18.2.3.4.6.1 of *this code.*

4) Commercial buildings requiring a fire flow of 2000gpm shall be provided with a second FDC. Each FDC shall be independent of each other, with each FDC being capable of flowing 500gpm by engineered design standards. The second FDC shall be located in an area approved by the AHJ with the idea of multiple Fire apparatus'conducting drafting operations at once, in mind.

5) Inspection and maintenance shall be in accordance to NFPA 25.

6) The owner or lessee of the property shall be responsible for maintaining the water level, quality, and appurtenances of the system.

EXCEPTIONS TO SECTION 18.3.8:

1) Agricultural buildings, storage sheds, and shade houses with no combustible or equipment storage.

2) Buildings less than 800 square feet in size that meets the minimum Fire Department Access Road requirements.

3) For one and two family dwellings, agricultural buildings, storage sheds, and detached garages 800 to 2000 square feet in size, and meets the minimum Fire Department Access Road requirements, the distance to the Fire Department Connection may be increased to 1000 feet.

4) For one and two family dwellings, agricultural buildings, and storage sheds greater than 2000square feet, but less than 3000 square feet and meets the minimum Fire Department Access Road requirements, the distance to the Fire Department Connection may be increased to 500 feet.

5) For buildings with an approved automatic sprinkler system, the minimum water supply required may be modified.

If there are any questions regarding these requirements, please contact the Fire Prevention Bureau at (808) 932-2911.

DARREN J. ROSARIO
Fire Chief

KV:ds

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

July 21, 2016

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

Dear Mr. Terry:

SUBJECT: ENVIRONMENTAL ASSESSMENT EARLY CONSULTATION FOR PROPOSED SINGLE-FAMILY RESIDENCE AND FARM IN THE CONSERVATION DISTRICT, PUNA DISTRICT, ISLAND OF HAWAII, TMK (3RD) 1-5-009:055

Staff, upon reviewing the provided document, does not anticipate any significant impact to traffic and/or other public safety concerns.

Thank you for allowing us the opportunity to comment.

If you have any questions, please contact Captain Samuel Jelsma, Puna District Commander, at 965-2716.

Sincerely,

HENRY J. TAVARES, JR.
ASSISTANT POLICE CHIEF
AREA I OPERATIONS BUREAU

SJ:lli
160478

From the office of -
Council Member
District 4 – Puna Makai

Office: (808) 965-2712
Fax: (808) 965-2707
Email: gilagan@hawaiicounty.gov

GREGGOR ILAGAN
25 Aupuni Street, Hilo, Hawai'i 96720

August 10, 2016

Ron Terry, Principal
Geometrician Associates
P.O. Box 396 Hilo, Hawai'i 96720

Dear Mr. Terry,

Thank you for reaching out to me to request input regarding the EA early consultation for the parcel covered by TMK: (3) 1-5-009:055. At this time, I have no additional input.

Sincerely,

Greggor Ilagan

Greggor Ilagan

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

August 12, 2016

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

via email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Environmental Assessment Early Consultation for Proposed Single-Family Residence and Farm in the Conservation District
Applicant: Garrett Dearing

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 (a) Engineering Division and (b) Land Division – Hawaii District on the subject matter. Should you have any questions, please feel free to call Lydia Morikawa at 587-0410. Thank you.

Sincerely,

Russell Y. Tsuji
Land Administrator

Enclosure(s)
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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LAND DIVISION
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DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 15, 2016

MEMORANDUM

TO: FR:

DLNR Agencies:
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
X Engineering Division
___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

TO:

FROM: Russell Y. Tsuji, Land Administrator
SUBJECT: Environmental Assessment Early Consultation for Proposed Single-Family Residence and Farm in the Conservation District
LOCATION: Puna District, Island of Hawaii; TMK: (3) 1-5-009:055
APPLICANT: Garrett Dearing

Transmitted for your review and comment is information on the above-referenced project. We would appreciate your comments on this project. Please submit any comments by **August 11, 2016.**

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 Lydia Morikawa at 587-0410. Thank you.

Attachments

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

Signed: _____

Print Name: Carty S. Chang, Chief Engineer
Date: 8/1/16

cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

To: Land Division
Ref: EA Proposed Single-Family Residence and Farm in the Conservation District, Puna, Island of Hawaii

COMMENTS

The rules and regulations of the National Flood Insurance Program (NFIP), Title 44 of the Code of Federal Regulations (44CFR), are in effect when development falls within a designated Flood Hazard.

The owner or the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zone designations can be found using the Flood Insurance Rate Map (FIRM), which can be accessed through the Flood Hazard Assessment Tool (FHAT) (http://gis.hawaiinfip.org/FHAT).

National Flood Insurance Program establishes the rules and regulations of the NFIP - Title 44 of the Code of Federal Regulations (44CFR). The NFIP Zone X is a designation where there is no perceived flood impact. Therefore, the NFIP does not regulate any development within a Zone X designation.

Be advised that 44CFR reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may take precedence over the NFIP standards as local designations prove to be more restrictive. If there are questions regarding the local flood ordinances, please contact the applicable County NFIP Coordinators below:

- Oahu: City and County of Honolulu, Department of Planning and Permitting (808) 768-8098.
- Hawaii Island: County of Hawaii, Department of Public Works (808) 961-8327.
- Maui/Molokai/Lanai County of Maui, Department of Planning (808) 270-7253.
- Kauai: County of Kauai, Department of Public Works (808) 241-4846.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: 8/1/16

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE
MANAGEMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 15, 2016

RECEIVED
LAND DIVISION
2016 JUL 29 AM 10: 48
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

MEMORANDUM

TO: **DLNR Agencies:**
___Div. of Aquatic Resources
___Div. of Boating & Ocean Recreation
X Engineering Division
___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: Environmental Assessment Early Consultation for Proposed Single-Family Residence and Farm in the Conservation District
LOCATION: Puna District, Island of Hawaii; TMK: (3) 1-5-009:055
APPLICANT: Garrett Dearing

Transmitted for your review and comment is information on the above-referenced project. We would appreciate your comments on this project. Please submit any comments by **August 11, 2016.**

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 Lydia Morikawa at 587-0410. Thank you.

Attachments

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

Signed: _____

Print Name: GORDON C. HEIT
Date: 7/25/16

cc: Central Files

From: Alex Mansour [mailto:alexmansour808@gmail.com]
Sent: Sunday, August 14, 2016 2:25 PM
To: rterry@hawaii.rr.com
Subject: TMK 1-5-009:055

Mr. Terry,

I own the property next to the Dearings. I have several concerns regarding the development of TMK 1-5-009:055. Among these concerns are unpermitted development, the historical rock wall, and the impact of development on the rights of Native Hawaiians.

Please do notify me of the availability of the draft EA, as I will be writing to the OCCL in regard to the EA.

Sincerely,
Alex Mansour

On Sun, Aug 14, 2016 at 3:10 PM, Ron Terry <rterry@hawaii.rr.com> wrote:
Thank you for the note. I will be sure to notify you when it is available. Do you have any specific information regarding cultural practices or sites on the property that might be impacted by development of a single-family home and farm? That would be helpful for my analysis.
Would you like me to include this email in the Draft EA in the responses to early consultation appendix? I normally would, but I just wanted to be sure in case you are sending this in the expectation of discretion.

From: Alex Mansour [mailto:alexmansour808@gmail.com]
Sent: Monday, August 15, 2016 2:14 PM
To: Ron Terry <rterry@hawaii.rr.com>
Subject: Re: TMK 1-5-009:055

The rock structure toward the oceanside of the property has been a site visited by cultural practitioners for many years. The Dearings claim this site is insignificant, but that is not for the Dearings to decide. If cultural practitioners have a history of regarding it as significant, then it is. I am concerned that the current unpermitted development and the planned development will impact this site by blocking access or damaging the site itself.

I appreciate your concern for discretion, thank you. However, there is no need for discretion. A need for discretion was lost when racist comments from Steve Dearing about enjoying the idea of Arabs being killed lead to my family needing to petition for a restraining order against the Dearings.

As I have personal experience with the bigotry of the Dearings and this paired with their insistence that cultural practitioners are mistaken in holding the structure on the property in high regard, gives me ample reason for concern.

William P. Kenoi
Mayor

Duane Kanuha
Director

Joaquin Gamiao-Kunkel
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

September 1, 2016

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

Dear Mr. Terry:

Subject: **Pre-Consultation on Environmental Assessment**
Land Owner: Garrett Dearing
Project: Single-Family Residence and Fruit Tree Farm
TMK: (3)1-5-009:055, Puna, Hawai'i

This is in regards to your letter dated July 13, 2016, requesting our comments for an Environmental Assessment on the above referenced project for this parcel.

According to your submittal, the applicant proposes to construct a home consisting of 2,300 square feet of living area, 2,500 square feet of space for a garage, lanais, pool and decks, and an Individual Wastewater System. Also proposed is establishing a fruit tree farm with a water well, a barn, and a pond for storing water.

The proposed house site will be set back from the edge of the coastal pali (cliff) a minimum of 100 feet and from the edge of the water about 150 feet.

We note the following for this parcel:

1. The subject 6.793 acre parcel is zoned Agricultural (A-1a) by the County. However, because it is located entirely within the State Land Use Conservation District, there is no County zoning, per se. Therefore, the State of Hawai'i Department of Land and Natural Resources (DLNR) has jurisdiction on any use or activity within the Conservation District.

2. It is designated Open by the General Plan's Land Use Pattern Allocation Guide (LUPAG) Map. The proposed project must be consistent with the policies, standards, and courses of action of the Hawai'i County General Plan, as amended in February 2005.

3. As the project site is located in the Puna Community Development Plan (CDP) planning area, the CDP document should be carefully reviewed. The project must be consistent with the goals, objectives, policies and action of this CDP.

4. It is located within the County's Special Management Area and has frontage along the coastline. Therefore, a Special Management Area Use Permit Assessment Application will be required to be submitted for the proposed development.

Please provide us with a copy of the Draft Environmental Assessment for our review and file.

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

Sincerely,

DUANE KANUHA
Planning Director

ETI:ja
P:\wpwin60\ETI\EAdraftPre-consul\Terry Dearing 1-5-9-55.doc

Environmental Assessment

Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko

APPENDIX 1b
Comments to Draft EA and Responses and SHPD AIS Letter

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DAVID Y. IGE
GOVERNOR OF HAWAI'I

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
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
KAHO'OLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

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

Ref: OCCL:LY

CDUA: HA-3797
Acceptance Date: May 10, 2017
180 Day Expiration Date: November 6, 2017

MAY 10 2017

Mr. James Leonard, AICP
JM Leonard Planning, LLC
P.O. Box 11321
Hilo, HI 96721

Dear Mr. Leonard:

NOTICE OF ACCEPTANCE AND PRELIMINARY ENVIRONMENTAL DETERMINATION
Conservation District use Application (CDUA) HA-3797
(Board Permit)

This acknowledges the receipt and acceptance for the processing of your client's (Garrett B. Dearing) CDUA for a Single Family Residence (SFR) and Agriculture Farm Project located in Keonepoko Iki, Puna, further identified as Tax Map Key (TMK) (3) 1-5-009:055.. The approximately 6.79 acre lot lies within the State Land Use Conservation District, Resource Subzone.

Based on the information provided, the applicant is proposing to construct a 4,992 square foot SFR and associated improvements along with a farm and related improvements covering approximately 5 acres of the site. The proposed single-story, three (3) bedroom, three (3) bathroom SFR will include a great-room (comprised of the kitchen, dining, and living room areas), a study, a laundry room, and patio and lanai areas. A salt water swimming pool and deck area, approximately 820 square feet in size, is also proposed to be constructed directly makai of the proposed SFR. The SFR is proposed to be set back 100 feet from the shoreline, as measured from the top of the rock cliff-face fronting the coast.

The proposed farm and associated improvements would be located mauka of the proposed SFR. The farm would be comprised of various tropical fruit trees; a 713 square foot barn to accommodate a tractor (set approximately 200 feet back from Government Beach Road), fertilizer/pesticide storage, tool and equipment storage, a small bathroom necessary for hygiene and worker use; and a 9,600 square foot drainage basin/irrigation pond for capturing excess stormwater runoff, storage or irrigation water, and for providing an additional water source for fire flow protection. The drainage basin/irrigation pond will have an average depth of four (4) feet and involve the placement of a sand lining, followed by a vinyl-beaded liner to create an impervious base. The pond will also involve extending a natural berm on the makai side of the pond for a total length of 275 linear feet. The berm will be made to have a consistent height of one (1) feet and will be approximately 3 feet wide. The applicant notes that the farm is intended to provide produce solely for the landowner's family's sustenance and use.

Electrical power and community antenna television (CATV) lines will tie in to existing Hawai'i Electric Light Company (HELCO) and CATV lines that run along the mauka side of the Government Beach Road by extending the lines to a single power located near the mauka property boundary and then would run underground, across the property to the barn and SFR sites. The power system will be supplemented with a photovoltaic (PV) system located on the barn roof top and control equipment within the barn itself. Domestic water will be provided from an onsite water well located in the center of the property, near the barn. An additional back-up well, to be used in the case of a mechanical failure at the primary well, is planned in the area directly mauka of the proposed drainage/irrigation basin. A 2,000 gallon water storage tank will be located within the barn with another 1,5000 gallon water storage tank located within the garage at the SFR. Wastewater would be treated with individual septic systems for the SFR and barn, respectively, and will be designed and installed in conformance with requirements of the State Department of Health (DOH).

Other related site improvements include paving of the existing dirt driveway, and paving of the proposed parking areas that would front the SFR and barn; installation of underground utilities (electric, CATV, water, septic, and irrigation lines); and landscaping for the house site and farm area.

Staff notes that this CDUA application also acts in lieu of an After-The-Fact Site Plan Approval Application that the landowner is required to file to resolve a Conservation District Enforcement Action (ENF HA 17-30) for unauthorized landscaping on the property.

After reviewing the application, the Department finds that:

1. The proposed use is an identified land use in the Resource subzone of the Conservation District, pursuant to §13-5-24, Hawaii Administrative Rules (HAR), R-7, SINGLE FAMILY RESIDENCE, (D-1) *A single family residence that conforms to design standards as outlined in this chapter* and HAR §13-5-23, L-1, AGRICULTURE, (D-1) *agriculture, within an area of more than one acre, defined as the planting, cultivating, and harvesting of horticultural corps, floricultural crops, or forest products, or animal husbandry. A management plan approved simultaneously with the permit, is also required.*

2. Pursuant to §13-5-40 of the HAR, a Public Hearing will not be required;

3. In conformance with Chapter 343, Hawaii Revised Statutes (HRS), as amended, and Chapter 11-200, HAR, a finding of no significant impact to the environment (FONSI) is anticipated for the proposed project; and

4. The subject area is within the Special Management Area (SMA). The applicant's responsibility includes complying with the provisions of Hawai'i's Coastal Zone Management law (Chapter 205A, HRS) that pertain to the Special Management Area (SMA) requirements administered by the various counties. Negative action on this application can be expected should you fail to obtain and provide us, at least forty-five (45) days prior to the 180-day expiration date, one of the following:

    - An official determination that the proposal is exempt from the provisions of the county rules relating to the SMA;
    - An official determination that the proposed development is outside the SMA; or
    - An SMA Use Permit for the proposed development.

Further, the OCCL offers the following comments on the Draft EA and CDUA:

- Please clarify the length and width of the driveway area. Also please provide the dimensions of the turnaround/guest parking areas fronting the SFR and barn.

- Regarding landscaping around the SFR site, please clarify if the 10 new hala trees planned include the relocation of the original 6 hala trees in the area. If the original 6 trees are not included, will they be relocated somewhere else on the property?

- Regarding landscaping in the makai area of the lot, please clarify how the ironwood trees will be removed (i.e. leave stump in place or complete root removal) and how the debris will be handled. Please also clarify if any replanting will be done once removal is complete. The project description section of the CDUA does not mention any replanting, however, the landscape plan notes that additional hala will be planted. Please elaborate.

Upon completion of the application review process, your CDUA will be placed on the agenda of the Board of Land and Natural Resources for their consideration. Should you have any questions regarding this application, please contact Lauren Yasaka of our Office of Conservation and Coastal Lands Staff at (808) 587-0386.

Sincerely,

Kehau Kaluhiwa

for SUZANNE D. CASE, Chairperson
Board of Land and Natural Resources

c: Hawaii Board Member
DOCARE/DOFAW/HDLO/SHPD
DOH/OHA/OEQC
CoH, Department of Planning
CoH, Fire Department
Malama O Puna
Pahoa State Library

DAVID Y. IGE
GOVERNOR OF HAWAI'I

2017 MAY 19 PM 12

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
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CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
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FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHO'OLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

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

ref:OCCL:LY

CDUA HA-3797
Acceptance Date: May 10, 2017
180 Day Expiration Date: November 6, 2017
SUSPENSE DATE: 21 Days from stamped date

MEMORANDUM:

MAY 17 2017

TO:

___ DLNR, Division of Conservation and Resource Enforcement
___ DLNR, Division of Forestry and Wildlife
___ DLNR, Historic Preservation Division
___ DLNR, Hawaii District Land Office
___ Office of Hawaiian Affairs
___ Department of Health
✓ CoH, Department of Planning
___ CoH, Fire Department

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

SUBJECT: REQUEST FOR COMMENTS
Draft Environmental Assessment and Conservation District Use Application (CDUA) HA-3797 for the Dearing Single Family Residence (SFR), Farm, and Associated Improvements

APPLICANT: Garrett B. Dearing

LOCATION: Keoneopoko Iki, Puna, Hawai'i
Tax Map Key: (3) 1-5-009:055

Please find enclosed, a CD with an electronic copy of the subject DEA, CDUA HA-3797, and our notice to the applicant. We would appreciate your agency's review and comment on this application. If no response is received by the suspense date, we will assume there are no comments. The suspense date starts from the date stamp. Please contact Lauren Yasaka at (808) 587-0386, should you have any questions on this matter.

( ) Comments Attached

(X) No Comments

Signature

Esther Imamura / Planner
Print Name/Title

Attachment
Enclosure

MAY 19 2017
111693

DAVID Y. IGE
GOVERNOR OF HAWAI'I

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON, P.E.
DEPUTY DIRECTOR - WATER

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ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHO'OLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

2017 MAY 19 P 12:22

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

ref:OCCL:LY

CDUA HA-3797
Acceptance Date: May 10, 2017
180 Day Expiration Date: November 6, 2017
SUSPENSE DATE: 21 Days from stamped date

MEMORANDUM:

MAY 17 2017

TO:

___ DLNR, Division of Conservation and Resource Enforcement
___ DLNR, Division of Forestry and Wildlife
___ DLNR, Historic Preservation Division
_I_ DLNR, Hawaii District Land Office
___ Office of Hawaiian Affairs
___ Department of Health
___ CoH, Department of Planning
___ CoH, Fire Department

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

SUBJECT: REQUEST FOR COMMENTS
Draft Environmental Assessment and Conservation District Use Application (CDUA) HA-3797 for the Dearing Single Family Residence (SFR), Farm, and Associated Improvements

APPLICANT: Garrett B. Dearing

LOCATION: Keoneopoko Iki, Puna, Hawai'i
Tax Map Key: (3) 1-5-009:055

Please find enclosed, a CD with an electronic copy of the subject DEA, CDUA HA-3797, and our notice to the applicant. We would appreciate your agency's review and comment on this application. If no response is received by the suspense date, we will assume there are no comments. The suspense date starts from the date stamp. Please contact Lauren Yasaka at (808) 587-0386, should you have any questions on this matter.

BY JUNE 7

( ) Comments Attached

(✓) No Comments

Signature

GORDON C. HEIT DLA
Print Name/Title

Attachment
Enclosure

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

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

July 31, 2017

Sam Lemmo, Administrator
Office of Conservation and Coastal Lands
Department of Land and Natural Resources
P.O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Lemmo:

Subject: **Comments on Draft Environmental Assessment (DEA)/Conservation District Use Application (CDUA) for Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko, Island of Hawai'i, TMK 3-1-5-009-055**

I am in receipt of the comment letters on the Draft EA for the subject project provided by Lauren Yasaka via email to project planner James Leonard.

I also note that your letter of May 10, 2017, accepting the CDUA and EA, also contained comments on the Draft EA (and CDUA). Although issued prior to the comment period's inception, we assume that we should treat these as comments that require a response in the context of Chapter 343. Accordingly, we have listed the comments and provided responses below.

1. *Length and width of the driveway, and dimensions of the turnaround/guest parking areas fronting the SFR and barn.* The driveway to the house would be 12 feet wide and approximately 610 feet long. The parking and turn-around area at the residence would be about 70 feet by 40 feet, encompassing approximately 2,800 square feet. The driveway to the barn would be 12 feet wide and approximately 50 feet long. It would terminate at a parking and turn-around area that would be roughly 70 feet by 30 feet, encompassing approximately 2,100 square feet. This information has been added into the Final EA.

2. *Disposition of hala trees displaced in development area. Do 10 new hala trees planned include the relocation of the original 6 hala trees in the area. If the original 6 trees are not included, will they be relocated somewhere else on the property?* The 10 hala that are to be planted in the area of the house site will include the replanting of the younger and more vigorous hala that would be removed for the construction of the home. Some of the hala that are to be removed are aged and dying and would not be appropriate for replanting. Those hala to be replanted near the house would be on the periphery so that the landscaping blended in with the existing vegetation in this area. This information has been added into the Final EA,

3. *Clarify how the ironwood trees will be removed (i.e. leave stump in place or complete root removal) and how the debris will be handled. Please also clarify if any replanting will be done once removal is complete. The project description section of the CDUA does not mention any replanting, however, the landscape plan notes that additional hala will be planted.* The ironwood stumps would be left in place so as to avoid ground disturbance. The cut debris and logs from the tree removal would generally be chipped, composted and used onsite as part of the farm operation, especially as a source of mulch around the planted fruit trees in the farm area. Following the pruning, thinning, and removal of the ironwoods in the makai area, the area will be replanted with hala. It is expected that, with the removal of the ironwoods, the native naupaka found primarily along the top of the cliff face will gradually extend into this area so that the vegetation will eventually match the mix of native species similar to that found in remainder of the makai area. This information has been added to the Final EA.

We would also note that pursuant to discussions with OCCL Planner Lauren Yasaka, Mr. Dearing has agreed that he would remove from existing and future plantings any plants listed as having invasive or weedy characteristics, including jasmine, mock orange, gingers, heliconia, and certain orchids, as indicated by the USFS Pacific Island Ecosystem at Risk (PIER) (http://hear.org/pier/) and University of Hawai'i, College of Tropical Agriculture and Human Resources (UH-CTAHR), Weeds of Hawai'i site (https://www.ctahr.hawaii.edu/invweed/weedsHi.html). This information has been added to the Final EA.

In the interest of a complete record on comment letters to the EA/CDUA, I would also like to acknowledge receipt of comments from DLNR and other agencies contained within form memos circulated by your office. We acknowledge here the *no-comment* remarks of the Hawai'i Island Land Division and the Planning Department.

We have also attached to this letter copies of our responses to the Hawai'i Fire Department, the Department of Health's Environmental Planning Office, and Ken Church. It is our understanding from Lauren Yasaka that no other comment letters were received.

Thank you for circulating the EA and CDUA for review by DLNR agencies. If you have any questions about the EA, please contact me at (808) 969-7090; for questions about the project or CDUA, please contact James Leonard, Project Planner, at (808) 896-3459.

Sincerely,

Ron Terry

Ron Terry, Principal
Geometrician Associates

Cc: James Leonard, Garrett Dearing

DAVID Y. IGE
GOVERNOR OF HAWAII

VIRGINIA PRESSLER, M.D.
DIRECTOR OF HEALTH

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

In reply, please refer to:
File:

EPO 17-123

June 1, 2017

Mr. Ron Terry
Geometrician Associates, LLC
P.O. Box 396
Hilo, Hawaii 96721
Email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Draft Environmental Assessment (DEA) and Conservation District Use Application (CDUA) for Dearing Single Family Residence and Farm in the Conservation District at Keonepoko TMK: (3) 1-5-009:055

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your DEA to our office via the OEQC link:
http://oeqc2.doh.hawaii.gov/EA_EIS_Library/2017-05-23-HA-DEA--Dearing-Residence-and-Farm.pdf

We understand from the OEQC publication form project summary that *"Garrett Dearing plans a single-family residence and fruit-tree farm on his 6.79-acre Conservation District property near the Hawaiian Shores subdivision in the Puna District, Island of Hawaii. The one-story, 20-foot tall home would be setback 100 feet from the shoreline. Associated features include a swimming pool, lanais, wells, a drainage retention/irrigation pond, a barn, an IWS, and a driveway. The home would not be visible from the Government Beach Road and barely visible from offshore. The property was almost fully bulldozed decades ago during previous farming, which left many ornamental and fruit trees. A primarily alien forest with some hala trees is now present, and the Dearings have planted fruit trees and ornamentals near the driveway. Hala trees would be preserved as much as feasible and integrated into the farm. Banana, mango, coconut, durian, and lychee would be planted in holes with minimal ground disturbance. Land clearing that would occur over less than an acre would produce short-term impacts to noise, air and water quality, and scenery, mitigated by Best Management Practices associated with the Farm Management Plan. One endangered plant, /schaemum byrone, is being preserved and managed. These grass clumps' survival is primarily due to the Dearings' ongoing care. Impacts to the island wide-ranging endangered Hawaiian hoary bats and Hawaiian hawks will be avoided through vegetation removal timing. Archaeological survey found one site, a mid-20th century wall used as a camping windbreak, which has been sufficiently studied and will be removed. There will be no interference with shoreline access or traditional cliff fishing and opihi picking."*

In the development and implementation of all projects, EPO strongly recommends regular review of State and Federal environmental health land use guidance. State standard comments and available strategies to support sustainable and healthy design are provided at: http://health.hawaii.gov/epo/landuse. Projects are required to adhere to all applicable standard comments. EPO has recently updated the environmental Geographic Information System (GIS) website page. It now compiles various maps and viewers from our environmental health programs. The eGIS website page is continually updated so please visit it regularly at: http://health.hawaii.gov/epo/egis

EPO also encourages you to examine and utilize the Hawaii Environmental Health Portal at: https://eha-cloud.doh.hawaii.gov. This site provides links to our e-Permitting Portal, Environmental Health Warehouse, Groundwater Contamination Viewer, Hawaii Emergency Response Exchange, Hawaii State and Local Emission Inventory System, Water Pollution Control Viewer, Water Quality Data, Warnings, Advisories and Postings.

Please note that all wastewater plans must conform to applicable provisions (HAR, Chapter 11-62, "Wastewater Systems"). We reserve the right to review the detailed wastewater plans for conformance to applicable rules. Should

you have any questions, please review online guidance at: http://health.hawaii.gov/wastewater and contact the Planning and Design Section of the Wastewater Branch (WWB) at (808) 586-4294.

Injection wells used for the subsurface disposal of wastewater, sewage effluent, or surface runoff are subject to environmental regulation and permitting (HAR, Chapter 11-23, "Underground Injection Control {UIC}"). DOH approval must be obtained before any injection well construction commences. A UIC permit must be issued before any injection well operation occurs. For specific questions please email sdwb@doh.hawaii.gov or call (808) 586-4258.

Any construction waste generated by the project needs to be disposed of at a solid waste disposal facility that complies with the applicable provisions (HAR, Chapter 11-58.1 "Solid Waste Management Control"). The open burning of any of these wastes, on or off site, is strictly prohibited. Additional information is accessible at: http://health.hawaii.gov/shwb. For specific questions call (808) 586-4226.

You may also wish to review the draft Office of Environmental Quality Control (OEQC) viewer at: http://eha-web.doh.hawaii.gov/oeqc-viewer. This viewer geographically shows where some previous Hawaii Environmental Policy Act (HEPA) {Hawaii Revised Statutes, Chapter 343} documents have been prepared.

To better protect public health and the environment, the U.S. Environmental Protection Agency (EPA) has developed a new environmental justice (EJ) mapping and screening tool called EJSCREEN. It is based on nationally consistent data and combines environmental and demographic indicators in maps and reports. EPO encourages you to explore, launch and utilize this powerful tool in planning your project. The EPA EJSCREEN tool is available at: http://www.epa.gov/ejscreen.

Hawaii's climate is changing. Sea level rise and the associated coastal impacts have the potential to harm an array of natural and built environments in Hawaii. For additional information on projected sea level rise in Hawaii, EPO recommends that you visit the following informative links:

- State of Hawaii Climate Adaptation Portal: http://climateadaptation.hawaii.gov
- University of Hawaii, Manoa, School of Ocean and Earth Sciences and Technology, Coastal Geology Group: http://www.soest.hawaii.edu/coasts/index.html
- US Environmental Protection Agency – Climate Impacts on Coastal Areas: https://www.epa.gov/climate-impacts/climate-impacts-coastal-areas

We request that you utilize all this information on your proposed project to increase sustainable, innovative, inspirational, transparent and healthy design. Thank you for the opportunity to comment.

Mahalo nui loa,

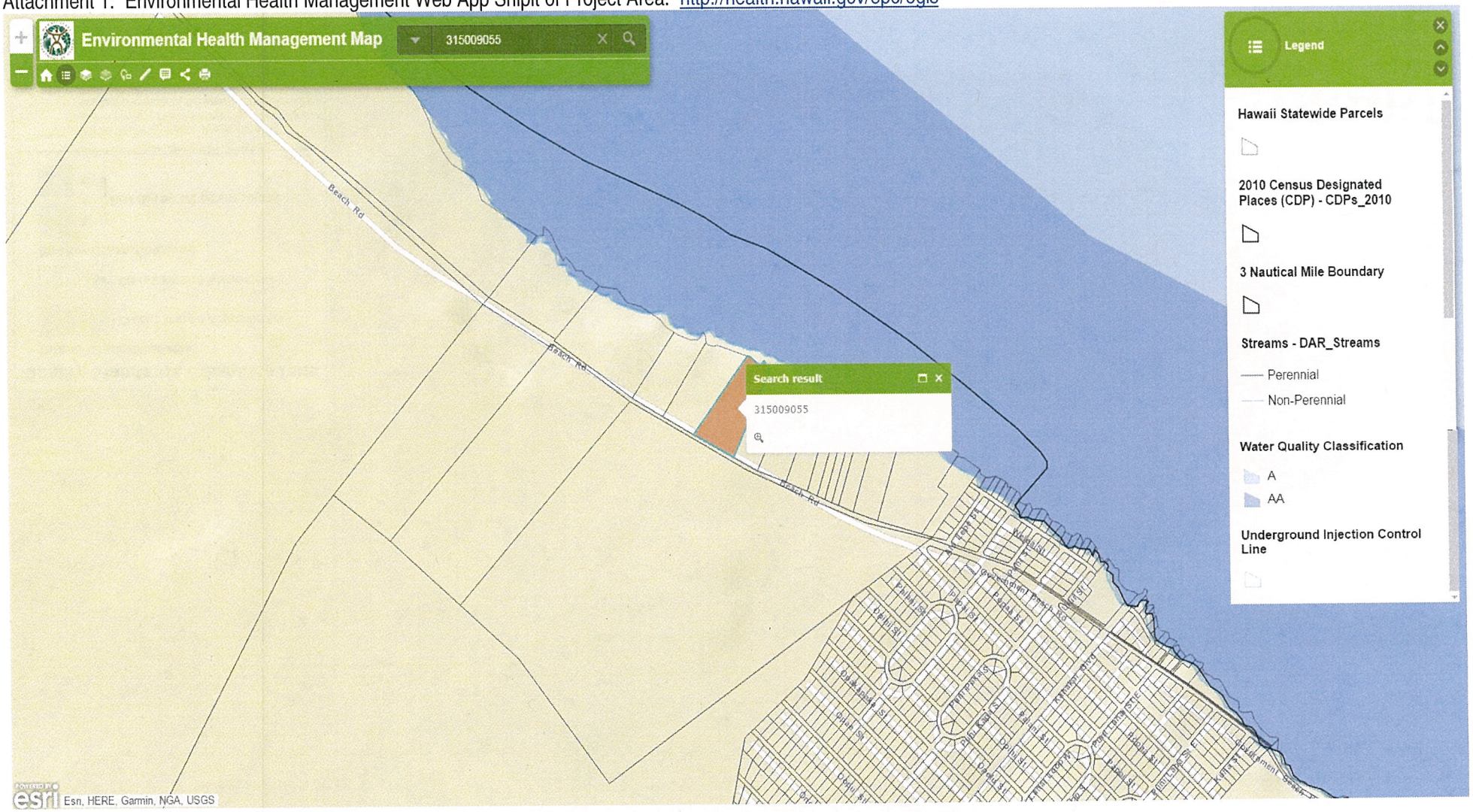
Laura Leialoha Phillips McIntyre, AICP
Program Manager, Environmental Planning Office

LM:nn

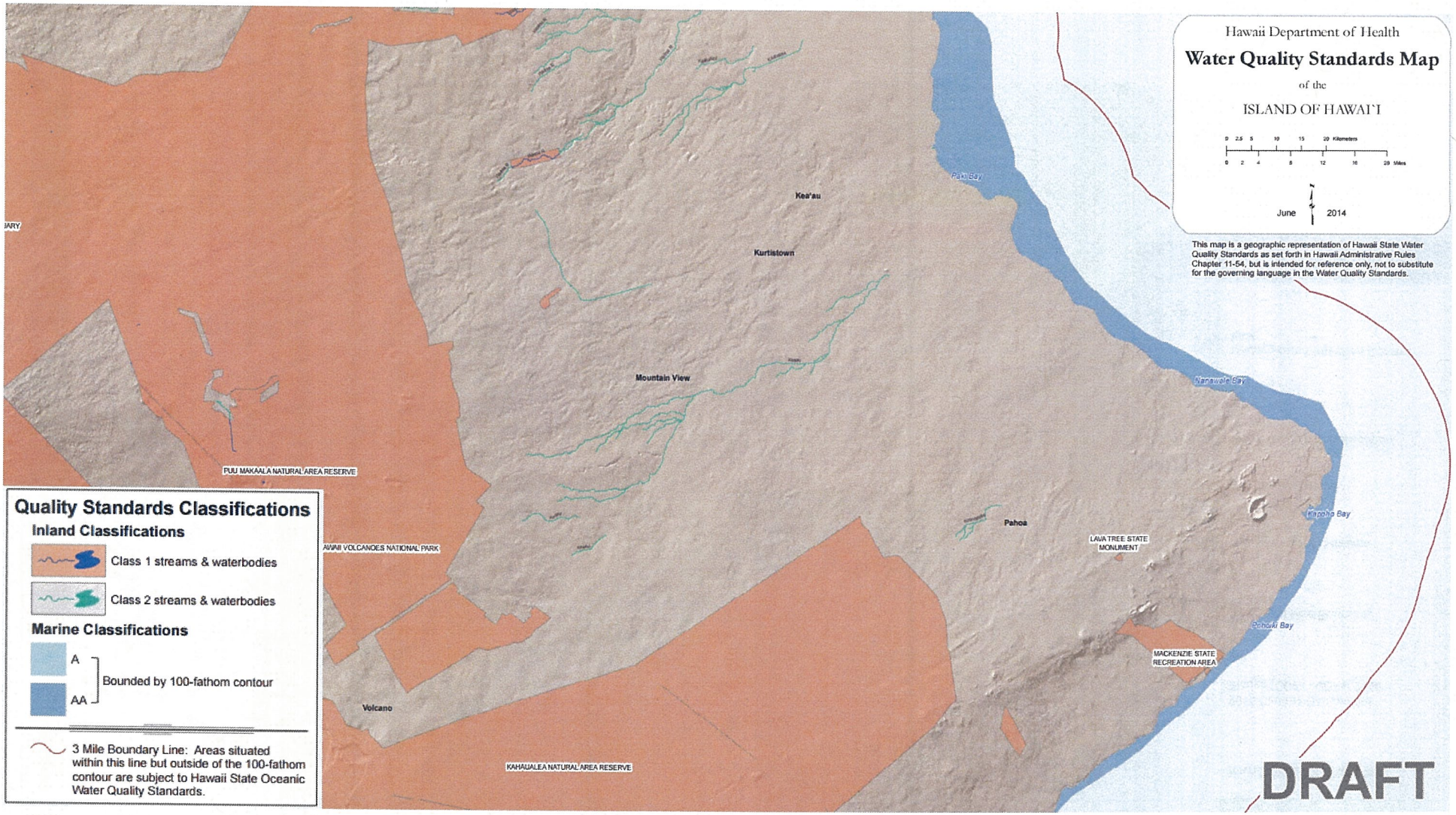
Attachment 1: Environmental Health Management Web App Snipit of Project Area: http://health.hawaii.gov/epo/egis
Attachment 2: Clean Water Branch: Water Quality Standards Map - Hawaii
Attachment 3: OEQC viewer (of some past EA's, EIS's in area)
Attachment 4: U.S. EPA EJSCREEN Report for Project Area

c: Garret B. Dearing, c/o James Leonard
Lauren Yasaka, DLNR (via email: lauren.e.yasaka@hawaii.gov)
DOH: CWB, WWB, SDWB, DHO HI {via email only}

Attachment 1: Environmental Health Management Web App Snipit of Project Area: http://health.hawaii.gov/epo/egis



Attachment 2: Clean Water Branch: Water Quality Standards Map - Hawaii



Attachment 3: OEQC viewer (of some past EA's, EIS's in area)

Puna, Hawaii

31 sites found

Results | Filter

Show sites with no location

Puna Community Medical Center (DEA-AFNSI)
Environmental Assessment (Applicant)

Puna Community Medical Center (FEA-FONSI)
Environmental Assessment (Applicant)

Pahoa Park Expansion Master Plan (FEA-FONSI)
Environmental Assessment (Agency)

Pahoa Park Expansion Master Plan (DEA-AFNSI)
Environmental Assessment (Agency)

PAHOA FIRE STATION AND POLICE SUB STATION (FEA-FONSI)
Environmental Assessment (Agency)

BT Kuwahara Private Development in Pahoa Village (DEA-AFNSI)
Environmental Assessment (Applicant)

Rueselle Zone Change (FEA-FONSI)
Environmental Assessment (Applicant)

B.T. Kuwahara Private Development (FEA-FONSI)
Environmental Assessment (Applicant)

ISLAND WIDE CONSTRUCTION OF WATER SPIGOTS (FEA-FONSI)
Environmental Assessment (Agency)

Bilinsky Residence Puna (DEA-AFNSI)
Environmental Assessment (Applicant)

Shafer Residence Puna (DEA-AFNSI)

Attachment 4: U.S. EPA EJSCREEN Report for Project Area

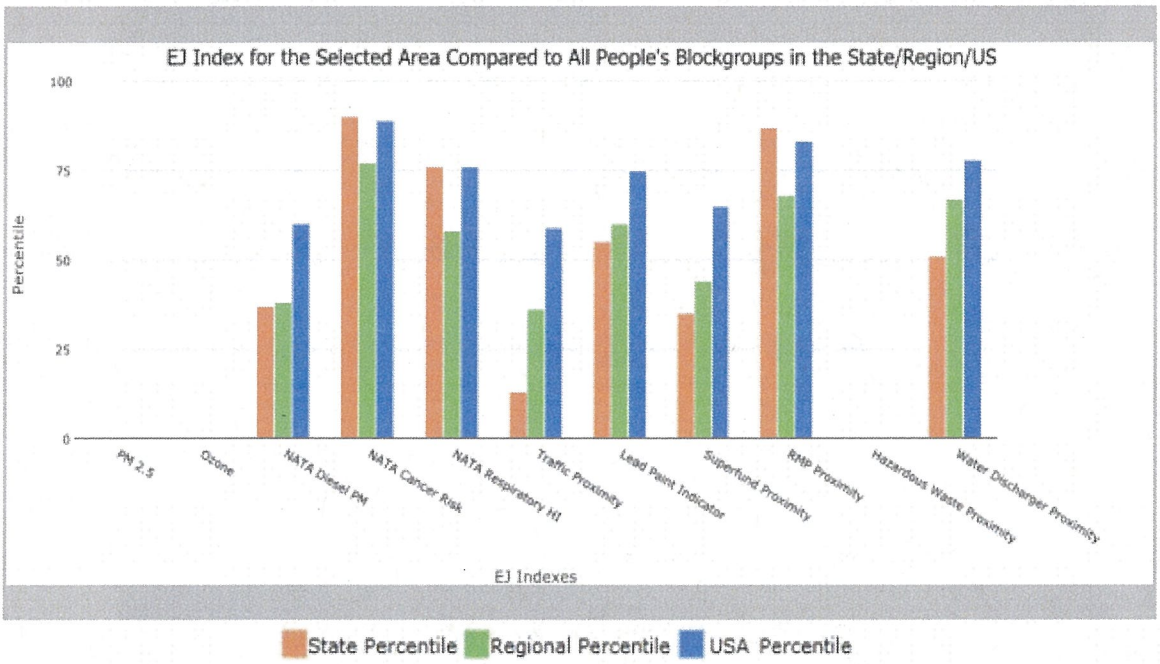
EJSCREEN Report (Version 2016)

1 mile Ring Centered at 19.566852,-154.903629, HAWAII, EPA Region 9

Approximate Population: 419

Input Area (sq. miles): 3.14

Selected Variables	State Percentile	EPA Region Percentile	USA Percentile
EJ Indexes			
EJ Index for PM2.5	N/A	N/A	N/A
EJ Index for Ozone	N/A	N/A	N/A
EJ Index for NATA* Diesel PM	37	38	60
EJ Index for NATA* Air Toxics Cancer Risk	90	77	89
EJ Index for NATA* Respiratory Hazard Index	76	58	76
EJ Index for Traffic Proximity and Volume	13	36	59
EJ Index for Lead Paint Indicator	55	60	75
EJ Index for Superfund Proximity	35	44	65
EJ Index for RMP Proximity	87	68	83
EJ Index for Hazardous Waste Proximity+	N/A	N/A	N/A
EJ Index for Water Discharger Proximity	51	67	78



This report shows the values for environmental and demographic indicators and EJSCREEN indexes. It shows environmental and demographic raw data (e.g., the estimated concentration of ozone in the air), and also shows what percentile each raw data value represents. These percentiles provide perspective on how the selected block group or buffer area compares to the entire state, EPA region, or nation. For example, if a given location is at the 95th percentile nationwide, this means that only 5 percent of the US population has a higher block group value than the average person in the location being analyzed. The years for which the data are available, and the methods used, vary across these indicators. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports.

EJSCREEN Report (Version 2016)

1 mile Ring Centered at 19.566852,-154.903629, HAWAII, EPA Region 9

Approximate Population: 419

Input Area (sq. miles): 3.14

May 24, 2017

Digitized Point

1:72,224

0 0.5 1 2 mi

0 1 2 4 km

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Sites reporting to EPA	
Superfund NPL	0
Hazardous Waste Treatment, Storage, and Disposal Facilities (TSDF)	0
National Pollutant Discharge Elimination System (NPDES)	0

EJSCREEN Report (Version 2016)

1 mile Ring Centered at 19.566852,-154.903629, HAWAII, EPA Region 9

Approximate Population: 419

Input Area (sq. miles): 3.14

Selected Variables	Value	State Avg.	%ile in State	EPA Region Avg.	%ile in EPA Region	USA Avg.	%ile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in µg/m³)	N/A	N/A	N/A	9.37	N/A	9.32	N/A
Ozone (ppb)	N/A	N/A	N/A	51	N/A	47.4	N/A
NATA* Diesel PM (µg/m³)	0.011	0.149	6	0.978	<50th	0.937	<50th
NATA* Cancer Risk (lifetime risk per million)	25	34	6	43	<50th	40	<50th
NATA* Respiratory Hazard Index	0.49	1	6	2	<50th	1.8	<50th
Traffic Proximity and Volume (daily traffic count/distance to road)	0	990	4	1100	2	590	2
Lead Paint Indicator (% Pre-1960 Housing)	0.03	0.16	29	0.24	29	0.3	20
Superfund Proximity (site count/km distance)	0	0.098	29	0.15	13	0.13	16
RMP Proximity (facility count/km distance)	0.12	0.19	61	0.57	25	0.43	34
Hazardous Waste Proximity+ (facility count/km distance)	N/A	0.14	N/A	0.14	N/A	0.11	N/A
Water Discharger Proximity (facility count/km distance)	0.048	0.34	13	0.2	11	0.31	8
Demographic Indicators							
Demographic Index	72%	52%	94	47%	82	36%	89
Minority Population	81%	77%	47	58%	71	37%	85
Low Income Population	63%	26%	96	36%	84	35%	87
Linguistically Isolated Population	3%	6%	50	9%	36	5%	63
Population With Less Than High School Education	13%	9%	75	17%	49	14%	58
Population Under 5 years of age	4%	6%	28	7%	29	6%	31
Population over 64 years of age	18%	15%	67	13%	80	14%	76

* The National-Scale Air Toxics Assessment (NATA) is EPA's ongoing, comprehensive evaluation of air toxics in the United States. EPA developed the NATA to prioritize air toxics, emission sources, and locations of interest for further study. It is important to remember that NATA provides broad estimates of health risks over geographic areas of the country, not definitive risks to specific individuals or locations. More information on the NATA analysis can be found at: https://www.epa.gov/national-air-toxics-assessment.

+ The hazardous waste environmental indicator and the corresponding EJ index will appear as N/A if there are no hazardous waste facilities within 50 km of a selected location.

For additional information, see: www.epa.gov/environmentaljustice

EJSCREEN is a screening tool for pre-decisional use only. It can help identify areas that may warrant additional consideration, analysis, or outreach. It does not provide a basis for decision-making, but it may help identify potential areas of EJ concern. Users should keep in mind that screening tools are subject to substantial uncertainty in their demographic and environmental data, particularly when looking at small geographic areas. Important caveats and uncertainties apply to this screening-level information, so it is essential to understand the limitations on appropriate interpretations and applications of these indicators. Please see EJSCREEN documentation for discussion of these issues before using reports. This screening tool does not provide data on every environmental impact and demographic factor that may be relevant to a particular location. EJSCREEN outputs should be supplemented with additional information and local knowledge before taking any action to address potential EJ concerns.

geometrician

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July 31, 2017

Laura Leialoha Phillips McIntyre, AICP
Environment Planning Office Manager
Hawai'i DOH Environmental Health Administration
Via email: epo@doh.hawaii.gov

Dear Ms. McIntyre:

Subject: **Comments on Draft Environmental Assessment (DEA)/Conservation District Use Application (CDUA) for Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko, Island of Hawai'i, TMK 3-1-5-009-055**

Thank you for the comment letter dated June 1, 2017, referring us to websites providing DOH standard comments and strategies to support sustainable and healthy design; the eGIS website; the Hawai'i Environmental Portal; the EPA EJSCREEN; administrative rules related to wastewater systems, runoff and injection wells, and construction debris; and miscellaneous publications dealing with climate change and sea level rise.

During EA development, many of these sources were consulted, and the website from the HEER office provided information on the potential for hazardous materials. It should be noted that during construction, the contractor will be required to comply with all applicable administrative rules. No injection well will be required, and the determination on whether an NPDES permit is required will occur after final grading plans have been developed. The proposed house and farm have been designed with energy efficiency and sustainable agriculture in mind. The home would be set back a minimum of 100 feet from the shoreline at an elevation of about 25 feet above sea level, and is not likely to be especially vulnerable to sea level rise or the increased hurricane activity expected over the next fifty years.

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: James Leonard, Garrett Dearing

Harry Kim
Mayor

Darren J. Rosario
Fire Chief

Renwick J. Victorino
Deputy Fire Chief

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AND COASTAL LANDS

2017 JUN -1 A 9:09

DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

County of Hawai'i

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

May 30, 2017

Samuel J. Lemmon, Administrator
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawai'i 96809

Dear Mr. Lemmon,

SUBJECT: Draft Environmental Assessment and Conservation District Use Application (CDUA) HA-3797 for the Dearing Single Family Residence (SFR), Farm, and Associated Improvements.

In regards to the above-referenced Draft Environmental Assessment and Conservation District Use application, the following shall be in accordance:

NFPA 1, UNIFORM FIRE CODE, 2006 EDITION
Note: Hawai'i State Fire Code, National Fire Protection Association 2006 version, with County of Hawaii amendments. County amendments are identified with a preceding "C~" of the reference code.

Chapter 18 Fire Department Access and Water Supply

18.1 General. Fire department access and water supplies shall comply with this chapter.

For occupancies of an especially hazardous nature, or where special hazards exist in addition to the normal hazard of the occupancy, or where access for fire apparatus is unduly difficult, or areas where there is an inadequate fire flow, or inadequate fire hydrant spacing, and the AHJ may require additional safeguards including, but not limited to, additional fire appliance units, more than one type of appliance, or special systems suitable for the protection of the hazard involved.

18.1.1 Plans.

18.1.1.1 Fire Apparatus Access. Plans for fire apparatus access roads shall be submitted to the fire department for review and approval prior to construction.

18.1.1.2 Fire Hydrant Systems. Plans and specifications for fire hydrant systems shall be submitted to the fire department for review and approval prior to construction.

C~ 18.1.1.2.1 Fire Hydrant use and Restrictions. No unauthorized person shall use or operate any Fire hydrant unless such person first secures permission or a permit from the owner or representative of the department, or company that owns or governs that water supply or system. Exception: Fire Department personnel conducting firefighting operations, hydrant testing, and/or maintenance, and the flushing and acceptance of hydrants witnessed by Fire Prevention Bureau personnel.

18.2 Fire Department Access.

18.2.1 Fire department access and fire department access roads shall be provided and maintained in accordance with Section 18.2.

18.2.2* Access to Structures or Areas.

18.2.2.1 Access Box(es). The AHJ shall have the authority to require an access box(es) to be installed in an accessible location where access to or within a structure or area is difficult because of security.

18.2.2.2 Access to Gated Subdivisions or Developments. The AHJ shall have the authority to require fire department access be provided to gated subdivisions or developments through the use of an approved device or system.

18.2.2.3 Access Maintenance. The owner or occupant of a structure or area, with required fire department access as specified in 18.2.2.1 or 18.2.2.2, shall notify the AHJ when the access is modified in a manner that could prevent fire department access.

18.2.3 Fire Department Access Roads. (*may be referred as FDAR)

18.2.3.1 Required Access.

18.2.3.1.1 Approved fire department access roads shall be provided for every facility, building, or portion of a building hereafter constructed or relocated.

18.2.3.1.2 Fire Department access roads shall consist of roadways, fire lanes, parking lots lanes, or a combination thereof.

18.2.3.1.3* When not more than two one- and two-family dwellings or private garages, carports, sheds, agricultural buildings, and detached buildings or structures 400ft^2 (37 m^2) or less are present, the requirements of 18.2.3.1 through 18.2.3.2.1 shall be permitted to be modified by the AHJ.

18.2.3.1.4 When fire department access roads cannot be installed due to location on property, topography, waterways, nonnegotiable grades, or other similar conditions, the AHJ shall be authorized to require additional fire protection features.

18.2.3.2 Access to Building.

18.2.3.2.1 A fire department access road shall extend to within in 50 ft (15 m) of at least one exterior door that can be opened from the outside that provides access to the interior of the building. Exception: 1 and 2 single-family dwellings.

18.2.3.2.1.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.1 shall be permitted to be increased to 300 feet.

18.2.3.2.2 Fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the first story of the building is located not more than 150 ft (46 m) from fire department access roads as measured by an approved route around the exterior of the building or facility.

18.2.3.2.2.1 When buildings are protected throughout with an approved automatic sprinkler system that is installed in accordance with NFPA 13, NFPA 13D, or NFPA 13R, the distance in 18.2.3.2.2 shall be permitted to be increased to 450 ft (137 m).

18.2.3.3 Multiple Access Roads. More than one fire department access road shall be provided when it is determined by the AHJ that access by a single road could be impaired by vehicle congestion, condition of terrain, climatic conditions, or other factors that could limit access.

18.2.3.4 Specifications.

18.2.3.4.1 Dimensions.

C~ 18.2.3.4.1.1 FDAR shall have an unobstructed width of not less than 20ft with an approved turn around area if the FDAR exceeds 150 feet. **Exception:** FDAR for one and two family dwellings shall have an unobstructed width of not less than 15 feet, with an area of not less than 20 feet wide within 150 feet of the structure being protected. An approved turn around area shall be provided if the FDAR exceeds 250 feet.

C~ 18.2.3.4.1.2 FDAR shall have an unobstructed vertical clearance of not less then 13ft 6 in.

C~ 18.2.3.4.1.2.1 Vertical clearances may be increased or reduced by the AHJ, provided such increase or reduction does not impair access by the fire apparatus, and approved signs are installed and maintained indicating such approved changes.

18.2.3.4.1.2.2 Vertical clearances shall be increased when vertical clearances or widths are not adequate to accommodate fire apparatus.

C~ 18.2.3.4.2 Surface. Fire department access roads and bridges shall be designed and maintained to support the imposed loads (25 Tons) of the fire apparatus. Such FDAR and shall be comprised of an all-weather driving surface.

18.2.3.4.3 Turning Radius.

C~ 18.2.3.4.3.1 Fire department access roads shall have a minimum inside turning radius of 30 feet, and a minimum outside turning radius of 60 feet.

18.2.3.4.3.2 Turns in fire department access road shall maintain the minimum road width.

18.2.3.4.4 Dead Ends. Dead-end fire department access roads in excess of 150 ft (46 m) in length shall be provided with approved provisions for the fire apparatus to turn around.

18.2.3.4.5 Bridges.

18.2.3.4.5.1 When a bridge is required to be used as part of a fire department access road, it shall be constructed and maintained in accordance with county requirements.

18.2.3.4.5.2 The bridge shall be designed for a live load sufficient to carry the imposed loads of fire apparatus.

18.2.3.4.5.3 Vehicle load limits shall be posted at both entrances to bridges where required by the AHJ.

18.2.3.4.6 Grade.

C~ 18.2.3.4.6.1 The maximum gradient of a Fire department access road shall not exceed 12 percent for unpaved surfaces and 15 percent for paved surfaces. In areas of the FDAR where a Fire apparatus would connect to a Fire hydrant or Fire Department Connection, the maximum gradient of such area(s) shall not exceed 10 percent.

18.2.3.4.6.2* The angle of approach and departure for any means of fire department access road shall not exceed 1 ft drop in 20 ft (0.3 m drop in 6 m) or the design limitations of the fire apparatus of the fire department, and shall be subject to approval by the AHJ.

18.2.3.4.6.3 Fire department access roads connecting to roadways shall be provided with curb cuts extending at least 2 ft (0.61 m) beyond each edge of the fire lane.

18.2.3.4.7 Traffic Calming Devices. The design and use of traffic calming devices shall be approved the AHJ.

18.2.3.5 Marking of Fire Apparatus Access Road.

18.2.3.5.1 Where required by the AHJ, approved signs or other approved notices shall be provided and maintained to identify fire department access roads or to prohibit the obstruction thereof of both.

18.2.3.5.2 A marked fire apparatus access road shall also be known as a fire lane.

18.2.4* Obstruction and Control of Fire Department Access Road.

18.2.4.1 General.

18.2.4.1.1 The required width of a fire department access road shall not be obstructed in any manner, including by the parking of vehicles.

18.2.4.1.2 Minimum required widths and clearances established under 18.2.3.4 shall be maintained at all times.

18.2.4.1.3* Facilities and structures shall be maintained in a manner that does not impair or impede accessibility for fire department operations.

18.2.4.1.4 Entrances to fire departments access roads that have been closed with gates and barriers in accordance with 18.2.4.2.1 shall not be obstructed by parked vehicles.

18.2.4.2 Closure of Accessways.

18.2.4.2.1 The AHJ shall be authorized to require the installation and maintenance of gates or other approved barricades across roads, trails, or other accessways not including public streets, alleys, or highways.

18.2.4.2.2 Where required, gates and barricades shall be secured in an approved manner.

18.2.4.2.3 Roads, trails, and other access ways that have been closed and obstructed in the manner prescribed by 18.2.4.2.1 shall not be trespassed upon or used unless authorized by the owner and the AHJ.

18.2.4.2.4 Public officers acting within their scope of duty shall be permitted to access restricted property identified in 18.2.4.2.1.

18.2.4.2.5 Locks, gates, doors, barricades, chains, enclosures, signs, tags, or seals that have been installed by the fire department or by its order or under its control shall not be removed, unlocked, destroyed, tampered with, or otherwise vandalized in any manner.

18.3 Water Supplies and Fire Hydrants

18.3.1* A water supply approved by the county, capable of supplying the required fire flow for fire protection shall be provided to all premises upon which facilities or buildings, or portions thereof, are hereafter constructed, or moved into or within the county. When any portion of the facility or building is in excess of 150 feet (45 720 mm) from a water supply on a fire apparatus access road, as measured by an approved route around the exterior of the facility or building, on-site fire hydrants and mains capable of supplying the required fire flow shall be provided when required by the AHJ. For on-site fire hydrant requirements see section 18.3.3.

EXCEPTIONS:

1. When facilities or buildings, or portions thereof, are completely protected with an approved automatic fire sprinkler system the provisions of section 18.3.1 may be modified by the AHJ.
2. When water supply requirements cannot be installed due to topography or other conditions, the AHJ may require additional fire protection as specified in section 18.3.2 as amended in the code.
3. When there are not more than two dwellings, or two private garage, carports, sheds and agricultural. Occupancies, the requirements of section 18.3.1 may be modified by AHJ.

18.3.2* Where no adequate or reliable water distribution system exists, approved reservoirs, pressure tanks, elevated tanks, fire department tanker shuttles, or other approved systems capable of providing the required fire flow shall be permitted.

18.3.3* The location, number and type of fire hydrants connected to a water supply capable of delivering the required fire flow shall be provided on a fire apparatus access road on the site of the premises or both, in accordance with the appropriate county water requirements.

18.3.4 Fire Hydrants and connections to other approved water supplies shall be accessible to the fire department.

18.3.5 Private water supply systems shall be tested and maintained in accordance with NFPA 25 or county requirements as determined by the AHJ.

18.3.6 Where required by the AHJ, fire hydrants subject to vehicular damage shall be protected unless located within a public right of way.

18.3.7 The AHJ shall be notified whenever any fire hydrant is placed out of service or returned to service. Owners of private property required to have hydrants shall maintain hydrant records of approval, testing, and maintenance, in accordance with the respective county water requirements. Records shall be made available for review by the AHJ upon request.

C~ 18.3.8 Minimum water supply for buildings that do not meet the minimum County water standards:

Buildings up to 2000 square feet, shall have a minimum of 3,000 gallons of water available for Firefighting.

Buildings 2001- 3000 square feet, shall have a minimum of 6,000 gallons of water available for Firefighting.

Buildings, 3001- 6000 square feet, shall have a minimum of 12,000 gallons of water available for Firefighting.

Buildings, greater than 6000 square feet, shall meet the minimum County water and fire flow requirements.

Multiple story buildings shall multiply the square feet by the amount of stories when determining the minimum water supply.

Commercial buildings requiring a minimum fire flow of 2000gpm per the Department of Water standards shall double the minimum water supply reserved for firefighting.

Fire Department Connections (FDC) to alternative water supplies shall comply with 18.3.8 (1)-(6) of *this code.*

NOTE: In that water catchment systems are being used as a means of water supply for firefighting, such systems shall meet the following requirements:

1) In that a single water tank is used for both domestic and firefighting water, the water for domestic use shall not be capable of being drawn from the water reserved for firefighting;

2) Minimum pipe diameter sizes from the water supply to the Fire Department Connection (FDC) shall be as follows:
   a) 4" for C900 PVC pipe;
   b) 4" for C906 PE pipe;
   c) 3" for ductile Iron;
   d) 3' for galvanized steel.

3) The Fire Department Connection (FDC) shall:
   a) be made of galvanized steel;
   b) have a gated valve with 2-1/2 inch, National Standard Thread male fitting and cap;
   c) be located between 8 ft and 16 ft from the Fire department access. The location shall be approved by the AHJ;
   d) not be located less than 24 inches, and no higher than 36 inches from finish grade, as measured from the center of the FDC orifice;
   e) be secure and capable of withstanding drafting operations. Engineered stamped plans may be required;
   f) not be located more than 150 feet of the most remote part, but not less than 20 feet, of the structure being protected;
   g) also comply with section 13.1.3 and 18.2.3.4.6.1 of *this code.*

4) Commercial buildings requiring a fire flow of 2000gpm shall be provided with a second FDC. Each FDC shall be independent of each other, with each FDC being capable of flowing 500gpm by engineered design standards. The second FDC shall be located in an area approved by the AHJ with the idea of multiple Fire apparatus'conducting drafting operations at once, in mind.

5) Inspection and maintenance shall be in accordance to NFPA 25.

6) The owner or lessee of the property shall be responsible for maintaining the water level, quality, and appurtenances of the system.

EXCEPTIONS TO SECTION 18.3.8:

1) Agricultural buildings, storage sheds, and shade houses with no combustible or equipment storage.

2) Buildings less than 800 square feet in size that meets the minimum Fire Department Access Road requirements.

3) For one and two family dwellings, agricultural buildings, storage sheds, and detached garages 800 to 2000 square feet in size, and meets the minimum Fire Department Access Road requirements, the distance to the Fire Department Connection may be increased to 1000 feet.

4) For one and two family dwellings, agricultural buildings, and storage sheds greater than 2000square feet, but less than 3000 square feet and meets the minimum Fire Department Access Road requirements, the distance to the Fire Department Connection may be increased to 500 feet.

5) For buildings with an approved automatic sprinkler system, the minimum water supply required may be modified.

If there are any questions regarding these requirements, please contact the Fire Prevention Bureau at (808) 932-2911.

DARREN J. ROSARIO
Fire Chief

KV:ds

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

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

July 31, 2017

Darren Rosario, Chief
Hawai'i Fire Department
25 Aupuni St., Suite 2501
Hilo HI 96720

Dear Chief Rosario

Subject: Comments on Draft Environmental Assessment (DEA)/Conservation District Use Application (CDUA) for Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko, Island of Hawai'i, TMK 3-1-5-009-055

Thank you for the comment letter dated May 30, 2017, citing portions of Chapter 18 of the amended Hawai'i State Fire Code with regard to Fire Department access and water supply. Please note that the owner and his family have been in contact with Battalion Chief Robert Perreira of the Hawai'i Fire Department to review their plans and the Fire Code requirements for the planned single-family residence and farm-related facilities, in order to ensure that the improvements to the property are planned and designed in compliance with the applicable Code requirements.

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: James Leonard, Garrett Dearing

May 23, 2017

State of Hawaii
Department of Land and Natural Resources
Office of Conservation and Coastal Lands
P.O. Box 621
Honolulu, Hawaii 96809

AND

Garrett B. Dearing
801 Kakala St. #42
Kapolei, Hawaii 96707

Subject: Public comments to proposed Dearing Single-Family Residence and Farm

To Whom it may concern,

Dearing family I celebrate your enthusiasm to develop this property and **restore** it's use to agriculture which appears to be the **historical use** (grandfathered). This was well described in the Proposed EA that the property had been cleared in the mid 20th century and there existed substantial plantings of fruit trees and the like growing on it (an apparent agricultural use) at the time that it was zoned into the State Conservation District.

If the existence substantial orchard plantings on the property can be evidenced that pre-dates the property's zoning into the State Conservation District-HAR 13-5 stipulates that such a historic use remains **'allowed'** (not necessarily required to be **'allowable'** through permitting requirements of HAR 13-5) from that date forward as a non-conforming land use. Clearly the County zoning of the Property was agriculture.

- The current regulation ***"definition"*** of non-conforming use is found in HAR §13-5-2 which states……..

> *"Nonconforming use" means the* ***lawful use of any*** *building, premises, or* ***land for any trade, industry,*** *residence,* ***or other purposes which is the same as and no greater than that established prior to October 1, 1964, or prior to the inclusion of the building, premises, or land within the conservation district."***

The submitted proposed EA seemingly has identified that fruit trees had been planted on a substantial area of the property ***'prior to the inclusion of the land within the conservation district.'*** What is not clear from the **'historical'** record presented in the proposed EA is the area of the former use. Such could likely be identified by the extent of the area of the existing fruit tree plantings that have continued to have survived or by a statement of someone familiar with the property's use at the time of Stat Conservation zoning in the 1960's. There is a seeming

requirement that any continued non-conforming agricultural use be ***'no greater than that established.....''***

- HAR §13-5-7 goes on to further define ***"non-conforming"*** uses of lands zoned in the State Conservation District.....

  *"§13-5-7 Nonconforming uses and structures. (a) This chapter shall **not** prohibit the continuance, or repair and maintenance, of nonconforming **land uses** and structures **as** **defined in this chapter**."*

- Particularly ***"agriculture"*** is a **defined** use in a State Conservation District regulating statute **chapter** *HAR §13-5-23 L-1 AGRICULTURE.....*

  *"Agriculture, within an area of more than one acre, **defined** as the planting, cultivating, and harvesting of horticultural crops, floricultural crops, or forest products, or animal husbandry. A management plan approved simultaneously **with the permit**, is also required."*

- It seems that if no permit is required then no management plan is a formal requirement either.
- A useful description of what was intended to be allowed in HAR §13-5-7 as a non-conforming land use in the State Conservation District can be found in an **Auditor's report to the State Governor and the Legislature of the State of Hawaii,** in 1991, ***"Review of the Regulation of Residential Construction in the Conservation District",*** *on its page 9 therein,* where the Auditor stated.....

  "Simply stated, a nonconforming use is a past use that does not have to conform to all of the restrictions in the statutes and rules;...."

  AND further from the Auditors review.....

  Nonconforming use
  "Grandfather" clauses in the forest and water reserve zones law allow two kinds of nonconforming use within the conservation district. These clauses cover activities that were (1) already being conducted or (2) intended to be conducted, on or before the dates stated in the statutes.

  The first clause covers a range of activities circumscribed by previous use of the land. ***It allows continued use of*** *"any building, premises or* ***land for any trade****, industrial, residential,* ***or other purpose for which the building premises or land is used on July 1, 1957 or at the time any regulation adopted under authority of this part takes effect".*
  The second provision covers a narrower range of activities circumscribed by intended use of the land. It considers as nonconforming any parcel of ten acres or less in the forest reserve "which, as of January 31, 1957, was subject to real property taxes and

*upon which the taxes were being paid, and which was held and intended for residential or farming use, whether actually put to such use or not." The rules include in the definition the requirement that intended nonconforming use is limited to either one residential dwelling or **a farm** with no more than one residential dwelling."*

It appears to me that your application need not necessarily require a CDUP for the agricultural use of your property nor a public hearing. The proposed barn and irrigation pond appear to be ***'structures accessory'*** to the agricultural use of the property however and they likely would require a SPA (site plan approval) from the OCCL which is a simple application and only appears to require the filing of a 50$ fee rather than the formal CDUP prescribed by the OCCL or can be incorporated in your CDUA for a residence. As for the filing and approval of a **'management plan'** for **'allowed non-conforming'** agricultural uses it is a matter of debate whether that is a requirement or a reasonable request for reference purposes by the OCCL.

The house appears to be a single family **'farm dwelling'**. The OCCL has **variably** required that such a residence be referred to as a **'single family residence'**. I say **variably** because Sam Lemmo, the Administrator of the OCCL, testified the following to the Land Use Commission during a hearing regarding LUC Docket A05 757.... *LUC testimony transcript, its page 10.....*

*"Mr. Lemmo described the CDUA process and stated that if you have a legal lot of record and it is greater than 10,000 square feet in size, located in a subzone that single family residences are identified in, **then you can apply for a permit to build a house <u>or</u> a farm dwelling**. Mr. Lemmo noted that he believed this particular parcel is currently resource subzone and that Mr. McCully could possibly apply for a permit to build a house and do farming. Mr. Lemmo added that they would process this application and would require an environmental assessment, shoreline certification, and possibly an erosion analysis depending on the location of the proposed facility."*

HRS **§205-4.5** defines ***'farm dwelling'*** as....

*"(4) Farm dwellings, employee housing, farm buildings, or activities or uses related to farming and animal husbandry. "Farm dwelling", as used in this paragraph, **means a <u>single-family dwelling</u> located on and used in connection with a farm,** including clusters of single-family farm dwellings permitted within agricultural parks developed by the State, or where agricultural activity provides income to the family occupying the dwelling;"*

The effect of whether the residence is deemed to be a single-family ***'farm dwelling'*** or a ***'single family residence'*** is believed to be of some importance as if it is determined that the dwelling/residence is being used to support the agricultural uses of the Property then the supporting reasoning throughout the CDUA and proposed EA can be reasonably stated that a residence on the property would represent an ***'improvement over the existing <u>allowed</u> site***

conditions' as it would assist the applicant in the ***'dynamic management'*** of the existing ***'allowed'*** uses of the property. Indeed management of pests, weed growth, erosion, run –off that may include agricultural use fertilizers and pesticides etc. would be better accomplished if the applicant had a residence on the property. This would seemingly include existing ag. uses as well as planned future ***'allowed'*** non-conforming agricultural uses (if indeed the former non-conforming agricultural use can be reasonably established today as an **'allowed'** use).

On page 2 of OCCL correspondence (COR; HA-17-02) the OCCL seemingly is requiring that the applicant submit 2 CDUA's. One for the residence and one for the agricultural use. This is inconsistent with the guidelines in that it has generally been required by the OCCL that, when possible, the entire plan of an applicant's use of their property be submitted so that its entire effect on the environment may be determined rather than the sequential effect. It may also be the case that the applicant does not want one use without the other. The sequential approach could seemingly permit one use and not the other.

Anyway it is very obvious that you have had a lot of professional assistance in putting your CDUA and draft EA together. I can't imagine how much time and money this must have cost you and I sympathize with you in that regard. The seemed resulting delay to your reasonable agricultural use and uses accessory to such uses of your Property does not speak well to the administration of land uses in the State Conservation District.

Thank you for an opportunity to comment on your draft EA.

Sincerely,

Ken Church, Hakalau, Hi.

geometrician
ASSOCIATES, LLC
integrating geographic science and planning

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

July 31, 2017

Ken Church
dockline3@yahoo.ca

Dear Mr. Church:

Subject: Comments on Draft Environmental Assessment (DEA)/Conservation District Use Application (CDUA) for Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko, Island of Hawai'i, TMK 3-1-5-009-055

Thank you for the comment letter to Garrett Dearing dated May 23, 2017, on the proposed single-family home and farm. After consulting with Mr. Dearing, I would like to answer to your specific comments:

1. *Agriculture as a non-conforming use on the property.* Although a case can be made that the proposed farm is simply a continuation of a non-conforming use, the plantings have since reverted to jungle and the documentary evidence for the farming is somewhat scant. As such, the applicant believed that a CDUA was the most appropriate mechanism.

2. *Farm dwelling.* Although the applicant does intend to conduct farming activities while living in the proposed residence, he did not wish to have its use restricted to being a farm dwelling.

3. *One or two CDUAs.* The proposed uses are being requested in one integrated CDUA and analyzed in one 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: James Leonard, Garrett Dearing

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
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ENGINEERING
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STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

STATE HISTORIC PRESERVATION DIVISION
KAKUHIHEWA BUILDING
601 KAMOKILA BLVD, STE 555
KAPOLEI, HAWAII 96707

May 26, 2017

Steve Dearing
15-2792 Au Street
Pāhoa, HI 96778

Log No. 2016.01899
Doc. No. 1703SN16
Archaeology

Aloha Mr. Dearing:

SUBJECT: **Chapter 6E-42 Historic Preservation Review –**
Archaeological Inventory Survey for the Dearing Property
Keonepoko Iki Ahupuaʻa, Puna District, Island of Hawaiʻi
TMK: (3) 1-5-009:055

Thank you for the opportunity to review the revised draft report titled, *Archaeological Inventory Survey of TMK: (3) 1-5-009:055 Keonepoko Iki Ahupuaʻa, Puna District, Island of Hawaiʻi, TMK: (3) 1-5-009:055* (Clark et al., August 2016). SHPD received this submittal on August 5, 2016.

This archaeological inventory survey (AIS) was completed at the request of Steve Dearing (landowner), in anticipation of applying for a County of Hawaiʻi Conservation District Use Permit (CDUP), for the construction of a single-family residence and to develop a fruit tree farm with associated infrastructure. The project area totals approximately 6.8 acres. SHPD staff conducted a field inspection of the parcel on August 10, 2012 to verify the presence of Bishop Museum Site 50-Ha-A4-21 and the likelihood of additional sites in the area (SHPD letter dated August 30, 2012; Log No. 2012.2536, Doc. No. 1208TD06). During the field inspection of Parcel 055, SHPD staff determined that Site 50-HA-A4-21 is located on an adjacent parcel (Parcel 053). During the inspection, a single unrecorded historic property was identified within Parcel 055. This site was described as a rather substantial wall segment and associated terrace, which was designated as State Inventory of Historic Places (SIHP) 50-10-45-29486.

While in 2012, the applicant indicated it would be preserved, no preservation plan was prepared. The current AIS indicates the applicant intends to dismantle the wall.

The AIS involved a 100% pedestrian survey and excavation of a single 1m^2 test unit. It documented a single historic property, a two-tiered historic wall (Site 50-10-45-30571) initially identified during the SHPD field inspection on August 10, 2012. A single surface artifact, a glass jug, manufactured in 1948 was found partially buried near the wall. No other surface artifacts were found.

A test unit was excavated through the center of the wall's lower tier. Cultural materials identified in the test excavation include an opihi shell, an unidentified shell fragment and a single fragment of a kukui nutshell. Based on the overall construction characteristics of the wall (core filled with chinked spaces between the courses), and the nearby glass jug, the report indicates that the wall likely dates to the mid-twentieth century and that the wall's orientation suggests that it was used as a wind break from prevailing trade winds. In consultation with the SHPD, concerns regarding the adequacy of documentation for the wall were raised as the wall will not be preserved as discussed in previous correspondence. In a meeting in November 2016, Dr. Rechtman provided sufficient justification as to the adequate documentation of the wall to mitigate the recent plans for the project area. Pursuant to Hawaii Administrative Rules (HAR) §13-284-6, the report assessed Site 30571, as significant under Criterion "d". Site 30571 will not be preserved and the report indicates that the documentation presented in the report serves to mitigate any potential impacts from future development of the single-family residence and that no further archaeological work is required. SHPD concurs with the significance assessments, effect determination, and the mitigation recommendation.

The report provides adequate discussion of the project, physical environment, cultural and historical background, previous archaeological studies, methods and field findings, and meets the requirements specified in HAR §13-276-5. **It is accepted by SHPD**. Please send two hardcopies of the document, clearly marked FINAL, along with a copy of this review letter and a text-searchable PDF version on CD to the Kapolei SHPD office, attention SHPD Library.

Please contact Sean Naleimaile at (808) 933-7651 or at Sean.P.Naleimaile@hawaii.gov for questions regarding archaeological resources or this letter.

Aloha,

Susan A. Lebo

Susan A. Lebo, PhD
Archaeology Branch Chief

cc. Dr. Robert Rechtman (brechtman@asmafiliattes.com)

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Environmental Assessment

Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko

APPENDIX 2
Archaeological Inventory Survey

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An Archaeological Inventory Survey of TMK: (3) 1-5-009:055

Keonepoko Iki Ahupuaʻa
Puna District
Island of Hawaiʻi

DRAFT VERSION

Prepared By:

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Prepared For:

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ASM Project Number 26640.00

An Archaeological Inventory Survey of TMK: (3) 1-5-009:055

Keonepoko Iki Ahupuaʻa
Puna District
Island of Hawaiʻi

ASM affiliates

EXECUTIVE SUMMARY

At the request of Steve Dearing, ASM Affiliates conducted an Archaeological Inventory Survey (AIS) of a roughly 6.8 acre parcel (TMK: (3) 1-5-009:055) in Keonepoko Iki Ahupuaʻa, Puna District, Island of Hawaiʻi. Garrett Dearing (the applicant) seeks a Conservation District Use Permit (CDUP) to build a single-family residence and farm on his 6.79-acre property located *makai* of the Government Beach Road in Keonepoko Iki, northwest of the Hawaiian Shores subdivision, in the Lower Puna area of the Island of Hawaiʻi. In addition to the home, he is seeking to permit development of a fruit tree farm with a water well, a barn, a water tank with capacity to supply both water supply and fire flow, and a pond for storing water and capturing any excess runoff. During an August 10, 2012 field visit to the study parcel, DLNR-SHPD staff identified a previously unrecorded archaeological feature on the property (a Historic wall), which necessitates the preparation of this AIS. The current study was undertaken in accordance with Hawaiʻi Administrative Rules13§13–284, and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawaiʻi Administrative Rules 13§13–276. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Hawaiʻi Planning Department.

As a result of the surface survey, one previously unrecorded site (Site 50-10-45-30571), a Historic wall with an unusual two-tiered construction, was recorded in the *makai* portion of the study area. To aid in the discussion of site function and age, a 1 x 1 meter test unit (TU-1) was excavated in the center of the wall's lower tier. Site 30571 is evaluated as significant under Criterion d for the information it has yielded relative to the mid-twentieth century use of the study area for short-term habitation (recurrent camping) purposes and the associated exploitation of marine resources. Given its orientation, it appears that Site 30571 was constructed as a windbreak designed to shelter the area in its lee from the prevailing trade winds. The height of the wall may suggest that it also served as a support for a lean-to structure. Associated debris, found adjacent to the wall edge and within TU-1, indicates that this site may have been occupied as recently as the late 1940s-50s, and that its occupants collected *ʻopihi* (and likely other nearshore resources) from the adjacent coastline. Site 30571was fully documented during the current study. As the significance of the archaeological resource derives from information already collected from Site 30571, and the likelihood of encountering additional significant subsurface archaeological resources is remote, no further historic preservation work is recommended. In the unlikely event that any unanticipated archaeological resources are unearthed within the study parcel during the proposed development activities, work in the immediate vicinity of those resources should be halted and DLNR-SHPD should be contacted in compliance with HAR 13§13-280.

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1. INTRODUCTION

At the request of Steve Dearing, ASM Affiliates conducted an Archaeological Inventory Survey (AIS) of a roughly 6.8 acre parcel (TMK: (3) 1-5-009:055) in Keonepoko Iki Ahupuaʻa, Puna District, Island of Hawaiʻi (Figures 1 and 2). Garrett Dearing (the applicant) seeks a Conservation District Use Permit (CDUP) to build a single-family residence and farm on his 6.79-acre property located *makai* of the Government Beach Road in Keonepoko Iki, northwest of the Hawaiian Shores subdivision, in the Lower Puna area of the Island of Hawaiʻi. In addition to the home, he is seeking to permit development of a fruit tree farm with a water well, a barn, a water tank with capacity to supply both water supply and fire flow, and a pond for storing water and capturing any excess runoff. During an August 10, 2012 field visit to the study parcel, DLNR-SHPD staff identified a previously unrecorded archaeological feature on the property (a Historic wall), which necessitates the preparation of this AIS.

The current study was undertaken in accordance with Hawaiʻi Administrative Rules13§13–284, and was performed in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawaiʻi Administrative Rules 13§13–276. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Hawaiʻi Planning Department. This report contains background information outlining the project area's physical and cultural contexts, a presentation of previous archaeological work in the vicinity of the project area, and current survey expectations based on that previous work. Also presented is an explanation of the project's methods, a detailed description of the archaeological feature encountered, interpretation and evaluation of that resource, and treatment recommendations for the site.

STUDY AREA DESCRIPTION

The study area consists of a roughly 6.8-acre parcel (TMK: (3) 1-5-009:055) located between the Old Government Beach Road and the coast within Keonepoko Iki Ahupuaʻa, Puna District, Island of Hawaiʻi (see Figures 1 and 2). The parcel is roughly 250 meters long and has approximately 130 meters of road frontage and 75 meters of coastline, where it is fronted by a low coastal bluff. Elevation within the study area ranges from 6 to 20 meters (20 to 70 feet) above sea level. This portion of the Puna coast is formed of mixed *pāhoehoe* and *ʻaʻā* lava flows that originated from Kīlauea Volcano between 200 and 750 years before present (Wolfe and Morris 1996). The thin soils that have developed in the vicinity of the study parcel are classified as Opihikao highly decomposed plant material on *pāhoehoe* lavas and Malama extremely cobbly highly decomposed plant material on *ʻaʻā* lavas (USDA 2016). The entire parcel, except for perhaps an area extending roughly 30 meters inland from the coastal bluff to a bulldozed road that parallels the coast, appears to have been grubbed and graded in the past (Figure 3). The current, tall, weedy vegetation across most of the parcel (Figure 4) has grown up since the 1960s, when an aerial photograph (taken on February 4, 1961; Figure 5) shows the area covered in low vegetation with only a few trees present. The bulldozed road paralleling the coast (Figure 6), which terminates a short distance to the west of the study parcel, and the Old Government Beach Road (Figure 7) are both clearly evident in the 1961 aerial photograph.

An access road (the current driveway; Figure 8) was bulldozed by a previous landowner (prior to the 2000's) through the center of the parcel from the Old Government Beach Road to the coastal road. In recent years the current landowner has hand cleared and landscaped an area along this access road (Figure 9), and has managed to remove an over story of Albizia trees that formerly dominated the vegetation in this area. The hand clearing currently extends to the eastern boundary of the study area in the central portion of the parcel (Figure 10). Vegetation throughout the remainder of the previously grubbed and graded portion of the parcel (inland of the bulldozed road paralleling the coast) consists of primarily of introduced weedy tree and vine species (Figure 11) such as *maile pilau* (*Paederia foetida*), various pothos (*Epipremnum aureum*) and philodendron vines, bingabing (*Macaranga mappa*), autograph trees (*Clusia rosea*), strawberry guava (*Psidium cattleianum*), umbrella trees (*Schefflera actinophylla*), gunpowder trees (*Trema orientalis*), and melochia (*Melochia umbellata*), with a few coconut palms *(Cocos nucifera)*, *lauaʻe* ferns (*Phymatosorus grossus*), *hala* (*Pandanus tectorius*), and ti plants *(Cordyline fruticosa)* also present. The vegetation of the coastal strand, *makai* of the bulldozed road (Figure 12), is comprised primarily of *naupaka* (*Scaevola guadichaudiana*), coconut palms (*Cocos nucifera*), *hala* (*Pandanus tectorius*) and ironwood trees (*Casuarina equisetifolia*). The coastal strand vegetation terminates above the ocean at the upper edge of the low coastal bluff (Figure 13).

Figure 1. Study area location (portion of U.S.G.S. 7.5 min. series quadrangle, Pāhoa North 1995).

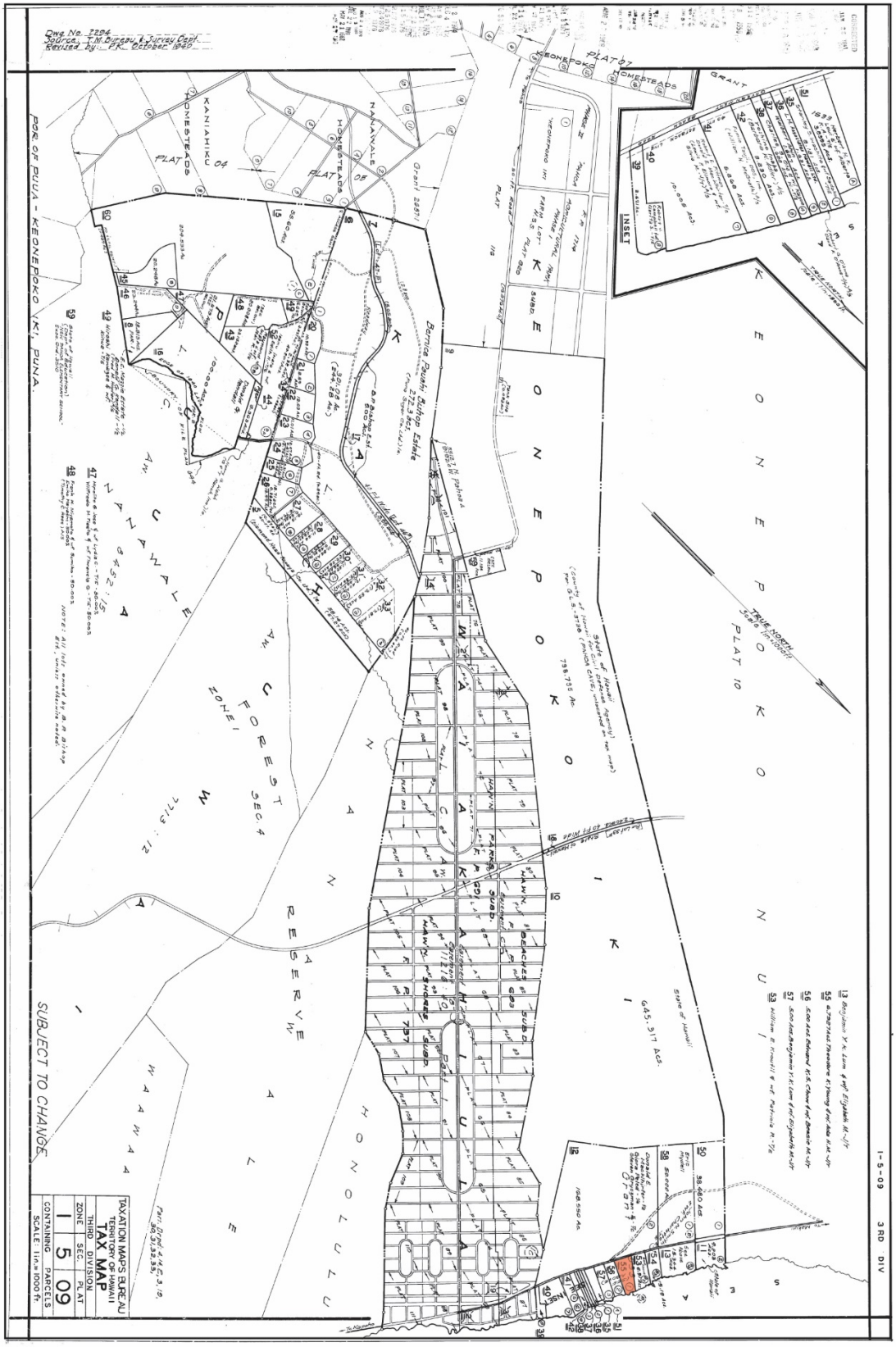

Figure 2. Tax Map Key (TMK) (3) 1-5-009 showing the current study parcel (055) shaded red.

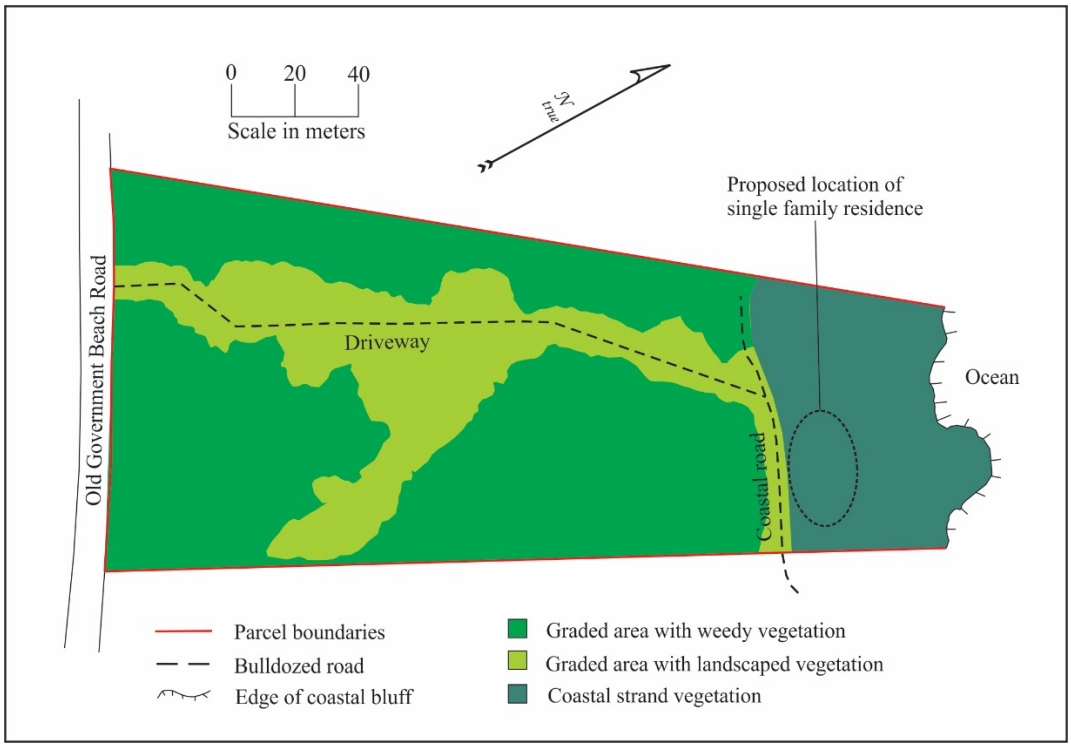

Figure 3. Map of the study parcel showing the improvements, vegetation, and proposed location of the single family residence

Figure 4. 2014 Google Earth™ satellite image showing the current study area (outlined in red).

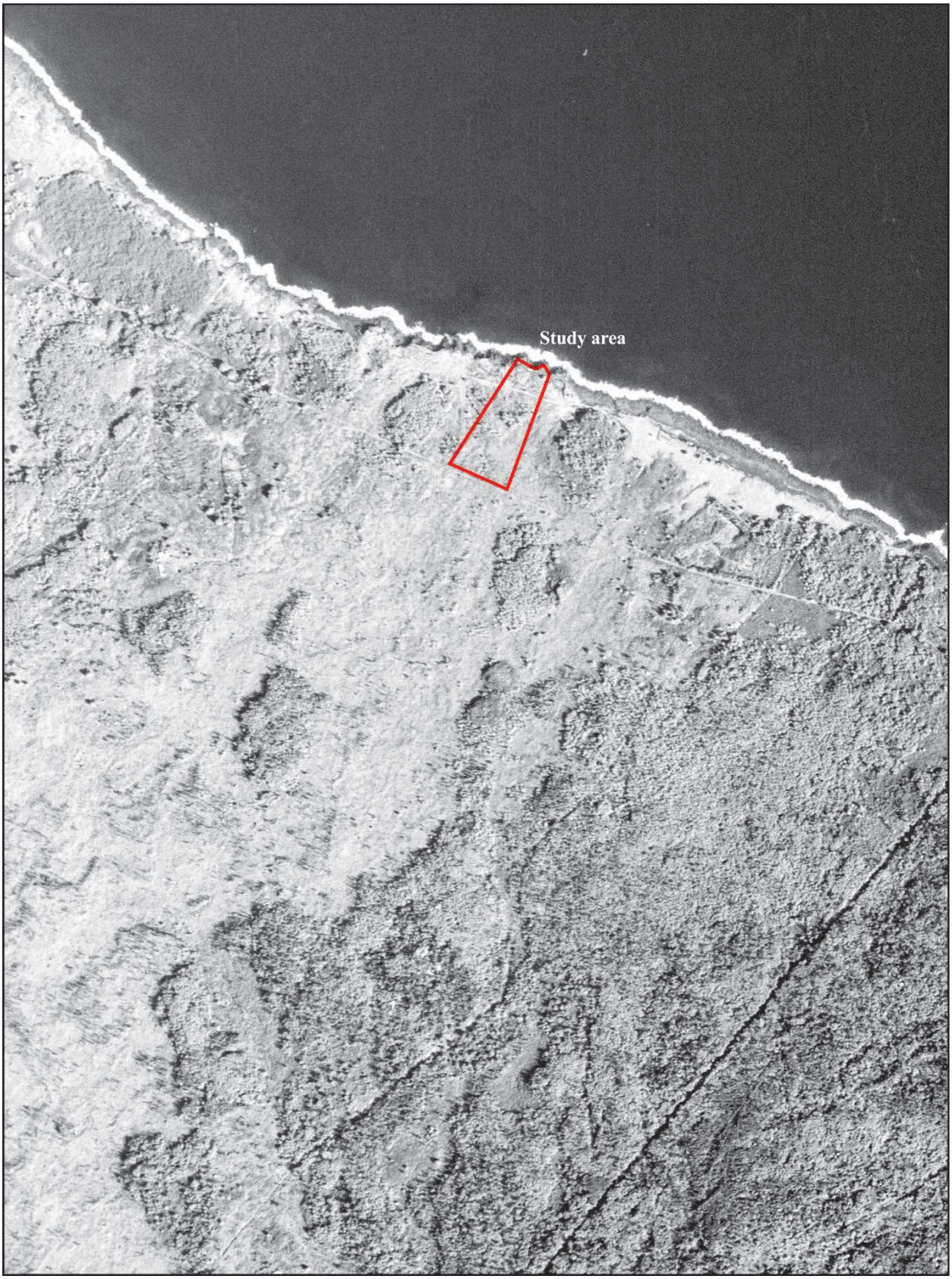

Figure 5. February 4, 1961 aerial photograph showing the current study area.

Figure 6. Bulldozed road paralleling the coast of the current study area, view to the northwest.

Figure 7. Old Government Beach Road along the *mauka* boundary of the current study area, view to the northwest.

Figure 8. Bulldozed driveway within the current study area, view to the northeast.

Figure 9. Landscaping within the current study area, view to the northeast.

Figure 10. Area hand cleared of vegetation near the eastern boundary of the study parcel, view to the southeast.

Figure 11. Weedy vegetation in the previously grubbed and graded *mauka* portion of the study parcel, view to the east.

Figure 12. Coastal vegetation in the northeastern corner of the study parcel, view to the southeast.

Figure 13. Low coastal bluff fronting the study area, view to the east.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the study parcel, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the region and a review of previous archaeological studies in the vicinity of the current study area are presented.

CULTURE-HISTORICAL CONTEXT

The *ahupuaʻa* of Keonepoko Iki is one of fifty traditional land divisions found in the District of Puna on the eastern shores of the Island of Hawaiʻi (see Figure 1). In the book *Native Planters In Old Hawaii*, Handy and Handy (1991) describe Puna as an agriculturally fertile land that has been repeatedly devastated by lava flows. Writing during the 1930s, they relate that:

> The land division named Puna—one of the six major chiefdoms of the island of Hawaiʻi said to have been cut (*ʻoki*) by the son of the successor of the island's first unifier, Umi-a-Liloa—lies between Hilo to the north and Kaʻu to the south, and it projects sharply to the east as a great promontory into the Pacific. Kapoho is the most easterly point at Cape Kumukahi. The uplands of Puna extend back toward the great central heights of Mauna Loa, and in the past its lands have been built, and devastated, and built again by that mountain's fires. In the long intervals, vegetation took hold, beginning with miniscule mosses and lichens, then ferns and hardier shrubs, until the uplands became green and forested and good earth and humus covered much of the lava-strewn terrain, making interior Puna a place of great beauty…
>
> …One of the most interesting things about Puna is that Hawaiians believe, and their traditions imply that this was once Hawaii's richest agricultural region and that it is only in relatively recent time that volcanic eruption has destroyed much of its best land. Unquestionably lava flows in historic times have covered more good gardening land here than in any other district. But the present desolation was largely brought about by the gradual abandonment of their country by Hawaiians after sugar and ranching came in… (Handy and Handy 1991:539-542)

The District of Puna is situated largely on the slopes of Kīlauea Volcano. The east rift zone of the volcano, a broad, low profile ridge (2-4 kilometers wide) formed by countless eruptions originating from numerous vents along its crest. The zone extends through the district from the Kīlauea Caldera to Cape Kumukahi at the eastern tip of the island, a distance of 55 kilometers. The north side of the rift zone, extending to the slopes of Mauna Loa and to the northeastern Puna coast, is covered primarily by lavas that erupted from the summit of Kīlauea about 200-750 years ago. In contrast, nearly the entire crest of the rift zone is covered by lava that is less than 200 years old, and most of the young lava flows that emanate from vents along the crest have spread southward towards the southeastern coast of the district, covering the older lava flows in the process (Wolfe and Morris 1996).

The *ahupuaʻa* of Keonepoko Iki includes areas of both the Coastal Settlement Zone (Zone I) and the Upland Agricultural Zone (Zone II) as described by McEldowney (1979:15-18). While this model is largely based on early historical accounts, it also considers environmental variables and human resource needs, and offers insights into the prehistoric past (Burtchard and Moblo 1994). In their refinement of the model as it applies to Puna, Burtchard and Moblo elaborate on McEldowney's concept of the Coastal Settlement Zone:

> As with her model, [the Coastal Settlement Zone] includes coastal terrain to about one half mile inland. This is the zone expected to have the greatest density and variety of prehistoric surface features in the general study area. Primary settlements are expected in places where agriculturally productive sediments (principally well-weathered ʻaʻā flows) co-occur with sheltered embayments and productive fisheries. Settlements within this zone are expected to be logistically linked to inland agricultural and forest exploitation zones accessed through a network of upslope-downslope (*Mauak-makai*) trails. Larger settlements and resource acquisition areas may have been connected by cross-terrain trail networks. (Burtchard and Moblo 1994:26)

Located along the coast, the current study parcel falls within Zone I of McEldowney's (1979) model. Because this part of the *ahupuaʻa* also extends out to the ocean fisheries fronting its coastline, with these marine resources and the *mauka* agricultural and forest resources, the former residents of Keonepoko Iki were once able to procure nearly all that they needed to sustain their families and contribute to the larger community from within the land division. The *ahupuaʻa* resources in turn helped support the *aliʻi* that ruled the District of Puna (Maly 1998).

It is within this general context 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 includes the presentation of a generalized model of Hawaiian Prehistory containing specific legendary references to the study *ahupuaʻa* and a discussion of the general settlement patterns. The discussion of Prehistory and legendary references is followed by a summary of Historic events in the district that begins with the arrival of foreigners in the islands and then continues with the history of land use in Puna 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 *ahupuaʻa* during the *Māhele ʻĀina* of 1848, and documentation of the transition to modern industries, agriculture, and residential development during the late nineteenth and twentieth centuries. A synthesis of the Precontact settlement patterns and the Historically documented land use, combined with a review of the findings of previously conducted archeological studies, provides a means for predicting the types of archaeological features that may be encountered within the project area, and a basis for assessing the function, age, and significance of any encountered archaeological sites.

A Generalized Model of Hawaiian Prehistory

The generalized cultural sequence that follows is based on Kirch's (1985) model, but is amended to include recent revisions offered by Kirch (2011). The conventional wisdom has been that first inhabitants of Hawaiʻi Island 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 Hawaiʻi Island (or perhaps anywhere in Hawaiʻi) during this initial settlement, or colonization stage of island occupation (A.D. 300 to 600). More recently, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have convincingly argued that Polynesians may not have arrived to the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the currently accepted chronology would alter the timing of the Settlement, Developmental, and Expansion Periods, possibly shifting the Settlement Period to A.D. 1000 to 1100, the Developmental Period to A.D. 1100 to 1350, the Expansion Period to A.D. 1350 to 1650, and the Proto-Historic Period to A.D.1650-1795.

The initial settlement in Hawaiʻi is believed to have occurred from the southern Marquesas Islands. The Settlement Period was a time of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). 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 *ʻaumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. Over a period of several centuries areas with the richest natural resources became populated and perhaps even crowded, and the population began expanding to the *kona* (leeward side) and more remote regions of the island (Cordy 2000). In Puna, initial settlements were likely established at sheltered bays with access to fresh water and rich marine resources. These small communities would have shared extended familial relations, and there was likely an occupational focus on the collection of marine resources.

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 (*koʻi*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. A few areas in Hawaiʻi produced quality basalt for adze production. Mauna Kea, on the island of Hawaiʻi, possessed a well-known adze quarry. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *ʻulu maika* stones and *lei niho palaoa*. The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). As the environment reached its maximum carrying capacity, the result was social stress, hostility, and war between neighboring groups (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 Hawaiʻi, this time from Tahiti in the Society Islands. According to Kamakau (1976), the *kahuna* Pāʻao settled in the islands during the 13th century. Pāʻao was the keeper of the god Kūʻkāʻilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pāʻao was expelled from his homeland by Lonopele. He prepared for a long voyage, and set out across the ocean in search of a new land. On board Pāʻao's

canoes were thirty-eight men (*kānaka*), two stewards (*kānaka ʻāʻīpuʻupuʻu*), the chief Pilikaʻaiea (Pili) and his wife Hinaʻaukekele, Nāmauʻu o Malaia, the sister of Pāʻao, and the prophet Makuakaʻūmana (Kamakau 1992). In 1866, Kamakau told the following story of their arrival in Hawaiʻi:

> Puna on Hawaiʻi Island was the first land reached by Pāʻao, and here in Puna he built his first *heiau* for his god Ahaʻula and named it Ahaʻula [Wahaʻula]. It was a *luakini*. From Puna, Pāʻao went on to land in Kohala, at Puʻuepa. He built a *heiau* there called Moʻokini, a *luakini*.
>
> It is thought that Pāʻao came to Hawaiʻi in the time of the *aliʻi* Laʻau because Pili ruled as *moʻi* after Laʻau. You will see Pili there in the line of succession, the *moʻo kūʻauhau*, of Hanalaʻanui. It was said that Hawaiʻi Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawaiʻi Island had been without a chief for a long time, and the chiefs of Hawaiʻi were *aliʻi makaʻāinana* or just commoners, *makaʻāinana*, during this time.
>
> . . . There were seventeen generations during which Hawaiʻi Island was without chiefs—some eight hundred years. . . . The lack of a high chief was the reason for seeking a chief in Kahiki, and that is perhaps how Pili became the chief of Hawaiʻi. He was a chief from Kahiki and became the ancestor of chiefs and people of Hawaiʻi Island. (1992:100-102)

According to Kirch's (1985) model, the concept of the *ahupuaʻa* 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. *Ahupuaʻa* were ruled by *aliʻi ʻai ahupuaʻa,* 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*. *Ahupuaʻa* 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).

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

The Precontact population of the Puna District lived in small settlements along the coast where they subsisted on marine resources and agricultural products. The villages of Puna, McEldowney (1979) notes, were similar to those of the Hilo District, and they:

> …comprised the same complex of huts, gardens, windbreaking shrubs, and utilized groves, although the form and overall size of each appear to differ. The major differences between this portion of the coast and Hilo occurred in the type of agriculture practiced and structural forms reflecting the uneven nature of the young terrain. Platforms and walls were built to include and abut outcrops, crevices were filled and paved for burials, and the large numbers of loose surface stones were arranged into terraces. To supplement the limited and often spotty deposits of soil, mounds were built of gathered soil, mulch, sorted sizes of stones, and in many circumstances, from burnt brush and surrounding the gardens. Although all major cultigens appear to have been present in these gardens, sweet potatoes, ti (*Cordyline terminalis*), *noni (Morinda citrifolia*), and gourds (*Lagenaria siceraria*) seem to have been more conspicuous. Breadfruit, pandanus, and mountain apple (*Eugenia malaccensis*) were the more significant components of the groves that grew in more disjunct patterns than those in Hilo Bay. (McEldowney 1979:17)

People probably began utilizing the agricultural resources of upland Puna during the early expansion period of Hawaiʻi Island (Burtchard and Moblo 1994). As coastal populations increased, the need for food caused people to seek arable land at higher elevations. This trend of population increase along desirable coastal locations and the expansion into upland regions to support the coastal populations would have continued throughout prehistory, slowly populating more marginal areas of Puna District. As population density increased through A.D.1600-1700s, so would

political competition. This competition, undoubtedly, produced conflict, which led to political exiles and the further expansion into upland areas as these refugees sought asylum in more remote places and hidden lava tubes (Burtchard and Moblo 1994).

By the seventeenth century, large areas of Hawai‘i Island (*moku āina* – districts) were controlled by a few powerful *ali‘i ‘ai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawai‘i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). ‘Umi a Līloa, a renowned *ali‘i* of the Pili line, is often credited with uniting the Island of Hawai‘i under one rule (Cordy 1994). According to Kamakau (1992:17-18), at this time, “Hua-‘a was the chief of Puna, but Puna was seized by ‘Umi and his warrior adopted sons… Hua-‘a was killed by Pi‘i-mai-wa‘a on the battle field of Kuolo in Kea‘au, and Puna became ‘Umi-a-Liloa’s.” Umi’s reign lasted until around ca. A.D. 1620, and was followed by the rule of his son, Keawenui a ‘Umi, and then his grandson, Lonoikamakahiki (Cordy 1994).

Kirch (1985) places the beginning of the Proto-Historic Period during the rule of Lonoikamakahiki. This was a time marked by both political intensification and stress and continual conquest by the reigning *ali‘i*. Wars occurred regularly between intra-island and inter-island polities. It was during this time of warfare that Kamehameha, who would eventually rise to power and unite all the Hawaiian Islands under one rule, was born in the District of North Kohala on the Island of Hawai‘i (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (1992:66–68) places the birth event sometime between A.D. 1736 and 1758, most likely nearer to the later date.

In A.D. 1754, after many bloody battles, Kalani’ōpu‘u, the *ali‘i ‘ai moku* of Ka‘ū, defeated his main rival Keaweopala in South Kona and declared himself ruler over all of the island of Hawai‘i (Kamakau 1992:78). Kalani’ōpu‘u 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. According to Barrère (1959), the chiefs of the Puna District did not figure prominently into the Precontact political strife and turmoil on Hawai‘i Island. Barrère writes:

> Puna, as a political unit, played an insignificant part in shaping the course of history of Hawaii Island. Unlike the other districts of Hawaii, no great family arose upon whose support one or another of the chiefs seeking power had to depend for his success. Puna lands were desirable, and were eagerly sought, but their control did not rest upon conquering Puna itself, but rather upon control of the adjacent districts, Kau and Hilo. (Barrère 1959:15)

Legendary References to the Puna District

Despite its perceived lack of importance with respect to the emerging political history of Hawaiian leadership, Puna was a region famed in legendary history for its associations with the goddess Pele and god Kāne (Maly 1998). Because of the relatively young geological history and persistent volcanic activity, the region’s association with Pele has been a strong one. However, the association with Kāne is perhaps more ancient. Kāne, ancestor to both chiefs and commoners, is the god of sunlight, fresh water, verdant growth, and forests (Pukui 1983). It is said that before Pele migrated to Hawai‘i from Kahiki, there was “no place in the islands . . . more beautiful than Puna” (Pukui 1983:11). Contributing to that beauty were the groves of fragrant *hala* and forests of *‘ōhi‘a lehua* for which Puna was famous:

> *Puna pāia ‘ala i ka hala* (Puna, with walls fragrant with pandanus blossoms)
> Puna, Hawai‘i, is a place of *hala* and *lehua* forests. In olden days the people would stick the bracts of *hala* into the thatching of their houses to bring some of the fragrance indoors. (Pukui 1983:301)

As the Hawaiian people had no written language until Post-contact times, traditional *mo‘olelo* were passed down orally through the generations. Plentiful are the myths and legends associated with the beautiful *wahi pana* of Puna, which frequently refer to the majestic female fire deity, Pele, or “Pele-honua-mea (Pele of the sacred earth)” (Beckwith 1970). Most closely associated with the powerful, temperamental volcanoes of Hawai‘i, she was perhaps both feared and respected equally by the people of the islands. Nimmo (1990) relates that, “although the actual worship of Pele was most important in the districts of Hawai‘i that experienced active volcanism, the mythology of the goddess was widespread throughout the Hawaiian Islands”, but that, “there is no evidence that Pele was worshipped extensively beyond the volcano area of Hawai‘i, although her mythology was apparently widespread throughout the Hawaiian Islands and members of her family were important in ritual throughout the archipelago” (Nimmo 1990:44).

The Heart Stirring Story of Ka-Miki

A traditional *moʻolelo*, "The Heart Stirring Story of Ka-Miki" (*Kaao Hooniua Puuwai no Ka-Miki*), originally appeared in *Ka Hoku o Hawaiʻi* (a Hawaiian language newspaper) between 1914 and 1917. The story tells of two supernatural brothers, Ka-Miki and Maka-ʻiole, who were skilled *ʻōlohe* (competitors/fighters) and their travels around Hawaiʻi Island by way of the ancient trails and paths (*ala loa* and *ala hele*), seeking competition with other *ʻōlohe.* As described by Maly:

> The narratives were primarily recorded for the paper by Hawaiian historians John Wise and J.W.H.I. Kihe (with contributions from Steven Desha Sr.). While Ka-Miki is not an ancient account, the authors set the account in the thirteenth century (by association with the chief Pili, who came to Hawaiʻi with Pāʻao). They used a mixture of local stories, tales, and family traditions in association with place names to tie together fragments of site specific history that had been handed down over the generations. Thus, while in many cases, the personification of individuals and their associated place names may not be "ancient," the site documentation within the "story of Ka-Miki" is of both cultural and historical value. (Maly 1998:17)

A portion of the legend set in Puna was published between October 21 and November 18, 1915. Translated by Maly (1998:17-25), this portion describes many people and places within the district, and mentions a young chief of Puna named Keahialaka. The Maly (1998) translation of the story is summarized below.

During an expedition through the uplands of Puna, Ka-Miki and Maka-ʻiole encountered a man named Pōhakuloa who was intensely working on a large *koa* log. They were headed to Keaʻau, but had lost their way. They stopped and asked Pōhakuloa for directions, but he was startled by the unexpected appearance of the brothers, and replied impolitely. Taunts were exchanged between the two parties, which led to a physical altercation. Pōhakuloa soon realized that these two men were extraordinarily skilled as well as spiritually protected, and he admitted his defeat. Pōhakuloa wished to prepare a meal and drink of *ʻawa* with his newfound friends, and solicited the help of his brother in law, an *ʻōlohe* chief named Kapuʻeuhi. However, Kapuʻeuhi had plans of his own. He intended to compete with and conquer the brothers, but was defeated by them instead. Kapuʻeuhi was infuriated by his defeat, and also by Pōhakuloa's refusal to aid in retaliation against Ka-Miki and Maka-ʻiole.

Kapuʻeuhi invited the brothers back to his house to partake in a meal and a particularly potent type of *ʻawa*, scheming to get them drunk. Unbeknownst to Ka-Miki and Maka-ʻiole, this was common practice for Kapuʻeuhi, who often housed weary travelers in his guest house, intoxicated them with *ʻawa*, then killed them and stole their precious belongings. Kapuʻeuhi waged a bet with the brothers; if they couldn't drink five cups of the *ʻawa*, then he would throw them out and they would be at the mercy of the Puna forest. Ka-Miki and Maka-ʻiole agreed, and counteracted his bet with one of their own; if they were able to drink five cups, they would throw Kapuʻeuhi out of his own house. The brothers prayed and chanted to their ancestral goddess, and were able to consume the entire quantity of *ʻawa* without getting drunk. As agreed upon, Kapuʻeuhi was thrown out. Stunned, and angered that he was thwarted once again, Kapu-ʻeuhi requested assistance from Kaniahiku (a much feared Puna *ʻōlohe* and forest guardian) and her grandson Keahialaka. "At that time, Keahialaka was under the guardianship of Pānau and Kaimū, and he enjoyed the ocean waters from Nānāwale to Kaunaloa, Puna" (*Ka Hoku o Hawaiʻi* October 28, 1915; translated by Maly 1998:20), which Maly (1998) suggests is symbolic of controlling those regions.

Together, Kapuʻeuhi and Kaniahiku conspired to lead the brothers deep into the Puna forest, where Kaniahiku would be able to murder them, all the while maintaining the façade that they were taking them to the *ʻawa* grove of Mauānuikananuha. Once Ka-Miki and Ka-ʻiole were well within the domain of Kaniahiku, she created a dark and murky environment, spreading gloomy mists and an overgrowth of twisted vegetation intended to ensnare the brothers. Ka-Miki and Kaʻiole were overcome, and left for dead by Kapuʻeuhi, who made his way back to safety, led by Kaniahiku's sister. They prayed to their ancestor, Ka-uluhe-nui-hihi-kolo-i-uka for help. All at once, her presence became apparent, and the brothers were able to continue on to the *ʻawa* grove. Another attempt by Kaniahiku to kill the brothers was made, however, Ka-uluhe's protection over them was too strong, and the endeavor failed.

Ka-Miki and Ka-ʻiole realized that Kapuʻehi had deceived them and had been in affiliation with Kaniahiku. They were angered, and trapped him in the *ʻawa* grove. In an effort of retaliation, Kaniahiku summoned for her grandson, Keahialaka, and readied herself for a battle. Ka-Miki and Maka-ʻiole reprimanded Kaniahiku for her deceitful actions, which only served to anger her even further. Aggressively, Kaniahiku attacked Ka-Miki with her tripping club and spear, but Ka-Miki was far too elusive for her. He swiftly evaded each attempt at injury made on his behalf. In desperate need of assistance, Kaniahiku beckoned to Keahialaka by playing her nose flute, urging him to hurry to her

side. Although Keahialaka was strong and skillful in the arts of *ʻōlohe*, he was all too easily overcome by Ka-Miki. His grandmother, in an attempt to free him from Ka-Miki, was also captured.

Kaniahiku was astounded at the dexterity of the brothers. Their skill was incomparable to any other *ʻōlohe* she had ever encountered, and even her own skill paled in comparison, for she had never been defeated. All at once she surrendered to Ka-Miki and Makaʻiole, who in turn released her and her grandson. Back at Kaniahiku's house, a meal was prepared, the *ʻawa* of Kaliʻu was enjoyed, and the gods were honored with offerings. Kaniahiku requested that the brothers take Keahialaka with them as they continued their journey on the *ala loa*, declaring that if they did, they would be welcomed wherever their travels took them in Puna. Ka-Miki and Makaʻiole approved of this request, and took Keahialaka on as their companion. Together, the three men journeyed throughout various districts of Hawaiʻi island, and competed in many *ʻōlohe* competitions.

In the legend of Ka-Miki, the land of Keoneopokoiki was named for an *ʻolohe* master of Puna, who was the *mokomoko* (rough hand fighting) instructor of the chief Puʻula (Maly 1992). According to the story Keoneopokoiki was a traditional training grounds for *ʻolohe* of Puna, were masters skilled in hand to hand combat and other martial arts techniques. In the story Ka-Miki quickly defeats the Puna master, Keoneopokoiki in an *ʻolohe* contest. Ka-Miki then threatened to kill Keoneopokoiki, who seeing that there was no one who could defeat Ka-Miki, gave his complete surrender and returned to his home. According to the story, Keoneopokoiki lived on the upland side of the *alaloa* (the around the island coastal trail). At his compound was an altar dedicated to his gods (Maly 1992). ⋯

History After Contact

The arrival of Western explorers in Hawaiʻi signified the end of the Precontact Period, and the beginning of the Historic Period. With the arrival of foreigners, Hawaiʻi's culture and economy underwent drastic changes. Demographic trends during the late Proto-Historic Period/early Historic Period indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. At first there was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history (Kirch 1985; Kent 1983). 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 very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered Oʻahu, Maui and Molokaʻi, in 1795, Hawaiʻi saw the beginnings of a market system economy (Kent 1983). Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early visitors. Introduced foods often grown for trade with Westerners included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845). 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 in the Hawaiian Islands. This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

The Arrival of Captain James Cook and the End of Kalaniʻōpuʻu's Reign (1778-1782)

British explorer Captain James Cook, in command of the ships *H.M.S. Resolution* and *H.M.S. Discovery*, landed in the Hawaiian Islands on January 18, 1778. The following January 17th [1779], on a return trip to Hawaiian waters, Cook anchored near Kaʻawaloa at Kealakekua Bay in the South Kona District to resupply his ships. This return trip occurred at the time of the annual *Makahiki* festival, and many of chiefs and commoners were gathered around the bay celebrating. According to John Ledyard, a British marine on board Cook's ship, upward of 15,000 inhabitants were present at the bay, and as many as 3,000 canoes came out to greet the ships (Jarves 1847:59). It has been suggested that Captain Cook was mistaken for the god Lono himself returned, as men would not normally be allowed to paddle out during the *Makahiki* without breaking the *kapu* and forfeiting all of their possessions (Kamakau 1992). On January 26th Kalaniʻōpuʻu, the reigning chief of Hawaiʻi Island, visited Cook on board the *H.M.S. Resolution*, where they exchanged gifts. Kamehameha, the future ruler of all of Hawaiʻi, was present at this meeting (Jarves 1847).

On February 4th, Cook set sail from Kealakekua Bay, but a storm off the Kohala coast damaged the mast of the *H.M.S. Resolution*, and both ships were forced to return to Kealakekua to make repairs. With Cook's return many of the inhabitants of Kealakekua began to doubt that he was actually the physical manifestation of Lono (Kamakau 1992). On February 13th, several natives were discovered stealing nails from the British ships. They were fired upon by the crew, and a chief close to Kalaniʻōpuʻu named Palea was knocked down, and his canoe taken. That night one of Cook's boats was stolen, and the following morning Cook set ashore at Kaʻawaloa with six marines to ask

Kalani‘ōpu‘u for its return. Kalani‘ōpu‘u, however, denied any knowledge of the theft; Cook decided to hold the chief captive until the boat was returned (Kamakau 1992). When Cook tried to seize Kalani‘ōpu‘u, however, a scuffle ensued and Cook was killed (along with four of his men and several natives) there on the shores of Ka‘awaloa, struck down by a metal dagger. When Captain Cook fell, the British ships fired cannons into the crowd at the shore and several more natives were killed. Kalani‘ōpu‘u and his retinue retreated inland, bringing the body of Cook with them.

In March of 1779, after Cook’s death, Captain King sailed along the Puna shoreline and described the district as a sparsely populated, but verdant and fertile (Maly 1998). Captain King, mentioned that Kalani‘ōpu‘u had one of his residences there, and he provided the following description of the landscape:

> …the SE sides of the districts of Opoona & Kaoo [Puna and Ka‘ū]. The East part of the former is flat, coverd with Coco nut trees, & the land far back is of a Moderate height. As well as we could judge this is a very fine part of the Island, perhaps the best. Terreeoboo [Kalani‘ōpu‘u] has one of his residences here.
>
> On the SW extremity of Opoona the hills rise abruptly from the Sea side, leaving but a narrow border, & although the sides of the hills have a fine Verdure, yet they do not seem Cultivated, & when we saild pretty near & along this end of Opoona, we did not observe that it was equally Populous with the Eastern parts; before we reachd the East point of the Island, & all along this SE side the snowy mountain calls Roa (or extensive) [Mauna Loa] is very conspicuous. It is flattish at the top or makes what we call Table land… (Beaglehole 1967:606)

After 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. Kalani‘ōpu‘u ordered that all the cultivated products of that district be seized, and he then set out on a circuit of the island. Kalani‘ōpu‘u first went to Hinakahua in Kapa‘au, North Kohala where he amused himself with “sports and games such as hula dancing, *kilu* spinning, *maika* rolling, and sliding sticks” (Kamakau 1992:106). During his stay in Kohala, around 1780, 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 (Fornander 1996; Kamakau 1992). It was during his time in Kohala that an uprising, led by a highly esteemed chief of Puna named Imakakoloa, occurred. Upon hearing of the uprising, Kalani‘ōpu‘u immediately went to Hilo to quell the rebellion.

Though customary at the time, to furnish the king’s court with items such as “pigs, fish, taro, fruits and other forms of wealth” (Elkin 1903:26), it is said that Imakakoloa rebelled because he was tired of the incessant and exorbitant demands of Kalani‘ōpu‘u. As a chief who loved the people of Puna, and was beloved by them in return, Imakakoloa refused Kalani‘ōpu‘u’s demands. He felt that “his own people who cultivated the ground should be provided with the necessaries of life, before the numbers of the royal court, who lived in idleness” (Elkin 1903:26). Rather than allow Kalani‘ōpu‘u access to the toils of the people of Puna, Imakakoloa:

> …seized the valuable products of his district, which consisted of hogs, gray tapa cloth (*‘eleuli*), tapas made of *mamaki* bark, fine mats made of young pandanus blossoms (*‘ahu hinalo*), mats made of young pandanus leaves (*‘ahuao*), and feathers of the *‘o‘o* and *mamo* birds of Puna. (Kamakau 1992:106)

This action angered Kalani‘ōpu‘u, who was insulted by the insubordination. He vowed revenge against Imakakoloa, and devised a plan to kill him. A battle between the two men ensued, and although Imakakoloa was a worthy opponent, his army was no match for Kalani‘ōpu‘u’s superior forces. After the battle, the Puna chief fled and was sheltered in the district by his people for more than a year. Kalani‘ōpu‘u, sworn to vengeance, ruthlessly stalked the fugitive chief for the duration of his emancipation, and in his rage he ordered that Puna be burned to the ground. Fornander (1969:202) indicates that the district was “literally laid in ashes” as a result of Kalani‘ōpu‘u’s vengeance.

While the rebel Puna 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). Imakakoloa was eventually captured and brought to the *heiau*, where Kiwala‘ō was to sacrifice him. “The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief” (Fornander 1996:202). However, before Kiwala‘ō could finish the first offerings, Kamehameha, “grasped the body of Imakakoloa 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 Kiwala‘ō’s authority with a sacrificial ritual in Ka‘ū, Kamehameha retreated to his home district of Kohala.

The Rule of Kamehameha I (1782-1819)

After Kalaniʻōpuʻu's death in April of 1782, several chiefs were unhappy with Kiwalaʻō's division of the island's lands, and civil war broke out. Kiwalaʻō, Kalaniʻōpuʻu's son and appointed heir, was killed at the battle of Mokuʻōhai, South Kona in July of 1782. Supporters of Kiwalaʻō, including his half-brother Keōua and his uncle Keawemauhili, escaped the battle of Mokuʻōhai with their lives and laid claim to the Hilo, Puna, and Kaʻū Districts. According to Iʻi (1963) nearly ten years of almost continuous warfare followed the death of Kiwalaʻō, as Kamehameha endeavored to unite the Island of Hawaiʻi under one rule and conquer the islands of Maui and Oʻahu. Keōua became Kamehameha's main rival on the Island of Hawaiʻi, and he proved difficult to defeat (Kamakau 1992). 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 Puʻukoholā in Kawaihae, which was to be dedicated to the war god Kūkaʻilimoku (Fornander 1996).

Westervelt (1916) relates a story of Keōua, Keawemauhili, and Kamehameha that begins after the battle of Mokuʻōhai, but tells of another battle in ca. 1790 when Kamehameha routed Keōua at Waimea and Hāmākua and then sent men to attack Kaʻū. As Keōua attempted to return to his home district a portion of his army was killed by an eruption of Kīlauea Volcano. Westervelt writes:

> . . . Kiwalao's half-brother Keoua escaped to his district Ka-u, on the southwestern side of the island. His uncle Keawe-mau-hili escaped to his district Hilo on the southeastern side.
>
> For some years the three factions practically let each other alone, although there was desultory fighting. Then the high chief of Hilo accepted Kamehameha as his king and sent his sons to aid Kamehameha in conquering the island Maui.
>
> Keoua was angry with his uncle Keawe-mau-hili. He attacked Hilo, killed his uncle and ravaged Kamehameha's lands along the northeastern side of the island.
>
> Kamehameha quickly returned from Maui and made an immediate attack on his enemy, who had taken possession of a fertile highland plain called Waimea. From this method of forcing unexpected battle came the Hawaiian saying, "The spear seeks Waimea like the wind."
>
> Keoua was defeated and driven through forests along the eastern side of Mauna Kea (The white mountain) to Hilo. Then Kamehameha sent warriors around the western side of the island to attack Keoua's home district. Meanwhile, after a sea fight in which he defeated the chiefs of the islands Maui and Oahu, he set his people to building a great temple chiefly for his war-god Ka-ili. This was the last noted temple built on all the islands.
>
> Keoua heard of the attack on his home, therefore he gave the fish-ponds and fertile lands of Hilo to some of his chiefs and hastened to cross the island with his army by way of a path near the volcano Kilauea. He divided his warriors into three parties, taking charge of the first in person. They passed the crater at a time of great volcanic activity. A native writer, probably Kamakau, in the native newspaper *Kuokoa*, 1867, describes the destruction of the central part of this army by an awful explosion from Kilauea. (Westervelt 1916:140-141)

The untimely eruption of Kīlauea, as Keōua's army attempted to return to Kaʻū to stop Kamehameha's warriors from ravaging their home district, cost him about 400 fighting men along with an untold number of women and children (Fornander 1996). Kamehameha's prophets said that this eruption was the favor of the gods who rejoiced at his building of Puʻukohola Heiau. According to Westervelt (1916:146), "The people said it was proof that Pele had taken Kamehameha under her special protection and would always watch over his interests and make him the chief ruler."

Unable to defeat Keōua in battle, Kamehameha resorted to trickery. 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 1792 (Greene 1993). It is widely thought that Keōua knew the likely outcome of his visit to Puʻukoholā Heiau, but sacrificed himself anyway to spare the people of Kaʻū further bloodshed.

By 1796, with the aid of foreign weapons and advisors, Kamehemeha conquered all of the island kingdoms except Kauaʻi. In 1810, when Kaumualiʻi of Kauai gave his allegiance to Kamehameha, the Hawaiian Islands were unified under a single leader (Kuykendall and Day 1976). Kamehameha would go on to rule the islands for another nine years. He and his high chiefs participated in foreign trade, but continued to enforce the rigid *kapu* system.

Early Written Accounts of Puna (1820-1847)

Following the death of Kamehameha I in 1819, the Hawaiian religious and political systems began a radical transformation; Ka‘ahumanu proclaimed herself "*Kuhina nui*" (Prime Minister), and within six months the ancient *kapu* system was overthrown. Within a year, Protestant missionaries arrived from America (Fornander 1969; I‘i 1963; Kamakau 1992). In 1823, British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Hawai‘i seeking out communities in which to establish church centers for the growing Calvinist mission. Ellis recorded observations made during this tour in a journal (Ellis 2004), and offers a rare glimpse at the study area during this time. Walking from Kīluea to Waiakea along Puna's southeastern shore with his missionary companions Asa Thurston and Artemas Bishop, Ellis recorded descriptions of residences and practices that are applicable to the general study area:

> The population in this part of Puna, though somewhat numerous, did not appear to possess the means of subsistence in any great variety or abundance; and we have often been surprised to find desolate coasts more thickly inhabited than some of the fertile tracts in the interior; a circumstance we can only account for, by supposing that the facilities which the former afford for fishing, induce the natives to prefer them as places of abode; for they find that where the coast is low, the adjacent water is usually shallow.
>
> We saw several fowls and a few hogs here, but a tolerable number of dogs, and quantities of dried salt fish, principally albacores and bonitos. This latter article, with their *poë* [*poi*] and sweet potatoes, constitutes nearly the entire support of the inhabitants, not only in this vicinity, but on the sea coasts of the north and south parts of the island.
>
> Besides what is reserved for their own subsistence, they cure large quantities as an article of commerce, which they exchange for the vegetable productions of Hilo and Mamakua [Hāmākua], or the *mamake* and other tapas of Ora [‘Ōla‘a] and the more fertile districts of Hawaii. (Ellis 2004:263-264)

Ellis and the ABCFM missionaries travelled along the coast of Kauwai, Wa‘awa‘a, and Nānāwale *ahupua‘a* and then turned *mauka* toward a village in Honolulu Ahupua‘a (Ellis 2004:294). On August 8, 1823, the Ellis and the ABCFM missionaries left Honolulu and visited the village of Waiakahiula to the southeast of the current study area. Ellis' journal provides a brief first-hand description of the village's location relative to the coast:

> We arose early on the 8th, and Mr. Thurston held morning worship with the friendly people of the place [Honolulu]. Although I had been much indisposed through the night, we left Honoruru [*sic*] soon after six a.m. and, travelling slowly towards the sea-shore, reached Waiakeheula [*sic*] about eight, where I was obliged to stop, and lie down under the shade of a canoe-house near the shore. Messrs. Thurston and Bishop walked up to the settlement about half a mile inland, where the former preached to the people…(Ellis 2004:295)

After preaching, Bishop continued on alone toward Waiakea, while Thurston returned to fetch Ellis from the canoe shed. Upon reaching the village, Ellis found its residences to be interspersed among the agricultural fields rather than in a single, nucleated settlement:

> The country was populous, but the houses stood singly, or in small clusters, generally on the plantations, which were scattered over the whole country. Grass and herbage were abundant, vegetation in many places luxuriant, and the soil, though shallow, was light and fertile. (Ellis 2004:296)

While other early visitors to Puna provide general descriptions of conditions in the district during subsequent decades. One year after Ellis' tour, the ABCFM established a base church in Hilo. From that church (Hāili), the missionaries traveled to the more remote areas of the Hilo and Puna Districts. David Lyman, who came to Hawai‘i in 1832, and Titus Coan, who arrived in 1835 were two of the most influential congregational missionaries in Puna and Hilo. As part of their duties they compiled census data for the areas within their missions. In 1835, 4,800 individuals were recorded as residing in the district of Puna (Schmitt 1973); the smallest total district population on the island of Hawai‘i. In 1841, Titus Coan recorded that most of the 4,371 recorded residents of Puna lived near the shore, though there were hundreds of individuals who lived inland (Holmes 1985).

In 1841, the United States Exploring Expedition under the direction of Commander Charles Wilkes, toured the Hawaii Island and travelled through the Puna District. Wilkes produced a map of Puna, which includes the coastal trail but shows only a large "Pandanus Forest" covering the lands in the vicinity of the study area (Figure 14). Wilkes,

travelling towards Kapoho at the eastern tip of the island, provides the following description of Puna:

> …Almost all of the hills or craters of any note have some tradition connected with them; but I found that the natives were now generally unwilling to narrate these tales, calling them "foolishness."
>
> After leaving the pahoihoi [sic] plain, we passed along the line of cone-craters towards Point Kapoho, the Southeast part of the island.
>
> Of these cone-craters we made out altogether, large and small, fifteen, trending about east-northeast. The names of the seven last are Pupukai, Poholuaokahowele [Pu'u-hōlua-o-Kahawali], Punomakalua, Kapoho, Puukea, Puuku, and Keala. On some of these the natives pointed out where there had formerly been slides, an amusement or game somewhat similar to the sport of boys riding down hill on sleds. These they termed kolua [sic – *holua*].
>
> This game does not appear to be practiced now, and I suppose that the chiefs consider themselves above such boyish amusements. The manner in which an old native described the velocity with which they passed down these slides was, by suddenly blowing a puff; according to him, these amusements were periodical, and the slides were usually filled with dried grass.

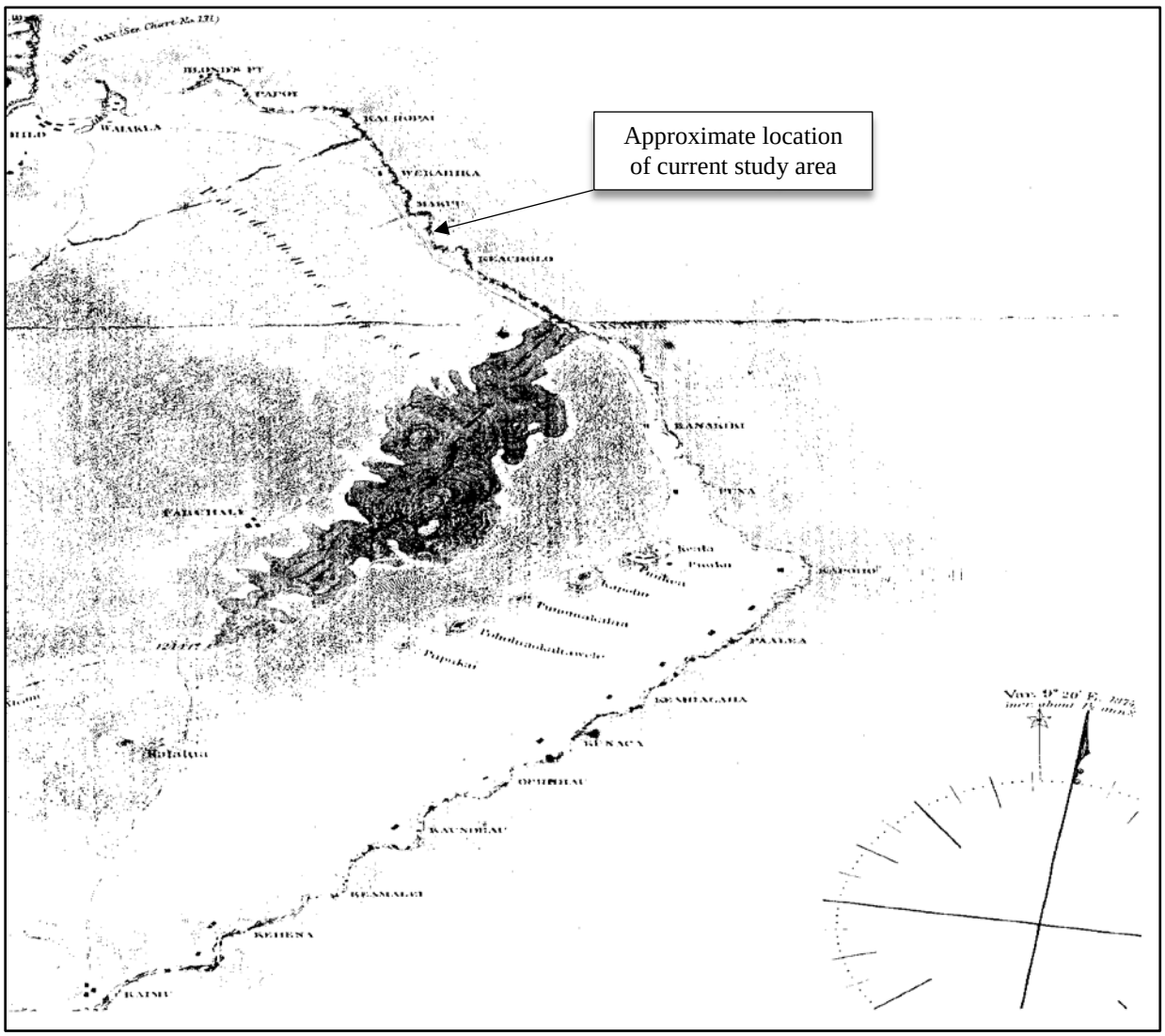

Figure 14. Portion of Hawai'i Registered Map No. 424 prepared by Wilkes in 1841.

> As we approached the sea-shore, the soil improved very much, and was under good cultivation, in taro, sweet-potatoes, sugar cane, and a great variety of fruit and vegetables. At about four o'clock, we arrived at the house of our guide, Kekahunanui, who was the "head man." I was amused to find that none of the natives knew him by this name, and were obliged to ask him, before they could give it to Dr. Judd…
>
> …The view from the guide's house was quite pretty, the eye passing over well-cultivated fields to the ocean, whose roar could be distinctly heard… [Wilkes 1845: Vol. IV:186]
>
> During the night, one of the heaviest rains I had experienced in the island, fell; but the morning was bright and clear,—every thing seemed to be rejoicing around, particularly the singing-birds, for the variety and sweetness of whose notes Hawaii is distinguished. Previous to our departure, all the tenantry, if so I may call them, came to pay their respects, or rather to take a look at us. We had many kind wishes, and a long line of attendants, as we wended our way among the numerous taro patches of the low grounds, towards Puna; and thence along the sea-coast where the lava entered the sea, at Nanavalie [Nānāwale]. The whole population of this section of the country was by the wayside, which gave me an opportunity of judging of their number; this is much larger than might be expected from the condition of the country, for with the exception of the point at Kapoho, very little ground that can be cultivated is to be seen. The country, however, is considered fruitful by those who are acquainted with it, notwithstanding its barren appearance on the roadsides. The inhabitants seemed to have an abundance if bread-fruit, bananas, sugar-cane, taro, and sweet-potatoes. The latter, however, are seen to be growing literally among heaps of stones and pieces of lava, with scarcely soil enough to cover them; yet they are, I am informed, the finest on the island…
>
> In some places they have taken great pains to secure a good road or walking path; thus, there is a part of the road from Nanavalie to Hilo which is built of pieces of lava, about four feet high and three feet wide on the top; but not withstanding this, the road is exceedingly fatiguing to the stranger, as the lumps are so arranged that he is obliged to take a long and short step alternately; but this the natives do not seem to mind, and they pass over the road with great facility, even when heavy laden…(Wilkes 1845, Vol. IV:188-193)

In 1846, Chester S. Lyman, "a sometime professor" at Yale University visited Hilo, Hawaiʻi, and stayed with Titus Coan (Maly 1998). Traveling the almost 100 mile long stretch of the "Diocese" of Mr. Coan, Lyman reported that the district of Puna had somewhere between 3,000-4,000 inhabitants (Maly 1998). Entering Puna from Hilo, and traveling to Keaʻau along the coast, Lyman offered the following observations of the Puna District:

> …The groves of Pandanus were very beautiful, and are the principal tree of the region. There is some grass and ferns, and many shrubs; but the soil is very scanty. Potatoes are almost the only vegetable that can be raised, and these seem to flourish well amid heaps of stone where scarcely a particle of soil could be discovered. The natives pick out the stones to the depth often of from 2 to 4 feet, and in the bottom plant the potato–how it can expand in such a place is a wonder.
>
> Nearly all Puna is like this. The people are necessarily poor—a bare subsistence is all they can obtain, and scarcely that. Probably there are not $10 in money in all Puna, and it is thought that not over one in five hundred has a single cent. The sight of some of these potatoe patches would make a discontented N.E. farmer satisfied with his lot. Yet, I have nowhere seen the people apparently more contented & happy. (Lyman ms. Book III:3 in Maly 1998:35)

Written accounts left by early visitors to the Island of Hawaiʻi offer insight into what life may have been like for the earliest residents of Puna. However, by the time Ellis visited Puna, less than fifty years after the arrival of the first Europeans, the population of Hawaiʻi was already beginning to decline. By 1850, the population of Hawaiʻi Island had dropped to 25,846 individuals (Schmitt 1973:8). Maly (1998) summarizes the reasons for the rapid decline of native populations thusly:

> Overall, historic records document the significant effect that western settlement practices had on Hawaiians throughout the islands. Drawing people from isolated native communities into selected village parishes and Hawaiian ports-of-call, had a dramatic, and perhaps unforeseen impact on native residency patterns, health, and social and political affairs. In single epidemics hundreds, and even thousands of Hawaiians died in short periods of time. (1998:36)

Legacy of the Great Māhele (1848-1873)

By the middle of the nineteenth century the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership, 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 1961:13).

During the *Māhele ʻĀina* of 1848, all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands. During the *Māhele*, land interests of the King (Kamehameha III), the high-ranking chiefs (the *aliʻi nui*), 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. To expedite the work of the Land Commission, these lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed (Chinen 1961:13). All lands awarded during the *Māhele* were subject to the rights of the native tenants therein. Native tenants of the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to, *kuleana* parcels that they actively lived on or farmed. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). In Puna, however, very few claims for *kuleana* were submitted. Maly (1998:37) notes that, with the exception of the islands of Kahoʻolawe and Niʻihau, no other land division of comparable size, had fewer claims for *kuleana* from native tenants than the district of Puna.

As a result of the *Māhele*, Keoneopoko Ahupuaʻa (assumed to be Keonepoko Nui, but not specified) was returned by Lunalilo and retained as Government Land (Soehren 2005). Keonepoko Iki Ahupuaʻa is not listed in the *Māhele* Book, but it too became Government Land, as did Kaʻohe Ahupuaʻa (returned by Ulumaheihei) adjacent to the southeastern coastal boundary of Keonepoko Iki. Kaʻohe was claimed by Ulumaheihei as portion of LCAw. 5207H, a claim that was not awarded. The partial boundaries of Kaʻohe (near the coast) are shown on only one of the Historic maps reviewed for this study (Hawaiʻi Registered Map No. 2258; Figure 15). On most maps the coastal lands of Kaʻohe have been lumped together with those of Keonepoko Iki (the Kaʻohe Homesteads, located within a detached piece of the *ahupuaʻa* above Pāhoa town, still retain the Kaʻohe name, however). As can be seen in Figure 15 the current study area is located in Keonepoko Iki Ahupuaʻa near its indefinite boundary with Kaʻohe Ahupuaʻa, between two coastal points labeled "Kawaiki" and "Keahu" on the map. No LCAw. claims were made for *kuleana* within either Keonepoko Iki or Kaʻohe *ahupuaʻa* during the *Māhele* (Waihona ʻĀina database).

In conjunction with the *Māheleʻ Āina* of 1848, the King authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* should be set aside and sold as grants. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the *Māhele*, to purchase lands of their own. Despite the stated goal of the grant program, in reality, many of the Government Lands were eventually sold or leased to foreigners. The current study area is a portion of a 277.8-acre grant parcel purchased by Kekoa in 1855 as Grant No. 1533 (see Figure 15). The record is silent regarding Kekoa's use of the grant lands.

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawaiʻi to legally set the boundaries of all the *ahupuaʻa* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between A.D. 1873 and 1885 and was usually given in Hawaiian and transcribed in English as they occurred. As Keonepoko Iki was retained as government land, its boundaries were not set by the land commission. However, the boundaries of neighboring Keonepoko Nui, which was returned by Lunalilo to the Government, were surveyed in 1880 for the estate of C. Kanaina, and place names along the common boundary with Keonepoko Iki are shown on a survey map (Figure 16).

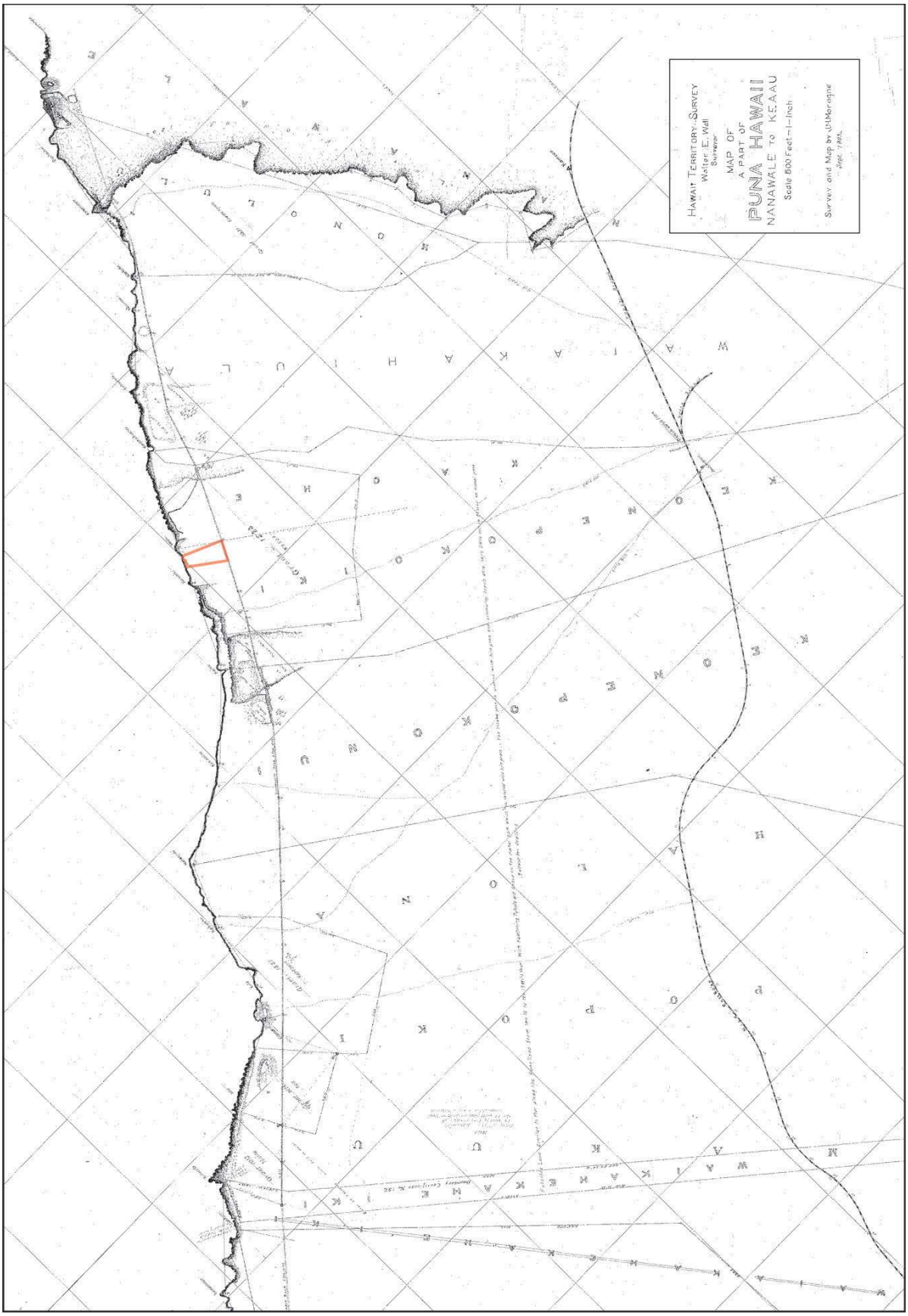

Figure 15. Portion of Hawai‘i Registered Map No. 2258 (prepared by J.H. Morange in Sept. 1903) showing the current study area (outlined in red).

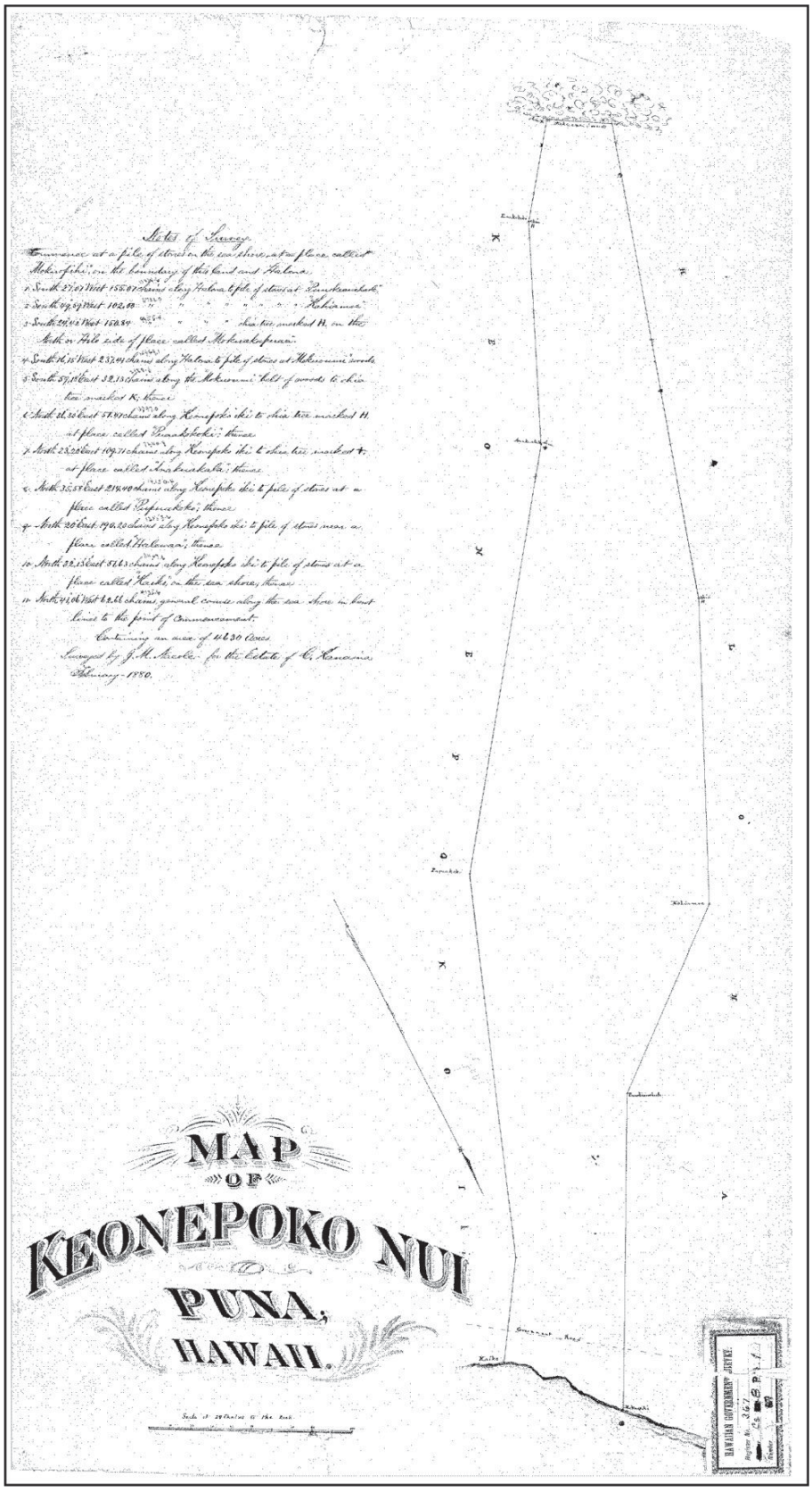

Figure 16. Hawai‘i Registered Map No. 367 showing the boundaries of Keonepoko Nui Ahupua‘a (prepared in 1880).

In 1868 a volcanic eruption emanating from Mauna Loa volcano shook Hawai‘i Island, bringing with it lava flows, earthquakes and a *tsunami* that transformed the landscape of the southern part of island forever, and further contributed to the depopulation of the District of Puna. Coan (1882) recorded that on April 2:

> …a terrific shock rent the ground, sending consternation through all Hilo, Puna, and Kau. In some places fissures of great length, breadth, and depth were opened… Stone houses were rent and ruined, and stone walls sent flying in every direction…the sea rose twenty feet along the southern shore of the island, and in Kau 108 houses were destroyed and forty-six people drowned…Many houses were also destroyed in Puna, but no lives were lost. During this awful hour the coast of Puna and Kau, for the distance of seventy-five miles subsided seven feet on average, submerging a line of small villages all along the shore. One of my rough stone meeting houses in Puna [Kapoho-Koa‘e], where we once had a congregation of 500 to 1,000 was swept away with the influx of the sea, and its walls are now under water… (Coan 1882:314-316)

The population of Puna continued to decline throughout the first half of the nineteenth century and Hawaiians maintained marginalized communities outside of the central population centers. These communities were located in “out-of-the-way” places. In the aftermath of the *Māhele*, economic interests in the region swiftly changed from the traditional Hawaiian land tenure system of subsistence farming and regional trading networks to the more European based cash crops including coffee, tobacco, sugar, timber, and pineapple, and emphasized dairy and cattle ranching. While large tracts of land in lower Puna were used for cattle grazing and sugarcane cultivation, the current project area does not appear to have been used for either purpose.

The Old Government Beach Road (Site 21273), which runs along the *mauka* edge of the current study parcel, is considered a historic property. The Old Government Beach Road (also referred to as the Puna Trail) was previously studied by Lass (1997) and Maly (1999) within the *ahupua‘a* of Kea‘au. Currently, this road is dirt covered and maintained for vehicular access. Maly (1999) relates that the current alignment of the Old Government Road, which evolved from earlier trail routes, was under construction by the 1840s. The road remained the preferred route of travel between Hilo and the out-lying areas of Puna until 1895, when the Kea‘au-Pāhoa Road (Highway 130) was established to access the growing inland population centers and agricultural areas (Maly 1999:6).

Keonepoko Iki Ahupua‘a and Coastal Puna during the Twentieth Century

By 1900 Puna was on the verge of major economic growth, spurred by the sugar and lumber industries. The rise and fall of these industries can be traced along the rusted railroad tracks that litter the landscape *mauka* of the study area. In 1899, the ‘Ōla‘a Sugar Company began operating in the Kea‘au area. The directors of the company realized early that the lack of mass transportation in would hinder the success of their business. As a result, they organized the Hilo Railroad Company and, on April 8, 1899, were granted a 50 year charter (Best 1978). The railroad’s infrastructure developed quickly. Rail service to ‘Ōla‘a (Kea‘au) from Hilo began on June 18, 1900. Another sugar company, the Puna Sugar Company, located near the village of Kapoho, had been organized within the Puna District on March 2 of that same year. Puna Sugar had cane fields scattered all over lower Puna from Kapoho to Pāhoa Town itself. Coastal Keonepoko Iki’s thin, sticky, acidic soils, however, spared the study area from the new sugar fields, and in fact wide dispersal of suitable agricultural lands also hindered the growth of the sugar industry in Puna. As with ‘Ōla‘a Sugar’s early Kea‘au operations, the lack of a reliable transportation system made it expensive to collect and transport the cane from the scattered fields to the mill. So, when Hilo Railroad proposed to lay 4 miles of track from Kapoho to Pāhoa, the Puna Sugar Company paid for half the cost. By March 1, 1902, the Hilo Railroad was making regular stops at the ‘Ōla‘a Sugar Mill, the town of Pāhoa, and in lower Puna.

The route of the railroad across Keonepoko Iki can be seen on Hawai‘i Registered Map No. 2258 prepared by J.H. Morange in September of 1903 (see Figure 15). On that map a “Section House” and a “Switch” at Pāhoa Junction are shown in Keonepoko Iki Ahupua‘a, *mauka* of the study area. Two “Old Trails” are shown extending *makai* from near the section house to the coast (and a short distance *mauka* as well). One of the trails terminates at the coast of Keonepoko Iki to the northwest of the current study area. Beginning in 1903 *mauka* portions of Keonepoko Nui and Keonepoko Iki *ahupua‘a* (in the vicinity of the town of Pāhoa) were subdivided into twenty-three homestead lots collectively called the Keonepoko Homesteads (Figure 17). Soon after that the sixteen lot Ka‘ohe Homesteads were created in the area above the town of Pāhoa (*mauka* and east of Keonepoko Iki Ahupua‘a). All of these parcels were sold as grants. By 1905 the harvests of the Puna Sugar Co. were being ground at the ‘Ōla‘a Mill, and the Puna Sugar Co. was operating as a division of the ‘Ōla‘a Sugar Co. (Dorrance and Morgan 2000).

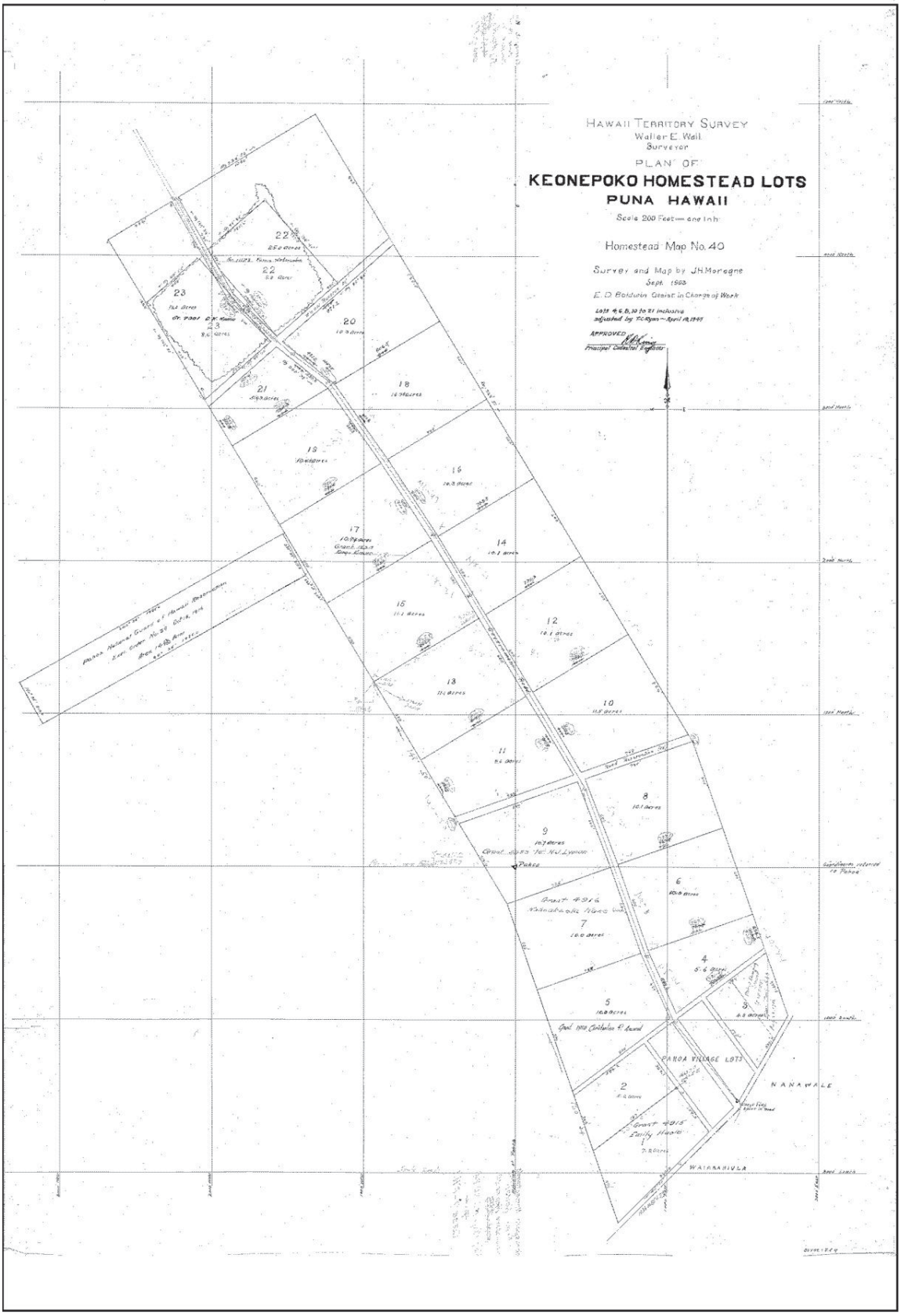

Figure 17. Hawai‘i Registered Map No. 2084 showing the Keonepoko Homestead lots.

In 1907, the Hawaiian Mahogany Lumber Company incorporated and signed a five-year contract with the Atchison, Topeka, and Santa Fe Railroads for the delivery of 90,000,000 board feet of *ʻōhiʻa* railroad ties from the vast forest reserves of Puna (Clark et al. 2001). Subsequently, in 1908 the company erected a lumber mill at Pāhoa. A network of narrow gauge railroad tracks, 3 feet wide, went from the lumber mill to the forests above Pāhoa. On March 24, 1909 the Hawaiian Mahogany Company became the Pāhoa Lumber Mill, and James B. Castle, the former managing director of the mill, became the new owner. The company then negotiated a contract with the Santa Fe Railway Company for the delivery 2,500,000 cross ties and 2,500 sets of switch ties. In addition to railway ties, the Pāhoa Lumber Mill began producing products such as roofing shingles, flooring, paving blocks and lumber for cars, wagons, and carriages.

On the night of January 28, 1913, however, a raging fire broke out in the mill and it burned to the ground along with most of the stock of milled lumber. Fortunately for Pāhoa residents, the wind blew the flames and smoke to the north away from the village. In spite of this disaster, J. B. Castle rebuilt the mill and by October the mill was operating again under the name of the Hawaiʻi Hardwood Company, part of the Hawaiian Development Company. The Santa Fe Railroad found, ultimately, that *ʻōhiʻa* wood did not last as long as expected in the dry climate of the American Southwest. They did not renew their contract, and, in 1916, the Hawaiian Hardwood Company, Inc. closed their doors permanently (Burtchard and Moblo 1994).

When the lumber business moved out of Pāhoa in ca. 1916, the mill was leased to ʻŌlaʻa Sugar. Standard gauge railroad track replaced the old timber railroad grade tracks, and the timber producing forests were converted to sugarcane fields. The company used four mogul type Baldwin locomotives to haul cane from the Puna fields through Pāhoa to their processing plant in Keaʻau. Passenger rail service in the Puna District also started to increase around this time. In 1916 the Hilo Railroad was reorganized as the Hawaiʻi Consolidated Railway. The railroad used Baldwin locomotives and Hall-Scott motorcars with passenger trailers to haul freight and passengers. Then, in 1925 the Hawaiʻi Consolidated Railway ordered and received three railbusses from the White Motor Company, which they used in Puna and Hilo districts, making daily stops in the town of Pāhoa. The railbusses became an especially popular form of transportation during World War II when mandatory gas rationing was in effect for all residents (Best 1978).

The *makai* lands of Keonepoko Iki (and neighboring Government Lands) became part of the Shipman Ranch during the early twentieth century. Hawaiʻi Territory Survey Plat Map No. 811 (prepared in 1915) shows that W.H. Shipman, Ltd. held a lease for roughly 7,400 acres of Keonepoko Nui and Keonepoko Iki (General Lease No. 1025) at an annual rental of $300.00 (Figure 18). The lease (Figure 19), which began on July 12, 1918 and expired on July 31, 1928, excluded the 277.8 acre Grant No. 1533 to Kekoa where the current study area is located. W.H. Shipman, Ltd. also held a lease for roughly 14,000 acres of the adjacent *ahupuaʻa* of Makuʻu, Holonā and Pōpōkī (General lease No. 854), which expired on November 25, 1929. On subsequent maps (Figure 20), the general area leased by Shipman is referred to as the Kaʻohe-Makuʻu-Keonepoko Iki Government Tract; no additional lease information for this tract was discovered.

By 1946 rail travel was becoming less popular, and less profitable, due to improved roads and increased trucking. In March of that year, stockholders of Hawaiʻi Consolidated Railway voted to abandon all railroad operations. This decision was further reinforced on April 1, 1946 when a devastating *tsunami* destroyed Hilo Bay, including all the rail lines, a drawbridge in the bay, and part of the Waiākea freight yards. On November 20, 1946 the company shut down its remaining lines, including all Puna railroad operations, and began auctioning off all its assets. The ʻŌlaʻa railroad line remained in operating condition and continued to be used for hauling sugar until December of 1948. In that year the sugar industry began phasing out its operations in Puna and closed the tracks permanently.

Throughout this period of industrial growth and decline in Puna, the coastal portion of Keonepoko Iki Ahupuaʻa remained largely undeveloped. The 1924 U.S.G.S. Makuʻu quadrangle (Figure 21) shows a single structure located in the coastal portion of Keonepoko Iki, situated inland and west of the current study area (interestingly this map does not show the Government Beach Road along the mauka boundary of the current study area). Farrell and Dega (2013:8) indicate the lands in the general vicinity of the current study area were planted in coconuts in 1942 (these were later harvested and sold as mature trees). The current study parcel was created in 1961 when Grant No. 1533 was subdivided (Farrell and Dega 2013). During the mid-1960s, the lands to the southeast and northwest of the study area were subdivided into the Hawaiian Beaches, Hawaiian Parks, and Hawaiian Shores subdivisions. In recent years several residences have been constructed along the coast of Keonepoko Iki within the subdivided parcels of the former grant property. Archaeological studies have been conducted at a number of those parcels; the results of these studies are discussed further below.

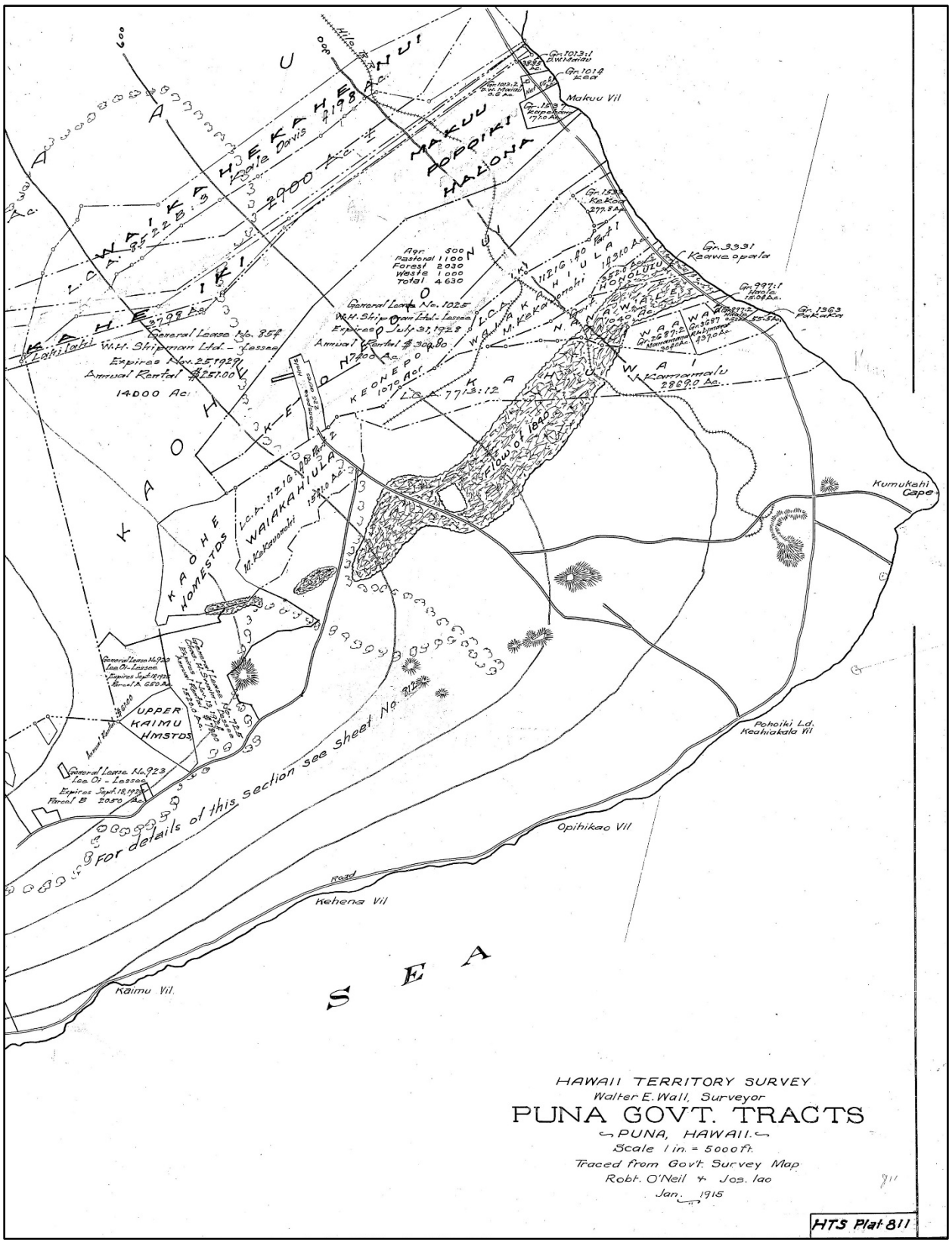

Figure 18. Portion of Hawai‘i Territory Survey Plat Map No. 811 (prepared in 1915) showing the area leased to W.H. Shipman Ltd.

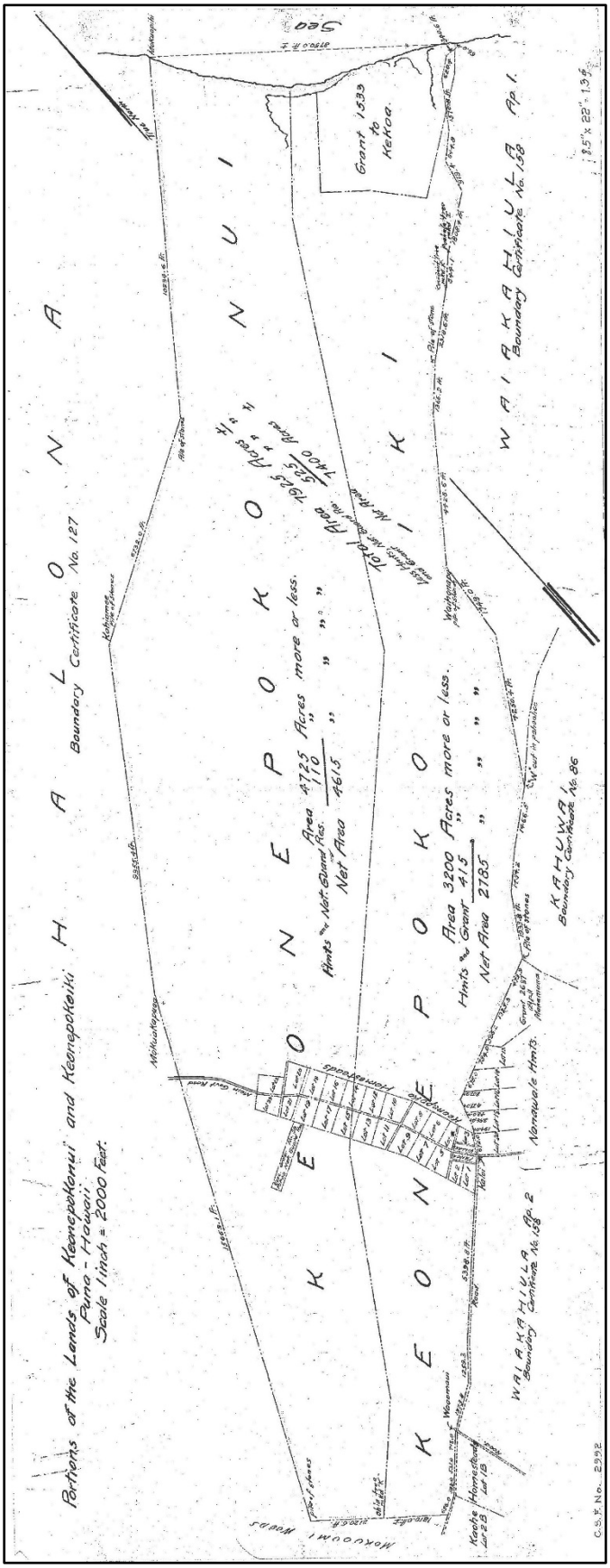

Figure 19. 1918 map (C.S.F. 2992) of General Lease No. 1025 to W.H. Shipman Ltd. in Keonepoko Nui and Iki *ahupua'a*.

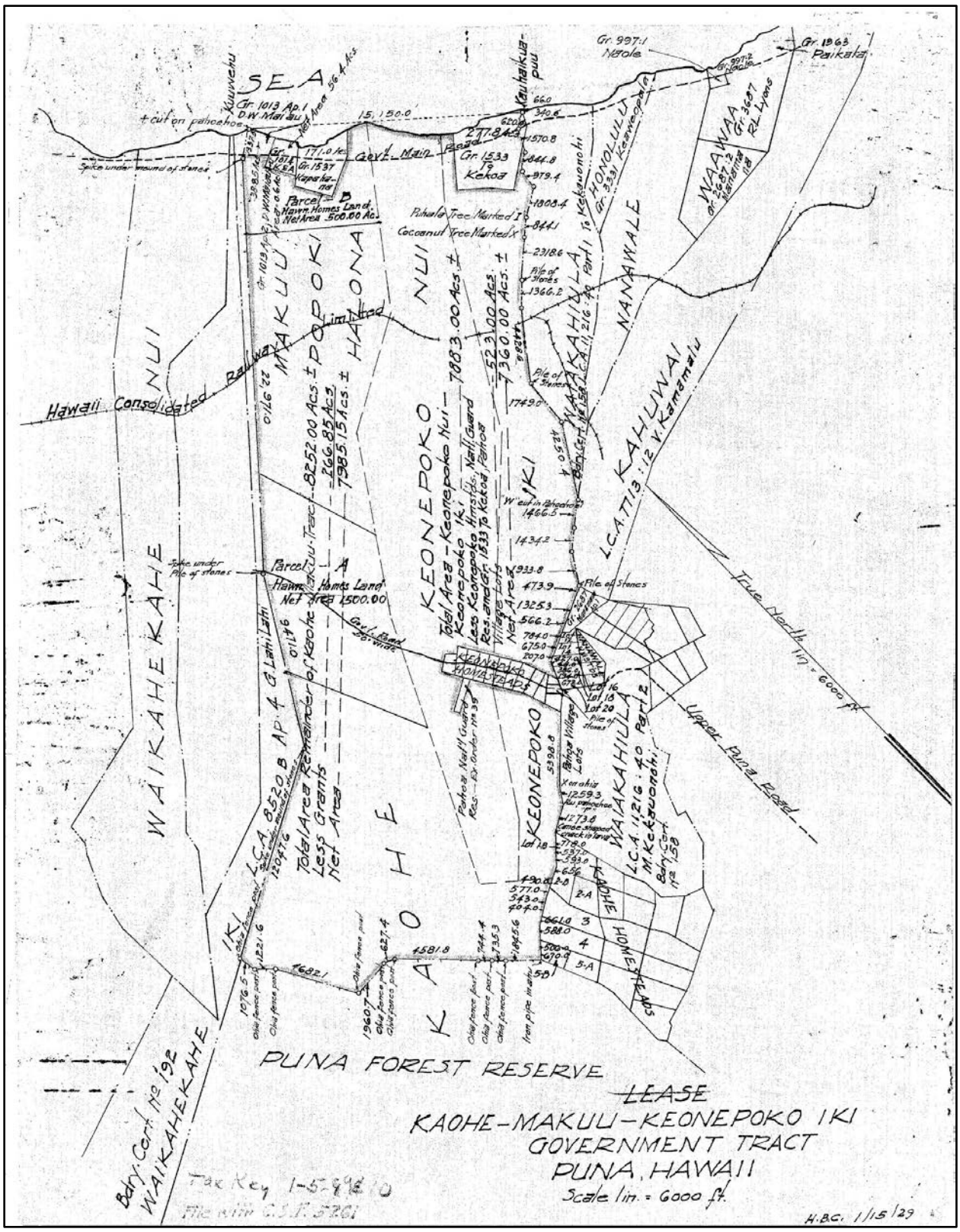

Figure 20. 1929 map (C.S.F. 5261) of the Ka‘ohe-Maku‘u-Keonepoko Iki Government Tract.

Figure 21. Portion of the 1924 U.S.G.S. Makuʻu quadrangle showing the current study area (shaded red).

PREVIOUS ARCHAEOLOGICAL STUDIES

Since the early 1900s, several archaeological studies have examined the coastal areas of Puna where Precontact and early Historic populations tended to concentrate (Figure 22). The earliest survey of archaeological resources in the vicinity of the study area was conducted by Hudson (1932). Hudson attempted to inventory the sites of East Hawai‘i Island from Waipi‘o Valley to the Ka‘u District for the B. P. Bishop Museum. He recorded a wide range of archaeological features including *heiau*, burials, caves, habitations, trails, and agricultural features during his survey. The route of the survey took him through the coastal portion of Keonepoko Iki Ahupua‘a. Hudson (1932:304) noted that it was difficult to obtain information about sites in Puna because “most of them are located along the coast between Keaau and Kapoho where no one now lives, and it is difficult to locate descendants of the former Hawaiian population of the area who might be able to shed light on the nature and function of certain sites”, and that, “back from the sea the land is under cultivation in cane, used for pasture, or covered with dense vegetation which can be penetrated only with difficulty.” Hudson did not recorded any specific features in the immediate vicinity of the current study area, although he did note a trail (Site 83) in Keonepoko Nui Ahupua‘a to the northwest of the study parcel, and a canoe shed (Site 84) in Waikahiula Ahupua‘a to the southeast of the study parcel.

Forty-two years later, Ewart and Luscomb (1974) of the B. P. Bishop Museum conducted a six-mile long archaeological reconnaissance survey of a proposed Kapoho-Keaukaha Highway route through the District of Puna from Waiakahiula Ahupua‘a to Kea‘au Ahupua‘a. The survey area consisted of a 2,000-foot wide corridor that generally followed the route of the old Government Road (Site 21273) that passes *mauka* of the current project area (see Figure 22). Ewart and Luscomb (1974) recorded sixty sites within the combined Keonepoko Nui and Iki *ahupua‘a* (designated *Ahupua‘a* 4 or A4). These sites included mounds, feature complexes, platforms, walls, a trail, *ahu*, c-shapes, stone alignments, faced depressions, pits and ravines, that were interpreted as having been used for habitation, burial, ceremonial, and agricultural purposes. A single site, a faced depression designated Site A4-21, was identified within the current study parcel (Figure 23). This site was described as “a partially stone-faced natural depression, 13 by 7m; bottom is covered with soil” (Ewart and Luscomb 1974:34). It was assessed as being in fair condition, but possessing poor archaeological potential. The location of A4-21 places it within the formerly grubbed and graded *mauka* section of the study parcel beneath the existing access road, suggesting it is unlikely to still be extant.

More recently five coastal parcels within former Grant No. 1533 to Kekoa to the southeast of the current study parcel have been subject to more detailed archaeological surveys (Figure 22). Farrell and Wells (1994) conducted a preliminary archaeological inventory of two adjacent coastal parcels (TMKs: (3) 1-5-009:038 and 042) situated roughly 150 meters southeast of the current study area. Fourteen features/feature groupings were identified during the survey (designated CRMS-1 to 14), although two of the identified feature areas (CRMS-3 and 6) were actually situated on the adjacent parcel to the northwest (TMK: (3) 1-5-009:037), and another (CRMS-6) was situated on the adjacent parcel to the southeast (TMK: (3) 1-5-009:041). With the exception of a core-filled boundary wall located along the *makai* edge of the Old Government Beach Road, the features were all interpreted as having been used for agricultural purposes during the Historic Period. The core-filled wall was later assigned the State Inventory of Historic Places (SIHP) site designation 50-10-45-18759, while the agricultural features were grouped as a complex designated 50-10-45-18758.

Former DLNR-SHPD Hawai‘i Island Assistant Archaeologist, Jeanne Knapp, conducted a field inspection of TMK: (3) 1-5-009:040 located roughly 200 meters to the southeast of the current study area on September 17, 2003 (see Figure 22). She noted “several wall remnants, possibly historic in age…in the interior of the property but not within the proposed development area” (Knapp 2003). These walls were not described in detail, nor were there locations plotted. As the landowner agreed to avoid any impacts to areas within the subject parcel containing the walls, DLNR-SHPD found that no historic properties would be affected by the development of a single-family residence on the property.

Rechtman (2005) conducted a field inspection of TMK: (3) 1-5-009:056, situated adjacent to the southeastern boundary of the current study parcel (see Figure 22). The majority of that property had been significantly mechanical altered in the past, and no archaeological resources were discovered. Surface features were observed on an adjacent parcel to the southeast of the Rechtman (2005) study area, however, as that parcel (TMK: (3) 1-5-009:057) had not been previously mechanically cleared. Rechtman (2005) also noted that no walls were present along the *makai* edge of the Old Government Beach Road (Site 21273) where it bordered the parcel, as they had been bulldozed away and ended in rubble to the southeast of the study parcel. Given the negative findings, Rechtman (2005) requested that DLNR-SHPD issue a written determination of “no historic properties affected” for TMK: (3) 1-5-009:056.

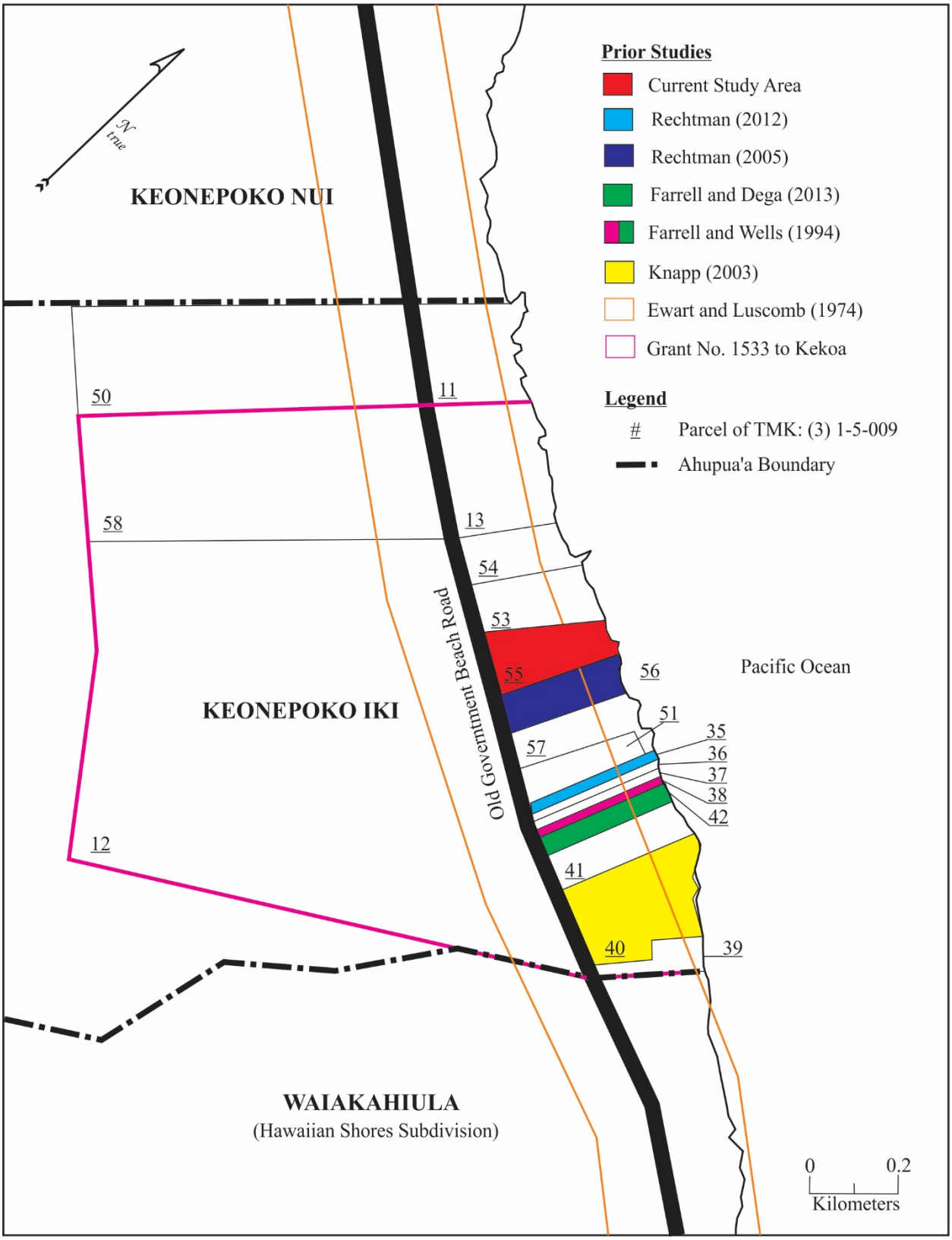

Figure 22. Previous archeological studies conducted in the vicinity of the current study area.

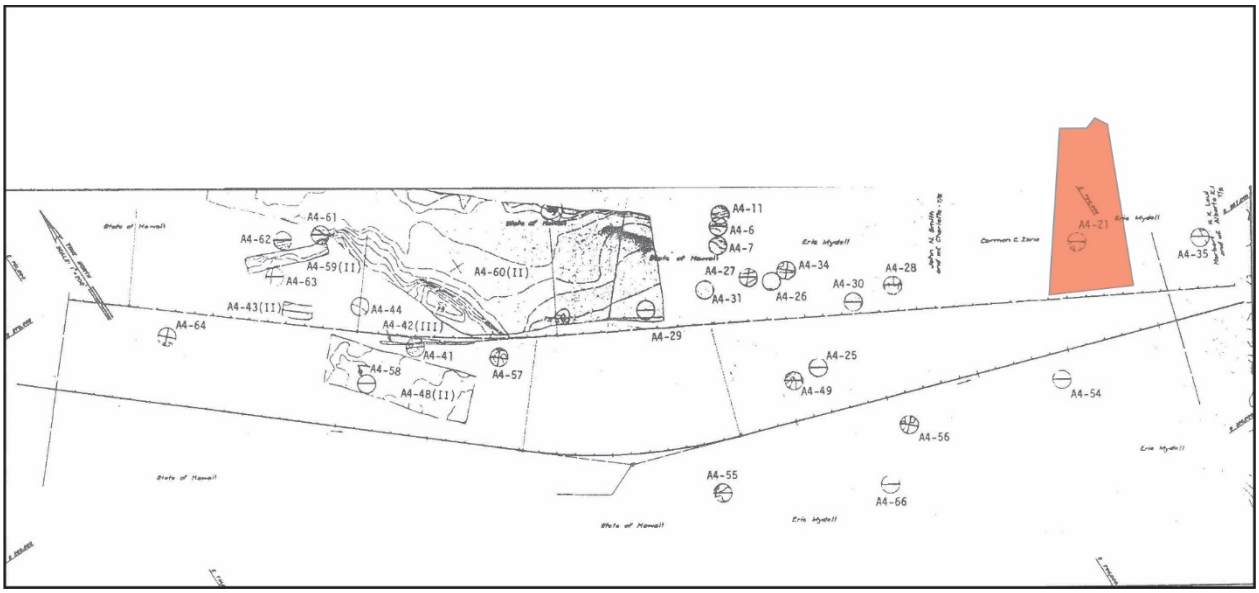

Figure 23. Site locations within Increment H of the Ewart and Luscomb (1974:7) survey area showing the location of the current study parcel (shaded red).

On August 10, 2012, DLNR-SHPD staff, in response to a special management use permit assessment application for a proposed coconut farm, conducted a field inspection of the current study parcel. They did not identify any historic resources in the previously grubbed and graded, *mauka* portion of the study area, but did note a Historic wall feature near the coast, *makai* of the bulldozed coastal road. In order to protect this Historic site, which was outside of the development area proposed at that time, without having to undertake any additional archaeology, Theresa Donham, former DLNR-SHPD branch chief, recommended that a construction barrier be erected along the *makai* edge of the coastal road prior to any development activities, and that no development associated activities be conducted *makai* of the construction barrier. The current study has been undertaken because of the change of proposed land use for the parcel and the presence of this known site.

Rechtman (2012) conducted a field inspection of TMK: (3) 1-5-009:035 situated roughly 100 meters southeast of the current study area (see Figure 22). The majority of that parcel had also been previously mechanically cleared and built upon, and as a result no archaeological resources were observed. Rechtman (2012) did note, however, that surface features were observed on the adjacent parcel to the northwest, as that parcel (TMK: (3) 1-5-009:051) had not been previously mechanically cleared. It was also reported that the rock wall typically present along the *makai* edge of the Old Government Beach Road (Site 21273) was absent, and had been bulldozed away, although Rechtman (2012) did note that a rock wall along the makai side of Site 21273 was present fronting parcels to the southeast and northwest of the study parcel. Given the negative findings, Rechtman (2012) requested that DLNR-SHPD issue a written determination of “no historic properties affected” for TMK: (3) 1-5-009:035.

Farrell and Dega (2013) updated the Farrell and Wells (1994) study for TMK: (3) 1-5-009:042, situated roughly 150 meters southeast of the current study parcel (see Figure 22). At the time that the 1994 study was prepared, the landowner did not have any formal development plans for the property, and the report was never submitted to DLNR-SHPD until 2012. Upon receipt of the 1994 report, DLNR-SHPD requested several revisions to meet the standards currently in place for Archaeological Inventory Survey reports. Farrell and Dega (2013) conducted some additional fieldwork (but did not identify any additional sites or features) and updated the earlier report to meet current standards, reporting only the findings specific to Parcel 042. As described above that parcel contained two archaeological sites, a core-filled wall along the Old Government Beach Road (Site 18759), and a complex of Historic Period agricultural features (Site 18758) that may have been initially created during the Precontact Period. Features identified at Site 18758 include walls, irregular rock mounds, modified depressions, rock rings that appeared to be planting circles, and a single faced terrace. The features of the agricultural complex extend onto neighboring parcels to the northwest and southeast.

3. STUDY AREA EXPECTATIONS

Previous archaeological studies conducted in the vicinity of the current study area provide a working model for the types and density of archaeological features that may be encountered within the subject parcel. Ewart and Luscomb (1974) identified sixty sites along the Old Government Beach Road in Keonepoko Nui and Iki *ahupuaʻa*, including mounds, feature complexes, platforms, walls, a trail, *ahu*, c-shapes, stone alignments, faced depressions, pits and ravines, that were interpreted as having been used for habitation, burial, ceremonial, and agricultural purposes. One site, a faced depression designated Site A4-21, described as "a partially stone-faced natural depression" (Ewart and Luscomb 1974:34), was identified within the *mauka* portion of the current study parcel (see Figure 23). This site, likely utilized for agricultural purposes, was not re-identified during an August 10, 2012, DLNR-SHPD field inspection of the current study parcel. Given its location, Site A4-21 was likely destroyed during the grubbing and creation of an access road across the study parcel, sometime between 1974 and 2000.

Farrell and Dega (2013) describe in detail similar agricultural features (Site 18758) to the southeast of the current study area, suggesting that opportunistic agriculture may have been common in mulched depressions along the coast of Keonepoko Iki during the late Precontact and Early Historic Periods. Knapp (2003) noted the presence of similar agricultural features on a nearby parcel as well. In addition to the agricultural complex Farrell and Dega (2013) identified a core-filled wall (Site 18759) along the *makai* edge of the Old Government Beach Road. The road itself (Site 21273) is not included within the current study area, it is however possible that a core-filled wall paralleling the road once extended along the *mauka* boundary of the parcel. The two most proximate studies to the subject parcel (Rechtman 2005, 2012) specifically note the absence of such walls adjacent to the Old Government Beach Road, indicating that they appeared to have been bulldozed away. Both of those parcels had also been previously grubbed and graded, and did not contain any historic properties. The August 10, 2012, DLNR-SHPD field inspection of the current study area confirmed that the *mauka* portion of the property had been likewise disturbed, and that the only site present was a Historic wall feature located near the coast. Although it is possible that additional features similar to those mentioned above may have once been present in the previously grubbed and graded, *mauka* portion of the subject parcel, given the findings of 2012 field inspection, the wall identified near the coast is the only historic property expected to still be extant within the current study area.

4. FIELDWORK

Fieldwork for the current project was conducted on July 1, 2016 by Matthew R. Clark, B.A., Genevieve Glennon, B.A., and Ivana Hall, B.A. under the direction Robert B. Rechtman, Ph.D.

METHODS

Fieldwork included a visual inspection of the surface of the entire study area and detailed site recordation. Within the study parcel fieldworkers walked pedestrian transects perpendicular to the Old Government Beach Road (oriented roughly northwest-southeast) spaced at 15-meter intervals. The entire study area was accessible and the corners of the study parcel were marked with lath and flagging tape. Ground surface visibility was excellent throughout the study area as the weedy vegetation consisted primarily of tall trees with very little ground cover, and the ground was fairly flat, as it had been previously impacted by mechanical land clearing. A single archaeological site, identified in the coastal portion of the property was cleared of vegetation and mapped in detail using a measuring tape and compass. The site was photographed (both with and without a meter stick for scale), and described using a standardized site record form. A 1 x 1 meter test unit (TU-1) was hand excavated at the identified site following natural stratigraphic layers. The recovered soil matrix was passed through 1/8-inch mesh screen, and all recovered cultural material was collected. During the excavations all of the material removed from the unit was deposited on a tarpaulin for its eventual return to the unit. Excavation forms, filled out for each stratigraphic layer, were used to record soil descriptions, cultural constituents collected, and the general layer characteristics. The test unit was excavated to the underlying bedrock, and upon completion of the unit, photographs were taken with a meter stick and north arrow for scale and orientation, and a scaled profile drawing was prepared. The unit was then back filled as close to its original specifications as possible.

FINDINGS

As a result of the surface survey, one previously unrecorded site (Site 50-10-45-30571), a Historic wall with an unusual two-tiered construction, was recorded in the *makai* portion of the study area (Figure 24). To aid in the discussion of site function and age, a 1 x 1 meter test unit (TU-1) was excavated in the center of the wall's lower tier. The site along the results of subsurface testing is described in further detail below.

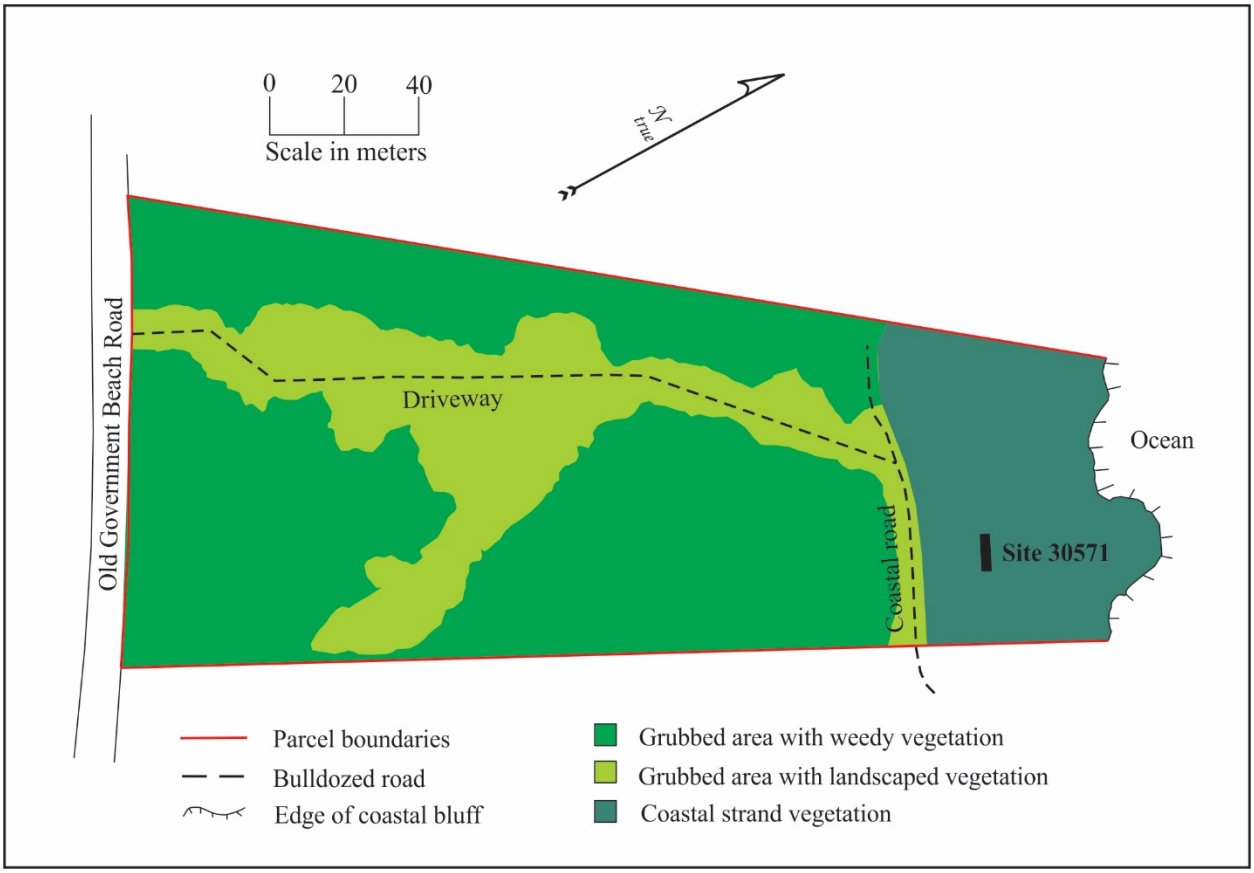

Figure 24. Site location map.

Site 50-10-45-30571

Site 30571 is a two-tiered wall located on the *makai* portion of the study area roughly 40 meters south of the sea cliff (Figure 25). The wall measures 8.7 meters long by 3 meters wide, and has a maximum height of 1.6 meters (taken along its northern face). It is set in a relatively open area of ironwood and coconut trees overlooking the ocean (Figure 26). The surrounding terrain consists of a slightly undulating *pāhoehoe* bedrock that is covered with a thick mat of ironwood needles. Prior to clearing, the site itself was also covered in ironwood needles, and partially buried beneath a thick tangle of vines. The wall is oriented northeast/southwest, which protects the area in its lee (along the *mauka* edge of the wall) from the prevailing trade winds. Both the northeastern and southwestern ends of the wall have suffered collapse and are partially tumbled. A modern rock fire ring that has been recently used is located adjacent to the northern face of the wall (Figure 27), and two small piles of firewood are stacked against the northwestern end of the wall (Figure 28). The bulldozed road that parallels the coast is located roughly 10 meters *mauka* of the southern edge of the wall. Several piles of loose organic debris, perhaps associated with the creation of this road, are present in the area to the south of the wall (Figure 29). These piles are currently covered by a dense growth of vines. Prior to the acquisition of the study parcel by the current landowner, this area was commonly used as a dumping ground for vehicles, appliances, and other modern trash, which has been removed from the property in recent years. A sign attached to an ironwood tree nearby Site 30571 by a previous landowner asks people to "Mālama da ʻĀina" (Figure 30).

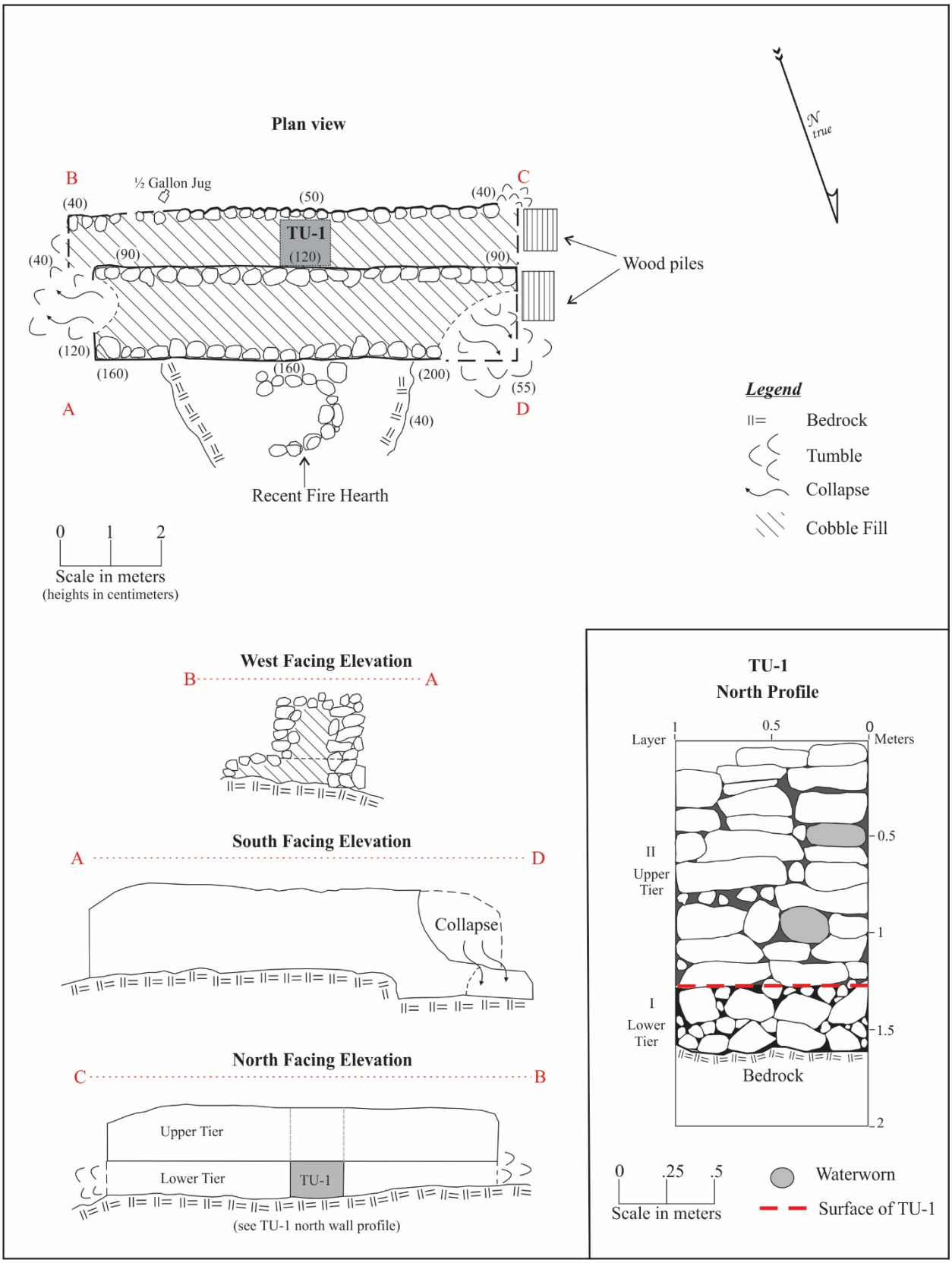

Figure 25. Site 30571 plan view, elevations, and TU-1 north wall profile.

Figure 26. Site 30571, two-tiered wall, view to the northwest.

Figure 27. Site 30571, north edge with recent fire hearth, view to the south.

Figure 28. Site 30571, northwest end with stacked firewood, view to the southeast.

Figure 29. Site 30571, area to the south of the wall, view to the northeast.

Figure 30. Old sign in tree near Site 30571.

Site 30571 has an unusual two-tiered construction (see Figure 25) with the narrower upper tier (2 meters wide) built on top of a wider bottom tier (3 meters wide). The 8.7 meter long lower tier extends 1 meter out (south) from the edge of the upper tier and stands roughly 0.5 meters tall (Figure 31). The lower tier is constructed of small to large cobbles (including *pāhoehoe*, *ʻaʻā*, and waterworn) with a loosely stacked southern edge (3-4 cobbles tall) that has collapsed outward in some areas. The fairly level, exposed, 1-meter wide surface of the lower tier consists of a loose cobble fill covered by a dense mat of ironwood needles and organic duff. The narrower southwestern and northeastern ends of the lower tier are both partially collapsed, and the longer northern edge consists of stacked cobbles and smaller boulders that transition seamlessly with the stacked northern edge of the upper tier.

The upper tier of Site 30571 consists of a roughly 2-meter wide core-filled wall that measures roughly 8 meters in length (northeast to southwest). Along its southern edge, the upper tier rises 0.9 to 1.2 meters above the top surface of the lower tier. Along its northern edge (including the northern edge of the lower tier), it stands 1.2 to 1.6 meters above the naturally undulating *pāhoehoe* bedrock ground surface. The exterior (northern and southern) edges of the upper tier are constructed primarily of angular *pāhoehoe* blocks and slabs with a few waterworn cobbles and boulders also included (Figures 32 and 33). The spaces between the angular blocks have been chinked with small cobbles and pebbles to level the slabs and create a stable base for the subsequent wall courses. The interior fill of the upper course consists of small to medium *ʻaʻā* and *pāhoehoe* cobbles, as well as some waterworn stones. The core-filled construction of the upper-tier is evident at the northeastern and southwestern ends of the wall, which are collapsed and not finished with stacking.

The only surface artifact associated with Site 30571 consists of a machine made, ½ gallon, clear glass jug discovered partially buried beneath ironwood needles (Figure 34). The jug, which measures 24.0 cm tall and has a base diameter of 9.5 centimeters, was found adjacent to the southern edge of the lower tier of the wall at its northeastern end (see Figure 24). It has 3.4-centimeter diameter opening made for a screw top lid and a small glass handle attached to the neck. The words “ONE HALF GALLON” are embossed along the side of the jug towards the base of the neck, and “Duraglas” is embossed in script just above the heel on one side of the jug (Figure 35). Additionally, the base of this jug is embossed with the diamond OI maker’s mark for Owens-Illinois Glass Co. (Figure 36) This type of maker’s mark was produced starting around 1920 and continued being used until about 1960 (https://sha.org/bottle/pdffiles/OLogoTable.pdf). Embossed on to the left side of the OI maker’s mark is the number “23” indicating that this jug was manufactured in Los Angeles California, and embossed to the right of the OI diamond is the number “48” indicating that this bottle was produced in the year 1948 (https://sha.org/bottle/pdffiles/OlogoTable.pdf). The codes “3A” and “1481-W” are also embossed along the rim of the jug’s base.

Figure 31. Site 30571, southeast end, view to the northwest.

Figure 32. Site 30571, south face of upper tier, view to the north.

Figure 33. Site 30571, north edge, view to the south.

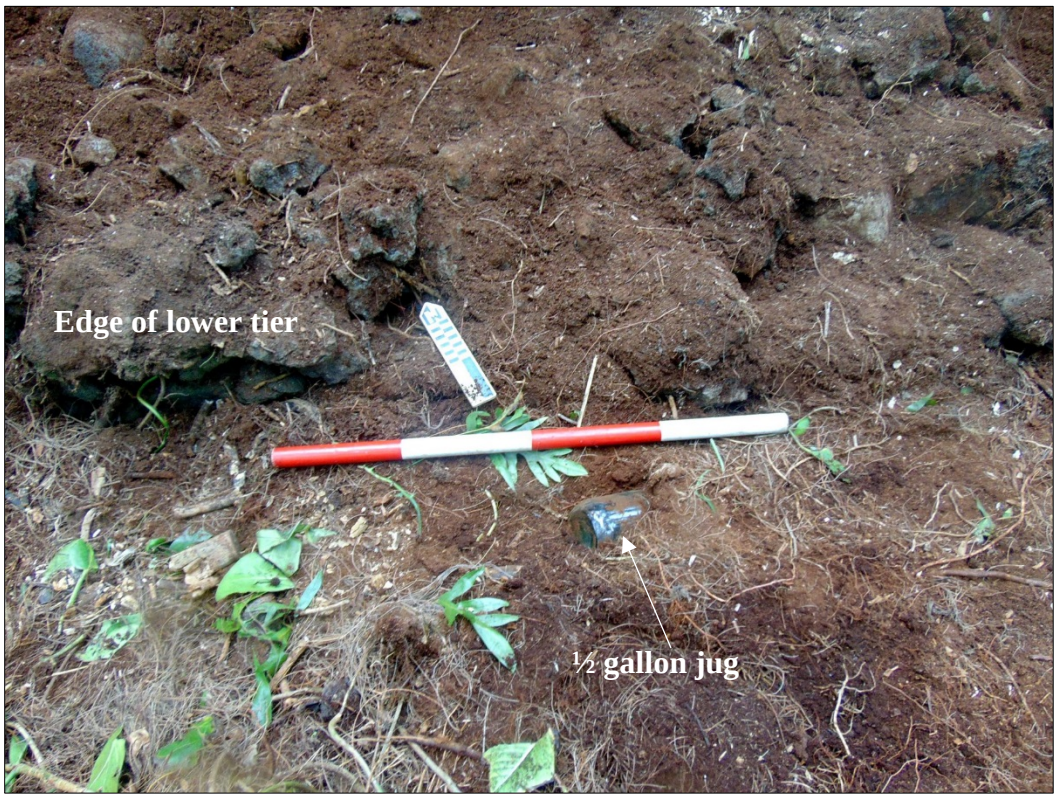

Figure 34. Site 30571, in situ ½ gallon jug, overview to the northeast.

Figure 35. ½ gallon jug with 10 centimeter scale.

Figure 36. Base of ½ gallon jug.

In an effort to better understand the function, age, and construction characteristics of Site 30571, a 1 x 1 meter test unit (TU-1) was excavated into the approximate center of the lower tier adjacent to the southern edge of the upper tier (see Figure 25). Excavation of TU-1 consisted of the removal of duff material from the surface of the unit (Figure 37), and then the removal of a single stratigraphic layer (Layer I) of rock material to the underlying *pāhoehoe* bedrock ground surface at a depth of approximately 40 centimeters (Figures J and K). Rock material removed from Layer I consisted primarily of small to medium *pāhoehoe* and *ʻaʻā* cobbles, with a few waterworn cobbles also included. It was noted that during excavation that very little soil was present within Layer I, or beneath it on the bedrock surface. This suggests that the wall was constructed on the exposed bedrock surface prior to the growth of the ironwood trees on the property. Cultural material collected from the unit consisted of a single piece of *ʻopihi* (*Cellana* sp.) (0.19 grams), a small unidentifiable fragment of marine shell (0.54 grams), and a single fragment of *kukui* (*Aleurites moluccanus)* nutshell (0.71 grams).

The profile of the northern wall of the excavation unit reveals that the upper tier of Site 30571 (Layer II), characterized by neatly stacked angular *pāhoehoe* blocks, was built on top of the prepared surface of the lower tier (Layer I), characterized by small cobble fill. The ecofacts collected during the excavation of TU-1 reveal little about the overall function of the site, except to suggest that nearshore, marine shell resources were being exploited by its users, and at least one *kukui* nutshell was imported to the location (likely for consumption). The presence of the ½ gallon jug in close proximity to the lower tier, and the overall construction characteristics of the wall (core-filled with chinked spaces between the courses), indicate that primary use of the Site 30571 location likely occurred during mid-twentieth century. An aerial photograph from 1961 indicates that the ironwood trees nearby the site were not yet present at that time, although the adjacent road was, indicating that the duff material covering the surface of the wall likely accumulated subsequent to the ca. 1970s. The orientation of Site 30571 strongly suggests that the wall was built to block the often strong, prevailing trade winds from blowing across the area in its lee. This area is currently obscured by vines that cover pushed piles of material likely left over from the bulldozing of the nearby road. This area may have been more level in the past, and served as an area suitable for short-term camping by fishermen accessing the adjacent coastline. It is possible, given the height of the wall, that in addition to blocking the wind, Site 30571 may have helped support a lean-to structure that sheltered the area in its lee from the rain and sun.

Figure 37. Site 30571, surface of TU-1, view to the northeast.

Figure 38. Site 30571, TU-1 base of excavation, view to northeast.

Figure 39. Site 30571, TU-1 base of excavation, view to the northwest.

5. SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

The recorded archaeological site is assessed for significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai‘i Administrative Rules 13§13-284-6. This significance evaluation should be considered preliminary until DLNR-SHPD provides concurrence. For a resource to be considered significant it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

- **a** Be associated with events that have made an important contribution to the broad patterns of our history;
- **b** Be associated with the lives of persons important in our past;
- **c** Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;
- **d** Have yielded, or is likely to yield, information important for research on prehistory or history;
- **e** Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity.

The significance and recommended treatment for Site 30571, which was documented as part of the current study, is presented in Table 1 and discussed below.

Table 1. Site significance and treatment recommendation.

*SIHP Site #**	*Site Type*	*Temporal Affiliation*	*Significance*	*Recommended Treatment*
30571	Windbreak wall	Historic	d	No Further Work

*SIHP Site number is preceded by the state, island, and U.S.G.S prefix 50-10-45.

Site 30571 is evaluated as significant under Criterion d for the information it has yielded relative to the mid-twentieth century use of the study area for short-term habitation (recurrent camping) purposes and the associated exploitation of marine resources. Given its orientation, it appears that Site 30571 was constructed as a windbreak designed to shelter the area in its lee from the prevailing trade winds. The height of the wall may suggest that it also served as a support for a lean-to structure. Associated debris, found adjacent to the wall edge and within TU-1, indicates that this site may have been occupied as recently as the late 1940s-50s, and that its occupants collected *‘opihi* (and likely other nearshore resources) from the adjacent coastline. Site 30571was fully documented during the current study, and it is argued that the site documentation presented above serves to mitigate any potential impacts from the future development of a single family residence. As the significance of the archaeological resource derives from information already collected from Site 30571, and the likelihood of encountering additional significant subsurface archaeological resources is remote, no further historic preservation work is recommended. In the unlikely event that any unanticipated archaeological resources are unearthed within the study parcel during the proposed development activities, work in the immediate vicinity of those resources should be halted and DLNR-SHPD should be contacted in compliance with HAR 13§13-280.

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Environmental Assessment

Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko

APPENDIX 3
Cultural Impact Assessment

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A Cultural Impact Assessment in Support of a Conservation District Use Permit Application for the Dearing Property

TMK: (3) 1-5-009:055

Keonepoko Iki Ahupuaʻa
Puna District
Island of Hawaiʻi

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A Cultural Impact Assessment in Support of a Conservation District Use Permit Application for the Dearing Property

TMK: (3) 1-5-009:055

Keonepoko Iki Ahupuaʻa
Puna District
Island of Hawaiʻi

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1. INTRODUCTION

At the request of Garrett Dearing (the applicant), ASM Affiliates has prepared this Cultural Impact Assessment (CIA) for the proposed construction of a single-family residence and farm on a roughly 6.8 acre parcel (TMK: (3) 1-5-009:055) in Keonepoko Iki Ahupuaʻa, Puna District, Island of Hawaiʻi (Figures 1 and 2). In addition to the home, the applicant seeks a Conservation District Use Permit (CDUP) to develop the 6.79-acre property into a fruit tree farm with a water well, a barn, a high capacity water tank, and a pond for storing water and capturing any excess runoff. During an August 10, 2012 field visit to the study parcel, Department of Land and Natural Resources-State Historic Preservation Division (DLNR-SHPD) staff identified a previously unrecorded archaeological feature on the property (a Historic wall). As a result, ASM Affiliates conducted an Archaeological Inventory Survey (AIS) in July of 2016 (Clark et al. 2016) in which the Historic wall (State Inventory of Historic Places [SIHP] Site 50-10-45-30571) was recorded in the *makai* portion of the project area.

The current report was prepared in support of an environmental assessment in compliance with HRS Chapter 343, and in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawaiʻi, on November 19, 1997. Below is a description of the general project area and the proposed development activities. Followed by a detailed cultural and historical background that includes a presentation of prior studies; all of which combine to provide a physical and cultural context for the project area. Finally, the consultation process is described, which includes a discussion of potential impacts to the cultural landscape and the historic and cultural properties therein as well as appropriate actions and strategies to mitigate any such impacts.

Figure 1. Project area location (portion of U.S.G.S. 7.5 min. series, Pāhoa North quadrangle, 1995).

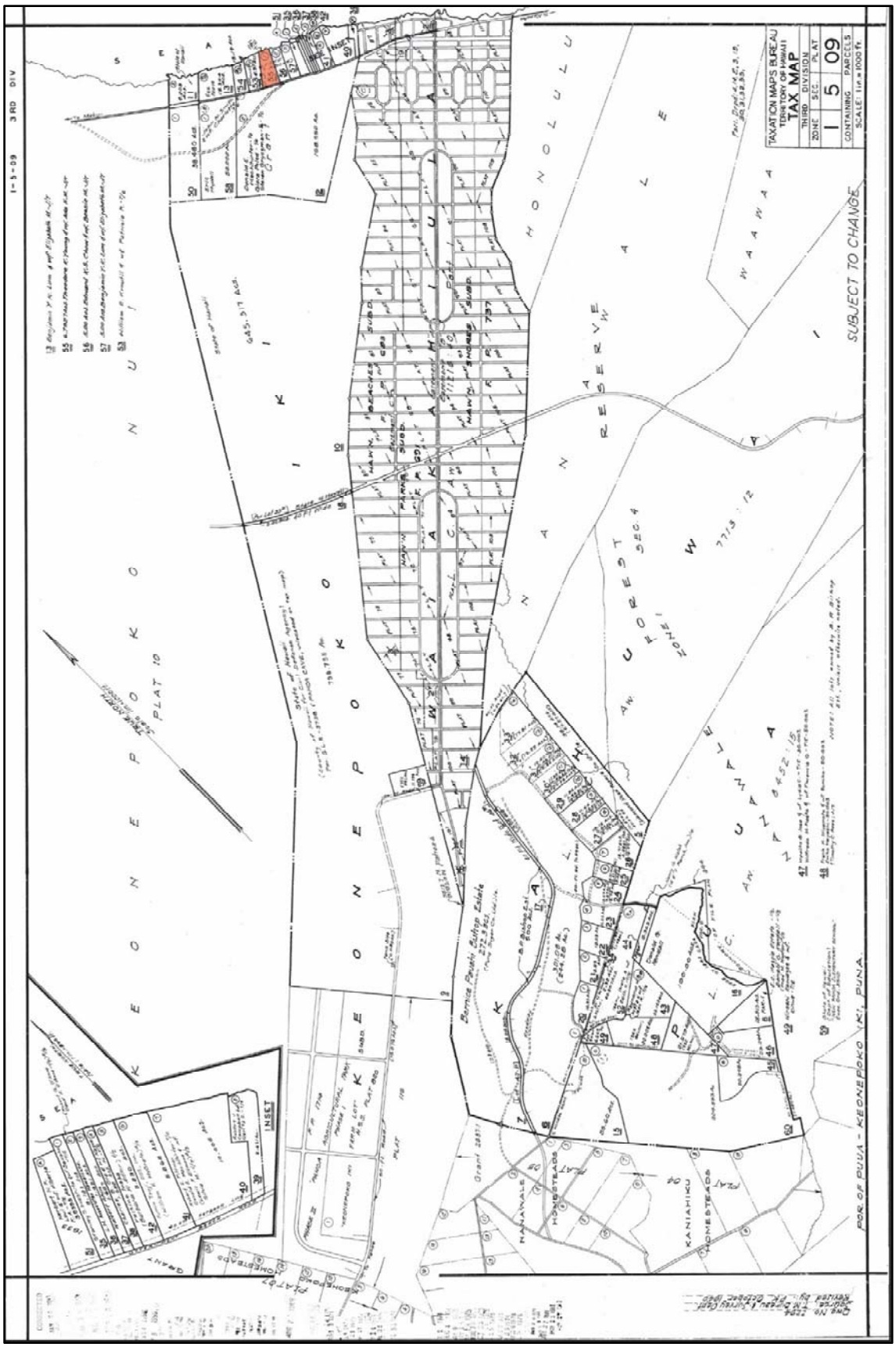


Figure 2. Tax Map Key (TMK) (3) 1-5-009 showing the current project area (Parcel 055) shaded red.

2. PROJECT AREA DESCRIPTION

The roughly 6.8-acre project area is located between the Old Government Beach Road and the coast (Figure 3) northwest of the Hawaiian Shores subdivision (see Figures 1 and 2). The parcel has approximately 130 meters of road frontage and 75 meters of coastline, fronted by a low coastal bluff (Figure 4). Elevation within the project area ranges from 6 to 20 meters (20 to 70 feet) above sea level. This portion of the Puna coast is formed of mixed *pāhoehoe* and *ʻaʻā* lava flows that originated from Kīlauea Volcano between 200 and 750 years before present (Wolfe and Morris 1996). The majority of the parcel has been grubbed and graded in the past (Figure 5). A driveway through the center of the parcel connecting the Old Government Beach Road with the coastal road (Figure 6), was bulldozed by a previous landowner prior to the 2000s.

The project area used to be dominated by low-growing vegetation with scattered trees as seen in a 1961 aerial photograph (Figure 7). Tall weedy vegetation and trees have taken over since then. However, in recent years the current landowner has hand-cleared and landscaped an area along the driveway in the central portion of the parcel (Figure 8), which extends to the eastern boundary of the project area. Vegetation throughout the remainder of the previously grubbed and graded portion of the parcel consists primarily of introduced weedy tree and vine species (Figure 9) such as *maile pilau* (*Paederia foetida*), various pothos (*Epipremnum aureum*) and philodendron vines, bingabing (*Macaranga mappa*), autograph trees (*Clusia rosea*), strawberry guava (*Psidium cattleianum*), umbrella trees (*Schefflera actinophylla*), gunpowder trees (*Trema orientalis*), and melochia (*Melochia umbellata*), with a few coconut palms *(Cocos nucifera)*, *lauaʻe* ferns (*Phymatosorus grossus*), *hala* (*Pandanus tectorius*), and ti plants *(Cordyline fruticosa)* also present. The vegetation of the coastal strand, *makai* of the bulldozed road is comprised primarily of *naupaka* (*Scaevola guadichaudiana*), coconut palms (*Cocos nucifera*), *hala* (*Pandanus tectorius*) and ironwood trees (*Casuarina equisetifolia*). The coastal strand vegetation terminates above the ocean at the upper edge of the low coastal bluff.

Figure 3. Google Earth™ satellite image showing location of current project area (outlined in red).

Figure 4. Low coastal bluff fronting the project area, view to the east.

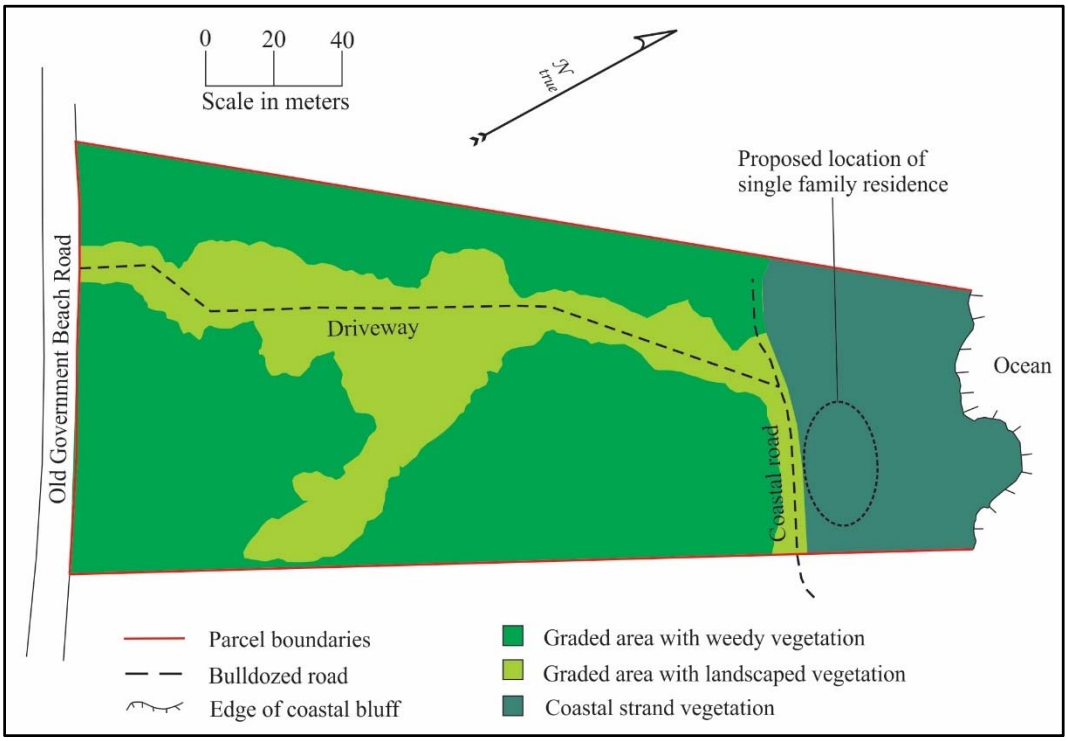


Figure 5. Map of the subject parcel showing the improvements and current vegetation pattern.

Figure 6. Bulldozed driveway within the current project area, view to the northeast.

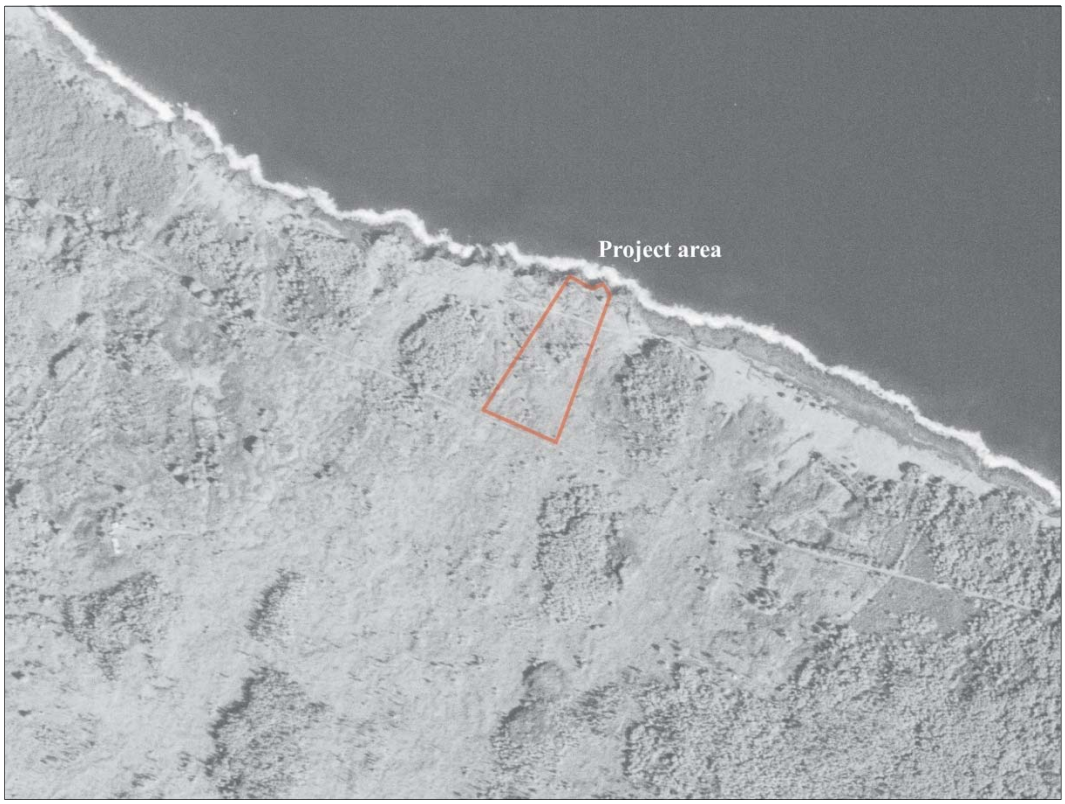


Figure 7. February 4, 1961 aerial photograph showing the current project area outlined in red.

Figure 8. Landscaping within the current project area, view to the northeast.

Figure 9. Weedy vegetation in the previously grubbed and graded *mauka* portion of the subject parcel, view to the east.

PROPOSED DEVELOPMENT ACTIVITY

The entire study property falls within the Resource Subzone of the Conservation District managed by the Department of land and Natural Resources-Office of Conservation and Coastal Lands (DLNR-OCCL). The proposed development plans (Figure 10) include the construction of a single-family residence within the *makai* portion of the property. The residence will include a swimming pool, and infrastructure such as a driveway (with turnaround and parking), a septic system and well. In addition, the landowner plans to develop roughly 1500 square feet (0.034 acres) within the *mauka* portion of the property as a fruit tree farm. The tree farm will also include a roughly 875 square foot barn, an additional water well and septic system. The development will adhere to the following setbacks: 100 feet from the shoreline, 40 feet from the county road along the *mauka* boundary of the parcel, and a 25-foot yard setback along the eastern and western boundaries of the parcel. Additionally, one twentieth century archaeological feature (Site 30571), a stacked rock wall, which is labelled "STACKED ROCK wall, 6' HT" on the development plan (see Figure 10), will be dismantled and removed.

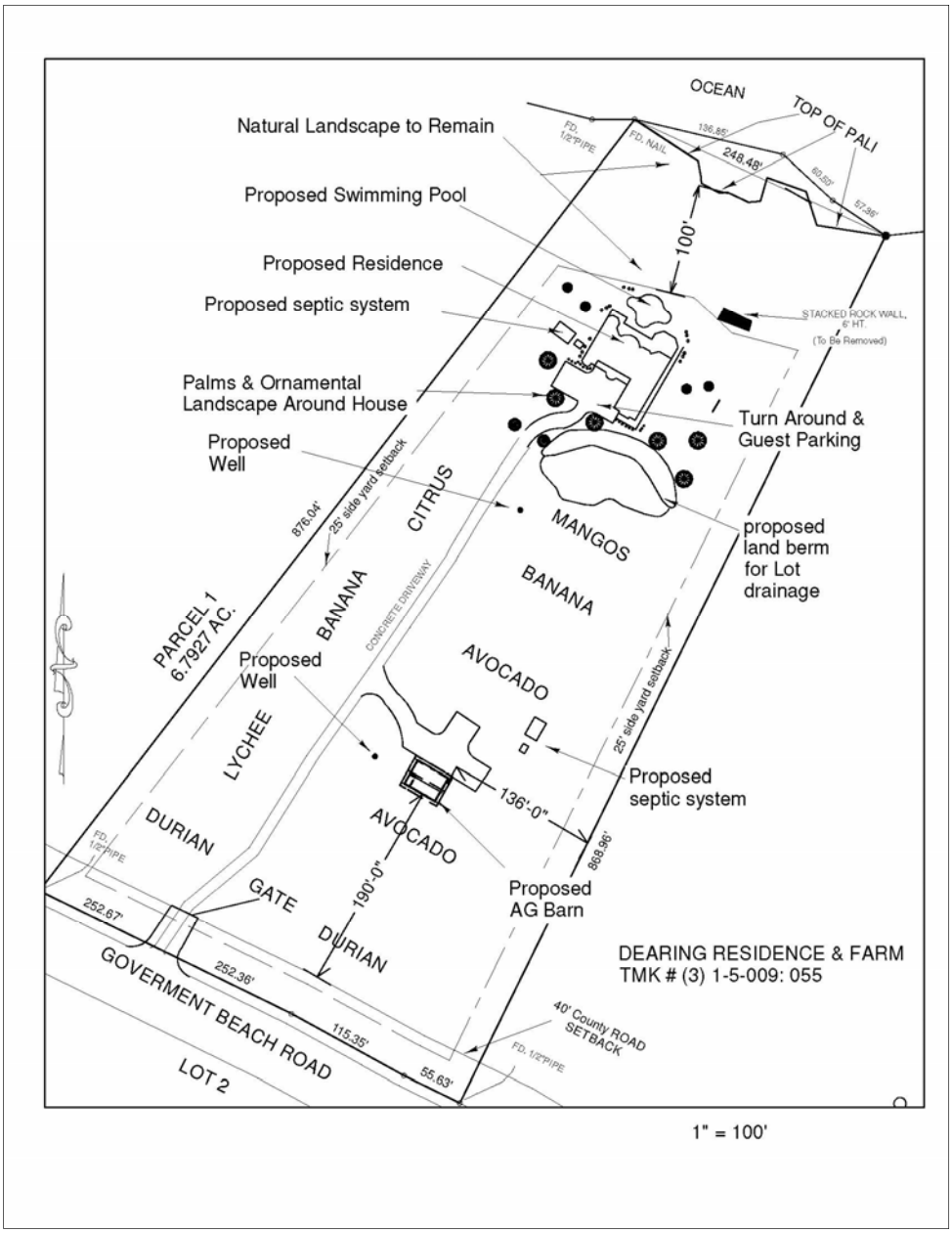


Figure 10. Development plan.

3. CULTURE-HISTORICAL CONTEXT

The *ahupuaʻa* of Keonepoko Iki is one of fifty traditional land divisions found in the District of Puna on the eastern shores of the Island of Hawaiʻi (see Figure 1). In the book *Native Planters In Old Hawaii*, Handy and Handy (1991) describe Puna as an agriculturally fertile land that has been repeatedly devastated by lava flows. Writing during the 1930s, they relate that:

> The land division named Puna—one of the six major chiefdoms of the island of Hawaiʻi said to have been cut (*ʻoki*) by the son of the successor of the island's first unifier, Umi-a-Liloa—lies between Hilo to the north and Kaʻu to the south, and it projects sharply to the east as a great promontory into the Pacific. Kapoho is the most easterly point at Cape Kumukahi. The uplands of Puna extend back toward the great central heights of Mauna Loa, and in the past its lands have been built, and devastated, and built again by that mountain's fires. In the long intervals, vegetation took hold, beginning with miniscule mosses and lichens, then ferns and hardier shrubs, until the uplands became green and forested and good earth and humus covered much of the lava-strewn terrain, making interior Puna a place of great beauty…
>
> …One of the most interesting things about Puna is that Hawaiians believe, and their traditions imply that this was once Hawaii's richest agricultural region and that it is only in relatively recent time that volcanic eruption has destroyed much of its best land. Unquestionably lava flows in historic times have covered more good gardening land here than in any other district. But the present desolation was largely brought about by the gradual abandonment of their country by Hawaiians after sugar and ranching came in… (Handy and Handy 1991:539-542)

The District of Puna is situated largely on the slopes of Kīlauea Volcano. The east rift zone of the volcano, a broad, low profile ridge (2-4 kilometers wide) formed by countless eruptions originating from numerous vents along its crest. The zone extends through the district from the Kīlauea Caldera to Cape Kumukahi at the eastern tip of the island, a distance of 55 kilometers. The north side of the rift zone, extending to the slopes of Mauna Loa and to the northeastern Puna coast, is covered primarily by lavas that erupted from the summit of Kīlauea about 200-750 years ago. In contrast, nearly the entire crest of the rift zone is covered by lava that is less than 200 years old, and most of the young lava flows that emanate from vents along the crest have spread southward towards the southeastern coast of the district, covering the older lava flows in the process (Wolfe and Morris 1996).

The *ahupuaʻa* of Keonepoko Iki includes areas of both the Coastal Settlement Zone (Zone I) and the Upland Agricultural Zone (Zone II) as described by McEldowney (1979). While this model is largely based on early historical accounts, it also considers environmental variables and human resource needs, and offers insights into the prehistoric past (Burtchard and Moblo 1994). In their refinement of the model as it applies to Puna, Burtchard and Moblo elaborate on McEldowney's concept of the Coastal Settlement Zone:

> As with her model, [the Coastal Settlement Zone] includes coastal terrain to about one half mile inland. This is the zone expected to have the greatest density and variety of prehistoric surface features in the general study area. Primary settlements are expected in places where agriculturally productive sediments (principally well-weathered ʻaʻā flows) co-occur with sheltered embayments and productive fisheries. Settlements within this zone are expected to be logistically linked to inland agricultural and forest exploitation zones accessed through a network of upslope-downslope (*Mauka-makai*) trails. Larger settlements and resource acquisition areas may have been connected by cross-terrain trail networks. (1994:26)

Located along the coast, the subject parcel falls within Zone I of McEldowney's (1979) model. Because this part of the *ahupuaʻa* also extends out to the ocean fisheries fronting its coastline, with these marine resources and the *mauka* agricultural and forest resources, the former residents of Keonepoko Iki were once able to procure nearly all that they needed to sustain their families and contribute to the larger community from within the land division. The *ahupuaʻa* resources in turn helped support the *aliʻi* that ruled the District of Puna (Maly 1998).

It is within this general context that the following discussion of the history and culture of the project area is framed. The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes the presentation of a generalized model of Hawaiian Prehistory containing specific legendary references to the subject *ahupuaʻa* and a discussion of the general settlement patterns. The discussion of Prehistory and legendary references is followed by a summary of Historic events in the district that begins with the arrival of foreigners in the islands and

then continues with the history of land use in Puna 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 subject *ahupuaʻa* during the *Māhele ʻĀina* of 1848, and documentation of the transition to modern industries, agriculture, and residential development during the late nineteenth and twentieth centuries. A synthesis of the Precontact settlement patterns and the Historically documented land use, combined with a review of the findings of previously conducted archeological studies, provides a means for understanding the types of archaeological features encountered within the project area and the greater cultural landscape.

A GENERALIZED MODEL OF HAWAIIAN PREHISTORY

The generalized cultural sequence that follows is based on Kirch's (1985) model, but is amended to include recent revisions offered by Kirch (2011). The conventional wisdom has been that first inhabitants of Hawaiʻi Island 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 Hawaiʻi Island (or perhaps anywhere in Hawaiʻi) during this initial settlement, or colonization stage of island occupation (A.D. 300 to 600). More recently, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have convincingly argued that Polynesians may not have arrived to the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the currently accepted chronology would alter the timing of the Settlement, Developmental, and Expansion Periods, possibly shifting the Settlement Period to A.D. 1000 to 1100, the Developmental Period to A.D. 1100 to 1350, the Expansion Period to A.D. 1350 to 1650, and the Proto-Historic Period to A.D.1650-1795.

The initial settlement of Hawaiʻi is believed to have originated from the southern Marquesas Islands. The Settlement Period was a time of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). 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 *ʻaumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. Over a period of several centuries areas with the richest natural resources became populated and perhaps even crowded, and the population began expanding to the *kona* (leeward side) and more remote regions of the island (Cordy 2000). In Puna, initial settlements were likely established at sheltered bays with access to fresh water and rich marine resources. These small communities would have shared extended familial relations, and there was likely an occupational focus on the collection of marine resources.

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 (*koʻi*) evolved from the typical Polynesian variations of plano-convex, trapezoidal, and reverse-triangular cross-section to a very standard Hawaiian rectangular quadrangular tanged adze. A few areas in Hawaiʻi produced quality basalt for adze production. Mauna Kea, on the island of Hawaiʻi, possessed a well-known adze quarry. The two-piece fishhook and the octopus-lure breadloaf sinker are Hawaiian inventions of this period, as are *ʻulu maika* stones and *lei niho palaoa*. The latter was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). As the environment reached its maximum carrying capacity, the result was social stress, hostility, and war between neighboring groups (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 Hawaiʻi, this time from Tahiti in the Society Islands. According to Kamakau (1976), the *kahuna* Pāʻao settled in the islands during the 13th century. Pāʻao was the keeper of the god Kūʻkaʻilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pāʻao 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 Pāʻao's canoes were thirty-eight men (*kānaka*), two stewards (*kānaka ʻāʻīpuʻupuʻu*), the chief Pilikaʻaiea (Pili) and his wife Hinaʻaukekele, Nāmauʻu o Malaia, the sister of Pāʻao, and the prophet Makuakaʻūmana (Kamakau 1992). Kamakau told the following story of their arrival in Hawaiʻi in 1866:

> 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. (1992:100-102)

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 which the land provided fruits, vegetables, and some meat for the diet, while the ocean provided a wealth of protein resources (Rechtman and Maly 2003).

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*. 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 for the diet, and the ocean provided a wealth of protein resources. Also, in communities with long-term royal residents, divisions of labor (with specialists in various occupations on land and in procurement of marine resources) came to be strictly adhered to.

The Precontact population of the Puna District lived in small settlements along the coast where they subsisted on marine resources and agricultural products. The villages of Puna, McEldowney notes, were similar to those of the Hilo District, and that they:

> …comprised the same complex of huts, gardens, windbreaking shrubs, and utilized groves, although the form and overall size of each appear to differ. The major differences between this portion of the coast and Hilo occurred in the type of agriculture practiced and structural forms reflecting the uneven nature of the young terrain. Platforms and walls were built to include and abut outcrops, crevices were filled and paved for burials, and the large numbers of loose surface stones were arranged into terraces. To supplement the limited and often spotty deposits of soil, mounds were built of gathered soil, mulch, sorted sizes of stones, and in many circumstances, from burnt brush and surrounding the gardens. Although all major cultigens appear to have been present in these gardens, sweet potatoes, ti (*Cordyline terminalis*), *noni (Morinda citrifolia*), and gourds (*Lagenaria siceraria*) seem to have been more conspicuous. Breadfruit, pandanus, and mountain apple (*Eugenia malaccensis*) were the more significant components of the groves that grew in more disjunct patterns than those in Hilo Bay. (1979:17)

People probably began utilizing the agricultural resources of upland Puna during the early expansion period of Hawai‘i Island (Burtchard and Moblo 1994). As coastal populations increased, the need for food caused people to seek arable land at higher elevations. This trend of population increase along desirable coastal locations and the expansion into upland regions to support the coastal populations would have continued throughout prehistory, slowly populating more marginal areas of Puna District. As population density increased through A.D.1600-1700s, so would political competition. This competition, undoubtedly, produced conflict, which led to political exiles and the further expansion into upland areas as these refugees sought asylum in more remote places and hidden lava tubes (Burtchard and Moblo 1994).

By the seventeenth century, large areas of Hawai‘i Island known as *moku āina* (districts) were controlled by a few powerful *ali‘i ‘ai moku*. There is island-wide evidence to suggest that growing conflicts between independent chiefdoms were resolved through warfare, culminating in a unified political structure at the district level. It has been suggested that the unification of the island resulted in a partial abandonment of portions of leeward Hawai‘i, with people moving to more favorable agricultural areas (Barrera 1971; Schilt and Sinoto 1980). ‘Umi a Līloa, a renowned *ali‘i* of the Pili line, is often credited with uniting the Island of Hawai‘i under one rule (Cordy 1994). According to Kamakau (1992:17-18), at this time, "Hua-‘a was the chief of Puna, but Puna was seized by ‘Umi and his warrior adopted sons… Hua-‘a was killed by Pi‘i-mai-wa‘a on the battle field of Kuolo in Kea‘au, and Puna became ‘Umi-a-Liloa's." Umi's reign lasted until around ca. A.D. 1620, and was followed by the rule of his son, Keawenui a ‘Umi, and then his grandson, Lonoikamakahiki (Cordy 1994).

Kirch (1985) places the beginning of the Proto-Historic Period during the rule of Lonoikamakahiki. This was a time marked by both political intensification and stress and continual conquest by the reigning *ali‘i*. Wars occurred regularly between intra-island and inter-island polities. It was during this time of warfare that Kamehameha, who would eventually rise to power and unite all the Hawaiian Islands under one rule, was born in the District of North Kohala on the Island of Hawai‘i (Kamakau 1992). There is some controversy about the year of his birth, but Kamakau (1992) places the birth event sometime between A.D. 1736 and 1758, most likely nearer to the later date.

In A.D. 1754, after many bloody battles, Kalani‘ōpu‘u, the *ali‘i ‘ai moku* of Ka‘ū, defeated his main rival Keawe‘ōpala in South Kona and declared himself ruler over all of the island of Hawai‘i (Kamakau 1992). Kalani‘ōpu‘u 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. According to Barrère (1959), the chiefs of the Puna District did not figure prominently into the Precontact political strife and turmoil on Hawai‘i Island. Barrère writes:

> Puna, as a political unit, played an insignificant part in shaping the course of history of Hawaii Island. Unlike the other districts of Hawaii, no great family arose upon whose support one or another of the chiefs seeking power had to depend for his success. Puna lands were desirable, and were eagerly sought, but their control did not rest upon conquering Puna itself, but rather upon control of the adjacent districts, Kau and Hilo. (1959:15)

LEGENDARY REFERENCES TO THE PUNA DISTRICT

Despite its perceived lack of importance with respect to the emerging political history of Hawaiian leadership the Puna region is often portrayed in legends associated with the goddess Pele and god Kāne (Maly 1998). Puna's association with Pele is strong and goes back many years because of the region's relatively young geological age and ongoing volcanic activity. However, the association with Kāne is perhaps more ancient still. Kāne, ancestor to both chiefs and commoners, is the god of sunlight, fresh water, verdant growth, and forests (Pukui 1983). It is said that before Pele migrated to Hawai‘i from Kahiki, there was "no place in the islands . . . more beautiful than Puna" (Pukui 1983:11). Contributing to that beauty were the groves of fragrant *hala* and forests of *‘ōhi‘a lehua* for which Puna was famous:

> *Puna pāia ‘ala i ka hala* (Puna, with walls fragrant with pandanus blossoms)
>
> Puna, Hawai‘i, is a place of *hala* and *lehua* forests. In olden days the people would stick the bracts of *hala* into the thatching of their houses to bring some of the fragrance indoors. (Pukui 1983:301)

Traditional *mo‘olelo* were passed down orally through the generations and many tales focus on *wahi pana* or legendary places. There are numerous myths and legends associated with the beautiful *wahi pana* of Puna, which frequently refer to the majestic female fire deity, Pele, or "Pele-honua-mea (Pele of the sacred earth)" (Beckwith 1970). Most closely associated with the powerful, temperamental volcanoes of Hawai‘i, she was likely feared and respected equally by the people of the islands. Nimmo (1990:44) relates that "although the actual worship of Pele was most important in the districts of Hawai‘i that experienced active volcanism, the mythology of the goddess was widespread throughout the Hawaiian Islands." And that "there is no evidence that Pele was worshipped extensively beyond the volcano area of Hawai‘i, although her mythology was apparently widespread throughout the Hawaiian Islands and members of her family were important in ritual throughout the archipelago" (Nimmo 1990:44).

The Heart Stirring Story of Ka-Miki

A traditional *moʻolelo*, "The Heart Stirring Story of Ka-Miki" (*Kaao Hooniua Puuwai no Ka-Miki*), originally appeared in *Ka Hoku o Hawaiʻi* (a Hawaiian language newspaper) between 1914 and 1917. The story tells of two supernatural brothers, Ka-Miki and Maka-ʻiole, who were skilled *ʻōlohe* (competitors/fighters) and their travels around Hawaiʻi Island by way of the ancient trails and paths (*ala loa* and *ala hele*), seeking competition with other *ʻōlohe.* As described by Maly:

> The narratives were primarily recorded for the paper by Hawaiian historians John Wise and J.W.H.I. Kihe (with contributions from Steven Desha Sr.). While Ka-Miki is not an ancient account, the authors set the account in the thirteenth century (by association with the chief Pili, who came to Hawaiʻi with Pāʻao). They used a mixture of local stories, tales, and family traditions in association with place names to tie together fragments of site specific history that had been handed down over the generations. Thus, while in many cases, the personification of individuals and their associated place names may not be "ancient," the site documentation within the "story of Ka-Miki" is of both cultural and historical value. (1998:17)

A portion of the legend set in Puna was published between October 21 and November 18, 1915. Translated by Maly (1998:17-25), this portion describes many people and places within the district, and mentions a young chief of Puna named Keahialaka, which is summarized below. During an expedition through the uplands of Puna, Ka-Miki and Maka-ʻiole encountered a man named Pōhakuloa who was intensely working on a large *koa* log. They were headed to Keaʻau, but had lost their way. They stopped and asked Pōhakuloa for directions, but he was startled by the unexpected appearance of the brothers, and replied impolitely. Taunts were exchanged between the two parties, which led to a physical altercation. Pōhakuloa soon realized that these two men were extraordinarily skilled as well as spiritually protected, and he admitted his defeat. Pōhakuloa wished to prepare a meal and drink of *ʻawa* with his newfound friends, and solicited the help of his brother in law, an *ʻōlohe* chief named Kapuʻeuhi. However, Kapuʻeuhi had plans of his own. He intended to compete with and conquer the brothers, but was defeated by them instead. Kapuʻeuhi was infuriated by his defeat, and also by Pōhakuloa's refusal to aid in retaliation against Ka-Miki and Maka-ʻiole.

Kapuʻeuhi invited the brothers back to his house to partake in a meal and a particularly potent type of *ʻawa*, scheming to get them drunk. Unbeknownst to Ka-Miki and Maka-ʻiole, this was common practice for Kapuʻeuhi, who often housed weary travelers, intoxicated them with *ʻawa*, then killed them and stole their belongings. Kapuʻeuhi waged a bet with the brothers; if they couldn't drink five cups of the *ʻawa*, then he would throw them out and they would be at the mercy of the Puna forest. Ka-Miki and Maka-ʻiole agreed, and made a bet of their own; if they were able to drink five cups, they would throw Kapuʻeuhi out of his own house. The brothers prayed and chanted to their ancestral goddess, and were able to consume the entire quantity of *ʻawa* without getting drunk. As agreed upon, Kapuʻeuhi was thrown out. Stunned, and angered that he was thwarted once again, Kapu-ʻeuhi requested assistance from Kaniahiku (a much feared Puna *ʻōlohe* and forest guardian) and her grandson Keahialaka. "At that time, Keahialaka was under the guardianship of Pānau and Kaimū, and he enjoyed the ocean waters from Nānāwale to Kaunaloa, Puna" (*Ka Hoku o Hawaiʻi* October 28, 1915; translated by Maly 1998:20), which Maly suggests is symbolic of controlling those regions. Together, Kapuʻeuhi and Kaniahiku conspired to lead the brothers deep into the Puna forest, where Kaniahiku would be able to murder them, while maintaining the façade that they were taking them to the *ʻawa* grove of Mauānuikananuha. Kaniahiku created a dark and murky environment, spreading gloomy mists and an overgrowth of twisted vegetation intended to ensnare the brothers, they were overcome, and left for dead by Kapuʻeuhi, who made his way back to safety, led by Kaniahiku's sister. They prayed to their ancestor, Ka-uluhe-nui-hihi-kolo-i-uka for help. She appeared and the brothers were able to reach the *ʻawa* grove. Another attempt by Kaniahiku to kill the brothers was made, however, Ka-uluhe's protection over them was too strong, and she failed.

Ka-Miki and Ka-ʻiole realized that Kapuʻehi had deceived them and had been in affiliation with Kaniahiku. They were angered, and trapped him in the *ʻawa* grove. In an effort of retaliation, Kaniahiku summoned for her grandson, Keahialaka, and readied herself for a battle. Ka-Miki and Maka-ʻiole reprimanded Kaniahiku for her deceitful actions, which only served to anger her even further. Aggressively, Kaniahiku attacked Ka-Miki with her tripping club and spear, but Ka-Miki was far too elusive for her. He swiftly evaded each attempt at injury made on his behalf. In desperate need of assistance, Kaniahiku beckoned to Keahialaka by playing her nose flute, urging him to hurry to her side. Although Keahialaka was strong and skillful in the arts of *ʻōlohe*, he was all too easily overcome by Ka-Miki. His grandmother, in an attempt to free him from Ka-Miki, was also captured.

Kaniahiku was astounded at the dexterity of the brothers. Their skill was incomparable to any other *ʻōlohe* she had ever encountered, and even her own skill paled in comparison, for she had never been defeated. All at once she surrendered to Ka-Miki and Makaʻiole, who in turn released her and her grandson. Back at Kaniahiku's house, a meal was prepared, the *ʻawa* of Kaliʻu was enjoyed, and the gods were honored with offerings. Kaniahiku requested that the brothers take Keahialaka with them as they continued their journey on the *ala loa*, declaring that if they did, they would be welcomed wherever their travels took them in Puna. Ka-Miki and Makaʻiole approved of this request, and took Keahialaka on as their companion. Together, the three men journeyed throughout various districts of Hawaiʻi island, and competed in many *ʻōlohe* competitions.

In the legend of Ka-Miki, the land of Keoneopokoiki was named for an *ʻolohe* master of Puna, who was the *mokomoko* (rough hand fighting) instructor of the chief Puʻula (Maly 1992). According to the story Keoneopokoiki was a traditional training grounds for ʻ*olohe* of Puna, were masters skilled in hand to hand combat and other martial arts techniques. In the story Ka-Miki quickly defeats the Puna master, Keoneopokoiki in an *ʻolohe* contest. Ka-Miki then threatened to kill Keoneopokoiki, who seeing that there was no one who could defeat Ka-Miki, gave his complete surrender and returned to his home. According to the story, Keoneopokoiki lived on the upland side of the *alaloa* (the around the island coastal trail). At his compound was an altar dedicated to his gods (Maly 1998).

HISTORY AFTER CONTACT

The arrival of Western explorers in Hawaiʻi signified the end of the Precontact Period ca. 1778, and the beginning of the Historic Period. With the arrival of foreigners such as British explorer Captain James Cook, in command of the ships *H.M.S. Resolution* and *H.M.S. Discovery*, Hawaiʻi's culture and economy underwent drastic changes. Demographic trends during the late Proto-Historic Period/early Historic Period indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. At first there was a continued trend toward craft and status specialization, intensification of agriculture, *aliʻi* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history (Kirch 1985; Kent 1983). 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 very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered Oʻahu, Maui and Molokaʻi, in 1795, Hawaiʻi had seen the beginnings of a market system economy (Kent 1983). Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early visitors. Introduced foods often grown for trade with Westerners included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845). 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 in the Hawaiian Islands. This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

Puna During the End of Kalaniʻōpuʻu's Reign (1779-1782)

In March of 1779, after Captain Cook's death, Captain James King sailed the *H.M.S. Resolution* and *Discovery* along the Puna shoreline and described the district as a sparsely populated, but verdant and fertile (Maly 1998). Captain King, mentioned that Kalaniʻōpuʻu, the reigning chief of Hawaiʻi Island had one of his residences there, and he provided the following description of the landscape:

> …the SE sides of the districts of Opoona & Kaoo [Puna and Kaʻū]. The East part of the former is flat, coverd with Coco nut trees, & the land far back is of a Moderate height. As well as we could judge this is a very fine part of the Island, perhaps the best. Terreeoboo [Kalaniʻōpuʻu] has one of his residences here.
>
> On the SW extremity of Opoona the hills rise abruptly from the Sea side, leaving but a narrow border, & although the sides of the hills have a fine Verdure, yet they do not seem Cultivated, & when we saild pretty near & along this end of Opoona, we did not observe that it was equally Populous with the Eastern parts; before we reachd the East point of the Island, & all along this SE side the snowy mountain calls Roa (or extensive) [Mauna Loa] is very conspicuous. It is flattish at the top or makes what we call Table land… (Beaglehole 1967:606)

After the departure of *H.M.S. Resolution* and *Discovery*, Kalaniʻōpuʻu moved to Kona. Soon after, famine struck and Kalaniʻōpuʻu ordered that all the cultivated products of that district be seized, and he then set out on a circuit of the island (Kamakau 1992). During his stay in Kohala, around 1780, Kalaniʻōpuʻu proclaimed that his son Kiwalaʻō

would be his successor, and he gave the guardianship of the war god Kūkaʻilimoku to Kamehameha (Fornander 1996; Kamakau 1992). During Kalaniʻōpuʻu's time in Kohala that an uprising, led by a highly esteemed chief of Puna named Imakakoloa, occurred. It is said that Imakakoloa rebelled because he was tired of the incessant and exorbitant demands of Kalaniʻōpuʻu. As a chief who loved the people of Puna, and was beloved by them in return, Imakakoloa refused Kalaniʻōpuʻu's demands. He felt that "his own people who cultivated the ground should be provided with the necessaries of life, before the numbers of the royal court, who lived in idleness" (Elkin 1903:26). Rather than allow Kalaniʻōpuʻu access to the toils of the people of Puna, Imakakoloa:

> …seized the valuable products of his district, which consisted of hogs, gray tapa cloth (*ʻeleuli*), tapas made of *mamaki* bark, fine mats made of young pandanus blossoms (*ʻahu hinalo*), mats made of young pandanus leaves (*ʻahuao*), and feathers of the *ʻoʻo* and *mamo* birds of Puna. (Kamakau 1992:106)

This action angered Kalaniʻōpuʻu, who was insulted by the insubordination. Upon hearing of the uprising, Kalaniʻōpuʻu immediately went to Hilo to quell the rebellion. He vowed revenge against Imakakoloa, and devised a plan to kill him. A battle between the two men ensued, and although Imakakoloa was a worthy opponent, his army was no match for Kalaniʻōpuʻu's superior forces. After the battle, the Puna chief fled and was sheltered in the district by his people for more than a year. Kalaniʻōpuʻu, sworn to vengeance, ruthlessly stalked the fugitive chief for the duration of his emancipation, and in his rage he ordered that Puna be burned to the ground. Fornander (1969:202) indicates that the district was "literally laid in ashes" as a result of Kalaniʻōpuʻu's vengeance.

While the rebel Puna chief was sought, Kalaniʻōpuʻu "went to Ka-ʻu and stayed first at Punaluʻu, then at Waiohinu, then at Kamaʻoa in the southern part of Ka-ʻu, and erected a heiau called Pakini, or Halauwailua, near Kamaʻoa" (Kamakau 1992:108). Imakakoloa was eventually captured and brought to the *heiau*, where Kiwalaʻō was to sacrifice him. "The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief" (Fornander 1996:202). However, before Kiwalaʻō could finish the first offerings, Kamehameha, "grasped the body of Imakakoloa and offered it up to the god, and the freeing of the tabu for the heiau was completed" (Kamakau 1992:109). Upon observing this single act of insubordination, many of the chiefs believed that Kamehameha would eventually rule over all of Hawaiʻi. After usurping Kiwalaʻō's authority with a sacrificial ritual in Kaʻū, Kamehameha retreated to his home district of Kohala.

The Rule of Kamehameha I (1782-1819)

After Kalaniʻōpuʻu's death in April of 1782, several chiefs were unhappy with Kiwalaʻō's division of the island's lands, and civil war broke out. Kiwalaʻō, Kalaniʻōpuʻu's son and appointed heir, was killed at the battle of Mokuʻōhai, South Kona in July of 1782. Supporters of Kiwalaʻō, including his half-brother Keōua and his uncle Keawemauhili, escaped the battle of Mokuʻōhai with their lives and laid claim to the Hilo, Puna, and Kaʻū Districts. According to Iʻi (1963) nearly ten years of almost continuous warfare followed the death of Kiwalaʻō, as Kamehameha endeavored to unite the Island of Hawaiʻi under one rule and conquer the islands of Maui and Oʻahu. Keōua became Kamehameha's main rival on the Island of Hawaiʻi, and he proved difficult to defeat (Kamakau 1992). 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 Puʻukoholā in Kawaihae, which was to be dedicated to the war god Kūkaʻilimoku (Fornander 1996).

As Keōua's army attempted to return to Kaʻū to stop Kamehameha's warriors from ravaging their home district, an untimely eruption of Kīlauea cost him about 400 fighting men along with an untold number of women and children (Fornander 1996). Kamehameha's prophets said that this eruption was the favor of the gods who rejoiced at his building of Puʻukoholā Heiau. According to Westervelt (1916:146), "The people said it was proof that Pele had taken Kamehameha under her special protection and would always watch over his interests and make him the chief ruler." Unable to defeat Keōua in battle, Kamehameha resorted to trickery. 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, and when he arrived at Kawaihae, he and his party were sacrificed to complete the dedication (Kamakau 1992), which secured Kamehameha's undisputed control of Hawaiʻi Island by 1792 (Greene 1993). It is widely thought that Keōua knew the outcome of his visit to Puʻukoholā Heiau, but sacrificed himself to spare the people of Kaʻū further bloodshed. By 1796, with the aid of foreign weapons and advisors, Kamehemeha conquered all of the island kingdoms except Kauaʻi. In 1810, when Kaumualiʻi of Kauai gave his allegiance to Kamehameha, the Hawaiian Islands were unified under a single leader (Kuykendall and Day 1976). Kamehameha would go on to rule the islands for another nine years.

Early Historic Accounts of Puna (1820-1847)

Following the death of Kamehameha I in 1819, the Hawaiian religious and political systems began a radical transformation; Kaʻahumanu proclaimed herself "*Kuhina nui*" (Prime Minister), and within six months the ancient *kapu* system was overthrown. Within a year, Protestant missionaries arrived from America (Fornander 1969; Iʻi 1963; Kamakau 1992). In 1823, British missionary William Ellis and members of the American Board of Commissioners for Foreign Missions (ABCFM) toured the island of Hawaiʻi seeking out communities in which to establish church centers for the growing Calvinist mission. Ellis recorded observations made during this tour in a journal (Ellis 2004), and offers a rare glimpse at the project area during this time. Walking from Kīluea to Waiakea along Puna's southeastern shore with his missionary companions Asa Thurston and Artemas Bishop, Ellis recorded descriptions of residences and practices that are applicable to the general cultural landscape:

> The population in this part of Puna, though somewhat numerous, did not appear to possess the means of subsistence in any great variety or abundance; and we have often been surprised to find desolate coasts more thickly inhabited than some of the fertile tracts in the interior; a circumstance we can only account for, by supposing that the facilities which the former afford for fishing, induce the natives to prefer them as places of abode; for they find that where the coast is low, the adjacent water is usually shallow.
>
> We saw several fowls and a few hogs here, but a tolerable number of dogs, and quantities of dried salt fish, principally albacores and bonitos. This latter article, with their *poë* [*poi*] and sweet potatoes, constitutes nearly the entire support of the inhabitants, not only in this vicinity, but on the sea coasts of the north and south parts of the island.
>
> Besides what is reserved for their own subsistence, they cure large quantities as an article of commerce, which they exchange for the vegetable productions of Hilo and Mamakua [Hāmākua], or the *mamake* and other tapas of Ora [ʻŌlaʻa] and the more fertile districts of Hawaii. (2004:263-264)

Ellis and the ABCFM missionaries travelled along the coast of Kauwai, Waʻawaʻa, and Nānāwale *ahupuaʻa* and then turned *mauka* toward a village in Honolulu Ahupuaʻa (Ellis 2004). On August 8, 1823, the Ellis and the ABCFM missionaries left Honolulu and visited the village of Waiakahiula to the southeast of the current project area. Ellis' journal provides a brief first-hand description of the village's location relative to the coast:

> We arose early on the 8th, and Mr. Thurston held morning worship with the friendly people of the place [Honolulu]. Although I had been much indisposed through the night, we left Honoruru [*sic*] soon after six a.m. and, travelling slowly towards the sea-shore, reached Waiakeheula [*sic*] about eight, where I was obliged to stop, and lie down under the shade of a canoe-house near the shore. Messrs. Thurston and Bishop walked up to the settlement about half a mile inland, where the former preached to the people…(2004:295)

After preaching, Bishop continued on alone toward Waiakea, while Thurston returned to fetch Ellis from the canoe shed. Upon reaching the village, Ellis found its residences to be interspersed among the agricultural fields rather than in a single, nucleated settlement:

> The country was populous, but the houses stood singly, or in small clusters, generally on the plantations, which were scattered over the whole country. Grass and herbage were abundant, vegetation in many places luxuriant, and the soil, though shallow, was light and fertile. (2004:296)

While other early visitors to Puna provide general descriptions of conditions in the district during subsequent decades. One year after Ellis' tour, the ABCFM established a base church in Hilo (Hāili) from which the missionaries traveled to the more remote areas of the Hilo and Puna Districts. David Lyman, who came to Hawaiʻi in 1832, and Titus Coan, who arrived in 1835 were two of the most influential congregational missionaries in Puna and Hilo. As part of their duties they compiled census data. In 1835, 4,800 individuals were recorded as residing in the district of Puna (Schmitt 1973); the smallest total district population on the island of Hawaiʻi. In 1841, Coan recorded that most of the 4,371 recorded residents of Puna lived near the shore, though there were hundreds of individuals who lived inland (Holmes 1985).

In 1841, the United States Exploring Expedition under the direction of Commander Charles Wilkes, toured Hawaii and travelled through Puna. Wilkes produced a map of Puna, which includes the coastal trail but shows only a large "Pandanus Forest" covering the lands in the vicinity of the project area (Figure 11).

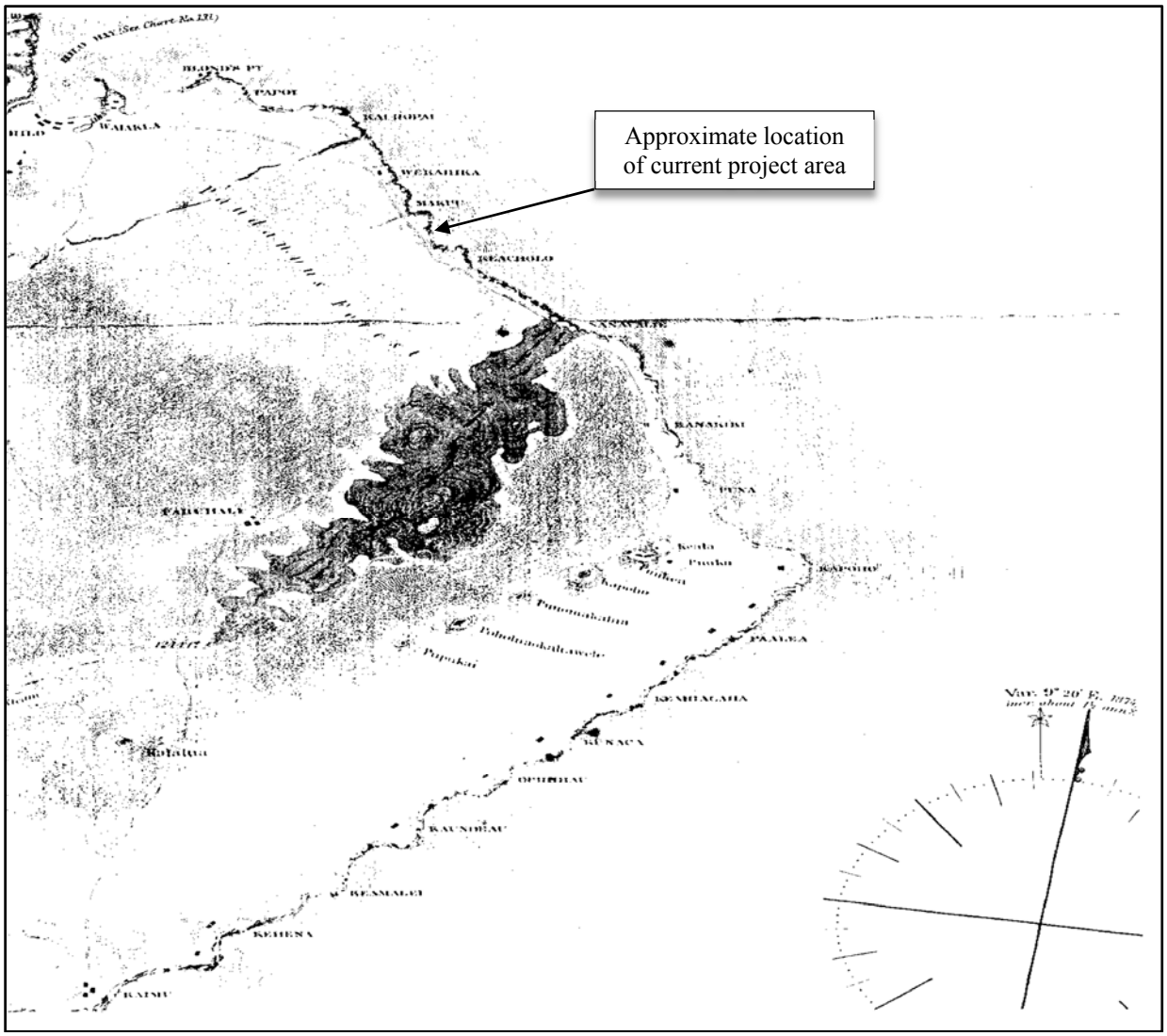


Figure 11. Portion of Hawai‘i Registered Map No. 424 prepared by Wilkes in 1841.

Wilkes, travelling towards Kapoho at the eastern tip of the island, provides the following description of Puna:

> …Almost all of the hills or craters of any note have some tradition connected with them; but I found that the natives were now generally unwilling to narrate these tales, calling them “foolishness.”
>
> After leaving the pahoihoi [sic] plain, we passed along the line of cone-craters towards Point Kapoho, the Southeast part of the island.
>
> Of these cone-craters we made out altogether, large and small, fifteen, trending about east-northeast. The names of the seven last are Pupukai, Poholuaokahowele [Pu‘u-hōlua-o-Kahawali], Punomakalua, Kapoho, Puukea, Puuku, and Keala. On some of these the natives pointed out where there had formerly been slides, an amusement or game somewhat similar to the sport of boys riding down hill on sleds. These they termed kolua [sic – *holua*].
>
> This game does not appear to be practiced now, and I suppose that the chiefs consider themselves above such boyish amusements. The manner in which an old native described the velocity with which they passed down these slides was, by suddenly blowing a puff; according to him, these amusements were periodical, and the slides were usually filled with dried grass.
>
> As we approached the sea-shore, the soil improved very much, and was under good cultivation, in taro, sweet-potatoes, sugar cane, and a great variety of fruit and vegetables. At about four o’clock,

> we arrived at the house of our guide, Kekahunanui, who was the "head man." I was amused to find that none of the natives knew him by this name, and were obliged to ask him, before they could give it to Dr. Judd…
>
> …The view from the guide's house was quite pretty, the eye passing over well-cultivated fields to the ocean, whose roar could be distinctly heard… (1845: Vol. IV:186)
>
> During the night, one of the heaviest rains I had experienced in the island, fell; but the morning was bright and clear,—every thing seemed to be rejoicing around, particularly the singing-birds, for the variety and sweetness of whose notes Hawaii is distinguished. Previous to our departure, all the tenantry, if so I may call them, came to pay their respects, or rather to take a look at us. We had many kind wishes, and a long line of attendants, as we wended our way among the numerous taro patches of the low grounds, towards Puna; and thence along the sea-coast where the lava entered the sea, at Nanavalie [Nānāwale]. The whole population of this section of the country was by the wayside, which gave me an opportunity of judging of their number; this is much larger than might be expected from the condition of the country, for with the exception of the point at Kapoho, very little ground that can be cultivated is to be seen. The country, however, is considered fruitful by those who are acquainted with it, notwithstanding its barren appearance on the roadsides. The inhabitants seemed to have an abundance if bread-fruit, bananas, sugar-cane, taro, and sweet-potatoes. The latter, however, are seen to be growing literally among heaps of stones and pieces of lava, with scarcely soil enough to cover them; yet they are, I am informed, the finest on the island…
>
> In some places they have taken great pains to secure a good road or walking path; thus, there is a part of the road from Nanavalie to Hilo which is built of pieces of lava, about four feet high and three feet wide on the top; but not withstanding this, the road is exceedingly fatiguing to the stranger, as the lumps are so arranged that he is obliged to take a long and short step alternately; but this the natives do not seem to mind, and they pass over the road with great facility, even when heavy laden…(1845: Vol. IV:188-193)

In 1846, Chester S. Lyman, "a sometime professor" at Yale University visited Hilo, Hawaiʻi, and stayed with Titus Coan (Maly 1998). Traveling the almost 100-mile long stretch of the "Diocese" of Mr. Coan, Lyman reported that the district of Puna had somewhere between 3,000-4,000 inhabitants (Maly 1998). Entering Puna from Hilo, and traveling to Keaʻau along the coast, Lyman offered the following observations of the Puna District:

> …The groves of Pandanus were very beautiful, and are the principal tree of the region. There is some grass and ferns, and many shrubs; but the soil is very scanty. Potatoes are almost the only vegetable that can be raised, and these seem to flourish well amid heaps of stone where scarcely a particle of soil could be discovered. The natives pick out the stones to the depth often of from 2 to 4 feet, and in the bottom plant the potato–how it can expand in such a place is a wonder.
>
> Nearly all Puna is like this. The people are necessarily poor—a bare subsistence is all they can obtain, and scarcely that. Probably there are not $10 in money in all Puna, and it is thought that not over one in five hundred has a single cent. The sight of some of these potatoe patches would make a discontented N.E. farmer satisfied with his lot. Yet, I have nowhere seen the people apparently more contented & happy. (Lyman ms. Book III:3 in Maly 1998:35)

Written accounts left by early visitors to the Island of Hawaiʻi offer insight into what life may have been like for the earliest residents of Puna. However, by the time Ellis visited Puna, less than fifty years after the arrival of the first Europeans, the population of Hawaiʻi was already beginning to decline. By 1850, the population of Hawaiʻi Island had dropped to 25,846 individuals (Schmitt 1973:8). Maly summarizes the reasons for the rapid decline of native populations thusly:

> Overall, historic records document the significant effect that western settlement practices had on Hawaiians throughout the islands. Drawing people from isolated native communities into selected village parishes and Hawaiian ports-of-call, had a dramatic, and perhaps unforeseen impact on native residency patterns, health, and social and political affairs. In single epidemics hundreds, and even thousands of Hawaiians died in short periods of time. (1998:36)

The Legacy of the Great *Māhele* in Puna (1848-1873)

By the middle of the nineteenth century the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership, 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 1961:13).

During the *Māhele ʻĀina* of 1848, all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands. During the *Māhele*, land interests of the King (Kamehameha III), the high-ranking chiefs (the *aliʻi nui*), 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. To expedite the work of the Land Commission, these lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed (Chinen 1961:13). All lands awarded during the *Māhele* were subject to the rights of the native tenants therein. Native tenants of the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to, *kuleana* parcels that they actively lived on or farmed. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). In Puna, however, very few claims for *kuleana* were submitted. Maly (1998:37) notes that, with the exception of the islands of Kahoʻolawe and Niʻihau, no other land division of comparable size, had fewer claims for *kuleana* from native tenants than the district of Puna.

As a result of the *Māhele*, Keoneopoko Ahupuaʻa (assumed to be Keonepoko Nui, but not specified) was awarded as Crown Land. Keonepoko Iki Ahupuaʻa, not listed in the *Māhele* Book, was retained as Government Land; and Kaʻohe Ahupuaʻa, adjacent to the southeastern coastal boundary of Keonepoko Iki, was a *konohiki* award to Ulumaheihei, but later commuted back to the government. Kaʻohe is depicted near the coast on only one of the Historic maps reviewed for this study (Figure 12). On most maps, the coastal lands of Kaʻohe have been lumped together with those of Keonepoko Iki and are not depicted (the Kaʻohe Homesteads, located within a detached piece of the *ahupuaʻa* above Pāhoa town, still retain the Kaʻohe name, however). As can be seen in Figure 12 the current project area is located in Keonepoko Iki Ahupuaʻa near its indefinite boundary with Kaʻohe Ahupuaʻa, between two coastal points labeled "Kawaiki" and "Keahu" on the map. No LCAw. claims were made for *kuleana* within either Keonepoko Iki or Kaʻohe *ahupuaʻa* during the *Māhele* (Waihona ʻĀina database).

In conjunction with the *Māheleʻ Āina* of 1848, the King authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* should be set aside and sold as grants. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the *Māhele*, to purchase lands of their own. Despite the stated goal of the grant program, in reality, many of the Government Lands were eventually sold or leased to foreigners. The current project area is a portion of a 277.8-acre grant parcel purchased by Kekoa in 1855 as Grant No. 1533 (see Figure 12). The record is silent regarding Kekoa's use of the grant lands.

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawaiʻi to legally set the boundaries of all the *ahupuaʻa* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between A.D. 1873 and 1885 and was usually given in Hawaiian and transcribed in English. Because Keonepoko Iki was retained as government land, its boundaries were not set by the land commission. However, the boundaries of neighboring Keonepoko Nui were surveyed in 1880 for the estate of C. Kanaina, and place names along the common boundary with Keonepoko Iki are shown on a survey map reproduced in Figure 13 below.

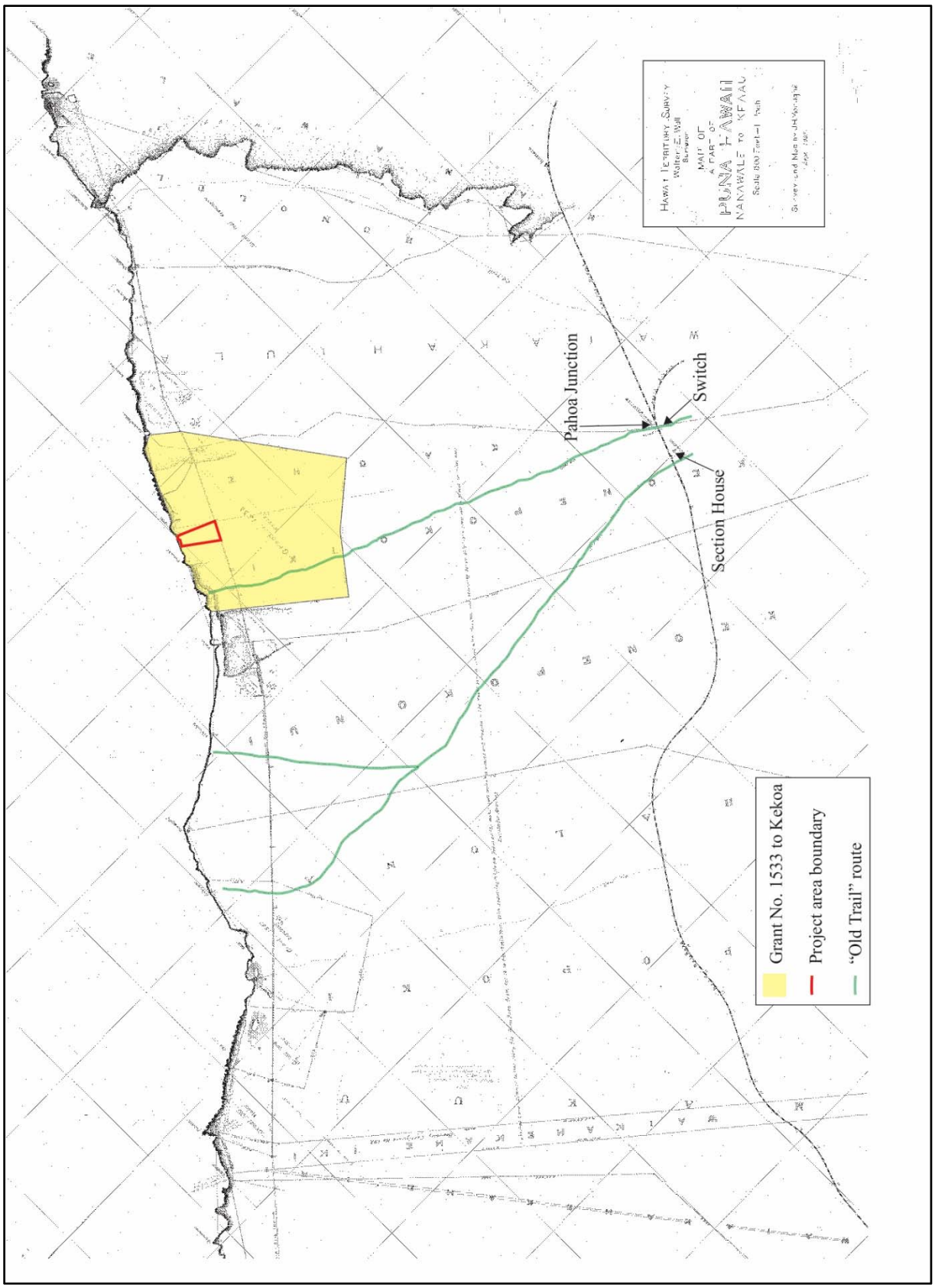


Figure 12. Portion of Hawai'i Registered Map No. 2258 showing the location of the current project area and other landmarks referenced in the text.

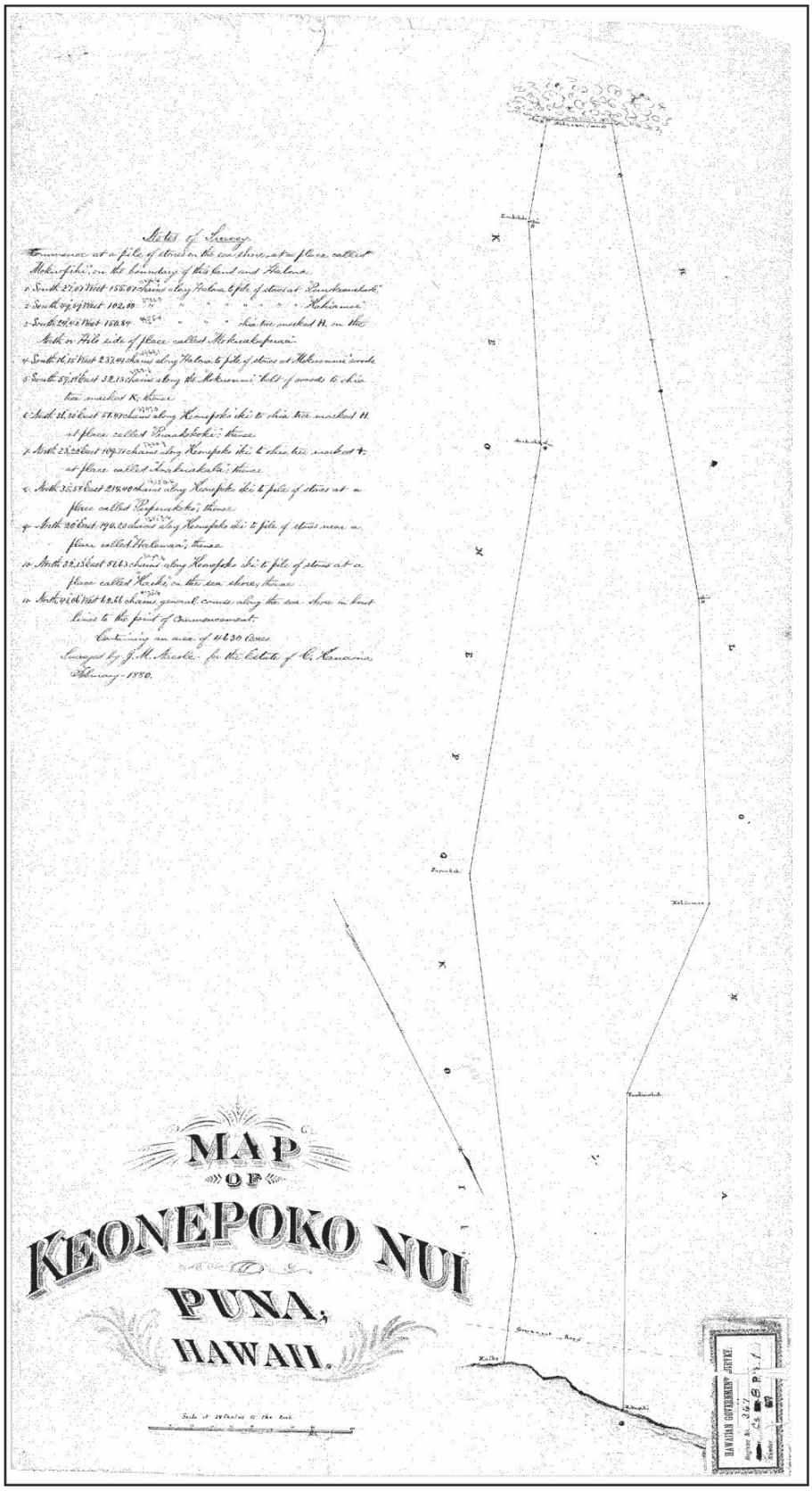


Figure 13. 1880 Hawai‘i Registered Map No. 367 showing the boundaries of Keonepoko Nui Ahupua‘a.

In 1868 a volcanic eruption emanating from Mauna Loa volcano shook Hawai‘i Island, bringing with it lava flows, earthquakes and a *tsunami* that transformed the landscape of the southern part of island forever, and further contributed to the depopulation of the District of Puna. Coan (1882) recorded that on April 2:

> …a terrific shock rent the ground, sending consternation through all Hilo, Puna, and Kau. In some places fissures of great length, breadth, and depth were opened… Stone houses were rent and ruined, and stone walls sent flying in every direction…the sea rose twenty feet along the southern shore of the island, and in Kau 108 houses were destroyed and forty-six people drowned…Many houses were also destroyed in Puna, but no lives were lost. During this awful hour the coast of Puna and Kau, for the distance of seventy-five miles subsided seven feet on average, submerging a line of small villages all along the shore. One of my rough stone meeting houses in Puna [Kapoho-Koa‘e], where we once had a congregation of 500 to 1,000 was swept away with the influx of the sea, and its walls are now under water… (Coan 1882:314-316)

The population of Puna continued to decline throughout the first half of the nineteenth century and Hawaiians maintained marginalized communities outside of the central population centers. These communities were located in out-of-the-way places. In the aftermath of the *Māhele*, economic interests in the region swiftly shifted from the traditional Hawaiian land tenure system of subsistence farming and regional trade networks to the more European for-profit trade cash crops including coffee, tobacco, sugar, timber, and pineapple, with an emphasis on dairy and cattle ranching. While large tracts of land in lower Puna were used for cattle grazing and sugarcane cultivation, the current project area does not appear to have been used for either purpose.

The Old Government Beach Road (SIHP Site 21273), which runs along the *mauka* edge of the subject parcel, is considered a historic property. The Old Government Beach Road (also referred to as the Puna Trail) was previously studied by Lass (1997) and Maly (1999) within the *ahupua‘a* of Kea‘au. Currently, this road is dirt covered and maintained for vehicular access. Maly (1999) relates that the current alignment of the Old Government Road, which evolved from earlier trail routes, was under construction by the 1840s. The road remained the preferred route of travel between Hilo and the out-lying areas of Puna until 1895, when the Kea‘au-Pāhoa Road (Highway 130) was established to access the growing inland population centers and agricultural areas (Maly 1999:6).

Keonepoko Iki Ahupua‘a and Coastal Puna during the Twentieth Century

By 1900 Puna was on the verge of major economic growth, spurred by the sugar and lumber industries. The rise and fall of these industries can be traced along the rusted railroad tracks that litter the landscape *mauka* of the project area. In 1899, the ‘Ōla‘a Sugar Company began operating in the Kea‘au area. The directors of the company realized early on that the lack of mass transportation would hinder the success of their business. As a result, they organized the Hilo Railroad Company and, on April 8, 1899, were granted a fifty-year charter (Best 1978). The railroad’s infrastructure developed quickly and rail service from Hilo to ‘Ōla‘a (Kea‘au) began on June 18, 1900. Puna Sugar Company was also organized within the Puna District on March 2 of that same year near the village of Kapoho. Puna Sugar Company had cane fields scattered all over lower Puna from Kapoho to Pāhoa Town itself. Coastal Keonepoko Iki’s thin, sticky, acidic soils, however, spared the project area from inclusion in the new sugar fields. In fact, wide dispersal of suitable agricultural lands also hindered the growth of the sugar industry in Puna. As with ‘Ōla‘a Sugar Company’s early Kea‘au operations, the lack of a reliable transportation system made it expensive to collect and transport the cane from the scattered fields to the mill. So, when Hilo Railroad proposed to lay four miles of track from Kapoho to Pāhoa, Puna Sugar Company paid for half the cost. By March 1, 1902, the Hilo Railroad was making regular stops at the ‘Ōla‘a Sugar Mill, the town of Pāhoa, and in lower Puna.

The route of the railroad across Keonepoko Iki can be seen on a 1903 Hawai‘i Registered Map No. 2258 prepared by J.H. Morange (see Figure 12). On that map a “Section House” and a “Switch” at Pāhoa Junction are shown in Keonepoko Iki Ahupua‘a, *mauka* of the subject parcel. Two “Old Trails” are shown extending *makai* from near the section house to the coast (and a short distance *mauka* as well). One of the trails terminates at the coast of Keonepoko Iki to the northwest of the current project area. Beginning in 1903, *mauka* portions of Keonepoko Nui and Keonepoko Iki *ahupua‘a* (in the vicinity of the town of Pāhoa) were subdivided into twenty-three homestead lots collectively called the Keonepoko Homesteads (Figure 14). Soon after that, the sixteen lot Ka‘ohe Homesteads were created in the area above the town of Pāhoa (*mauka* and east of Keonepoko Iki Ahupua‘a). All of these parcels were sold as grants. By 1905, Puna Sugar Company harvests were milled at the ‘Ōla‘a Mill, and Puna Sugar Company became a division of ‘Ōla‘a Sugar Company (Dorrance and Morgan 2000).

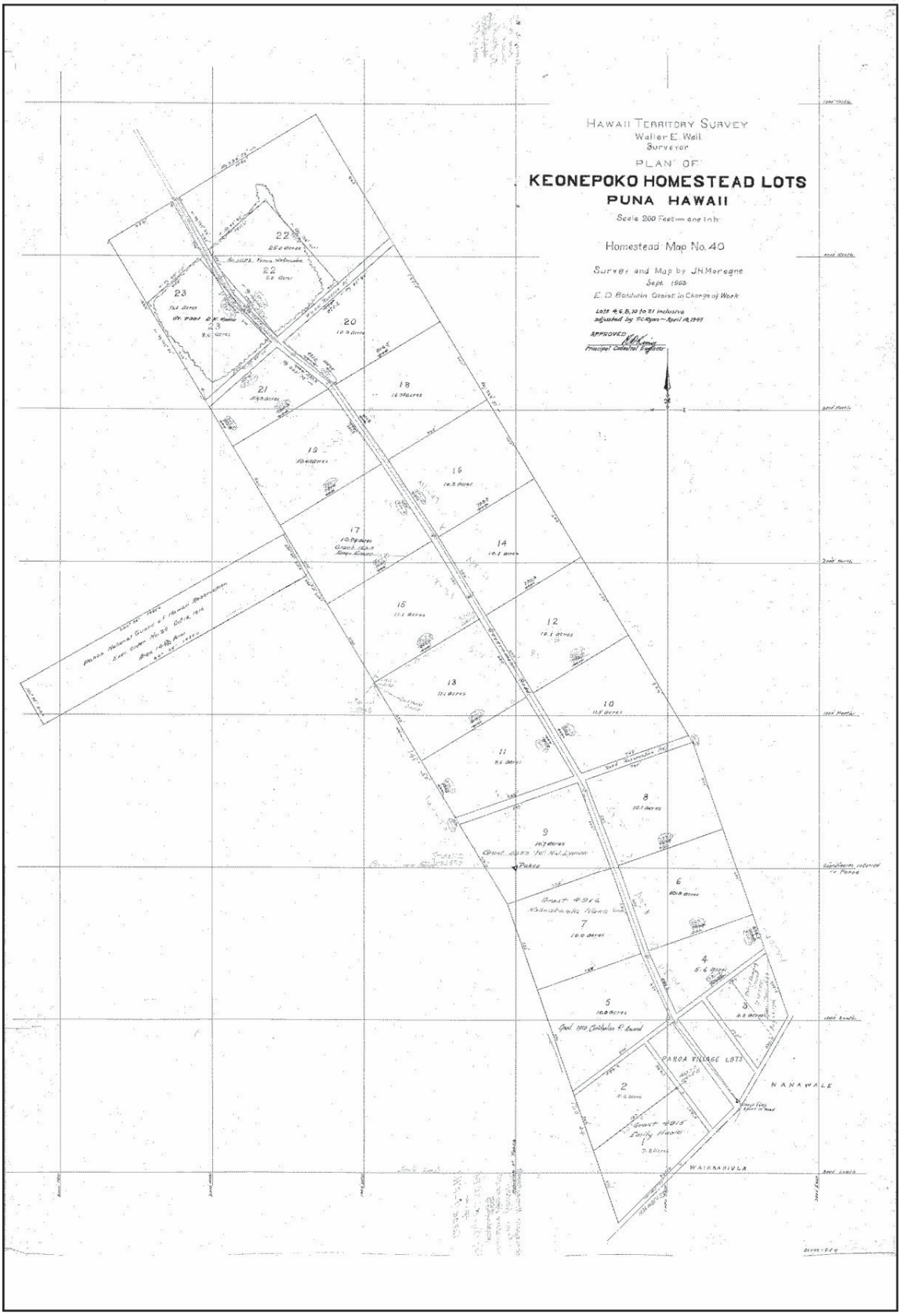


Figure 14. Hawai‘i Registered Map No. 2084 showing the Keonepoko Homestead lots.

In 1907, the Hawaiian Mahogany Lumber Company incorporated and signed a five-year contract with the Atchison, Topeka, and Santa Fe Railroads for the delivery of 90,000,000 board feet of *ʻōhiʻa* railroad ties from the vast forest reserves of Puna (Clark et al. 2001). Subsequently, in 1908, the company erected a lumber mill at Pāhoa. A network of narrow gauge railroad tracks, three feet wide soon connected the lumber mill to the forests above Pāhoa. On March 24, 1909 the Hawaiian Mahogany Company became the Pāhoa Lumber Mill, and James B. Castle, the former managing director of the mill, became the new owner. The company then negotiated a contract with the Santa Fe Railway Company for the delivery of 2,500,000 cross ties and 2,500 sets of switch ties. In addition to railway ties, the Pāhoa Lumber Mill produced products such as roofing shingles, flooring, paving blocks, and lumber for cars, wagons, and carriages.

On the night of January 28, 1913, however, a fire broke out that burned the mill to the ground along with most of the milled lumber stock. Fortunately for Pāhoa residents, the wind blew the flames and smoke to the north away from the village. Despite this disaster, the mill was operating again by October under the name of the Hawaiʻi Hardwood Company, part of the Hawaiian Development Company. The Santa Fe Railroad found, ultimately, that *ʻōhiʻa* wood did not last as long as expected in the dry climate of the American Southwest. They did not renew their contract, and, in 1916, the Hawaiʻi Hardwood Company closed their doors permanently (Burtchard and Moblo 1994).

When the lumber business moved out of Pāhoa ca. 1916, the mill was leased to ʻŌlaʻa Sugar Company. Standard gauge railroad track replaced the old timber railroad grade tracks, and the timber producing forests were converted to sugarcane fields. The company used four mogul type Baldwin locomotives to haul cane from the Puna fields through Pāhoa to their processing plant in Keaʻau. Passenger rail service in the Puna District also started to increase around this time. In 1916, the Hilo Railroad was reorganized as the Hawaiʻi Consolidated Railway. The railroad used Baldwin locomotives and Hall-Scott motorcars with passenger trailers to haul freight and passengers. Then in 1925, the Hawaiʻi Consolidated Railway ordered and received three railbusses from the White Motor Company, which they used in Puna and Hilo districts, making daily stops in the town of Pāhoa. The railbusses became an especially popular form of transportation during World War II when mandatory gas rationing was in effect for all residents (Best 1978).

The *makai* lands of Keonepoko Iki (and neighboring Government Lands) became part of the Shipman Ranch during the early twentieth century. A 1915 Hawaiʻi Territory Survey Plat Map (No. 811) shows that W.H. Shipman, Ltd. held a lease for roughly 7,400 acres of Keonepoko Nui and Keonepoko Iki (General Lease No. 1025) at an annual rate of $300.00 (Figure 15). The lease, which began on July 12, 1918 and expired on July 31, 1928, excluded the 277.8-acre Grant No. 1533 to Kekoa where the current project area is located (Figure 16). W.H. Shipman, Ltd. also held a lease for roughly 14,000 acres of the adjacent *ahupuaʻa* of Makuʻu, Holonā and Pōpōkī (General lease No. 854), which expired on November 25, 1929. On subsequent maps (Figure 17), the general area leased by Shipman is referred to as the Kaʻohe-Makuʻu-Keonepoko Iki Government Tract; no additional lease information for this tract was discovered. Information obtained during the oral-historical consultation conducted as a part of the current study (see below) indicated that by the 1920s, the Midell/Kaʻaiawe family operated the Kekoa grant property as a cattle ranch. Members of that family continue to manage a substantial portion of the Kekoa grant, some of the former grant land were subdivided and sold, as is the case of the current study property.

By 1946 rail travel was becoming less popular, and less profitable, due to improved roads and increased trucking. In March of that year, stockholders of Hawaiʻi Consolidated Railway voted to abandon all railroad operations. This decision was further reinforced on April 1, 1946 when a devastating *tsunami* destroyed Hilo Bay, including all the rail lines, a drawbridge in the bay, and part of the Waiākea freight yards. On November 20, 1946 the company shut down its remaining lines, including all Puna railroad operations, and began auctioning off all its assets. The ʻŌlaʻa railroad line remained in operating condition and continued to be used for hauling sugar until December of 1948. In that year the sugar industry began phasing out its operations in Puna and closed the tracks permanently.

Throughout this period of industrial growth and decline in Puna, the coastal portion of Keonepoko Iki Ahupuaʻa remained largely undeveloped. The 1924 U.S.G.S. Makuʻu quadrangle (Figure 18) shows a single structure located in the coastal portion of Keonepoko Iki, situated inland and west of the current project area (interestingly this map does not show the Government Beach Road along the *mauka* boundary of the subject parcel). Farrell and Dega (2013) indicate that in 1942 the lands in the general vicinity of the current project area were planted in coconuts, which were later harvested and sold as mature trees.

According to Farrell and Dega (2013), the subject parcel was created in 1961 when Grant No. 1533 was subdivided. During the mid-1960s, the lands to the southeast and northwest of the subject property were subdivided into the Hawaiian Beaches, Hawaiian Parks, and Hawaiian Shores subdivisions. In recent years several residences have been constructed along the coast of Keonepoko Iki within the subdivided parcels of the former grant property. Archaeological studies have been conducted at a number of those parcels; the results of these studies are discussed further below.

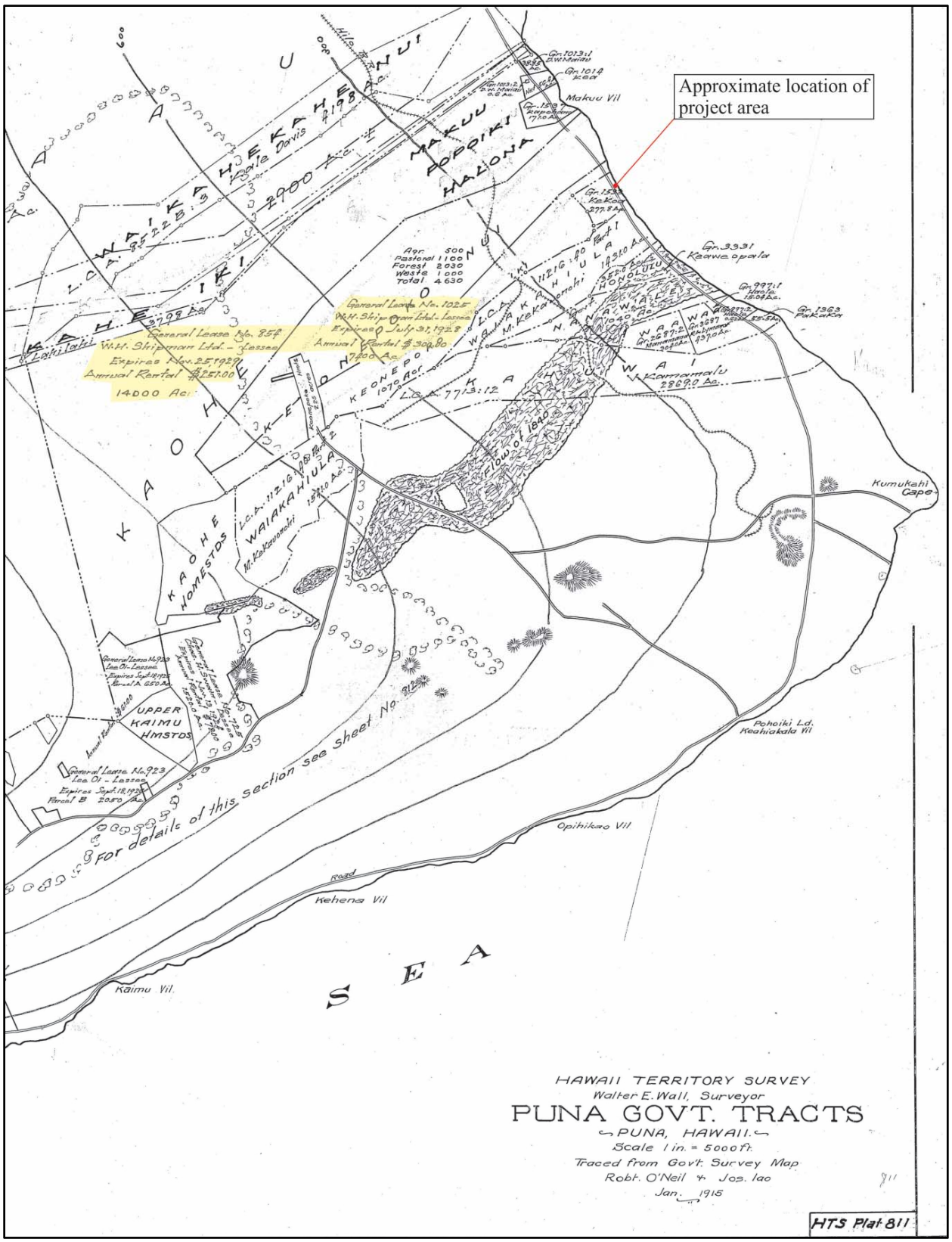
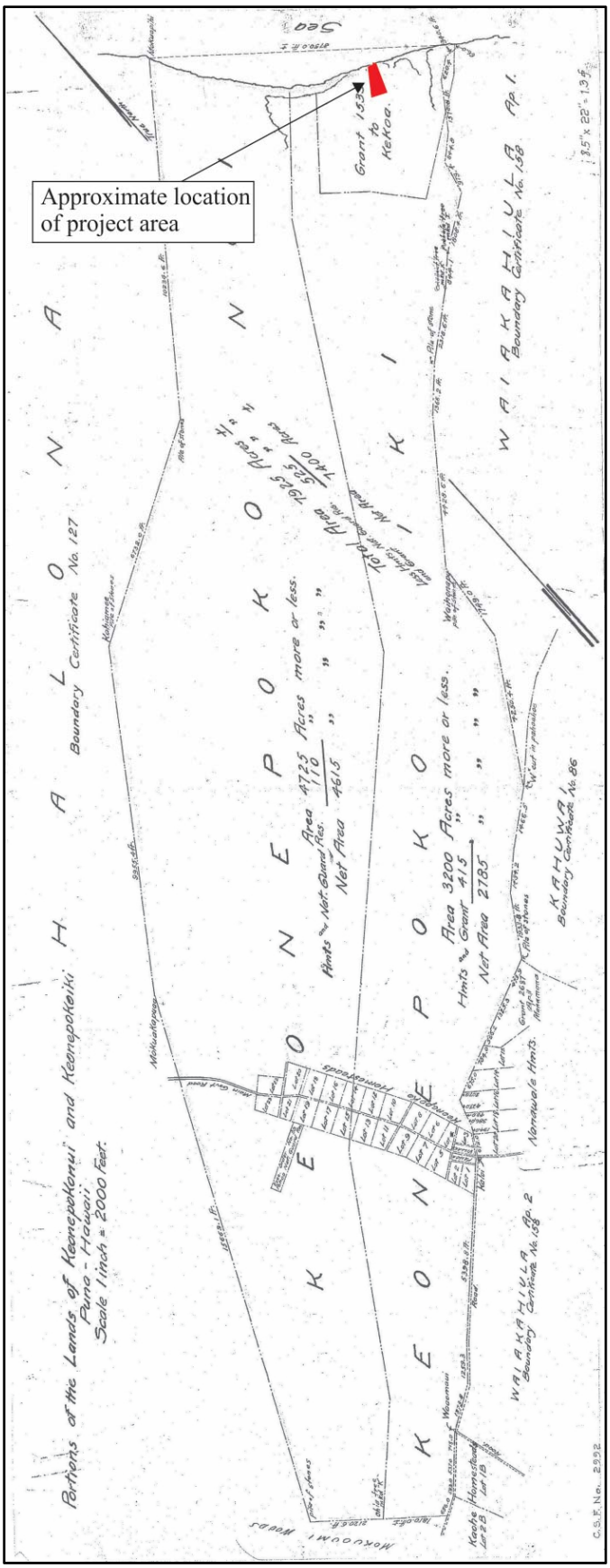


Figure 15. Portion of Hawai‘i Territory Survey Plat Map No. 811 (prepared in 1915) showing the areas leased to W.H. Shipman Ltd (text highlighted in yellow).


Approximate location of project area
Portions of the Lands of Keonepokonui and Keonepokeiki
Puna - Hawaii
Scale 1 inch = 2000 feet
Sea
Grant 1,538 to Kekoa.
Boundary Certificate No. 127
Boundary Certificate No. 138
Boundary Certificate No. 86
Nonuiwale Limits
Homesteads
Kaohe
Lot 28
Lot 18
Lot 17
Lot 16
Lot 15
Lot 14
Lot 13
Lot 12
Lot 11
Lot 10
Lot 9
Lot 8
Lot 7
Lot 6
Lot 5
Lot 4
Lot 3
Lot 2
Lot 1
Area 4725 Acres more or less.
Limits & Net. Grant Res. 110 " " " "
Net Area 4615 " " " "
Area 3200 Acres more or less.
Limits & Grant 415 " " " "
Net Area 2785 " " " "
Total Area 7925 Acres
Less Grant 1538 " "
Net Area 7400 " " " "
Nakuaiopoo
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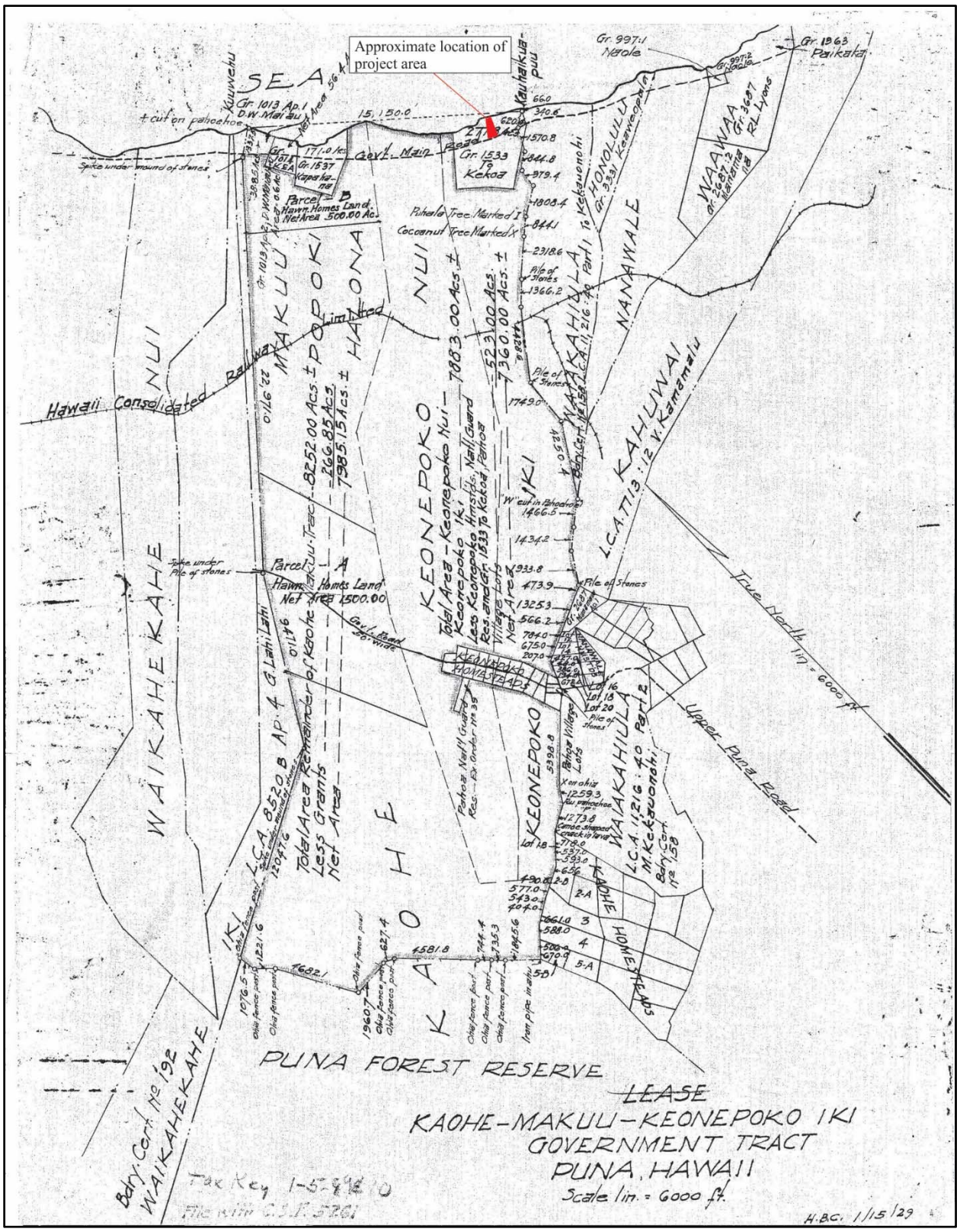

Figure 17. 1929 map (C.S.F. 5261) of the Kaʻohe-Makuʻu-Keonepoko Iki Government Tract.

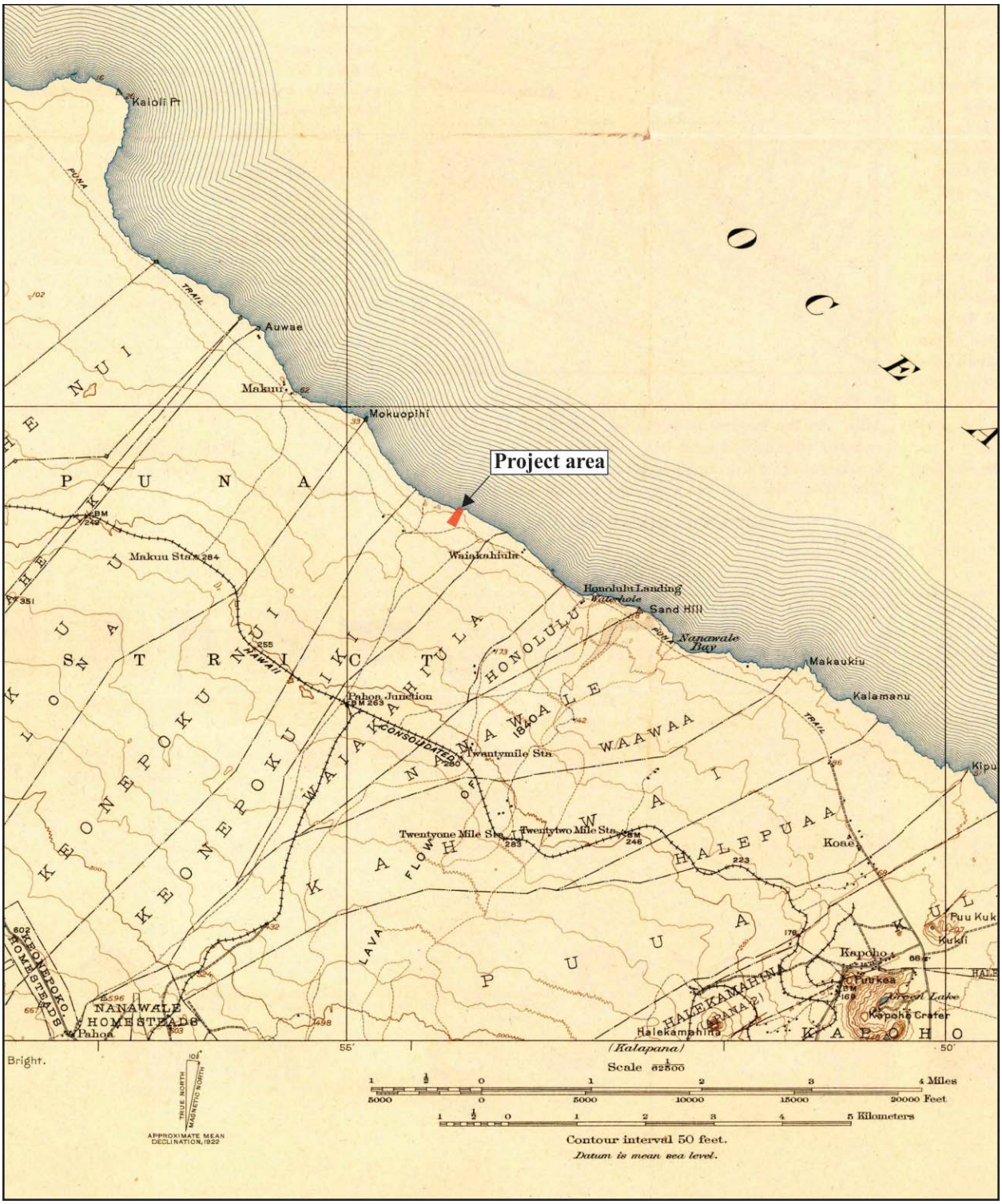

Figure 18. Portion of the 1924 U.S.G.S. Makuʻu quadrangle showing the current project area (shaded red).

PRIOR STUDIES

Since the early 1900s, several archaeological studies (Figure 19) have examined the coastal areas of Puna where Precontact and early Historic populations tended to concentrate. The earliest survey of archaeological resources in the vicinity of the project area was conducted by Hudson (1932) on behalf of the B. P. Bishop Museum. Hudson attempted to inventory the sites of East Hawaiʻi Island from Waipiʻo Valley to the Kaʻū District, and recorded a wide range of archaeological features including *heiau*, burials, caves, habitations, trails, and agricultural features during his survey. The route of the survey took him through the coastal portion of Keonepoko Iki Ahupuaʻa. Hudson noted that it was difficult to obtain information about sites in Puna because most of them were located "along the coast between Keaau and Kapoho where no one now lives, and it is difficult to locate descendants of the former Hawaiian population of the area who might be able to shed light on the nature and function of certain sites" (1932:304). Hudson continues thusly, "back from the sea the land is under cultivation in cane, used for pasture, or covered with dense vegetation which can be penetrated only with difficulty" (1932:304). Hudson did not record any specific features in the immediate vicinity of the subject parcel, although he did note a trail (Site 83) in Keonepoko Nui, to the northwest of the subject parcel, and a canoe shed (Site 84) in Waikahiula, to the southeast of the project area.

Forty-two years later, Ewart and Luscomb (1974) of the B. P. Bishop Museum conducted a six-mile long archaeological reconnaissance survey of a proposed Kapoho-Keaukaha Highway route through the District of Puna from Waiakahiula Ahupuaʻa to Keaʻau Ahupuaʻa. The survey area consisted of a 2,000-foot wide corridor that generally followed the route of the old Government Road (SIHP Site 21273) that passes *mauka* of the current project area (see Figure 19). They recorded sixty sites within the combined Keonepoko Nui and Iki *ahupuaʻa* (designated *Ahupuaʻa* 4 or A4), including mounds, feature complexes, platforms, walls, a trail, *ahu*, c-shapes, stone alignments, faced depressions, pits and ravines, interpreted as having been used for habitation, burial, ceremonial, and agricultural purposes. A single site, a faced depression designated Site A4-21, described as "a partially stone-faced natural depression" (Ewart and Luscomb 1974:34), was identified within the *mauka* portion of the current subject parcel (Figure 20). It was assessed as being in fair condition, but possessing poor archaeological potential. This site, likely utilized for agricultural purposes, was not re-identified during an August 10, 2012, DLNR-SHPD field inspection of the current project area. Given its location, Site A4-21 was likely destroyed during the grubbing and creation of an access road across the subject parcel, sometime between 1974 and 2000.

More recently five coastal parcels within former Grant No. 1533 to Kekoa, to the southeast of the current project area, have been subject to more detailed archaeological surveys (see Figure 19). Farrell and Wells (1994) conducted a preliminary archaeological inventory of two contiguous coastal parcels (TMKs: (3) 1-5-009:038 and 042) situated roughly 150 meters southeast of the current project area. Thirteen features/feature groupings were identified during the survey (designated CRMS-1/2 to CRMS-14). The majority of the features were recorded within Parcel 042, with the exception of a portion of CRMS-5 located in the *makai* portion of Parcel 41 located to the southeast of their study area; and two additional feature groupings, CRMS-3 and CRMS-8, situated on Parcel 037 to the northwest of their study area. All of the features recorded were interpreted as having been used for agricultural purposes during the Historic Period with the exception of a core-filled boundary wall located along the *makai* edge of the Old Government Beach Road. The core-filled wall was later assigned the SIHP site designation 18759, while the agricultural features were grouped as a complex designated SIHP 18758.

In 2003, former DLNR-SHPD Hawaiʻi Island Assistant Archaeologist, Jeanne Knapp, conducted a field inspection of TMK: (3) 1-5-009:040 located roughly 200 meters to the southeast of the current project area (see Figure 19). She noted "several wall remnants, possibly historic in age…in the interior of the property but not within the proposed development area" (Knapp 2003 Letter Report). Knapp did not provide location data or detailed descriptions of these features. The landowner agreed to avoid any impacts to areas within the subject parcel containing the walls. As a result, DLNR-SHPD found that no historic properties would be affected by the development of a single-family residence on the property.

Rechtman (2005) conducted a field inspection of TMK: (3) 1-5-009:056, situated adjacent and to the southeast of the current project area (see Figure 19). The property had undergone significant mechanical alteration in the past, and no archaeological resources were discovered. Surface features were observed on a neighboring undeveloped parcel (TMK: (3) 1-5-009:057). Rechtman (2005) also noted that no walls were present along the *makai* edge of the Old Government Beach Road (SIHP Site 21273) where it bordered the parcel. Rather, they had been bulldozed, which resulted in a collection of rubble at the southeast of the study parcel. Given the negative findings, Rechtman (2005) requested that DLNR-SHPD issue a written determination of no historic properties affected.

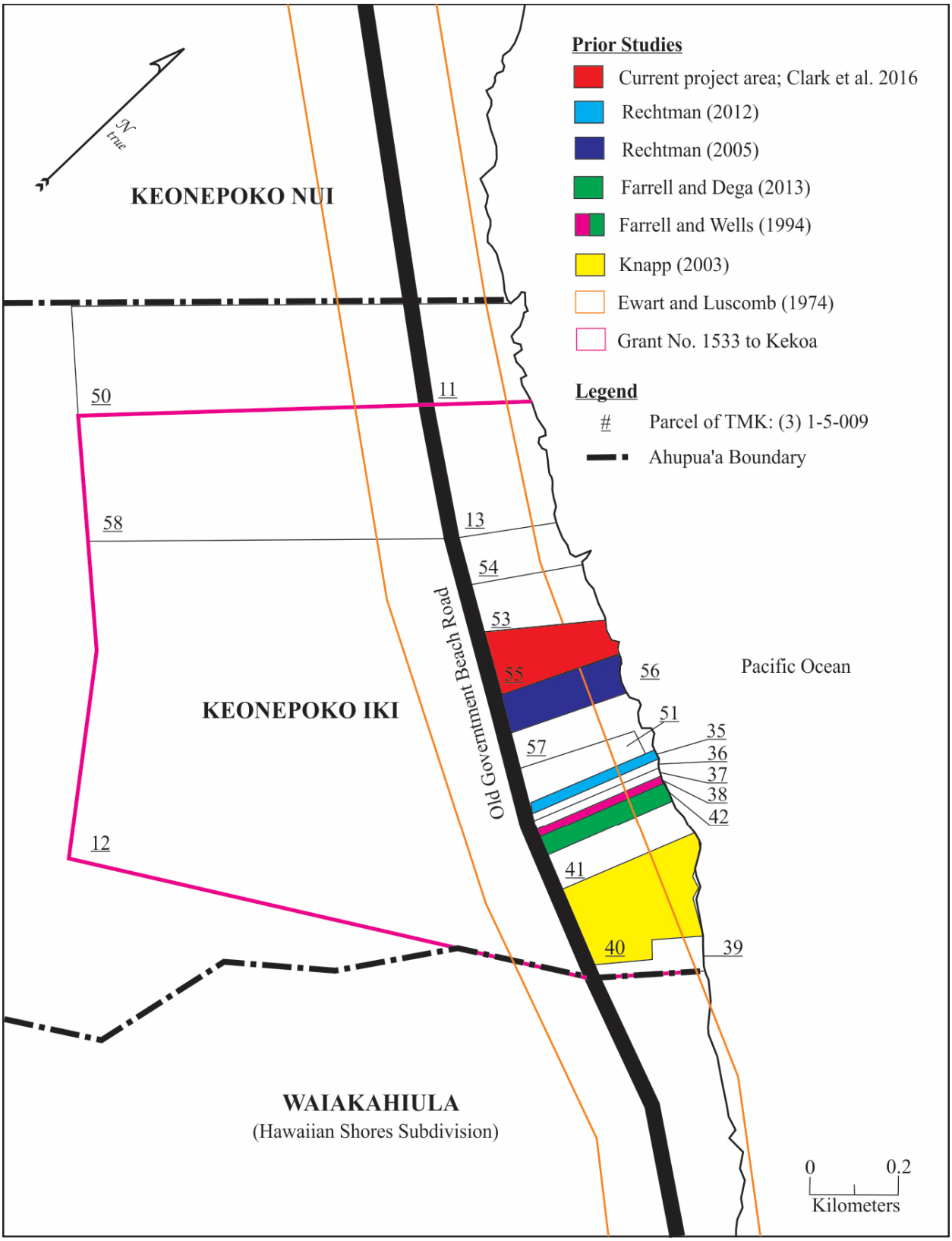

Figure 19. Previous archeological studies conducted in the vicinity of the current project area.

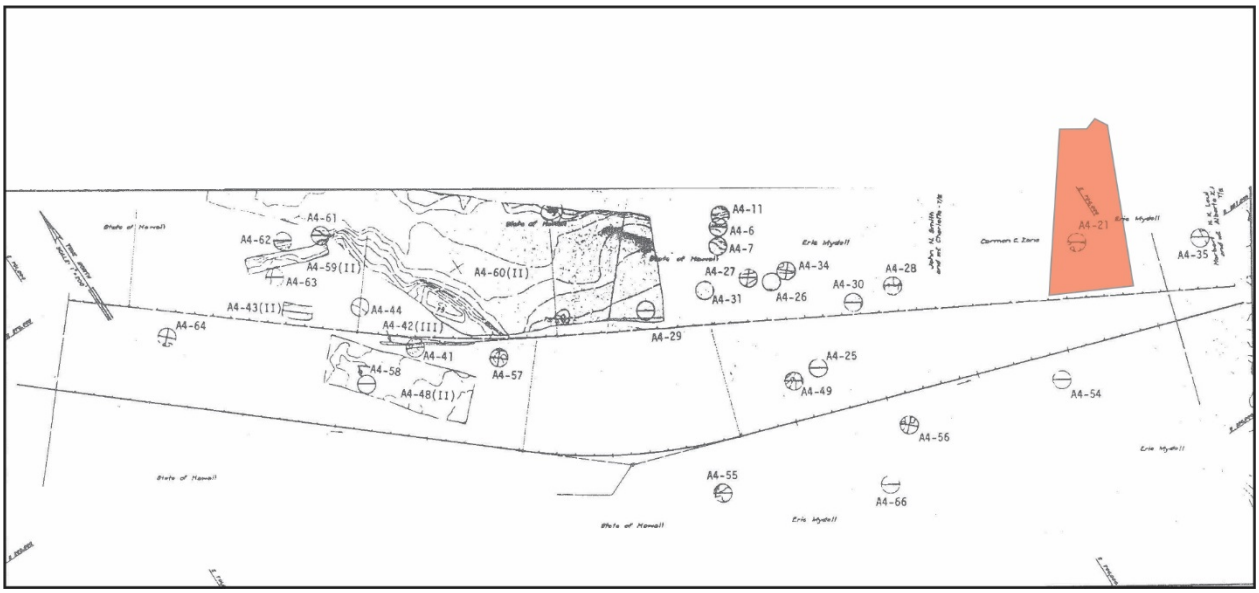

Figure 20. Site locations within Increment H of the Ewart and Luscomb (1974:7) survey area showing the location of the subject parcel (shaded red).

On August 10, 2012, DLNR-SHPD staff, in response to a special management use permit application for a proposed coconut farm, conducted a field inspection of the subject parcel. They did not identify any historic resources in the previously grubbed and graded, *mauka* portion of the current project area, but did note the presence of a Historic wall feature near the coast, *makai* of the bulldozed coastal road. In order to protect this Historic feature, which was outside of the then proposed development area, without having to undertake any additional archaeology, Theresa Donham, former DLNR-SHPD branch chief, recommended that a construction barrier be erected along the *makai* edge of the coastal road prior to any development activities, and that no development associated activities be conducted *makai* of the construction barrier.

Rechtman (2012) conducted a field inspection of TMK: (3) 1-5-009:035 situated roughly 100 meters southeast of the current project area (see Figure 19). The majority of that parcel had also been mechanically cleared previously and built upon, and as a result no archaeological resources were observed. Rechtman (2012) did note, however, that surface features were observed on an undeveloped parcel (TMK: (3) 1-5-009:051) located to the northwest and adjacent to his study area. Rechtman (2012) also reported that the rock wall typically present along the *makai* edge of the Old Government Beach Road (SIHP Site 21273) had been bulldozed, although Rechtman (2012) did note that a rock wall along the *makai* side of SIHP Site 21273 was still standing along parcels to the southeast and northwest of his study parcel. Given the negative findings, Rechtman (2012) requested that DLNR-SHPD issue a written determination of no historic properties affected.

Farrell and Dega (2013) updated the Farrell and Wells (1994) study for TMK: (3) 1-5-009:042, situated roughly 150 meters southeast of the current project area (see Figure 19). At the time that the 1994 study was conducted, the landowner did not have any formal development plans for the property, and the report was never submitted to DLNR-SHPD until 2012. Upon receipt of the 1994 report, DLNR-SHPD requested several revisions to meet the standards currently in place for Archaeological Inventory Survey reports. Farrell and Dega (2013) conducted some additional fieldwork (but did not identify any additional sites or features) and updated the earlier report to meet current standards, reporting only the findings specific to Parcel 042. As described above, Parcel 042 contained only two archaeological sites, a core-filled wall (SIHP Site 18759) along the *makai* edge of the Old Government Beach Road, and a complex of ten Historic Period agricultural features (SIHP Site 18758) that may have been initially created during the Precontact Period. Features identified at SIHP Site 18758 include walls, irregular rock mounds, modified depressions, rock rings that appeared to be planting circles, and a single faced terrace. The features of the agricultural complex extend onto neighboring parcels to the northwest and southeast. The findings from the Farrell and Dega (2013) study suggest that opportunistic agriculture may have been common in mulched depressions along the coast of Keonepoko Iki during the late Precontact and Early Historic Periods. Knapp (2003) noted the presence of similar agricultural features on a nearby parcel as well.

As previously mentioned, in 2016 ASM Affiliates conducted an AIS of the subject parcel (Clark et al. 2016) because of a proposed change of land use for the parcel, and the presence of the Historic wall originally noted by DLNR-SHPD staff during the aforementioned 2010 field inspection. As a result of the surface survey the wall was formally recorded and designated SIHP Site 30571. The Historic wall feature is oriented northeast/southwest, which protects the area in its lee (along the *mauka* edge of the wall) from the prevailing trade winds. It is located on the *makai* portion of the project area roughly 40 meters south of the sea cliff (Figure 21) in a relatively open area of ironwood and coconut trees overlooking the ocean (Figure 22). A modern rock fire ring that has been recently used is located adjacent to the northern face of the wall (Figure 23).

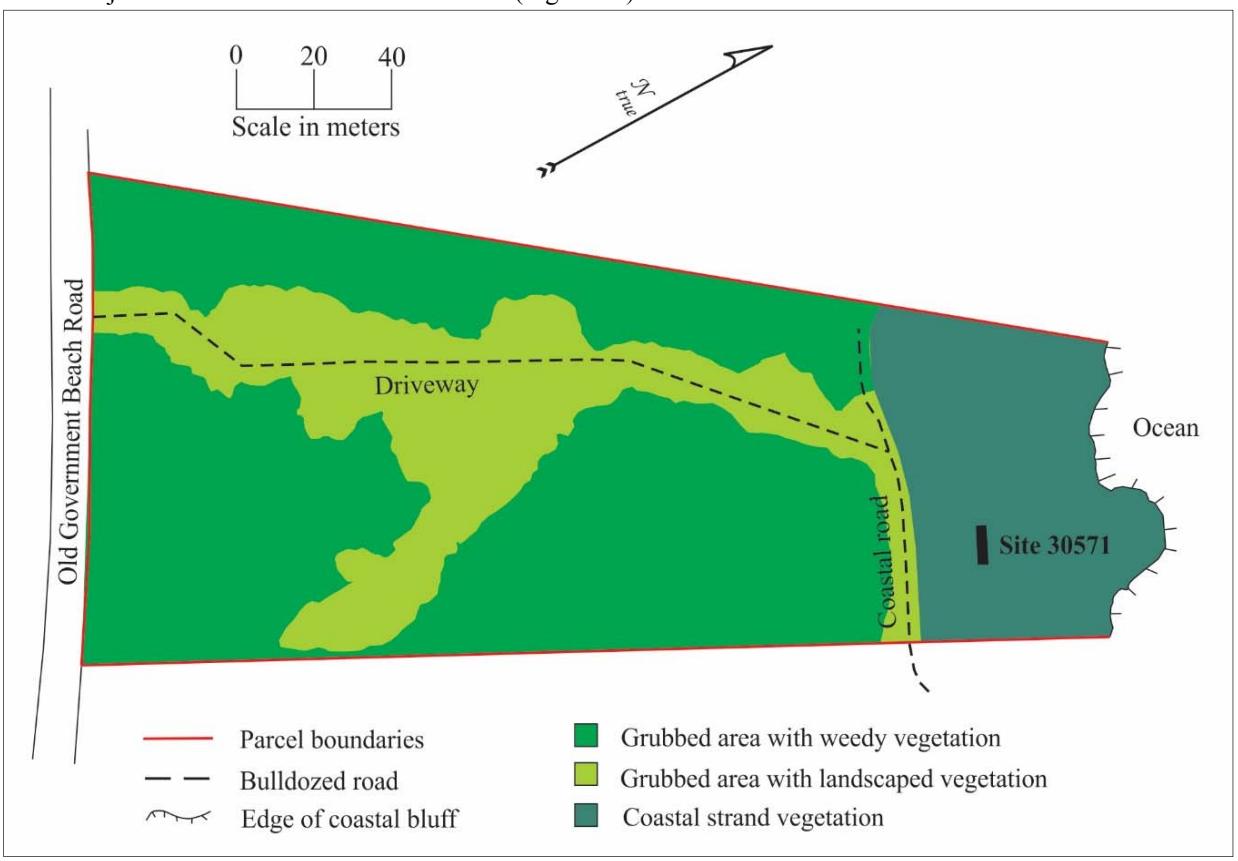

Figure 21. Site location map (Clark et al. 2016:35).

According to Clark et al. (2016), the area was commonly used as a dumping ground for vehicles, appliances, and other modern trash, which has been removed from the property in recent years. SIHP Site 30571 has an unusual two-tiered construction with the narrower upper tier (2 meters wide) built on top of a wider bottom tier (3 meters wide). The only surface artifact encountered consists of a machine made, ½ gallon, clear glass jug, which was manufactured in 1948. Subsurface testing revealed the following limited cultural material: a single piece of *ʻopihi* (*Cellana* sp.) (0.19 grams), a small unidentifiable fragment of marine shell (0.54 grams), and a single fragment of *kukui* (*Aleurites moluccanus)* nut shell (0.71 grams); and reached the underlying *pāhoehoe* bedrock ground surface at a depth of approximately 40 centimeters. Rock material removed from Layer I consisted primarily of small to medium *pāhoehoe* and *ʻaʻā* cobbles, with a few waterworn cobbles. It was noted that during excavation that very little soil was present within or beneath Layer I, which suggests that the wall was constructed on the exposed bedrock surface prior to the growth of the ironwood trees on the property. Clark et al. (2016) evaluated SIHP Site 30571 as significant under Criterion d for the information it has yielded relative to the mid-twentieth century use of the project area for short-term habitation (recurrent camping) purposes and the associated exploitation of marine resources. Based on the feature's orientation, they concluded that SIHP Site 30571 was likely used as a windbreak designed to shelter the area in its lee from the prevailing trade winds and may have served as a support for a lean-to structure. The associated debris and limited cultural material indicate that this site may have been constructed/occupied as recently as the late 1940s-50s, and that its occupants collected *ʻopihi* (and likely other nearshore resources) from the adjacent coastline. (Clark et al 2016). No further historic preservation work was the recommended treatment for SIHP Site 30571.

Figure 22. SIHP Site 30571, two-tiered wall, view to the northwest (Clark et al 2016:37).

Figure 23. SIHP Site 30571, north edge with recent fire hearth, view to the south (Clark et al 2016:37).

In addition to the prior archaeological investigations discussed above, a few cultural impact studies have been conducted for coastal parcels between Makuʻu and Pohoiki (Ketner and Rechtman 2011; Maly 1998; Rechtman 2011; Rechtman and Bautista 2010) that collectively highlight the "cultural attachment" felt by native families of the area, who still maintain a close relationship with the environment. It is that relationship that provides individuals with a sense of place. Specific issues raised in the prior studies concern the protection of flora including the shoreline groves of *hala*, the continued access to the coast for both recreational and subsistence activities, and the preservation and protection of burial sites and other archaeological resources.

As part of a cultural impact assessment (Rechtman 2013) prepared for development on TMK: (3) 1-5-009:035, located to the southeast of the current project area, Rechtman consulted Mark Lindsey Franklin., a 40-year resident of Puna. Mr. Franklin is of Hawaiian descent, and his family roots also extend to Maui, where his *ʻohana* are cultural practitioners involved in the preservation of traditional lands. According to Rechtman (2013), Mr. Franklin is well-versed in native flora and was working on a project to identify and protect remnant stands of *ʻiliahi* (sandalwood) on Mauna Kea. When Mr. Franklin met with Rechtman at that study parcel, he related that he had fished in this area accessing the coastline along an old road located to the northwest of the study property. Rechtman continues,

> After walking the entire property, he suggested that given the past disturbances to the property and the widespread growth of invasive species that the proposed development would be a welcome addition as long as the invasive vegetation can be controlled and replaced with a landscape of native species. (2013:21)

4. CONSULTATION

When assessing potential cultural impacts to resources, practices, and beliefs; input gathered from community members with genealogical ties and/or long-standing residency relationships to the project area is vital. It is precisely these individuals who ascribe meaning and value to traditional resources and practices. Community members may also possess traditional knowledge and beliefs that are unavailable elsewhere in the historical or cultural record of a place. As stated in the OEQC Guidelines for Assessing Cultural Impacts, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present author's further contention that the oral interviews should also be used to augment the process of assessing the significance of any traditional cultural properties that may be identified. It is the researcher's responsibility, therefore, to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary. The following notice was published in the Office of Hawaiian Affairs (OHA) newspaper *Ka Wai Ola* (Vol. 33, No. 11 page 27), and a complete copy of the current study was shared with OHA.

> ASM Affiliates is preparing a Cultural Impact Assessment (CIA) to accompany a Conservation District Use Permit (CDUP) to build a single-family residence and farm on a 6.79-acre property (TMK: (3) 1-5-009:055) located *makai* of the Government Beach Road in Keonepoko Iki Ahupuaʻa, northwest of the Hawaiian Shores and Hawaiian Beaches subdivisions, in the Lower Puna area of the Island of Hawaiʻi. We are seeking consultation with any community members that might have knowledge of traditional cultural uses of this coastal area; or who are involved in any ongoing cultural practices that may be occurring on the subject property, or in the general vicinity of the subject property, which may be impacted by the proposed development of the subject property. If you have and can share any such information please contact Bob Rechtman brechtman@asmaffiliates.com, or Lauren Tam Sing ltamsing@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikāula Street, Hilo, HI 96720.

As part of the current investigation the primary author met with Wayland Lum, the current manager of the remaining lands that were formerly a part of the Kekoa grant. The Kekoa grant property in its entirety (of which the current study parcel is a part) has been in Wayland Lum's family since at least the 1920s, when his maternal grandfather (Erik Mydell [Mejdell], of mixed Norwegian/Hawaiian ancestry) and grandmother (Mary Kiawe [Kaiewe] Mydell, of Hawaiian ancestry) either purchased or inherited the property. According to Wayland the property was used for cattle ranching, and as part of that activity, the observed coastal road was created by his grandfather. Wayland was born in 1954 and his personal experiences on the property continue to this day. He was not familiar with the rock construction (Site 30571), and he related that when his was growing up the property was very remote to the then Puna population. He was not aware of anybody using their land or the immediate shoreline area for cultural practices. When asked what he thought about the proposed development of the study parcel, Wayland related that he had no concerns as long as the proposed development was "tasteful" and "fit the environment."

5. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are nature features of the landscape and historic sites, including traditional cultural properties. In the Hawai‘i Revised Statutes–Chapter 6E the following definition is provided.

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. "Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place.

However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties. As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

a Be associated with events that have made an important contribution to the broad patterns of our history;

b Be associated with the lives of persons important in our past;

c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

d Have yielded, or is likely to yield, information important for research on prehistory or history;

e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion D at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion E. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Pa‘akai O Ka‘āina* v. Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify

whether any valued cultural, historical, or natural resources are present; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigation actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

As a result of the archaeological inventory survey (Clark et al. 2016) conducted within the project area, a single archaeological site was identified (see Figure 21). This site (SIHP Site 30571) was interpreted to have functioned as a windbreak structure built and used during the middle twentieth century, and was evaluated as significant under Criteria d with a treatment of no further work required. This site is not considered a traditional cultural property nor does it appear to have been the location of any traditional cultural practices.

While the consultation with Wayland Lum produced no evidence that the current project area was used for traditional cultural activities during his (beginning in the 1950s), and likely his family's tenure (beginning for sure in the 1920s) on the property, it is recognized that shoreline areas of Puna can be regularly accessed for recreation and fishing in both traditional and non-traditional contexts. With respect to the current project area, the proposed residence will be set back a minimum of 100 feet from the shoreline and the development and use of the property will in no way inhibit any existing or future traditional use of the shoreline area fronting the study parcel.

Given the negative findings of the current study with respect to the identification of any traditional cultural practices and properties; or any specific valued cultural, historical, or natural resources, it is concluded that the proposed development of TMK: (3) 1-5-009:055 will not have a significant cultural impact.

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Environmental Assessment

Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko

APPENDIX 4
Farm Management Plan

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Dearing Single Family Residence and Farm Conservation District Use Permit Application

FARM MANAGEMENT PLAN

Prepared for: Garrett B. Dearing
Prepared by: J M Leonard Planning, LLC

November 2016

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Dearing Single Family Residence and Farm
Conservation District Use Permit Application

FARM MANAGEMENT PLAN

I. INTRODUCTION

A. Project Location and Setting

The planned farm is located on a 6.79-acre property in the State Conservation District, Resource Subzone, in Lands of Keonepoko Iki, Puna, Hawaii. The subject property is located makai of the Government Beach Road, approximately ½ mile northwest of the Hawaiian Beaches Subdivision in the District of Puna, Island of Hawaii, and is described as TMK parcel: (3) 1-5-009:055. The **Island and Regional Location, and TMK Maps** showing the location of the property are included in **Figures 1 and 2**.

Elevations over this relatively level site range from 24 feet above mean sea level (AMS) on the makai boundary, to approximately 46 feet AMS at the mauka boundary with the Government Beach Road. The soil conditions consist primarily of a well-drained, cobbly soil formed from organic material and overlaying a base of ʻaʻa and pāhoehoe lava parent material. No water features such as streams, springs, or anchialine ponds are found on or near the property.

A distinct 20 to 25-foot rocky cliff face near the makai property boundary defines the vegetated shoreline, which is approximately 30-feet inland of the ocean at its closest point and in front of which is a sloping field of angular and rounded boulders that is about 30 to 50 feet wide in the area fronting the property. On top of this bank is found a naupaka strand and clusters of ironwood. Occasional ironwood, coconut palms and clusters of hala are found further inland, especially in the northeastern corner of the property that had not been previously disturbed.

The property had been nearly completely bulldozed in the middle of the last century in association with prior farming activities. Since that time, the area has re-grown with primarily non-native vegetation, except for the occasional hala

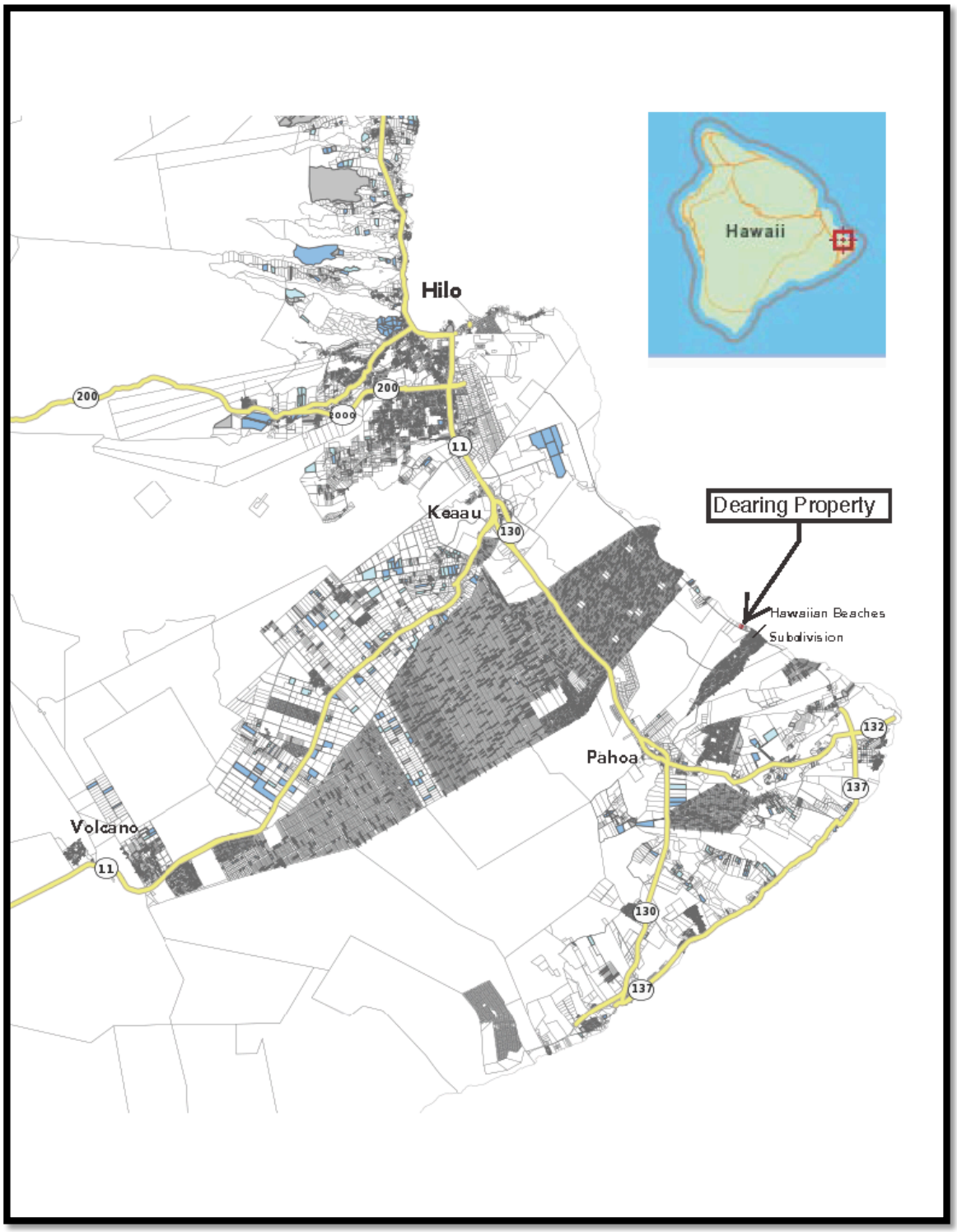


Figure 1
Project Island and Regional Location Map
Dearing Farm Management Plan

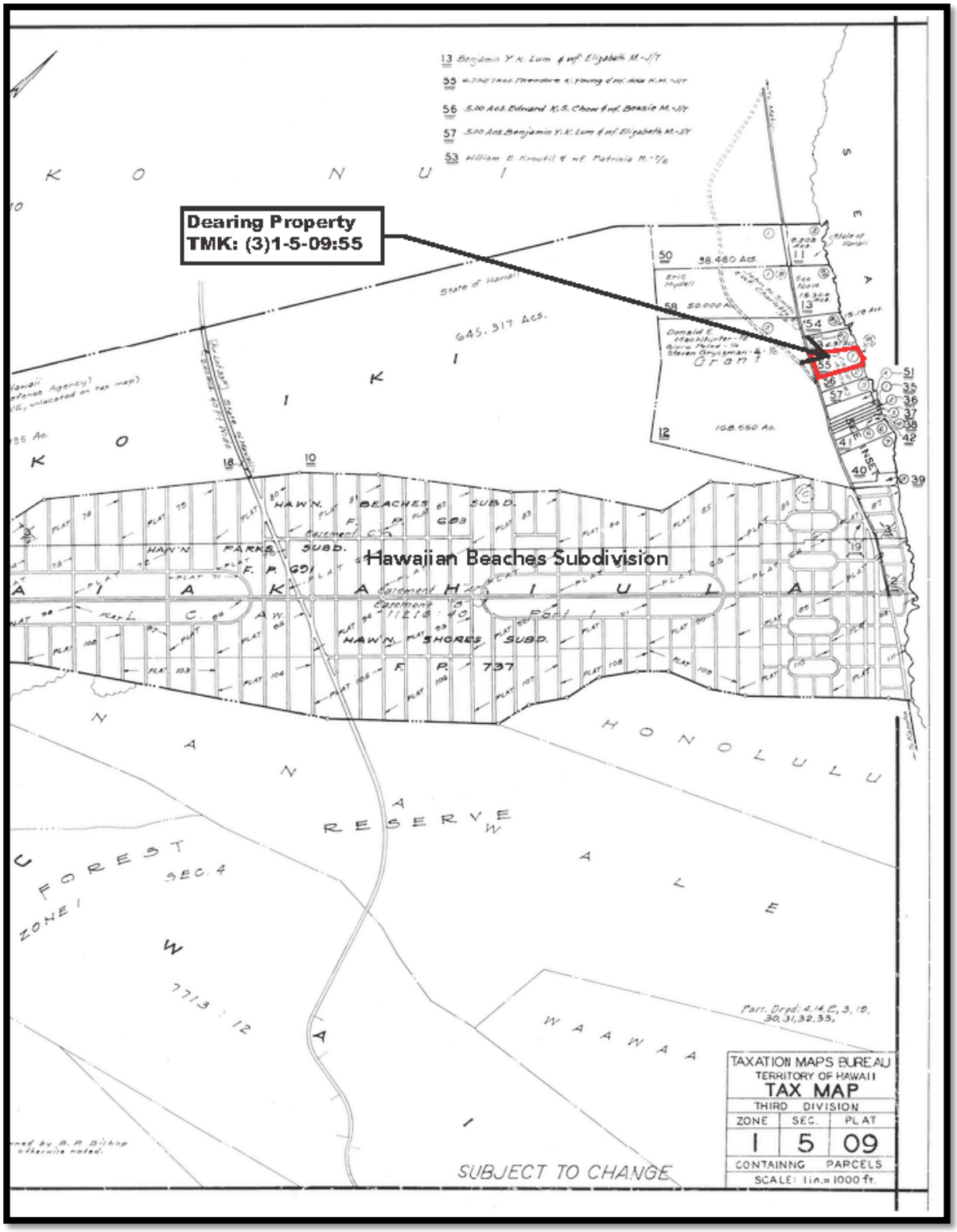


Figure 2

TMK Map (Parcel (3) 1-5-009: 0

that re-sprouted after the bull-dozing, The vegetation of much of the property, especially in the previously disturbed areas which are planned for farming, is currently dominated by weedy trees and vines including bingabing, strawberry guava, umbrella, autograph, gunpowder, albizia, maile pilau, pathos and philodendron vines.

B. Dearing Farm - General Goals and Objectives

The Dearing family is planning to establish a family farm (Farm) intended for the family's use, consisting primarily of tropical fruit tree plantings, including mango, citrus, banana, avocado, durian, lychee, and coconut. The farm is planned to encompass approximately 5-acres, in the previously disturbed, *mauka* portion of the property. The overall site and farm layout has been planned with the goal of protecting the natural resources of the site and minimizing the potential impacts to environment and surrounding area. In meeting this goal, planned improvements to the property and Farm operation and management have been planned according to the followings overall objectives:

- Siting improvements in previously disturbed areas and in relation to the existing topography so as to to minimize the amount of grading required.

- Maintaining a protective buffer area along the coast that will be left in its natural state and undisturbed for the protection of the native species and to minimize potential impacts to the coastal area.

- Providing drainage related improvements in concert with a Farm Drainage Plan to prevent any runoff from the site, especially towards the oceans.

- Implementing a program for Best Management Practices as described in this Farm Management Plan (Plan), which are collectively aimed at maximizing crop production while minimizing potential environmental or health related impacts that could result from the Farm related activities.

- Implementing a program for the systematic removal of invasive species that cover much of the property and monitoring for the control of invasive species that would otherwise dominate the landscape.

II. DESCRIPTION OF PROPOSED AGRICULTURAL ACTIVITIES AND SUPPORTING FACILITIES

The planned Farm related improvements consisting of a mix of tropical fruit-tree plantings, a barn of approximately 768-square feet, primary and back-up well sites, and drainage and irrigation related improvements, all of which would be located on about 5-acres of the property in the interior portion of the property and a minimum of 200-feet from the shoreline.

The farm related improvements, as shown in the **Preliminary Site Plan** in **Figure 3**, will be located *mauka* of the planned residence and set back from the adjoining properties, including a 40-foot setback from the Government Beach Road. The drainage and irrigation reservoir is planned in relation to a preliminary drainage plan that was prepared for the Farm and is located in area *makai* of the cultivated areas where there is a existing berm and natural depression, which would be expanded and enhanced to effectively serve as both a retention area for potential site runoff and as a irrigation reservoir for the Farm use. Primary and backup well sites to serve the property will be located in the *mauka* portion of the property and irrigation lines consisting of primarily 2" PVC piping will extend through the cultivated areas. Irrigation of the cultivated areas will be handled primarily by means of sprinklers and supplemental watering. The barn structure will serve to house the tractor, farm tools, and chemicals and to provide an "in-field" work area and bathroom. The **Barn Plan and Elevation Drawings** are shown in **Figure 4**.

In the cultivated area, the existing trees; especially the invasive albezia, octopus, gunpowder and strawberry guava, will be removed by hand and disposed of onsite by chipping or burning. The weedy vines, including the maile pilau, pathos, and philidendron will be similarly be removed by hand and disposed of on site. The fruit trees would be planted in holes with minimal disturbance to the ground. The existing ground cover would remain, except of the area of the planned drainage basin and irrigation pond, and would be maintained by mowing or weed-wacking. All vegetative cuttings will be composted onsite, which would then be used as mulch around the tree plantings.

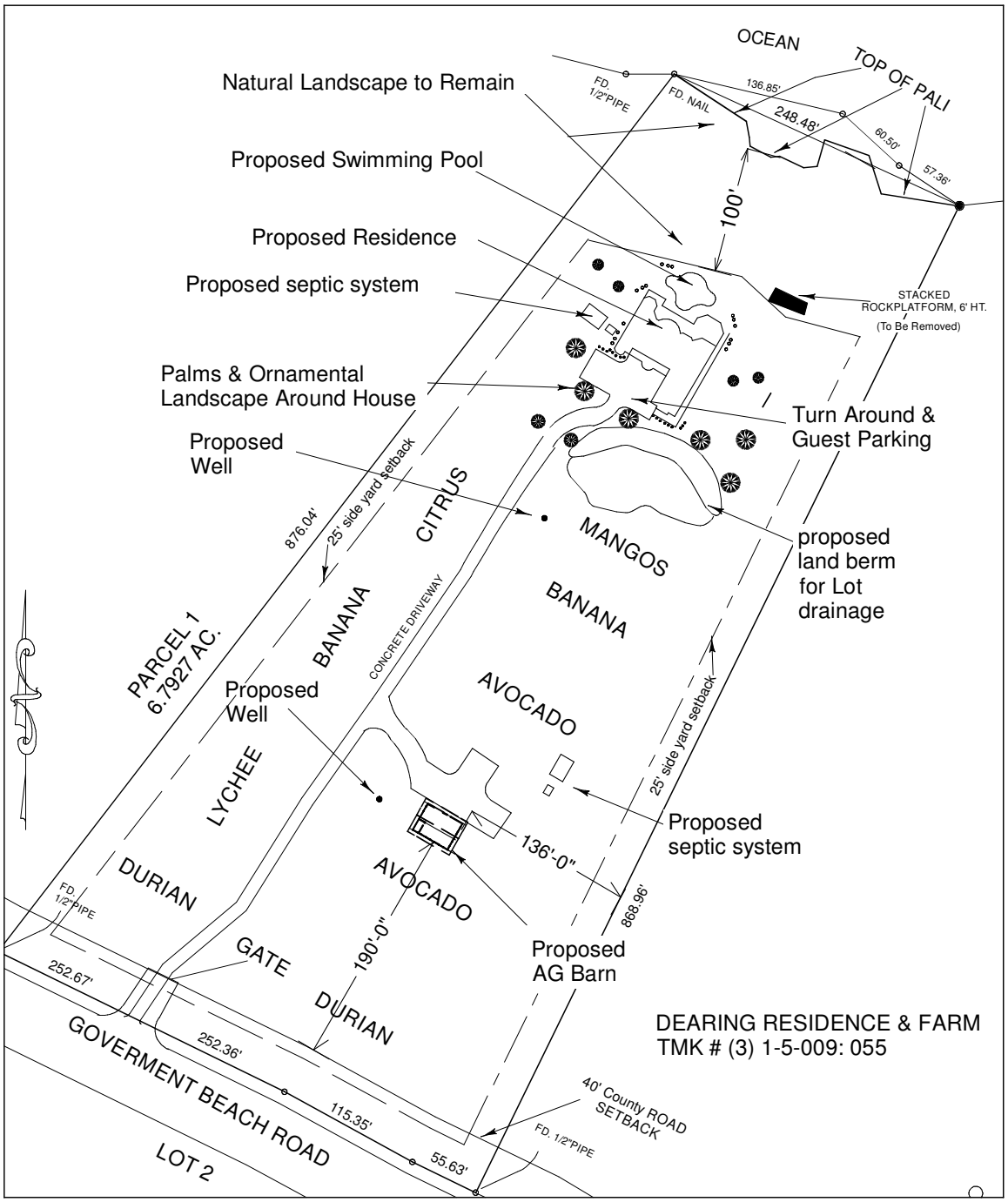
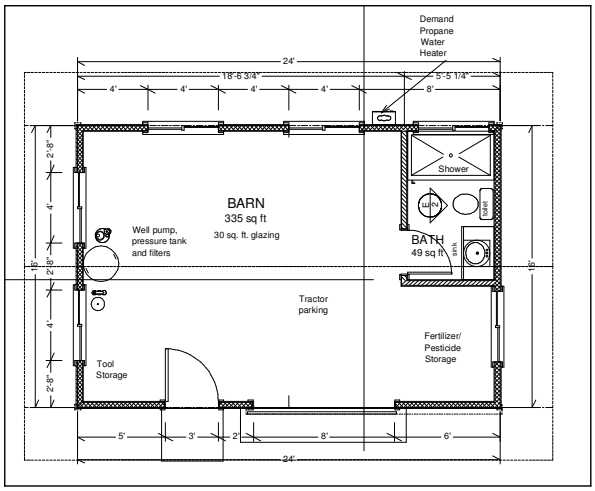
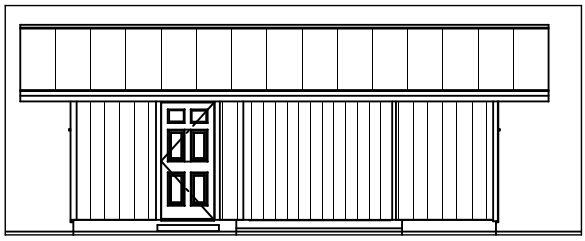


Figure 3
Preliminary Site Plan FARM MANAGEMENT PLAN
Dearing Single Family Residence and Farm

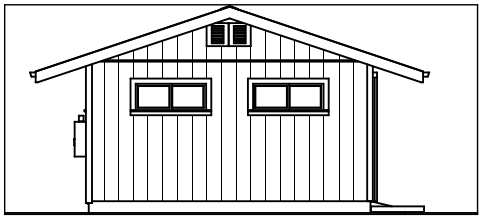
DEARING BARN
TMK # (3) 1-5-009: 055
scale: 1/8" = 1'- 0"



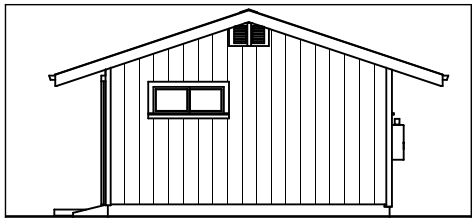
FLOOR PLAN



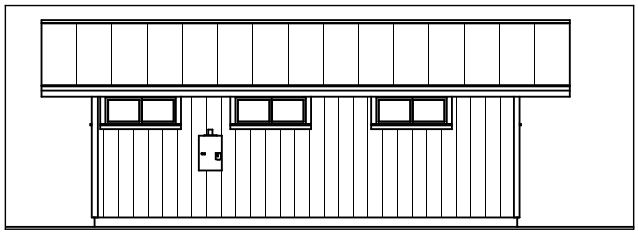
NORTH EAST ELEVATION



SOUTH EAST ELEVATION



NORTH WEST ELEVATION



SOUTH WEST ELEVATION

Figure 4
Dearing Barn – Floor Plan/Elevations FARM MANAGEMENT PLAN
Dearing Residence and Farm

III. ASSESSMENT OF AFFECTED NATURAL ENVIRONMENT AND RESOURCES

A. Existing Site Conditions

1. Existing Land Use on the Property

The approximately 6.79-acre property is located between the Government Beach Road, and the shoreline at its northeastern boundary. The coastline fronting the property, as is typical of much of the southeastern Puna coastline, is characterized by rocky cliffs bounded by steep submarine slopes, with no beaches or shallow offshore areas. A distinct rocky cliff face that is between 20 to 25 feet in height near the *makai* property boundary defines the vegetated shoreline, which is approximately 30 feet inland of the ocean at its closest point. The property had been nearly completely bulldozed in the middle of the last century in association with farming activities. Since that time, the majority of the property, with the exception of the previously undisturbed coastal strip, has re-grown with primarily non-native vegetation that and invasive species that typically dominate disturbed areas of Puna. Currently the property is largely vacant and unused, although there has been ongoing maintenance to the driveway with the period additional of gravel and grassing along the shoulders, replacement of the gate and ornamental landscaping at the property entry, hand removal of invasive trees and weedy vines (primarily gunpowder, octopus, autograph, albizia trees and the maile pilau and pothos vines that dominate the landscape), which have been replaced with the occasional fruit tree plantings, including, banana, avocado, papaya, and citrus.

2. Geology and Soils

Elevations over this relatively level site range from 20-feet above mean sea level (AMS) near the *makai* boundary, to approximately 66-feet AMS at the *mauka* boundary with the Government Beach Road. There are no water features such as streams, drainage ways, springs, or anchialine ponds are found on or near the property.

The lava flows of this area are all derived from eruptive vents on Kilauea volcano's East Rift Zone, located as close as four miles east of the project site. The specific lava flow that underlies the project site erupted between 200 and 750 years by Moore and Trusdell (1991). Soil in the area is classified with the Malama series, which are characterized as deep, well drained soils consisting of organic material over fragmental 'a'a lava substrata at a shallow depth. The specific soil is Malama extremely cobbly highly decomposed plant material. It

has a soil subclass of VIIs, which means it has limitations that make it generally unsuitable for cultivation and restrict its use to pasture, range, woodland or wildlife. (U.S. Soil Conservation Service 1973).

3. Coastal Conditions and Resources

Typical of much of the southeastern Puna coastline, the coastal stretch fronting the property is characterized by steep rocky cliffs bounded by steep submarine slopes, and no beaches or shallow offshore areas are present. The coastal waters fronting the property are pristine and classified as Class AA waters by the Hawaii Department of Health (DOH). The coastal and marine fauna and flora are typical of the high-energy coasts of Puna, which are young ecosystems with limited coral growth but a variety of algae, fish and invertebrates. Marine life along the shoreline, principally crabs, mollusks (*opihi*) and seaweed, cling to the boulders and cliffs along the shore. Marine mammals and reptiles, some of them endangered, also visit the Puna coastal waters.

4. Flora and Fauna

A survey of the flora and fauna found on the site was conducted in June 2016 by biologist, Ron Terry, PhD. As noted in the flora survey, the vegetation found over the majority and previously disturbed portion of the property where the farming activities would take place, includes Chinese banyan (*Ficus microcarpa*), strawberry guava (*Psidium cattleianum*), umbrella (*Schefflera actinophylla*), autograph (*Clusia rosea),* gunpowder (*Trema orientalis*), albizia (*Falcataria moluccana*), bingabing (*Macaranga mappa*), maile pilau (*Paederia foetida*), pathos (*Epipremnum aureum*), Laua'e fern (*Phymatosorus grossus*) and philodendron vines (*Philodendron sp*). Within the previously undisturbed coastal strip, the shoreline vegetation is dominated by hala, naupaka and especially the invasive tree ironwood (*Casuarina equisetifolia*), with several short, shrubby native hapu‘u (*Cibotium glaucum*) and ama‘u (*Sadleria cyatheoides*) tree ferns found intermingled in the naupaka. Two clusters of Hilo Ischaemum grass (*Ischaemum byrone*), a State and federally listed endangered grass, which is known to grow on *pahoehoe* lavas close to sea cliffs, were also found during a previous survey of the property. These clusters were found within 60-feet of the shoreline, which are out of the footprint of any planned development or farm related activities, and would be left undisturbed, as would the rest of the previously undisturbed coastal strip, other than the careful removal of several of the invasive ironwood trees that are a threat to the native species found in this coastal portion.

No other rare, threatened or endangered plant species appear to be present, either in the coastal portion (which is to be protected) or in any other part of the property.

Those birds that are common to this area and observed during the faunal survey include Common Myna (Acridotheres tristis), Northern Cardinal (Cardinalis cardinalis), Spotted Dove (Streptopelia chinensis), Japanese White-eye (Zosterops japonicus), and House Finch (Carpodacus mexicanus), although only the Spotted Dove was seen during the site visits. No native birds were identified during the site survey, and it is unlikely any native forest birds would use the project site due to its low elevation, alien vegetation and lack of adequate forest resources. Although, it is possible that Hawai'i 'amakihi (*Hemignathus virens*) are sometimes present, as some populations of this native honeycreeper appear to have adapted to the mosquito borne diseases of the Hawaiian lowlands.

Common shorebirds, such as Golden Plover (Pluvialis fulva), Ruddy Turnstone (Arenaria interpres), and Wandering Tattler (Heteroscelus incanus), are often seen on the Puna coastline feeding on shoreline resources. Although not observed during survey, these common shorebirds might be found in the coastal areas makai of the property despite the minimal habitat offered by the cliffy coast. It would be unlikely, however, for the shorebirds to make much use of the property itself, which is densely vegetated and offers no habitat for them. The seabird Black Noddy (Anous minutus melanogenys), though not observed on the property, has been observed flying near the cliffs and over the near-shore waters, as it frequently does over the coastal cliffs of the Island where it nests in the crevices and cavities along the sea cliffs.

As with all of East Hawai'i, several endangered native terrestrial vertebrates may be present in the general area and may overfly, roost, nest, or utilize resources of the property. These include the endangered Hawaiian hawk (*Buteo solitarius*), the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*), the endangered Hawaiian petrel (*Pterodroma sandwichensis*), and the threatened Newell's shearwater (*Puffinus newelli*).

Other mammals in the project area are all introduced species, including feral cats (*Felis catus*), feral pigs (*Sus scrofa*), small Indian mongooses (*Herpestes a. auropunctatus*) and various species of rats (*Rattus* sp.), none of which are of conservation concern and all are deleterious to native flora and fauna.

5. Archaeological, Cultural, and Historical Resources

In July 2016, following a field survey of the property, an archaeological assessment survey report was prepared by ASM Affiliates, LLC, a copy of which is attached for reference as Appendix A of the accompanying Conservation District Use Application. As a result of the survey, one previously unrecorded site (Site 50-10-45-30571), a historic wall with an unusual two-tiered construction was recorded in the *makai* portion of the property, within the coastal strip. Given its orientation and construction, it appears that the wall was constructed as a windbreak designed to shelter the area in its lee from the prevailing trade winds. According to the survey report, the height of the wall suggests that it also served as a support for a lean-to structure. Associated debris found adjacent to the wall edge indicates that this site may have been occupied as recently as the late 1940s-50s, and that its occupants collected *'opihi* (and likely other nearshore resources) from the adjacent coastline.

Site 30571 was fully documented during the archaeological survey and the archaeologists proposed that documentation of the site should serve to mitigate any potential impacts from the future development of the property. As the significance of the archaeological resource derives from the information already collected from Site 30571, and the likelihood of encountering additional significant subsurface archaeological resources is remote, the archaeologist recommended that no further historic preservation work should be required. Other than the previously identified Site 30571, there were no additional archaeological features found on the property as a result of the survey. The survey report with it findings and recommendations was submitted to the State Historic Preservation Division (SHPD) on August 1, 2016 for their review and approval.

Additionally, a Cultural Impact Assessment of the proposed development on the property, performed by ASM Affiliates, LLC, did not reveal any cultural resources or practices occurring on or near the site that may be affected by the proposed construction. As part of the Cultural Impact Assessment, consulted individuals with family ties and personal knowledge of area were able to provide information concerning the prior ownership and uses on the property; however, they were not aware of any use of the property or the immediate shoreline area for cultural practices. Still, it is recognized that shoreline areas of *Puna*, including the areas fronting the property are accessed for recreation and fishing in the traditional and non-traditional context. As noted, the proposed residence and farming activities will be set back a significant

distance from the shoreline such that the development and use of the property will not inhibit any existing or future traditional use of the shoreline area fronting the property.

The Dearing property does not contain any springs, land features, or caves that might be cultural importance. The dense vegetation, especially in the area to be farmed, consists mainly of weedy trees and herbs with no cultural values or associations. However, the scattered coconut palms near the shoreline provides nuts that fall onto the coastal basalt shelf and could potentially be used, as could the *hala* found in the coastal area near the shoreline.

7. Recreational Resources

The shoreline constitutes the most significant public recreational asset in the Project area. There is relatively little use of the rough and irregular shoreline in this area. According to the County of Hawai‘i (http://www.hawaiicounty.gov/pl-shoreline-access-big-island), there are no official *mauka-makai* shoreline public access routes extending from the Government Road, however, there are some driveways that are informally used. Lateral access along the rocky shoreline between Hawaiian Shores and Hawaiian Paradise Park is possible, though difficult, and is practiced by few fishers and gatherers that are occasionally seen in the area fishing or gathering *opihi*.

8. Scenic Resources

The primary scenic and open space resource in the project area is the coastal area and, to some extent, some of the open areas found along the Government Beach Road that provide open vistas to the mountains or ocean, especially in the areas northwest of the property towards the Maku‘u and Hawaiian Paradise Park subdivisions. The area along the Government Road fronting and adjacent to the property, however, is largely overgrown, limiting any opportunity for scenic views along the portion of this road fronting or near the property. Most scenic opportunities are provided by walking out over the intervening properties to the shoreline beyond the vegetation where views along the rocky shoreline are dramatic throughout the day.

B. Assessment of Potential Environmental Threats

As part of a Draft Environmental Assessment (EA) that was prepared in support of the Conservation District Use Application for the proposed single-family residence and farm uses on the property, surveys were conducted of the flora, fauna, historical and cultural resources that may be found on the property.

The flora and fauna survey found that that the property is dominated by alien vegetation, with the only sensitive ecosystem on the property being the shoreline vegetation, where common native plants are present, as well as two clumps of the endangered Hilo Ishaemum grass (Ischaemum byron). The development completely avoids this area and all farm related improvements would be a minimum of 200-feet from the shoreline at the closest point. According to the Environmental Assessement prepared for the Project, because of the location and nature of the farm related activities relative to sensitive vegetation and species, implementation and the ongoing operation of the farm is not likely to result in any adverse biological impacts.

Additionally, an archaeological inventory survey properly documented the one historic site present on the property, a mid-20th century wall likely used as a camping shelter. The archaeologists have proposed that the wall is no longer significant and it is proposed for removal in association with the construction of the residence. No valuable cultural resources and practices such as coastal access, fishing, gathering, hunting, or access to ceremonial sites would be affected in any way. On this basis, the Draft Environmental Assessment presented a determination that the proposed project will not involve an irrevocable commitment or loss or destruction of any natural, historical or cultural resources.

The most significant natural resources in the area are the native ecosystem found near the shoreline and coastal resources. The areas planned for the tropical fruit tree planting are set back at least 200-feet from the shoreline. The area of the property proposed for farming and family residence, which would be located makai of the cultivated area, are buffered from the shoreline by a proposed 100-foot shoreline setback area in which the existing natural landscape will be left undisturbed. Given the relatively level character of the property, the modest nature of the agricultural related activities taking place, and the protective measures that are planned, there appears to be no potential threat the coastal resources of the area from the proposed agricultural related uses on the property.

III. ASSESSMENT OF NATURAL HAZARDS

The subject property being located adjacent to and makai of the Government Beach Road, lies within the State Civil Defense Agency, Tsunami Evacuation Zone. Tsunami warning sirens are situated in the area to alert residents of a Tsunami alert and possible evacuation to areas mauka of the Government Road. The orchard area on the property is located at an elevation of roughly 20-25 feet above sea level, and over 200-feet back from the shoreline at the closest point (and over 230 feet from open water) in an area with no evidence of tsunami inundation.

The floodplain status for many areas of the Island of Hawai‘i is determined by the Federal Emergency Management Agency (FEMA), which produces the National Flood Insurance Program's Flood Insurance Rate Maps (FIRM). While the FIRM map for the project area (Map No. 1551661150C) has not been printed, the property is classified as being in Flood Zone X, signifying areas outside the mapped 500-year floodplain and with minimal risk from tsunami inundation.

High surf conditions may produce salt spray over portions of the property near the shoreline, however, the cultivated areas of the property and related improvements are sufficiently removed the shoreline so as to be for removed from danger of impacted during periods of high surf and is buffered from shoreline related impacts by a broad band of natural vegetation between the farm area and the shore.

In terms of seismic risk, the entire Island of Hawaii is rated Zone 4 Seismic Hazard (*Uniform Building Code, 1997 Edition*). Zone 4 areas are at risk from major earthquake damage, especially to structures that are poorly designed or built. The project site does not appear to be subject to subsidence, landslides, or other forms of mass wasting.

Regarding the potential for lava hazards, similar to much of the lower Puna area, the property is situated in a Lava Flow Hazard Zone 3, indicating areas of relatively higher hazard risk due to the property's location down slope from Kilauea, which is an active volcano. In Zone 3, approximately 1-5 percent of the land area has been covered by lava flows since 1800, but more than 75 percent has been covered in the last 750 years. As such, there is a moderate risk of lava inundation of the property over short time scales. While a lava flow impacting the area could overrun the farm area and curtail further agricultural use on the property, due to the slow speed of the flows, there would be ample time for warning and evacuation of the area and thus a very low risk to human life from lava activity.

IV. DESCRIPTION OF BEST MANAGEMENT PRACTICES (BMP)

The following description of BMP recommendations for the farm implementation and operation is taken from the University of Hawaii-Manoa, College of Tropical Agriculture and Human Resource (CTAHR), *"Best Management Practices to Manage Non-Point Pollution in Agriculture",* F. Abbas and A. Fares, June 2009, and from University of Hawaii-Manoa, College of Tropical Agriculture and Human Resource (CTAHR), *"Integrated Pest Management for the Home Gardens: Insect Identification and Control",* R. Ebesu, July 2003.

A. Short-term BMPs (During Implementation)

During the implementation of the farm related improvements, consisting of the drainage and irrigation improvements, barn construction, clearing of vegetation, and tree plantings, the primary threats to the environment during these activities would be from the potential for particulate dust, erosion and sedimentation as a result of the planned grading activities, which would be concentrated in the areas of the drainage basin/irrigation pond, well sites (2) and barn site. Consequently, the BMPs to be implemented during this period would be similar to those followed for most construction related activities, which would include:

- Minimizing the total amount of land disturbance required which will be delineated to construction contractor prior to the commencement of any onsite work.
- Construction activities with the potential to produce potential stormwater run-off will not be allowed during periods of unusually heavy rains or storm conditions.
- Prior to the start of construction, contractors will implement erosion and dust control measures to prevent any sediment from leaving the construction areas, especially towards the ocean.
- Graded areas will be replanted or otherwise stabilized, as soon as possible following grading activity.

As a further protective measure, the Farm related drainage and erosion control measures would be implemented as one of the first steps in the Farm implementation. These specific drainage and erosion control measures, consisting of a retention berm, drainage basin and irrigation pond and selection of areas for cultivation, have been planned in accordance with a Drainage and Erosion Control Study prepared for the Project and are shown in **Farm Drainage Plan (Figure 5).** These improvements are planned in relation to the existing topography, such that the Drainage Basin and

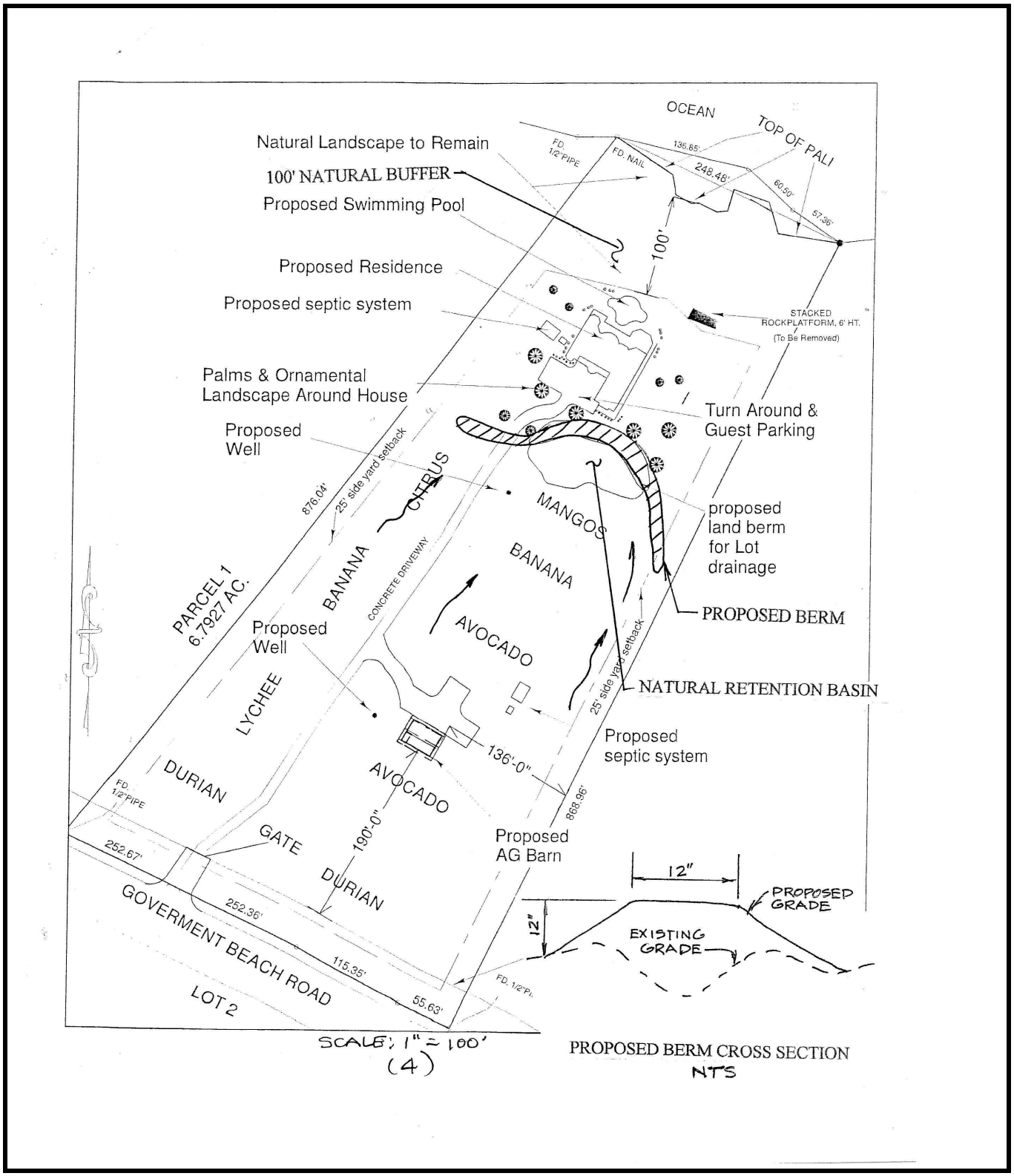


Figure 5.
Dearing Farm – Drainage Plan
Source: Erosion and Sedimentation Control Study, Dearing Residence and Farm, Paul A. Nash, PE

Irrigation Pond can serve as a natural collection area for any potential farm related runoff and potential source of irrigation water for the farm related irrigation. As noted, a natural buffer area, located *makai* of the drainage basin and the other residence related improvements, would serve to provide further protection to the ocean and coastal related resources. A copy of the **Drainage and Erosion Control Study for the Dearing Farm,** prepared by Atlas Engineering, is included for reference as **Appendix A** of this Plan.

B. Long-term BMPs (Following Implementation/Ongoing Operations)

The BMPs listed below that would be implemented as part of the ongoing farm operations are designed to minimize the potential environmental and health impacts by curtailing the potential movement of sediments, nutrients, pesticides, or other potential pollutants, while maximizing the efficient use of resources and optimizing crop production. These Long-term BMPs pertaining to soil, water, nutrient, and pest management also require ongoing data collection, record keeping and monitoring to insure their effective implementation.

Soil Management. Effective Soil Management BMPs are aimed at minimizing the potential for soil erosion, surface water run-off, soil compaction or soil loss. The emphasis is placed on cultivation practices that minimize tillage, adds organic material to the soils and establishes ground covers. As proposed for the Farm site, these objectives would be achieved by creating holes for the tree plantings rather than grading or tilling the area for cultivation; maintaining the existing ground cover; adding mulch from onsite composting and green-waste. The existing ground conditions in the farm are typically rocky with only thin layers of organic soils. The fractured lava rock substrate makes for well-draining soil conditions with low potential for ponding or soil erosion. What soils that are present or added at the tree plantings will be retained in place by berming soils around individual plantings.

Water Management. The BMPs for water management are focused on effective irrigation management, also referred to as "right time-right amount" irrigation to insure that the specific crop water requirements are met, while avoiding overwatering and the potential for soil, nutrient, or chemical movement. Pressurized irrigation systems, such as drip or sprinkler system, as proposed for the Farm site, have substantially higher irrigation efficiencies to traditional surface irrigation methods. Irrigation needs are minimized through the ongoing monitoring of each crop and their associated soil conditions. Irrigation scheduling should also

be optimized based on regular review of the soil conditions and water content, rainfall data, and crop parameters.

Nutrient Management. BMPs for nutrient management seek to monitor and regulate the application of nutrients to the soil according to the specific crop nutrient requirements. Nutrient management also includes selecting and using the appropriate organic manure amendments, which can help build and stabilize soils while reducing the need for chemical nutrients. Additionally, effective nutrient management involves the following practices:

- Understand the principles for nutrient management
- Understand the existing soil characteristics, fertility reserves, and nutrient requirements.
- Calibrate the application equipment in order to know and monitor the rate of nutrient application
- Implement BMPs for nutrient application (i.e, precautionary measures) to avoid the potential for nutrient leaching.
- Implement BMPs for soil and water conservation to minimize the potential for soil or nutrient movement.

Also, when using livestock manure as a nutrient source, the following should be considered:

- Local, state and federal laws and regulations must be followed during manure application.
- Take all precautionary measures to control against accidental leakage, spillage, or runoff from manure store and a site near a water body or source.
- Certain manures, such as chicken manure, can be volatile and contribute a noxious odor to the environment through ammonia emission and efforts should be taken to reduce emissions during manure storage and application.

Pest Management (Pesticide Storage, Handling and Application). The safe and effective handling of pesticides is as important to personal health and safety as is to environmental protection. The BMPs related to the safe storage, handling and application of pesticides that should be integrated as part of the farm operations, include the following:

- Buy pesticides in small quantities.
- Store then in a secured area.

- Dispose of them in accordance with federal, state, and local regulations.
- Maintain application equipment in working condition and calibrate to ensure recommended rates are applied
- Ensure that the pesticide applicator know the exact location in the field to be treated.
- Avoid unnecessary application of pesticides.
- Avoid overspray and drift, especial when in close proximity to surface waters.
- Avoid pesticide application when soil moisture status is high, to prevent possible runoff or deep percolation.
- Avoid irrigation right after a pesticide application.
- Establish buffer zones to maintain a safe-distance from wells and surface water (50-100 feet recommended); and do not apply pesticides in buffer zones.
- Avoid repetitive use of the same pesticide, which may lead to pesticide resistance in the pest.
- Read and follow safety directions, and maintain appropriate Material Safety Data Sheets.
- Use appropriate protective equipment specified on the pesticide label to minimize unnecessary exposure.
- Formulate a safety plan to provide emergency hand and eye wash facilities for personnel who might be accidentally exposed to pesticides.
- Have a pesticide first-aid kit available when handling pesticides.

Integrated Pest Management (IMP). IMP is a holistic approach to pest management that can reduce the use of pesticides that may potentially impact the environment or the health and safety of those handling them. A successful IPM program involves the application of a mix of cultural, biological and chemical control methods, including pest monitoring, identification and control, the result of which provides a program for effective pest management with fewer pesticide applications. Essential elements of an effective IPM program include the following:

- Selection of pest-resistant crops.
- Maintaining strict sanitary conditions.
- Including biological control with mulching.
- Effective insect identification and control.*
- Removal, and eradication of affected plants.
- Effective control and timing of pesticide applications.

*[For Reference on IPM Insect Identification and Control, See: *IPM for Home Gardens: Insect Identification and Control,* College of Tropical Agriculture and Human Resources (CTAHR), University of Hawaii-Manoa, Honolulu, Ebesu, R., July 2003.]

VI. SCHEDULE AND SEQUENCE OF ACTIVITIES

A. Project Schedule and Sequencing of Actions

The projected sequence and scheduling of actions related to the Farm operations, which would be initiated after securing the necessary permits and approvals, would be as follows:

Action	Time-frame Occurring in Months / (Years)
Removal of trees from planned construction areas	1
Removal of trees from planned areas of tree plantings	Ongoing (Yrs-1-3)
Grading within defined construction areas	2-3
Construction of Drainage Improvements/ Irrigation Pond	3
Well Construction	3-4
Implement Irrigation Related Improvements	4-5
Barn Construction	5-8
Tree Plantings	Ongoing (Yrs 1-3)

TABLE 1. DEARING FARM - GENERAL TIMETABLE AND SEQUENCE OF ACTIONS												
ACTION	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
Removal of trees from planned construction areas												
Removal of trees from planned areas of tree plantings			ONGOING (Yrs. 1-3)									
Grading within defined construction areas												
Construction of Drainage Improvements/ Irrigation Pond												
Well Construction												
Implement Irrigation Related Improvements												
Barn Construction												
Tree Plantings				ONGOING (Yrs. 1-3)								

VII. PLANS FOR ON-GOING MONITORING AND MAINTENANCE

Regular and ongoing monitoring of the farm soils, water and plant conditions is an essential component to identifying potential environmental or biological threats early on; to insuring the effective use of available resources; and to maintaining optimum growing conditions for the selected crops. Close monitoring of the site conditions is also an essential component of and effective IPM program in order to identify the early signs of invasive pests to be managed and beneficial organisms to be encouraged.

Those areas to be monitored on a regular basis as part of the ongoing farm operations, include the following:

- Tree plantings for signs of nutrient deficiencies and invasive pests;

- Ground conditions for signs of erosion, especially in and around the irrigation pond, irrigation equipment, and irrigated areas;
- Irrigation water supply for signs of excessive pumping or the presence of chemicals from the farm use;
- Water storage for signs of leakage or unexpected loss;
- Soil conditions, especially around tree plantings, for signs of overwatering, chemical build-up or nutrient deficiencies.

Similarly, regular monitoring and maintenance of the Farm facilities and equipment are important to maintaining safe environmental conditions, especially in the storage of potentially harmful chemicals or volatile compounds; for the safe and effective application of chemicals in the cultivated areas; and the efficient use of resources. Those areas that require special attention in terms of regular inspection and maintenance include:

- Buildings and the storage areas used for storing fertilizers and chemicals, to insure that they remain dry, safe and secure;
- Application equipment to insure they remain in working conditions and are properly calibrated so that recommended rates are applied; and
- Irrigation storage facilities and equipment to identify any signs of leakage.

It is understood that the Dearing family has extensive experience with growing fruit in Hawaii. That empirical understanding of the local growing conditions and crops is invaluable; and combined with implementation of the guidelines and management actions set forth in the Plan, will help insure that the Agricultural Best Practices that are specific for the area and crops being grown are utilized towards the long-term goal of protection and care for the land and natural resources of the area while optimizing the growing conditions for the selected crops.

APPENDIX A

Dearing Single Family Residence and Farm
EROSION AND SEDIMENTATION PLAN

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DRAINAGE AND EROSION CONTROL STUDY

for

DEARING RESIDENCE AND FARM

TMK: (3) 1-5-009: 055

by

PAUL A. NASH, P.E.

September 14, 2016

PAUL A. NASH
REGISTERED
PROFESSIONAL
ENGINEER
No. 7469-C
HAWAII, U.S.A.

This report discusses drainage and erosion concerns that may arise from the development of TMK: (3) 1-5-009: 055. It is intended that this report provide expert commentary from a licensed, professional civil engineer with twenty-five years of experience in Hawaii and specifically in lower Puna to assist State and local officials in their decision-making.

PROPOSED DEVELOPMENT

The owner proposes to develop the parcel to be a dwelling and a fruit farm. The proposed dwelling is to have a swimming pool, a driveway, and a parking area. The property is to be planted with various fruit trees, and an agricultural barn is to be built to support the farming. Wastewater is to be treated by septic systems in accordance with the rules and regulations of the State of Hawaii Department of Health. No development or disturbance of any kind is proposed within 100' of the certified shoreline.

DESCRIPTION OF SOIL

There is extremely little soil on top of the a'a flow. What soil there is comprises of decomposed plant material and is no more than two or three inches deep. Many places on the site have no soil at all. Instead, the ground is composed of a'a. Even in places where some soil exists, the ground is extremely porous, to the extent that water does not accumulate or run off even in heavy rains. The falling rain is absorbed directly into the ground.

I have included soils data on pages 5 and 6 that was gathered from the NRCS Soils Survey online.

RISK OF SOIL RUNOFF

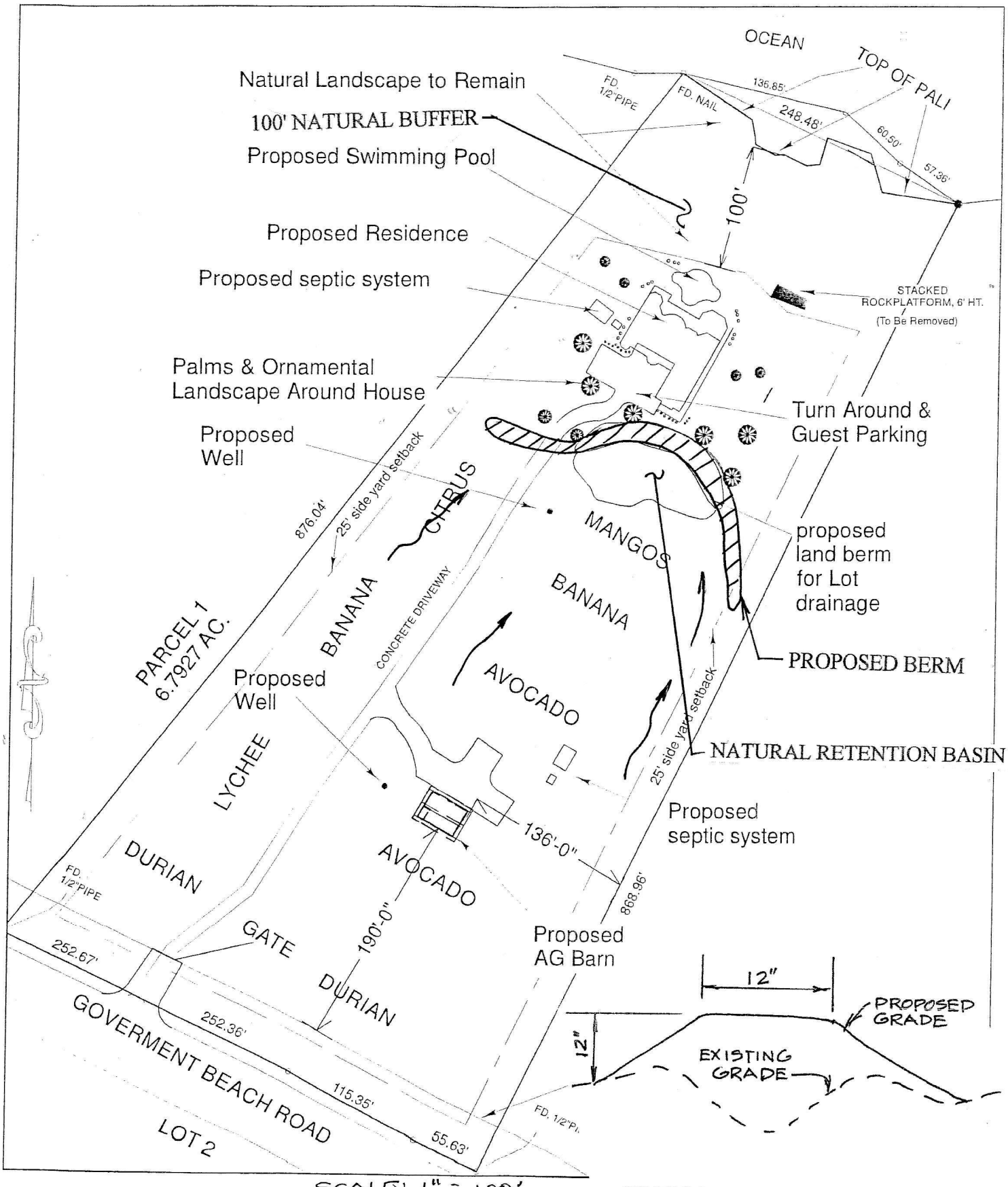
The risk of soil being carried off of the property as a result of development is very small due to the soil's extremely high porosity. The risk of soil running off into the ocean is very close to zero because of the 100' natural buffer that is proposed along the ocean front. Regardless of how heavy the rain is, runoff cannot make it past the 100' natural buffer before the runoff is absorbed into the ground.

PROPOSED MITIGATION MEASURES

The most effective way of treating runoff is through absorption into the ground, where the natural processes of filtration and decomposition clean the runoff and prevent the runoff from exiting the property. Ground infiltration is used across the country as a Best Management Practice to remove impurities, such as soil particulates or nitrogen from fertilizer, from surface water.

In addition to the natural soil's ability to absorb the runoff and the 100' buffer, a small retention basin is proposed as an additional means to trap the drainage onsite and prevent erosion. A natural depression exists on the site in front of the proposed dwelling. The developer proposes to enhance the effectiveness of the natural depression by constructing berms to guide the runoff to the natural depression, which will act as a retention basin by capturing the runoff and allowing the runoff to percolate into the ground.

A schematic is included showing the location of the berms and retention basin on page 4. Please note that the berms may be replaced with swales in some areas as site conditions dictate.



SCALE: 1" = 100'

PROPOSED BERM CROSS SECTION
NTS

CONCLUSION

In my engineering opinion, the proposed development of the parcel will have no negative impact on natural resources or neighboring properties. In fact, by enhancing the natural depression by guiding the runoff into the depression, the developer may be improving conditions that preserve the adjacent natural resources, such as the ocean and the shoreline vegetation.

SOILS CHARACTERISTICS

Island of Hawaii Area, Hawaii

659—Malama extremely cobbly highly decomposed plant material, 2 to 40 percent slopes

Map Unit Setting

National map unit symbol: 2kllj
Elevation: 0 to 1,200 feet
Mean annual precipitation: 60 to 120 inches
Mean annual air temperature: 70 to 75 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Malama and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Malama

Setting

Landform: Aa lava flows
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Organic material over aa lava

Typical profile

2C1/Oa - 0 to 3 inches: extremely cobbly highly decomposed plant material
2C2 - 3 to 50 inches: cobbles
2R - 50 to 60 inches: bedrock

Properties and qualities

Slope: 2 to 40 percent
Percent of area covered with surface fragments: 3.0 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 1.3 inches)

Interpretive groups

Land capability classification (irrigated): 7s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A

Ecological site: Isohyperthermic Forest (F162XY500HI)
Hydric soil rating: No

Minor Components

Lava flows, `a`a
Percent of map unit: 10 percent
Landform: Aa lava flows
Down-slope shape: Linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Data Source Information

Soil Survey Area: Island of Hawaii Area, Hawaii
Survey Area Data: Version 8, Sep 28, 2015

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Environmental Assessment

Dearing Single-Family Residence and Farm in the Conservation District at Keonepoko

APPENDIX 5
Coastal Erosion Study

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GEOHAZARDS CONSULTANTS INTERNATIONAL, INC.

Appraisal of hazards – reduction of risk

P.O. Box 479 Volcano, HI 96785

COASTAL EROSION STUDY FOR THE PROPERTY OF GARRETT DEARING (TMK (3) 1-5-9-055), KEONEPOKO IKI AHUPUA'A, PUNA DISTRICT, HAWAI'I

by
R. W. Hazlett, Ph.D., Geology

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Introduction:

Single Family Residential permitting in Conservation Districts in the State of Hawaiʻi is regulated by State of Hawai'i Administrative Rules governing Conservation Districts (Title 13, Subtitle 1 Chapter 5, adopted August 12, 2011). Applications to permit shoreline residential construction in the Conservation Districts must consider rates of coastal erosion. The State Department of Land and Natural Resources requires an estimate of annual erosion rate for any property for which construction is proposed in the form of a "Coastal Erosion Study" (CES). A CES integrates on-site quantitative measurements by a credentialed specialist or specialists, inspection of available aerial and satellite imagery taken over a period of time, and a review of relevant geological literature. The current report is submitted as a CES in support of a construction proposal for the Dearing family property in the eastern Puna district (TMK (3) 1-5-9-055; Figures 1, 2).

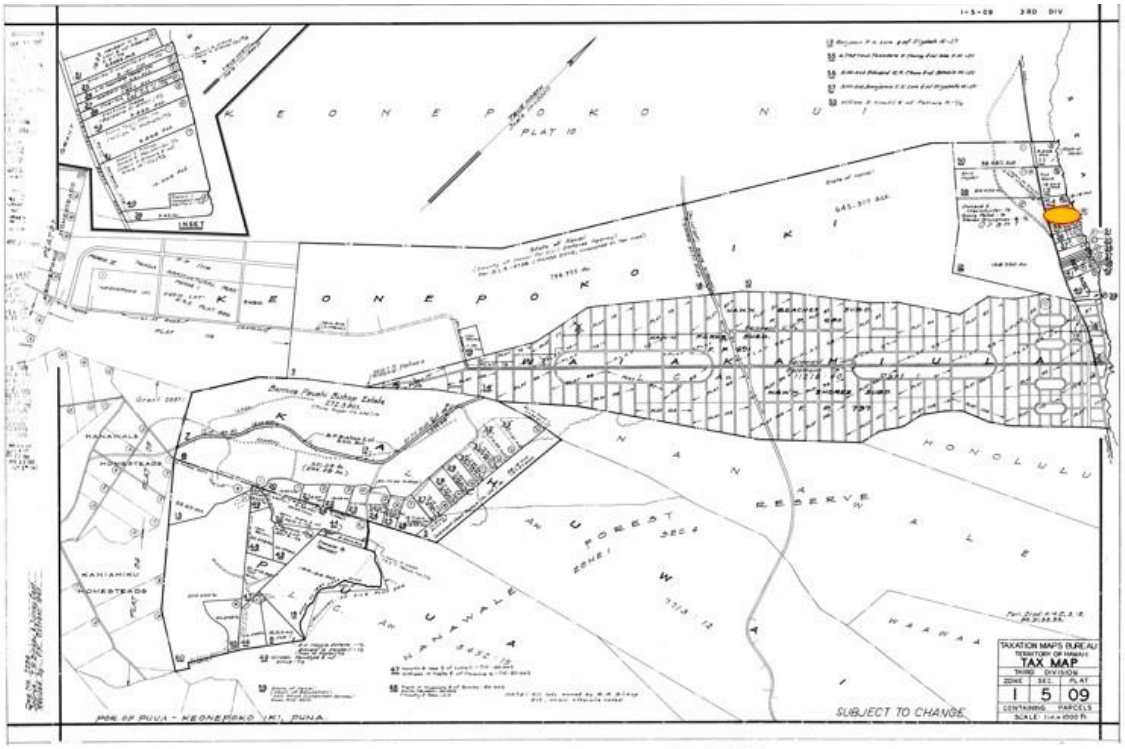

Figure 1: Copy of relevant Hawaii County tax map including the Dearing holding (indicated by yellow ellipse, far right).

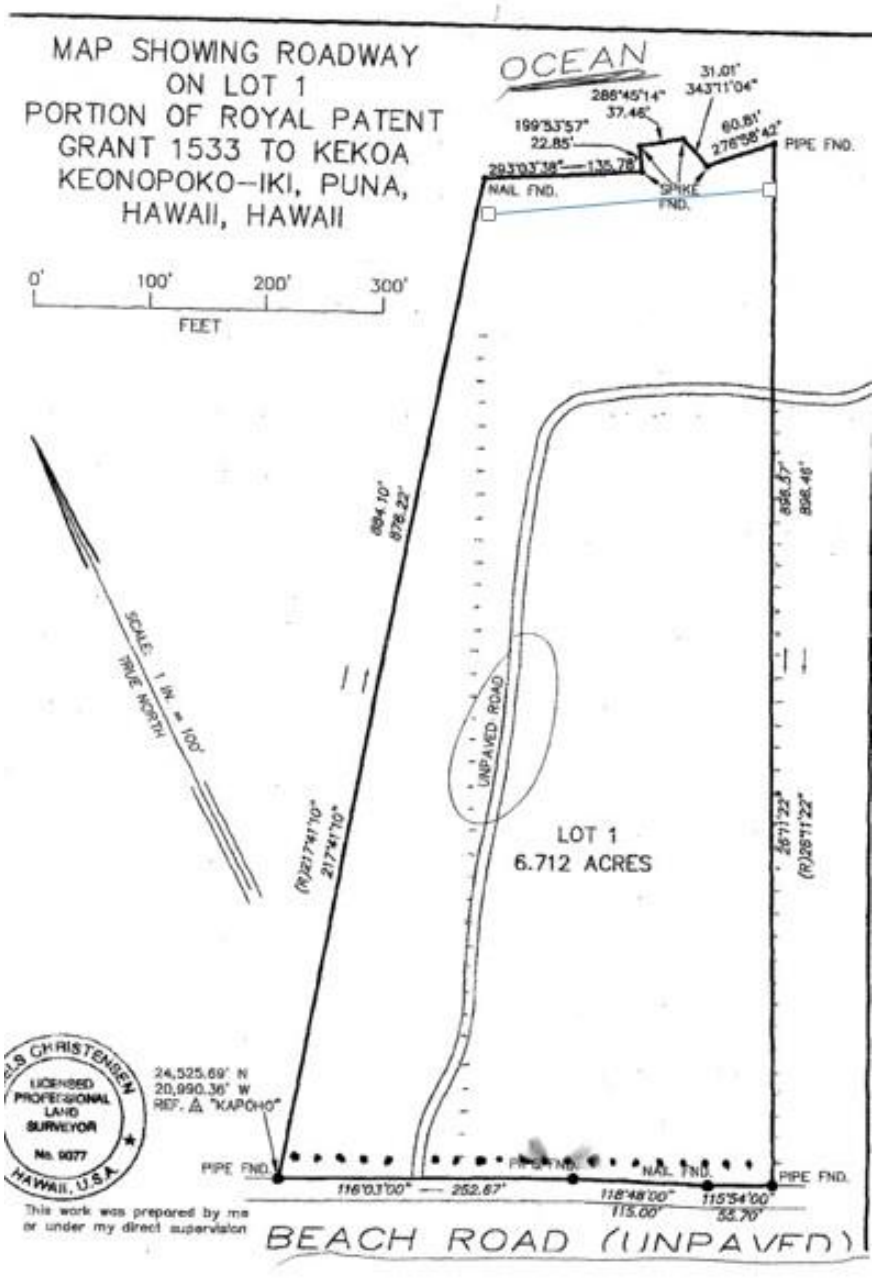

Figure 2: Survey map of the Dearing property, showing the shoreline boundary at the top. The straight blue line for reference is 240 feet long, while the total length of shoreline border next to it, accounting for "ins and outs," is 287.9 feet.

Physical Setting:

The Dearing property is a roughly rectangular strip of heavily forested coastal land in the eastern Puna District, Hawaiʻi, covering 6.12 acres. About 12% of the almost half-mile long parcel perimeter borders the shoreline (Figure 2). The terrain slopes gently (less than

1% grade) from its frontage on Beach Road to the rim of a littoral bluff or low sea cliff which rises from 12 to 20 feet above mean sea level, and which is separated from the water by a natural buffer zone of eroded rocky debris ranging from 30-80 feet wide, depending upon specific location, tidal, and sea conditions (Figure 3). The shoreline is not linear, but rather is gently scalloped with a maximum point-to-head of inlet distance of approximately 80 feet (Figures 4, 5).

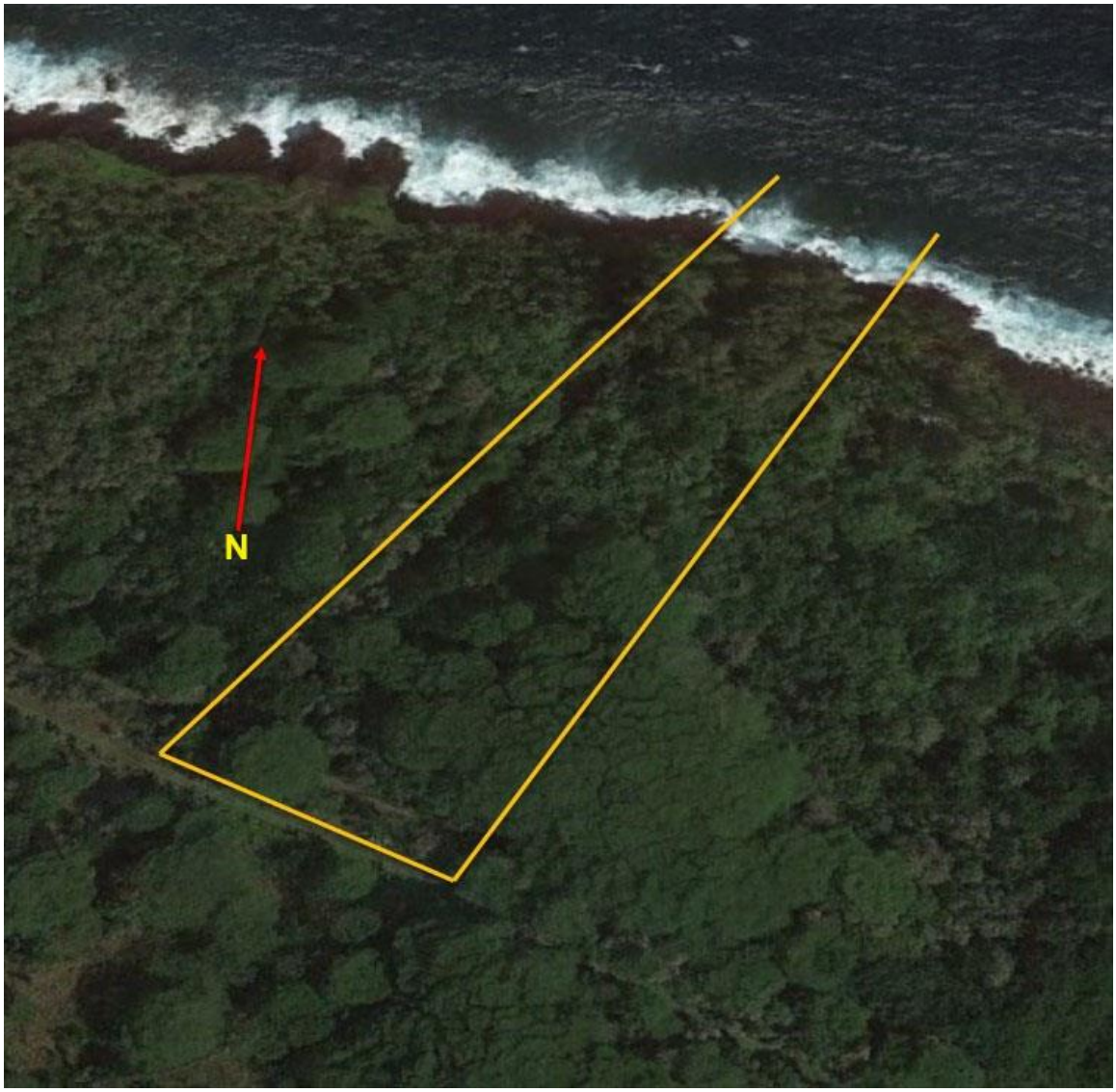

Figure 3: Oblique GoogleEarth image of the Dearing Property described in this report. Yellow lines indicate property boundaries. Beach (aka Government, or Old Government) Road borders the property along its southwest side. See text for details.

Figure 4: A face of massive lava, the core of an ʻaʻā flow (blue arrow), makes up from a third to most of the vertical bluff face at the center point of the Dearing shoreline. Seaward of the bluff is a tidal "buffer zone" of boulders and other rocky debris left from erosion (yellow arrow). (This is the view as seen from the area of the yellow star looking toward the blue dot shown in Figure 5, below. Photo taken by Richard Hazlett).

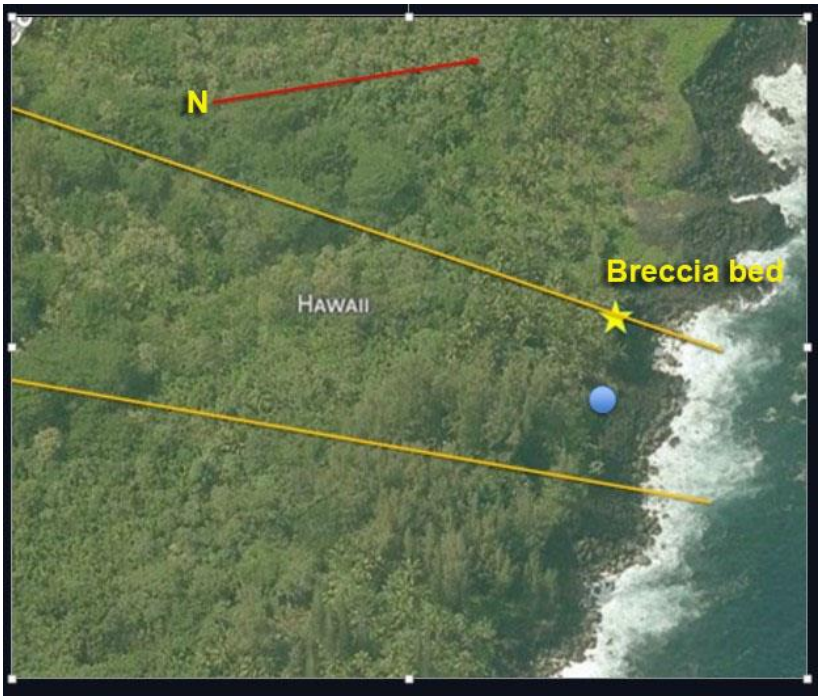

Figure 5: Oblique Bing Maps image showing details of the Dearing shoreline. The NW and SE boundaries of the property are shown by the yellow-orange lines, separated by a distance of 240 feet at the coast. The yellow star indicates location of a wide wedge of intensely eroded breccia near the NW corner of the holding, mentioned frequently in the ensuing text.

Geology:

Figure 6 is a geologic map including the Dearing property (Moore and Trusdell, 1991). Two primary stratigraphic units (Table 1) underlie the area, as shown by different colors on the map. Vegetation and soil cover largely obscure these rocks inshore, but coastal exposures are good to excellent.

The lower 10-15 feet of Dearing shoreline bluff consists of lava of Moore and Trusdell's (1991) stratigraphic mapping unit "f7d12." This is a complex of ʻaʻā flow lobes erupted sometime in the interval between 400 and 750 years ago. Whether each of these lobes is a product of an individual eruption or they all pertain to a single multi-phase outpouring over a long period of time cannot be determined. In any event, only a single massive f7d12 flow core and its related breccia dominates the bluff along this length of the shore, presenting a somewhat simple impression of the significantly more involved eruptive sequence observed elsewhere. Northwestward, the flow core slants toward sea level as associated superjacent breccia attains its greatest thickness on-site, approximately 10 feet. This is also the area in which the most significant erosion on the Dearing property is evident (yellow star, Figure 5). Locally, semi-consolidated subjacent flow breccia also crops out (Table 1).

Moore and Trusdell (1991) describe f7d12 lava as containing less than 1% pyroxene phenocrysts, 2-7% plagioclase, and scattered gabbro xenoliths of unspecified composition. I found this description appropriate to hand samples examined in the field, with most crystals occurring as fine needle-like to equant microlites (<0.1 inches diameter). Subhedral to anhedral olivine crystals up to ¼ inch diameter are scattered throughout the lava, discolored from mild oxidation and weathering.

Capping the ʻaʻā is a much thinner "veneer" of pāhoehoe related to Moore and Trusdell's (1991) unit "f8d4." Averaging of four radiocarbon ages collected by Holcomb (1987) suggest that the pāhoehoe erupted 360 years ago, which is the age that will be utilized by this report. Moore and Trusdell (1991) describe f8d4 lava as containing 1-4 volume percent olivine phenocrysts with no other crystalline component, though most of the hand samples I studied lack phenocrysts altogether. The flow ranges in thickness from ~1-3 feet (Table 1).

Unit f8d4 does not entirely overlie the older ʻaʻā within the study area. For instance, the pāhoehoe appears to be absent at the site of the breccia accumulation marked by the yellow star in Figure 5 and immediately to the northwest of the Dearing property line. A solid arching rim of lava atop the above mentioned breccia (Figure 7 and 8) is stratigraphically related to unit f7d12, and appears to extend only locally.

Table 1: Age relations of stratigraphic units (Moore and Trusdell, 1991) exposed along the Dearing shoreline, ordered from youngest (top) to oldest (bottom) in the table, and as observed physically in the field:

Unit	Age (years before present)	General thickness (feet)	Notes
f8d4	360	~1-3	Not present everywhere as a capping unit
f7d12 superjacent breccia	400-750	~3-10	Heavily eroded at NW corner of property
f7d12 flow core	400-750	~3-10	A major source of bouldery rubble on shoreline points. Apparent dip to the north.
f7d12 subjacent breccia	400-750	Unknown	Highly localized at NW end of shoreline. Locally more consolidated than superjacent breccia

Figure 6: Portion of geologic map by Moore and Trusdell (1991) showing the lava flows forming the modern shoreline of the Dearing property (red triangle) and adjoining areas. The brown-colored lava (labeled "f7d12") erupted sometime during the interval from 400-700 years ago, as did the separate yellow-colored flow in the lower right hand corner ("f7c10"). Overlying cream-colored lava (labeled "f8d4" elsewhere on the source map) erupted sometime between 200-450 years old, with averaged radiocarbon ages suggesting an age of 360 years for this flow. See text for additional information.

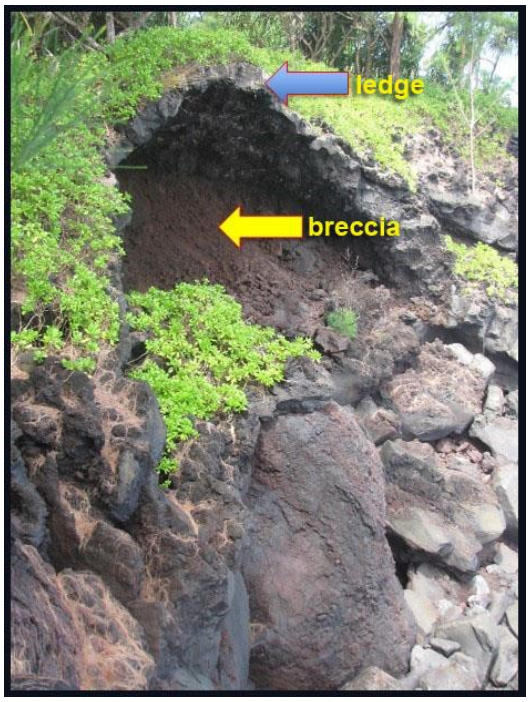

Figure 7: Ledge overlying intensively eroded breccia at site of yellow star shown in Figure 5. See text for detailed discussion. (Photo: Richard Hazlett)

Figure 8: View of exposure of ʻaʻā flow breccia with a 6 foot (1.9 m) rod for scale at position of thickest accumulation along the Dearing shoreline (shown by the yellow star in Figure 5). (Photo: Richard Hazlett)

Marine conditions

The coast of this part of the Puna District faces the open ocean with no barrier of offshore reefs or bars. The submarine slope is approximately 1300 ft/mile for a distance of roughly 6 miles, descending into the deep water Puna Canyon. Large waves reaching the coast are predominantly related to trade wind conditions, though the shoreline is also exposed in part to North Pacific swells (Figure 9). Some storm-related breakers reported by the property owner have sent frothy water over the 12-20 foot high bluff line at least "several meters" inland (Steve Dearing, pers. commun., 2016).

Tidal conditions are summarized in Figure 10 based upon data collected in nearby Hilo Bay. The total range of tidal change is ~ 2.4 feet. During my two visits to the Dearing shoreline, weather conditions were fine to overcast with very gentle to mild winds blowing off the sea. Swells of 4-6 foot height broke with no noticeable difference in white-water spray along the entire length of shore, after initially breaking at the points.

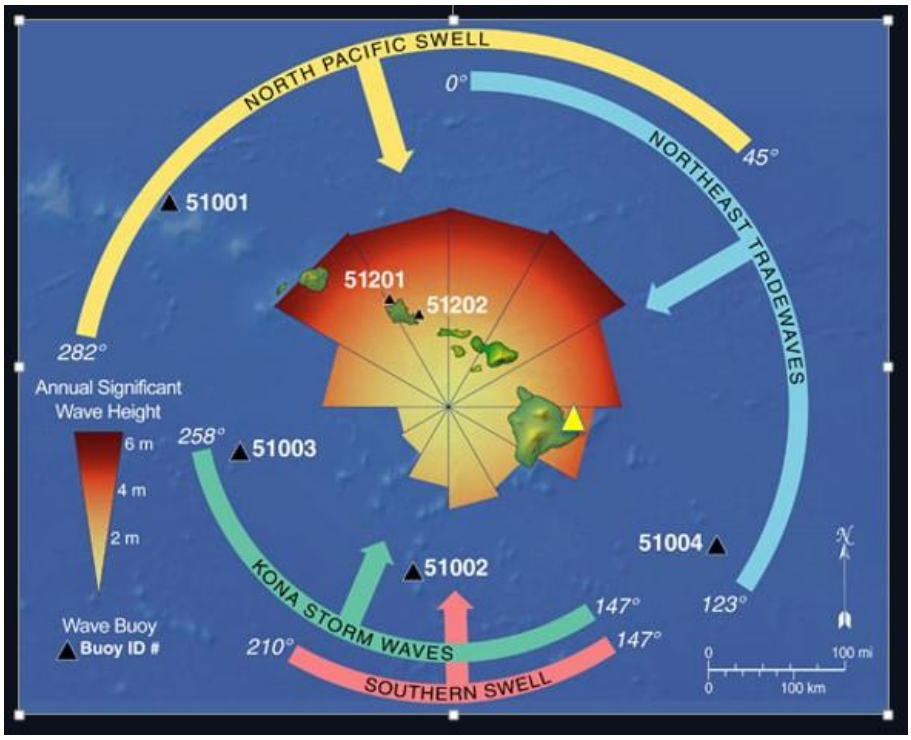

Figure 9: Orientation of Dearing shoreline (yellow triangle) relative to typical incoming significant wave directions. Annual average significant wave height along this coast falls in the 10-12 foot range, and is predominantly related to trade winds. (Figure from the School of Ocean, Earth, and Science Technology, University of Hawai'i at Manoa).

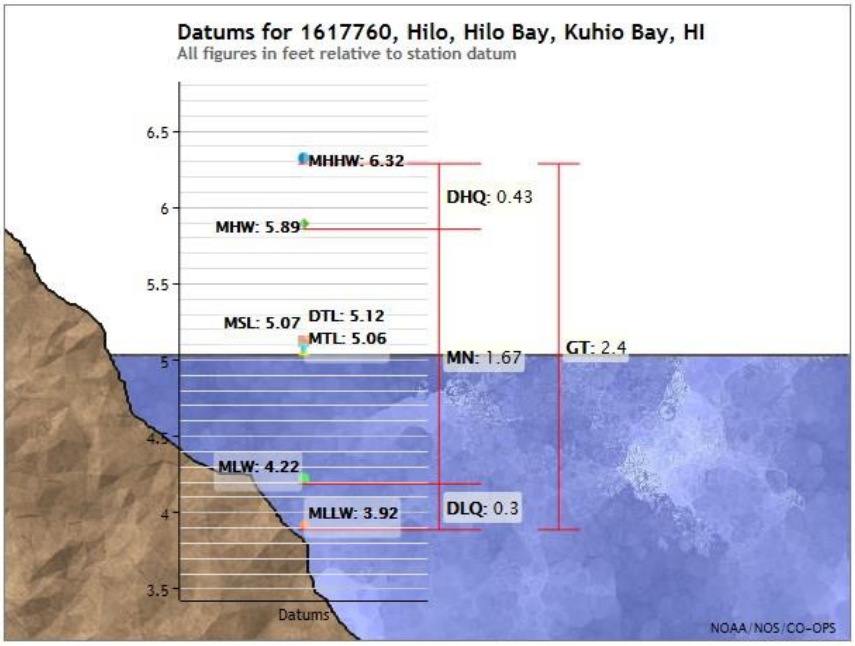

Figure 10: Tidal data for Hilo Bay (in feet), the closest continuously monitored tidal station to the Dearing shoreline. Acronyms of significance to this study are MHHW = Mean Highest High Water level and MLLW = Mean Lowest Low Water level, where MSL = Mean Sea Level and GT = Great Diurnal Range. MHHW and MLLW are related to the fortnightly tidal cycle, when tidal currents or ranges tend to be strongest. (Figure: National Oceanographic and Atmospheric Administration).

Evidence of Erosion:

For conservation management purposes, the New Zealand government classifies coasts into two categories; "soft" and "hard," depending upon whether they consist of sands and related fine, easily transportable sediments or of stolid, unweathered rock (Anonymous, 2016). The Dearing shoreline is a "hard" one in this scheme, and by nature resists erosion far more effectively than Hawaii's beaches and bars. Nevertheless, clear signs of erosion may be seen here. These include numerous large blocks mostly of massive ʻaʻā rubble ranging from a few tens of inches to 3-6 feet in diameter, concentrated primarily at the points of land along the shore (e.g.—Figure 4, yellow arrow). The characteristic massiveness, low density of vesicles, fracturing, and positions of these big pieces of lava show that most derive from the adjacent ʻaʻā flow core within the bluff face. Not simply the core itself breaks to yield these blocks, however. Overlying breccia and where present the capping pāhoehoe flow layer, also contribute debris. The blue dot shown in Figure 5, for instance, marks the location of a section of vegetated terrace along the bluff line adjoining the midpoint of the Dearing shoreline. At this site irregular fractures ranging up to 1.5 feet wide have opened subparallel to the coast. These could "section" future blocks loosened by strong wave action to join the pile accumulating at the foot of the bluff below (Figure 11).

Figure 11: Collapsing bluff edge near the center of the Dearing shoreline (location of blue dot in Figure 5) (Photo: Richard Hazlett)

Within the inlets, too, large blocks, and more distinctively, smaller cobbles and boulders form a crudely-developed "beach" (Figure 12). Many of these coarse, water-worn fragments are notably sub-rounded, in contrast to the larger, angular blocks at the points. This indicates abrasion which may be localized by repeated rolling and knocking together of fragments confined within the inlets during periods of rough wave activity. In addition to this material, oxidized breccia clasts, at least some of which may tumble downslope from poorly consolidated faces due simply to gravity, occur scattered around the heads of inlets.

As mentioned above, the superjacent ʻaʻā breccia layer of flow unit f7d12, has eroded back significantly at the position marked by the yellow star in Figure 5. The arching ledge of lava overlying the breccia extends as much as 12 feet out over free air space that formerly must have been packed with breccia fragments, as suggested by the "ceiling" shown at the top of Figure 8. In this exposure, some breccia pieces appear to be embedded in the overlying lava.

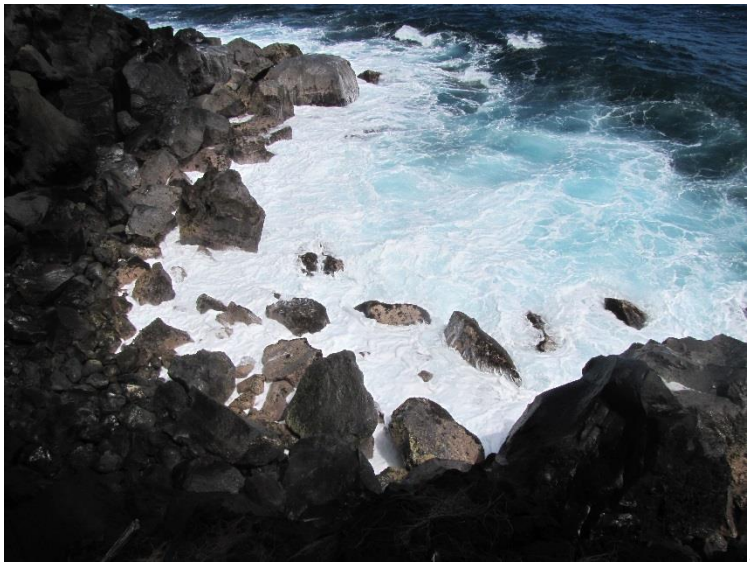 .

Figure 12: Inlet directly beneath the thick accumulation of flow breccia at the position of the yellow star, Figure 5. Note fine rubble making up the shoreline along the interior of the inlet. (Photo: Richard Hazlett).

Erosional Processes:

Several key processes are at work contributing to erosion of this and all typical hard coasts. Wave energy impacting the bluff loosens masses of rock by compressing air within fractures, while the drag of moving water abrasively grinds smaller fragments at the shore. Wind and gravity can loosen free pieces of breccia that have dried out beneath overhangs, such as the one shown in Figure 8. (In fact during my second site visit, one small fragment dropped spontaneously from the brecciated wall of this face while I stood by taking notes).

Storm seas perhaps timed with spring (fortnightly) tides can be especially erosive. And, on a larger scale—though not evident here—the coastline may suddenly drop because of undersea sliding that extends right up into neighboring land. There is no way to definitely quantify the relative contributions of these processes, though it is reasonable to say that the energy released by wave action is probably the main cause of shoreline retreat at this locality.

Measuring the erosion:

I first examined aerial imagery to search for evidence of major changes in shoreline profile during historic times. Two flight lines for black-and-white photos exist that allow comparison of what is now the Dearing property coast between 1965 and 1977. Image EKL-12CC-30 (1965) and GS-VEEC 6-125(-42) (1977) show no evident change in shoreline configuration, though vegetative cover, variable tidal and sea conditions,

shading and resolution differences can easily obscure important smaller-scale details such as the shifting of a boulder here or modest collapse of a ledge there. Likewise, both GoogleEarth and Bing imagery registered in color over a period of years, show no evident changes.

I then undertook a literature search for the purpose of collecting data on erosional retreat of hard coasts elsewhere around the world. For practical reasons, however, almost all shoreline change studies focus on soft coasts, including quite recently within the Hawaiian Islands (e.g.—Anderson et al., 2015), and available data are otherwise scarce.

Andriati and Walsh (2007) studied the erosion of carbonate (limestone and low-grade marble) hard coast near Bari, Italy, and documented the important observation that *the finer the crystallinity of the rock, the slower the rate of retreat*. They established shoreline shift rates of 0.03-0.3 ft/yr—as much as 4 inches/yr. Of course the conditions of the present study are considerably different--not simply in terms of the relative crystallinity of the rock, but its degree of fracturing, marine dynamics, climate, and a host of other factors. Nevertheless, their work reinforces the observation that hard coasts are significantly more resistant to erosion.

I conclude that the most cautious estimate of shoreline retreat rate for protecting future improvements on the Dearing property is obtained by measuring at a right angle to the general coast the length from *the furthermost point* (seen at low tide) to the location of shoreline erosion lying *farthest inland*, then dividing this distance (approximately 130 feet) by the age of the youngest lava making up the bluff (360 years; Figure 14). While this estimate--0.36 ft/year--discounts the possibility of erosion having removed land that once extended even farther out to sea than is presently observed, it also is positively biased simply because I've used the age of the *youngest* lava in the area (unit f8d4) to establish the rate.

Slower coastal shoreline retreat rates—from 0.33 to as low as 0.17 ft/yr—are determined by factoring in the full possible age range of the lava making up most of the shoreline (unit f7d12). These estimates fall within range, perhaps coincidentally, of hard coast erosion rates determined by Andriati and Walsh in their 2007 Italian study.

These numbers imply a Dearing shoreline retreat of 8.5-18 feet over the coming half-century.

Figure 14: Google Earth image of Dearing coast showing 130 foot long line of shoreline retreat used to calculate erosion rate in this study. The line is orthogonal to the coast and drawn through the position of the yellow star shown in Figure 5, site of maximum interior erosion.

Other erosion rate estimates at this site may be obtained as well, all slower than the rate just presented. These are summarized in Table 2:

Table 2: Shoreline retreat / erosion rate estimates, Dearing property

Rate type	Calculation	Notes
Minimal rate of erosion under ledge (Figure 12)	10 ft / 360 yr = 0.3 inches/yr	Does not assume ledge collapse, and presumes ledge and underlying breccia are 360 years old.
Rate of opening fractures parallel to coast (blue dot, Figure 4)	1.6 ft/360 yr = .05 inches/yr	
Rate of inlet formation	80 ft /400 yr = 0.2 ft/yr 80 ft/750 yr = 0.12 ft/yr	Assumes inlet began eroding 400-750 years ago from offshore distance of "furthermost point" (see text)
"Most cautious" estimate of general shoreline retreat rate	0.36 ft/yr	See text for discussion

In addition to the assumptions made and noted in the table above, these rates need to be considered in the context of the environment. The shoreline is not retreating everywhere uniformly, nor is it doing so continuously. Erosion is episodic and principally storm-related. In addition, the estimates presented above do not reflect three facts that need to be taken into long-term consideration: (1) the island is sinking isostatically; (2) eustatic sea level change is taking place in response to climate change, and (3) wave and storm conditions also appear to be changing in the central and eastern Pacific, also in response to climate change. The next section considers these influences.

Shoreline Retreat Owing to SLR and Isostasy:

Sea-level rise (SLR) is taking place simultaneously with isostatic subsidence of the Island of Hawaiʻi, increasing the rate of shoreline retreat along all coasts except where active lava flows are actually adding new land. A worst-case scenario incorporating all aspects of potential sea level flux related to warming global climate forecasts a rise of as much as 6.5 feet by the end of this century (Pfeffer, 2008), with 3.25 feet a more conservative estimate (Solomon, 2007). This change should be added to an annual estimated crustal subsidence rate for easternmost Puna in the range of 0.4-0.7 inches/yr (Hwang and Brooks, 2007), which gives a relative SLR of 6-12 feet by the year 2100 along the Dearing shoreline. The greatest rate of SLR will take place during the second half of this century according to recent modelling (e.g.--Cazenave and Le Cozannet, 2014).

Anderson and others (2015) studied this phenomenon in the context of soft coasts throughout the Hawaiian Islands and concluded that average rates of shoreline recession would double by the year 2050, and increase to 2.5 times present and historically measured values by 2100, with shoreline retreats of as great as 190 feet possible in some places. The relevancy of this study to the Dearing property is slight, however, given the elevated rockiness at this location.

SLR studies such as the above generally do not take into account potential changes in storminess and significantly high wave heights though, which are critical factors in discussion erosion along hard coasts. Merrifield and Maltrud (2011) noted that trade winds have intensified across the Pacific gradually since the early 1990s, and this has increased sea level trends significantly in western Pacific waters relative to other regions in the World Ocean, with some rates of rise as much as three times the global average.

"Shorelines" are defined administratively in Hawaiʻi as the maximum (inshore) reaches of the wash of waves (Hawaiʻi Revised Statutes [H.R.S.])§205-A (Vitousek and Fletcher, 2008). For tropical waters, the incidence of "one-in-ten year" extreme waves impacting shorelines may double or triple as a consequence of the wind intensification described above (Wang and others, 2014). Substantial wave height increases—by as much as 40%--have also been observed along some Pacific shores, though to what extent this relates to climate change or pulsating phenomena as the Pacific Decadal Oscillation is unclear (e.g.—Ruggiero and others, 2010). Hypothetically, the incidence of hurricanes in the eastern Pacific may actually *decrease* with warming climate, but the strongest storms will likely become even more intense (e.g.--Grinsted, 2012; Holland and Bruyére, 2013). Rising sea surface temperatures in Hawaiian waters could also unfavorably influence the incidence of hurricane storm tracks impacting the islands (Businger, 1998).

In a worst-case scenario where SLR by the year 2100 reduces the height above sea level of the Dearing coastal shelf to just a couple of meters at most, run-up from extreme waves breaking ashore will be significantly greater than at present. Estimating future wave run-ups requires the application of detailed engineering and mathematical models and the collection of data however, that are beyond the capacity of this study. Parameters

for consideration include surface friction, nearshore bathymetry, shoreline motion trajectories, wave dispersion effects, wave breaking characteristics, and hydrodynamic relationship of multiple parallel land profiles (e.g.—see Mustafid and Hargono, 2001, and Frandsen, 2008). Most of these are not accurately knowable under highly irregular natural conditions. Post SLR run-up is a question for the distant future though, and the investigator does not consider it relevant to the present case.

A final factor for consideration is the potential role of seismicity in raising relative sea level at this site. Infrequent (once or twice-a-century) severe seismic activity has accompanied significant subsidence along the south coast of the Puna District. During the M7.5-7.7 November 1975 earthquake the coast at Kaimu Bay dropped roughly three feet; while at Kapoho 6 miles to the northeast the land settled 0.75 feet. The area of the Dearing property, however, lies in a footwall position north of the zone of active normal faulting associated with the southern flank of Kīlauea Volcano (Owen and Bürgmann, 2006), and may be regarded as tectonically stable. Future tsunamis related to large, local earthquakes, however, would certainly impact the coast here. Compared to the potential of storm-driven waves, however, tsunamis represent a trivial concern in terms of erosion.

Summary

Site investigation of the Dearing property on the east coast of Puna revealed an elevated coastal shelf with gentle inlet development in a rocky shoreline of primarily ʻaʻā lava and related breccia. The shelf exhibits considerable strength and resistance to erosion, though evidence of undercutting and collapse over a period of centuries is plentiful. Air and satellite imagery show no clear evidence of significant erosion at least since the mid-1960s. Measured rates of tectonic subsidence and projected sea level rise do not pose immediate threats (i.e.—within the coming few decades) to the landscape atop the shelf. The most cautiously estimated average coastal retreat rate of 0.36 ft /yr is based upon dividing the distance of maximum geological shoreline retreat with the age of the youngest lava flow exposed at the coast.

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