DAVID Y. IGE
GOVERNOR OF HAWAII

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

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

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
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

REF: OCCL: TF

CDUA: HA-3885

Jan 19, 2022

To: Mary Alice Evans, Director
Office of Planning and Sustainable Development
Environmental Review Program

Suzanne D. Case

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

Subject: Draft Environmental Assessment (DEA) for Conservation District Use Application (CDUA) HA-3885 for the Roehrig Single-Family Residence, Landscaping, and Related Improvements project located at 14-3543 Government Beach Road, Waawaa Subdivision, Waawaa, Puna, Hawaii
Tax Map Key (TMK): (3) 1-4-028:008

The applicants, Christopher and Wendi Roehrig, are proposing to construct an approximately 2,573 sq. ft single-story post-on-pier single-family residence consisting of 2 bedrooms, 2 bathrooms, a living room, kitchen, dining area, pantry, lanai, breezeway, and garage. A roof-mounted photovoltaic system; solar water heating panels; rainfall water catchment and storage tank; propane gas and storage tank for cooking, backup water heating, and electric power; a gravel driveway; fencing and a driveway gate on the mauka portion of the property; and an individual wastewater system are also proposed to support the residence. Additionally, the applicants are proposing to replace hala trees that are removed for the siting of the proposed driveway and single-family residence as well as remove and replace invasive trees on the property with hala trees or naupaka vegetation.

The Department of Land and Natural Resources has reviewed the DEA for the project and anticipates a Finding of No Significant Impact (FONSI) determination based on the information provided. In accordance with HAR §11-200.1-13, the reasons supporting the anticipated FONSI determination are as follows:

1. The project would not irrevocably commit a natural, cultural, or historic resource. Several common native plants are present, including naupaka, hala, Mauu aki aki and ekaha, of which only a portion will be affected. New individuals of these species will be replanted or will naturally regrow. An archaeological inventory survey determined that there are no historic sites. No valuable cultural resources and

practices such as shoreline access, fishing, gathering, hunting, or access to ceremonial sites would be adversely affected.

2. The project would not curtail the range of beneficial uses of the environment.

3. 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 applicant is committed to developing the property in a manner that preserves and protects natural and cultural resources. It appears that the proposed project is consistent with the State's long-term environmental policies.

4. The project would not result in substantial adverse impacts to the economic welfare, social welfare, or cultural practices of the community and State.

5. The project would not substantially affect public health and safety.

6. 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 project is small in scale and would not appear to contribute to environmental degradation.

8. The adverse effects of building a single-family residence in this area appear to be minor and limited to temporary disturbances to traffic, air quality, noise, and visual quality during construction. There are no traffic issues associated with the driveway on the Government Beach Road which has very light traffic levels. There appear to be no substantial government or private projects in construction or planning in the area; and therefore, 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 of the proposed project.

9. The site has been surveyed for threatened and endangered plants, and none are present. Other than the Hawaiian hoary bat, an island wide-ranging species that will experience no adverse impacts due to mitigation in the form of timing of vegetation removal; no rare, threatened, or endangered species of fauna are known to exist on or near the project site, and none would appear to be affected by any project activities. Only very minor exterior lighting is planned, and it will be shielded and will consist blue-deficient lighting such as filtered LED lights or amber LED lights, with a Correlated Color Temperature (CCT) of 2700 Kelvin. This will reduce the risk that transiting threatened or endangered seabirds may be attracted to and then disoriented by the lighting.

10. No substantial effects to air, water, or ambient noises are anticipated and Best Management Practices for erosion and sedimentation will be implemented during any proposed grading.

11. The proposed home site is not located in a flood zone nor would it affect one. In general, geologic conditions do not impose undue constraints on the proposed action, although, as with all of the Puna District, there is the potential for volcanic hazard. The house will meet or exceed all seismic hazard standards. The house would be set back a minimum of 70 feet from the shoreline, and at an elevation of about 30 feet above sea level, it is unlikely to be affected directly by sea level rise or the very slow retreat of shoreline cliffs. The project has adapted to climate change by accounting for the potential for larger storms, through minimizing hard surfaces that generate runoff and removing nearby tall invasive trees. The applicants understand that there are hazards associated with homes in this geologic setting and have made the decision that a residence is not imprudent to construct or inhabit.

12. No substantial adverse effects to scenic vistas and view planes are anticipated.

13. Negligible amounts of energy input and greenhouse gas emission would be required for construction and occupation of the residence. The residence is designed as a single structure with efficient use of energy and materials and natural ventilation and lighting. Electrical power to the home would be provided primarily by rooftop solar photovoltaic panels. A rooftop solar water heater would supply hot water. Even with a propane gas tank to support cooking and the back-up generator and water heater, energy use and greenhouse gas emissions from use of the home would be minimal.

Please publish notice of availability for this project in the February 8th, 2022 edition of *The Environmental Notice*. The DEA will be attached and submitted to ERP via ERP's online submittal form.

Please contact Trevor Fitzpatrick of our Office of Conservation and Coastal Lands staff at (808) 798-6660 or trevor.j.fitzpatrick@hawaii.gov should you have any questions.

From: webmaster@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Monday, January 24, 2022 10:48:47 AM

Action Name

Roehrig Single-Family Residence in the Conservation District in Waʻawaʻa

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (2) Propose any use within any land classified as a conservation district

Judicial district

Puna, Hawaiʻi

Tax Map Key(s) (TMK(s))

(3) 1-4-028:008

Action type

Applicant

Other required permits and approvals

County of Hawaiʻi: Special Management Area Permit Plan Approval and Grubbing, Grading, and Building Permits Driveway Access Permit State of Hawaiʻi: Conservation District Use Permit Wastewater System Approval Chapter 6E SHPD Approval of Archaeological Survey

Discretionary consent required

Conservation District Use Permit

Approving agency

Department of Land and Natural Resources

Agency contact name

Trevor Fitzpatrick

Agency contact email (for info about the action)

trevor.j.fitzpatrick@hawaii.gov

Email address or URL for receiving comments

trevor.j.fitzpatrick@hawaii.gov

Agency contact phone

(808) 798-6660

Agency address

1151 Punchbowl Street #131
Honolulu, HI 96813
United States

Map It

Applicant

Christopher and Wendi Roehrig

Applicant contact name

James Leonard

Applicant contact email

jmleonard@mac.com

Applicant contact phone

(808) 987-4826

Applicant address

64-629 Kohala Place
Kamuela, HI 96743
United States
Map It

Was this submittal prepared by a consultant?

Yes

Consultant

GEOMETRICIAN ASSOCIATES, LLC

Consultant contact name

RON TERRY

Consultant contact email

rterry@hawaii.rr.com

Consultant contact phone

(808) 969-7090

Consultant address

10 Hina Street
Hilo, HI 96720
United States
Map It

Action summary

Applicants propose a home on their 0.459-acre shoreline property within a subdivision in Puna. The 1-story home will be set back 70 feet from the shoreline and will have 2,356-square of interior space, 2 bedrooms, 2 baths, and a garage and lanai. The off-grid home will have rooftop solar PV. The project includes landscaping with the natural hala/naupaka vegetation and replaces hala trees that need to be removed within areas that have or will have invasive trees removed. No threatened and endangered plants are present, and no archaeological sites are present. Grading will be minimal and mitigated by BMPs. Clearing timing restrictions will help prevent impacts to endangered Hawaiian hoary bats. Cultural practices in the form of fishing and gathering sometimes occur makai of the lot and would not be adversely affected.

Reasons supporting determination

Chapter 11-200.1-13, Hawai‘i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

(a) In considering the significance of potential environmental effects, agencies shall consider and evaluate the sum of effects of the proposed action on the quality of the environment.

(b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed action, the expected impacts, and the proposed mitigation measures. In most instances, an action shall be determined to have a significant effect on the environment if it may:

1. Irrevocably commit a natural, cultural, or historic resource. No valuable natural or cultural resource would be committed or lost. Several common native plants are present, including naupaka, hala and bird’s nest fern, of which only a portion will be affected. New individuals of these species will be replanted or will naturally regrow An archaeological inventory survey determined that there are no historic sites. No valuable cultural resources and practices such as shoreline access, fishing, gathering, hunting, or access to ceremonial sites would be adversely affected in any way.

2. Curtail the range of beneficial uses of the environment. No restriction of beneficial uses would occur by residential use on this lot, as the hala forest that would require some tree removal is widespread in the area, and the applicants would be planting as many hala trees as they remove. Shoreline uses on the adjacent narrow shoreline lot would not be affected.

3. Conflict with the State’s environmental policies or long-term environmental goals established by law. 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 environmentally benign and minor, and it is thus consistent with all elements of the State’s long-term environmental policies.

4. Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and 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. Cultural practices would not be affected.

5. Have a substantial adverse effect on public health. An individual wastewater system compliant with Department of Health regulations and adherence to best management practices to minimize or completely avoid water pollution will ensure that the proposed single-family residence will not be detrimental to public health.

6. Involve adverse secondary impacts, such as population changes or effects on public facilities. The small scale of the proposed project would not produce any noticeable secondary impacts, such as population changes or effects on public facilities.

7. Involve a substantial degradation of environmental quality. The project is minor and environmentally benign, and thus it would not contribute to environmental degradation.

8. Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions. The adverse effects of building a single-family residence in this area are limited very minor and temporary disturbance to traffic, air quality, noise, and visual quality during construction.. There are no traffic issues associated with the driveway on the Government Beach Road, which has very light traffic levels. There are no substantial government or private projects in construction or planning in the area, 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.

9. Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat. The site has been surveyed for threatened and endangered plants, and none are present. Other than the

Hawaiian hoary bat, an island wide-ranging species that will experience no adverse impacts due to mitigation in the form of timing of vegetation removal, 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. Only very minor exterior lighting is planned, and it will be shielded and will consist blue-deficient lighting such as filtered LED lights or amber LED lights, with a Correlated Color Temperature (CCT) of 2700 Kelvin. This will reduce the risk that transiting threatened or endangered seabirds may be attracted to and then disoriented by the lighting.

10. Have a substantial adverse effect on air or water quality or ambient noise levels. No substantial effects to air, water, or ambient noise would occur. Erosion and sedimentation impacts will be avoided by implementation of Best Management Practices during grading, which will occur in a very limited area. Brief, temporary noise effects would occur during construction, but sequential house construction is a normal fact of life in rural Puna subdivisions and does not represent an undue impact to neighbors, who themselves underwent the same process. No parks, medical facilities, or other sensitive uses are nearby.

11. Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters. The proposed home site is not located in a flood zone nor would it affect one. In general, geologic conditions do not impose undue constraints on the proposed action, although, as with all of the Puna District, there is substantial volcanic hazard. The house will meet or exceed all seismic hazard standards. The house would be set back a minimum of 70 feet from the shoreline, and at an elevation of about 30 feet above sea level, it is unlikely to be affected directly by sea level rise or the very slow retreat of shoreline cliffs. The project has adapted to climate change by accounting for the potential for larger storms, through minimizing hard surfaces that generate runoff and removing nearby tall invasive trees. The applicants understand 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. Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies. No protected scenic views are located nearby or would be affected in any way. The proposed use is consistent with other single-family residential uses in the area, including the adjacent home on the west, another home one lot away to the east, and homes across the street. Due to the small size of the lot, the home will be visible, but not obtrusive. It will not be visible from the nearest State highway (State Highway 130). Only very minor exterior lighting is planned, and it will be shielded and will consist blue-deficient lighting such as filtered LED lights or amber LED lights, with a Correlated Color Temperature (CCT) of 2700 Kelvin. This will protect dark skies and reduce the risk that the threatened or endangered seabirds may be attracted to and then disoriented by the lighting.

13. Require substantial energy consumption or emit substantial greenhouse gases. Negligible amounts of energy input and greenhouse gas emission would be required for construction and occupation of the residence. The residence is designed as a single structure with efficient use of energy and materials and natural ventilation and lighting. Electrical power to the home would be provided primarily by rooftop solar photovoltaic panels. A rooftop solar water heater would supply hot water. Even with a propane gas tank to support cooking and the back-up generator and water heater, energy use and greenhouse gas emissions from use of the home would be minimal.

Attached documents (signed agency letter & EA/EIS)

- Draft-EA-Roehrig-Single-Family-Residence-in-Conservation-District.pdf
- afonsi-Roehrig-SFR-HA-3885-DEA-Transmittal-Ltr-to-OEQC-part-1-signed.pdf

Action location map

- Roehrig-Property.zip

Authorized individual

RON TERRY

Authorization

- The above named authorized individual hereby certifies that he/she has the authority to make this submission.

Draft Environmental Assessment

Roehrig Single-Family Residence in the Conservation District in Wa‘awa‘a

January 2022

TMK (3rd): 1-4-028:008
Wa‘awa‘a, Puna District, County of Hawai‘i, State of Hawai‘i

APPLICANTS:

Christopher and Wendi Roehrig
64-629 Kohala Place
Kamuela, Hawai‘i 96743

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
10 Hina Street
Hilo, Hawai‘i 96720

Draft Environmental Assessment

Roehrig Single-Family Residence in the Conservation District in Wa‘awa‘a

TMK (3rd): 1-4-028:008
Wa‘awa‘a, Puna District, County of Hawai‘i, State of Hawai‘i

APPLICANTS:

Christopher and Wendi Roehrig
64-629 Kohala Place
Kamuela, Hawai‘i 96743

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
10 Hina Street
Hilo, Hawai‘i 96720

CLASS OF ACTION:

Use of Land in Conservation District

This document is prepared pursuant to:
The Hawai‘i Environmental Policy Act,
Chapter 343, Hawai‘i Revised Statutes (HRS), and
Title 11, Chapter 200.1, Hawai‘i Department of Health Administrative Rules (HAR)

[This page intentionally left blank]

TABLE OF CONTENTS

SUMMARY ii
PART 1: PROJECT DESCRIPTION AND E.A. PROCESS 1
1.1 Project Description and Location 1
1.2 Environmental Assessment Process 1
1.3 Public Involvement and Agency Coordination 9
PART 2: ALTERNATIVES 9
2.1 Proposed Project, Alternative Sites and Alternative Uses 9
2.2 No Action 10
PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION 10
3.1 Physical Environment 10
3.1.1 Climate, Geology, Soils and Geologic Hazards 10
3.1.2 Flood Zones and Shoreline Setting 10
3.1.3 Water Quality 18
3.1.4 Flora and Fauna 19
3.1.5 Air Quality and Noise 24
3.1.6 Scenic Resources 24
3.1.7 Hazardous Substances, Toxic Waste and Hazardous Conditions 25
3.2 Socioeconomic and Cultural 26
3.2.1 Land Use, Socioeconomic Characteristics and Recreation 26
3.2.2 Cultural and Historic Resources 27
3.3 Public Roads, Services and Utilities 44
3.3.1 Roads and Access 44
3.3.2 Public Utilities and Services 44
3.4 Secondary and Cumulative Impacts 45
3.5 Required Permits and Approvals 45
3.6 Consistency with Government Plans and Policies 46
3.6.1 Hawai'i County General Plan 46
3.6.2 Hawai'i County Zoning and Special Management Area 50
3.6.3 Conservation District 51
PART 4: DETERMINATION, FINDINGS AND REASONS 54
4.1 Determination 54
4.2 Findings and Supporting Reasons 54
REFERENCES 57

LIST OF TABLES

TABLE 1 Plant Species Observed on Property 21

LIST OF FIGURES

FIGURE 1 Project Location Map 2
FIGURE 2 Site Photos 3
FIGURE 3 Site Plans 5
FIGURE 4 Flood Zone Map 12
FIGURE 5 Sea Level Rise Exposure Map 14
FIGURE 6 Coastal Photos 16
FIGURE 7 Cross-section of Shoreline Makai of Property 17
FIGURE 8 State Land Use District 52

APPENDIX 1a Comments in Response to Early Consultation
APPENDIX 2 Archaeological Inventory Survey
APPENDIX 3 Coastal Erosion Study
APPENDIX 4 Cultural Consultation Report

SUMMARY OF PROJECT, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Christopher and Wendi Roehrig (the applicants) seek a Conservation District Use Permit (CDUP) to build a single-family residence on their 0.459-acre property located *makai* of the Government Beach Road in the Conservation District in the Wa‘awa‘a Residential Subdivision. This area is between the Hawaiian Shores Subdivision and the Four Corners area of Kapoho, in Lower Puna on the Island of Hawai‘i. The plan for the home, which they have named “Ulu Hala” (Hala Grove), consists of an approximately 2,356-square foot, 2-bedroom, 2-bath, single-story structure with a living room, kitchen and dining area, pantry, lanai, breezeway and garage. The home will feature roof-mounted solar photovoltaic and solar water heating panels, rainfall water catchment and storage, propane gas for cooking and backup water heating and electric power, a gravel driveway, fencing and a driveway gate on the *mauka* road boundary, and an individual wastewater system. The project includes minimal landscaping emphasizing the natural hala/naupaka vegetation and replaces hala trees that need to be removed for the driveway and home site in areas that have already had or will have invasive trees removed.

The proposed home site would be subtly placed in the middle of the lot, partially hidden from the Government Beach Road by existing and new planted hala trees. It will be set back a minimum of 70 feet from the shoreline, which is within a long, narrow common Beach Reserve lot that lies between the coastal residential lots of the subdivision and the sea. The house location is in a slightly elevated, relatively level portion of the property that is outside the native coastal vegetation zone of naupaka, avoiding any coastal hazards and effects on shoreline resources and processes.

Landclearing and construction activities would occur over an area of less than 0.2 acres, 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 and grading permit. The applicants will ensure that all earthwork and grading conforms to applicable laws, regulations and standards. No streams or other water features are present on the lot. The site has been surveyed for threatened and endangered plants, and none are present. Impacts to the island wide-ranging endangered Hawaiian hoary bat will be avoided through timing of vegetation removal. Cultural practices in the form of fishing and gathering sometimes occur *makai* of the lot and would not be adversely affected. An archaeological inventory survey determined that no sites are present. In the unlikely event that additional undocumented archaeological resources, including shell, bones, midden deposits, lava tubes, or similar finds, are encountered during construction, 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.

PART 1: PROJECT DESCRIPTION AND E.A. PROCESS

1.1 Project Description and Location

Christopher and Wendi Roehrig (the applicants) seek a Conservation District Use Permit (CDUP) to build a single-family residence on their 0.459-acre property located *makai* of the Government Beach Road in the Conservation District in the Wa‘awa‘a Residential Subdivision (Figures 1-2). This area is between the Hawaiian Shores subdivision and the Four Corners area of Kapoho, in Puna on the Island of Hawai‘i.

The plan for the home, which they have named “Ulu Hala” (Hala Grove), consists of an approximately 2,356-square foot, 2-bedroom, 2-bath, single-story structure with a living room, kitchen and dining area, pantry, lanai, breezeway and garage. The home will feature roof-mounted solar photovoltaic and solar water heating panels, rainfall water catchment and 10,000-gallon storage tank, propane gas for cooking and backup water heating and electric power, a gated gravel driveway, fencing on the *mauka* boundary and an individual wastewater system. The project includes minimal landscaping emphasizing the natural hala/naupaka vegetation and replaces hala trees that need to be removed for the driveway and home site in areas that have already had or will have invasive trees removed. The Total Development Area for the residence, per Title 13-5, HAR, Exhibit 4, which includes such features such as water and propane storage tanks, is 2,573 sf.

No streams, threatened or endangered plants or archaeological sites are present on the lot. The proposed home site would be subtly placed in the middle of the lot, partially hidden from the Government Beach Road by existing and new planted hala trees. It will be set back a minimum of 70 feet from the shoreline, which is within a long, narrow common Beach Reserve lot that lies between the coastal residential lots of the subdivision and the sea. The house location is in a slightly elevated, relatively level portion of the property that is outside the native coastal vegetation zone of naupaka, avoiding any coastal hazards and effects on shoreline resources and processes. Landclearing and construction activities including the home, driveway, turnaround area, utility structures, catchment tank, and septic system would occur over an area of less than 0.2 acres. Very minor short-term impacts to noise, air and water quality and scenery would be mitigated by Best Management Practices associated with the CDUP and grading permit.

1.2 Environmental Assessment Process

This Environmental Assessment (EA) is being conducted in accordance with Chapter 343 of the Hawai‘i Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200.1, 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 preliminary finding that no significant impacts are expected to occur, based on the findings for each criterion made by the consultant in consultation with the Hawai‘i State Department of Land and Natural Resources (DLNR), the determining agency. If, after considering comments to the Draft EA, DLNR concludes that no significant impacts would be expected to occur, then the agency will issue a Finding of No Significant Impact

Figure 1 Project Location Map

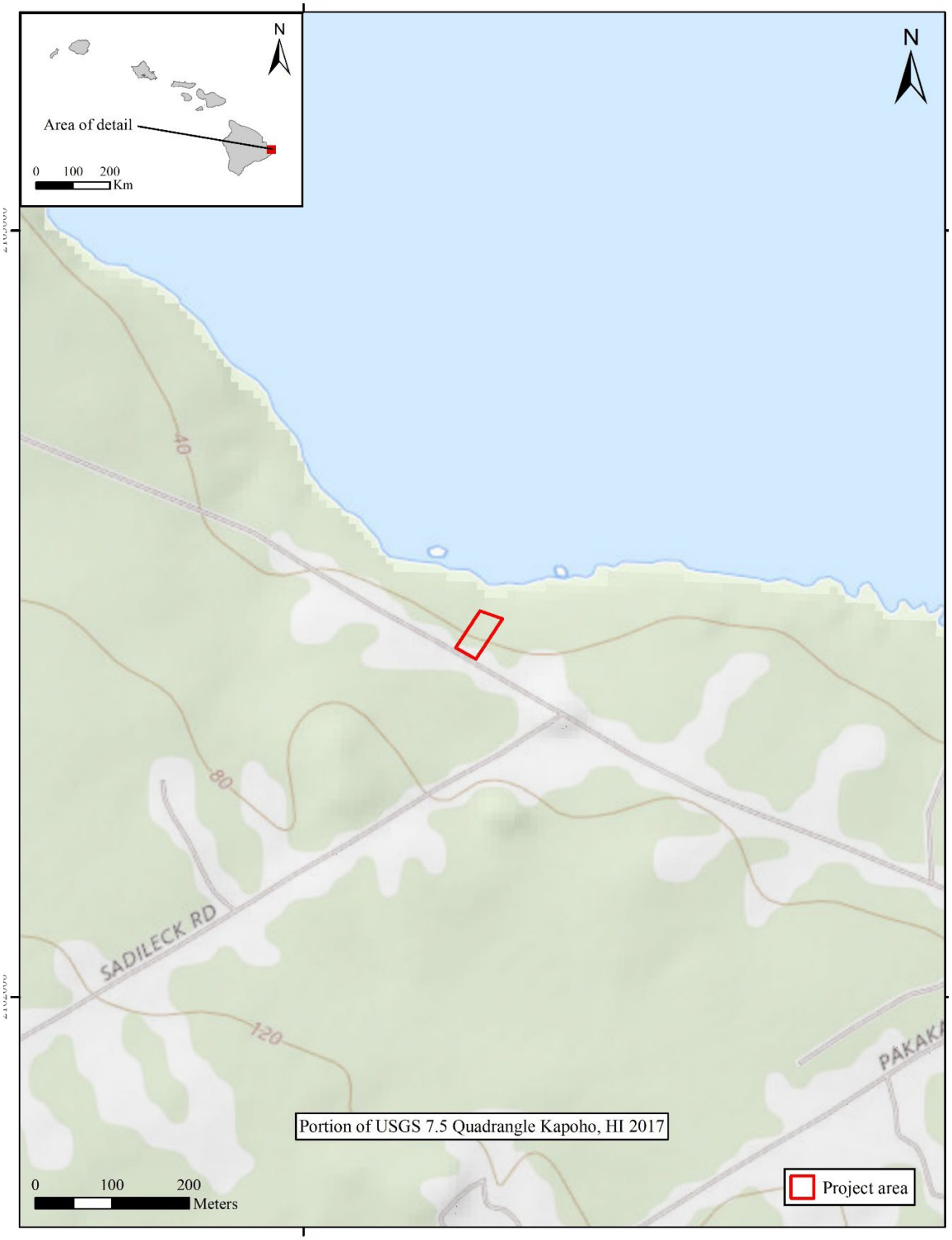


Figure 2 Site Photos

2a: Aerial Image from Google Earth © with Approximate Property Boundary ▲

▼ 2b. Government Beach Road frontage

Figure 2. Site Photos

2c. ▲ Interior of lot

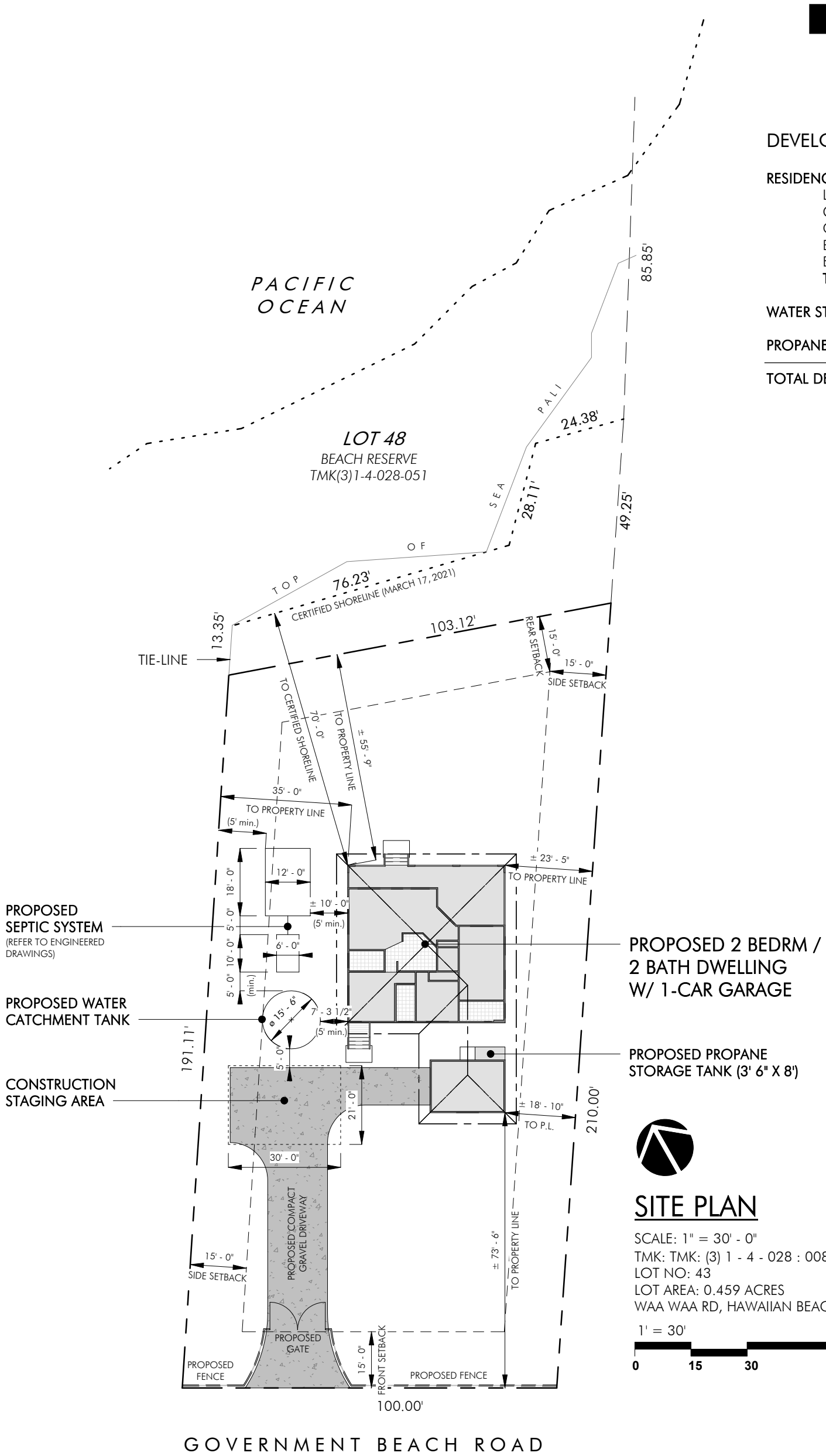
▼ 2d. Shoreline area, naupaka and hala zone

HPM HOMES

HOME PLANNING & DESIGN SERVICES BY
HPM BUILDING SUPPLY

DEVELOPMENT AREA TABULATION

RESIDENCE	
Living Area	1,344.50 SF
Garage	280.00 SF
Covered Lanai	419.50 SF
Breezeway	200.00 SF
Exterior Steps and Landings	112.30 SF
TOTAL AREA - RESIDENCE	**2,356.30 SF**
WATER STORAGE TANK	**188.71 SF**
PROPANE STORAGE TANK	**28.00 SF**
TOTAL DEVELOPMENT AREA	**2,573.01 SF**



SITE PLAN

SCALE: 1" = 30' - 0"
TMK: TMK: (3) 1 - 4 - 028 : 008
LOT NO: 43
LOT AREA: 0.459 ACRES
WAA WAA RD, HAWAIIAN BEACHES, HAWAII

1' = 30'

0 15 30 60 90

HOME OWNER SIGNATURE

BY SIGNING ABOVE, I ACKNOWLEDGE THAT I ACCEPT THE PRELIMINARY DRAWINGS APPROVED ABOVE AS MY FINAL DESIGN. I'M READY TO MOVE FORWARD WITH PREPARING CONSTRUCTION DOCUMENTS FOR MY PROJECT, AND UNDERSTAND THAT ANY CHANGES TO THE SCOPE OF THE PROJECT OR REVISIONS TO THE DESIGN/SPECIFICATIONS MAY RESULT IN ADDITIONAL DRAFTING OR PROJECT COSTS AND AFFECT MY PROJECT TIMELINE.

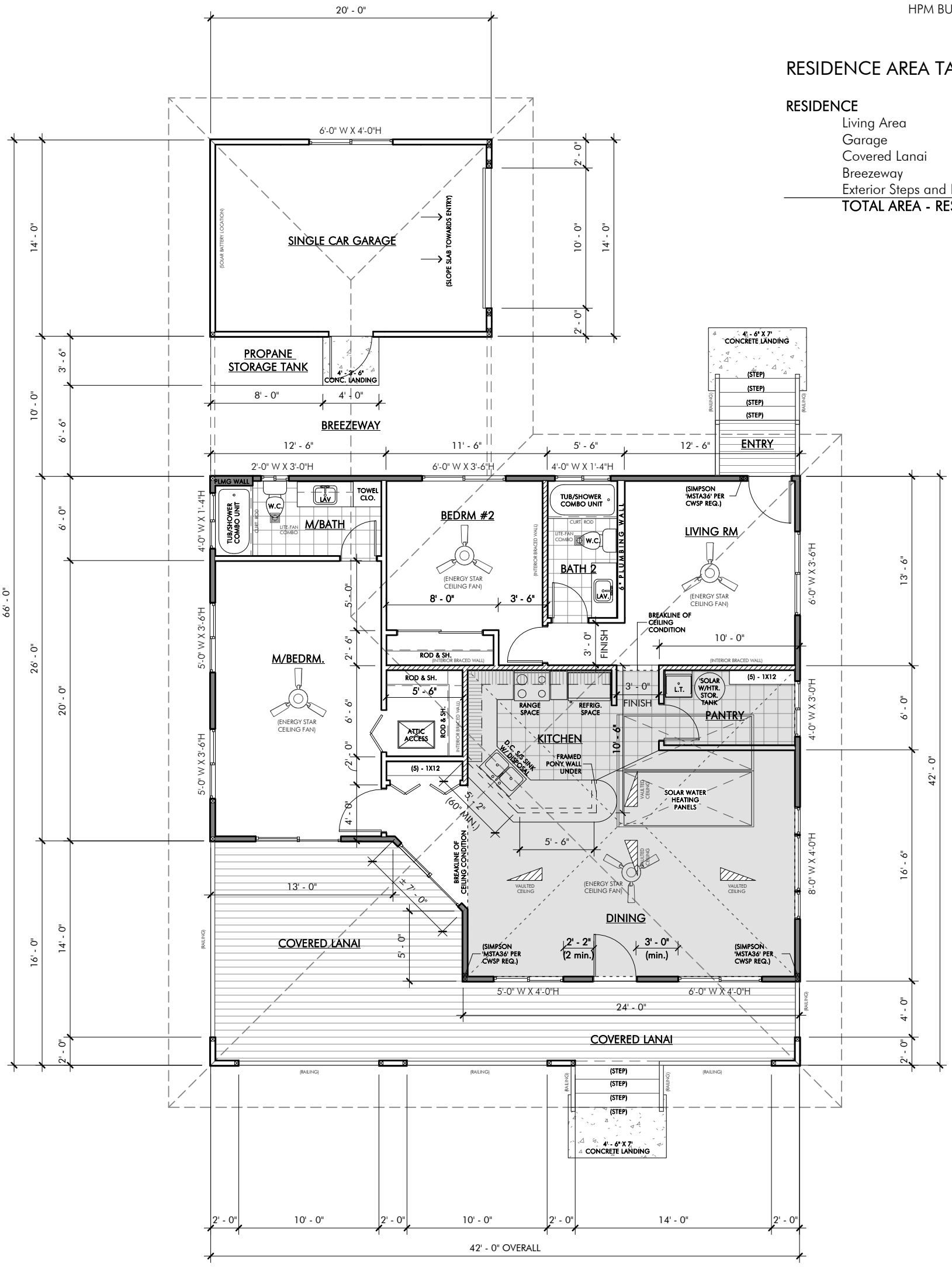
DATE: 11/09/2021	A PROPOSED NEW CONSTRUCTION FOR:	SCALE: As indicated
REVISION NO.: 5	CHRISTOPHER J ROEHRIG & WENDI L ROEHRIG TMK: (3) 1 - 4 - 028 : 008	SHEET NO.: 1 of 3

HPM HOMES

HOME PLANNING & DESIGN SERVICES BY
HPM BUILDING SUPPLY

RESIDENCE AREA TABULATION

RESIDENCE	
Living Area	1,344.50 SF
Garage	280.00 SF
Covered Lanai	419.50 SF
Breezeway	200.00 SF
Exterior Steps and Landings	112.30 SF
TOTAL AREA - RESIDENCE	**2,356.30 SF**



FLOOR PLAN

SCALE: 1/8" = 1' - 0"

1/8" = 1'

0 2 4 8 12 16 20 24

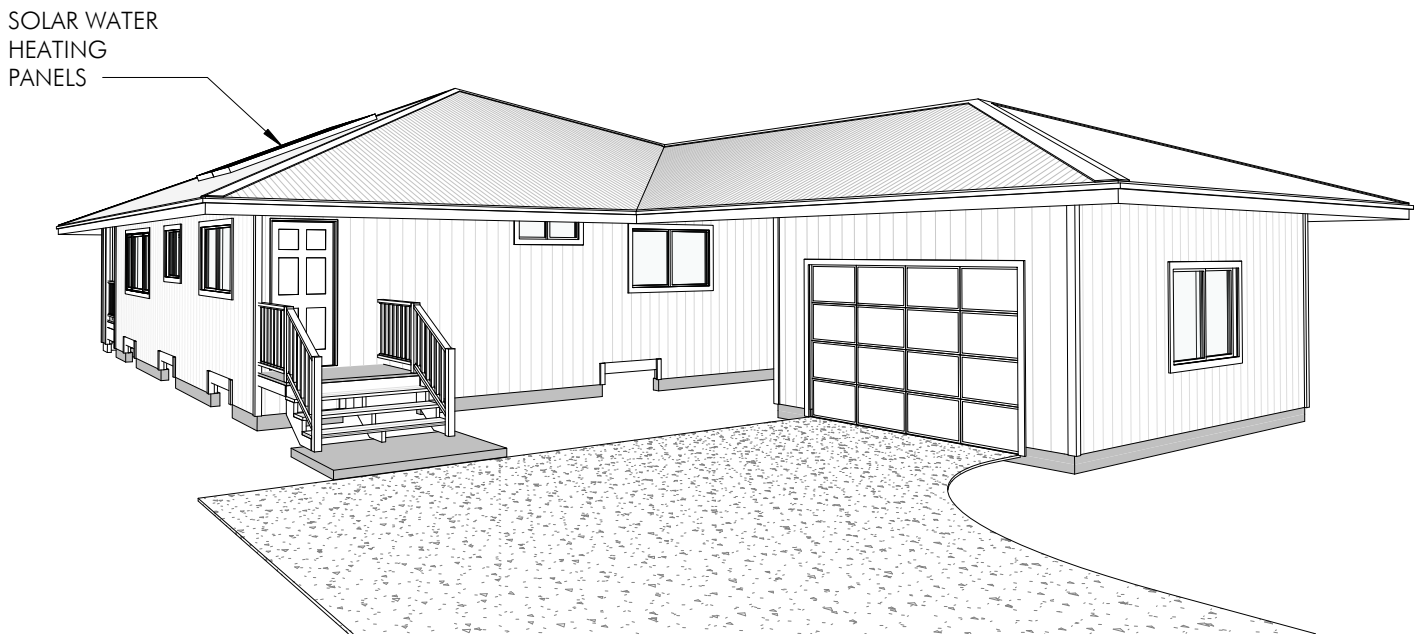
HOME OWNER SIGNATURE

BY SIGNING ABOVE, I ACKNOWLEDGE THAT I ACCEPT THE PRELIMINARY DRAWINGS APPROVED ABOVE AS MY FINAL DESIGN. I'M READY TO MOVE FORWARD WITH PREPARING CONSTRUCTION DOCUMENTS FOR MY PROJECT, AND UNDERSTAND THAT ANY CHANGES TO THE SCOPE OF THE PROJECT OR REVISIONS TO THE DESIGN/SPECIFICATIONS MAY RESULT IN ADDITIONAL DRAFTING OR PROJECT COSTS AND AFFECT MY PROJECT TIMELINE.

DATE: 11/09/2021	A PROPOSED NEW CONSTRUCTION FOR:	SCALE: As indicated
REVISION NO.: 5	CHRISTOPHER J ROEHRIG & WENDI L ROEHRIG TMK: (3) 1 - 4 - 028 : 008	SHEET NO.: 2 of 3

HPM
HOMES

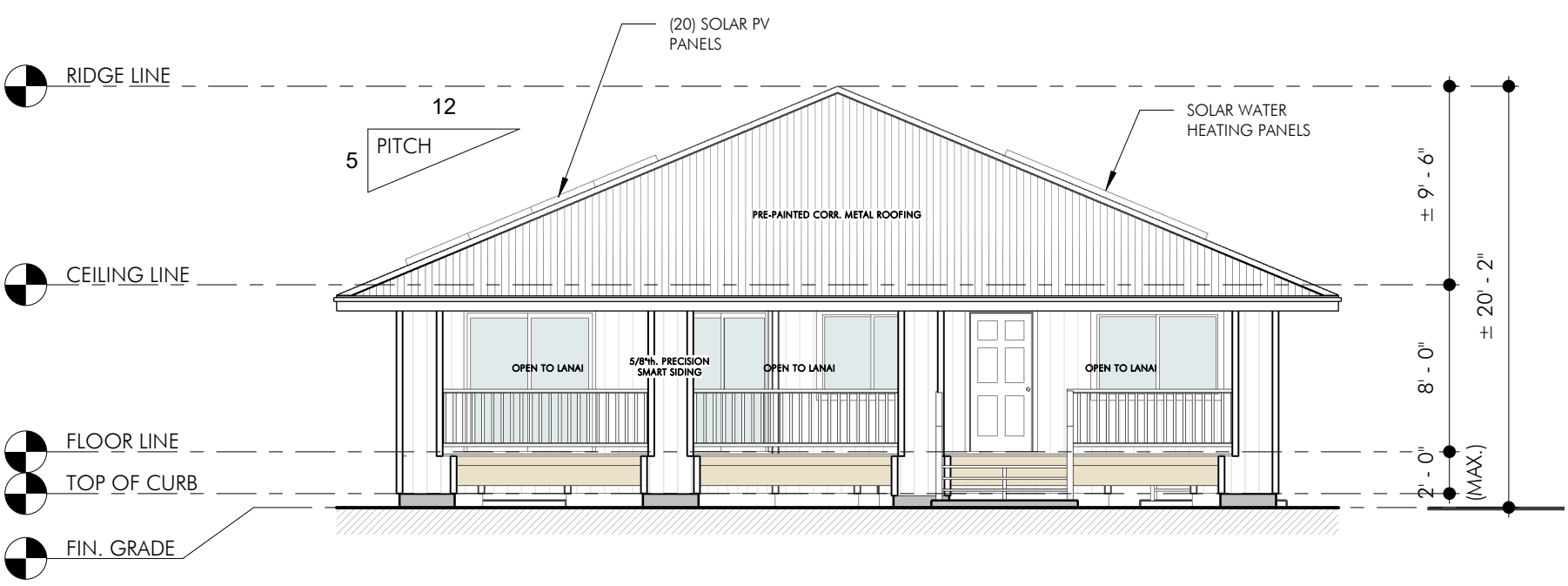
HOME PLANNING & DESIGN SERVICES BY
HPM BUILDING SUPPLY



FACING ROAD

FACING OCEAN

EXTERIOR PERSPECTIVES



FRONT ELEVATION

SCALE: 1/8" = 1' - 0"

1/8" = 1'

0 2 4 8 12 16 20 24

HOME OWNER SIGNATURE

BY SIGNING ABOVE, I ACKNOWLEDGE THAT I ACCEPT THE PRELIMINARY DRAWINGS APPROVED ABOVE AS MY FINAL DESIGN. I'M READY TO MOVE FORWARD WITH PREPARING CONSTRUCTION DOCUMENTS FOR MY PROJECT, AND UNDERSTAND THAT ANY CHANGES TO THE SCOPE OF THE PROJECT OR REVISIONS TO THE DESIGN/SPECIFICATIONS MAY RESULT IN ADDITIONAL DRAFTING OR PROJECT COSTS AND AFFECT MY PROJECT TIMELINE.

DATE: 11/01/2021	A PROPOSED NEW CONSTRUCTION FOR:	SCALE: 1/8" = 1'-0"
REVISION NO.: 4	CHRISTOPHER J ROEHRIG & WENDI L ROEHRIG TMK: (3) 1 - 4 - 028 : 008	SHEET NO.: 3 of 3

[This page intentionally left blank]

(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 EA 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), Land Division and OCCL
Office of Hawaiian Affairs

Private:

Sierra Club
Hawai'i Island Chamber of Commerce
Three Adjacent Property Owners: Surdock, Blair, Bilinsky, Nelson Trust
Malama O Puna

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

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 lot size is only 0.459 acres, limiting choices for location of the home site. As shown in Figure 3a, the home would be located roughly in the middle of the property, perched on a subtle rise that ascends out of the makai portion of the property. This maximizes shielding for viewers from the both the Government Beach Road and the sea. It affords coastal views and coastal breezes while avoiding shoreline hazards and interfering with shoreline processes and recreation. While several dozen hala trees would require removal, disturbance would avoid the shoreline naupaka zone, and there is ample room on the property for additional hala to be planted, utilizing the abundant hala keiki.

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 all three factors: breezes, views and shoreline hazard/resource avoidance. There are no known environmental or other reasons 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 farm or tourist nature park, are desired by the applicants, and thus none are addressed in this EA.

2.2 No Action

Under the No Action Alternative, the residence would not be built. The lot would remain unused, except for perhaps temporary camping and picnicking by the owner and his guests. 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

3.1 Physical Environment

3.1.1 Climate, Geology, Soils and Geologic Hazards

Environmental Setting

Temperatures are warm year-round at the project site, with slightly cooler winters, and annual rainfall is about 103 inches. Winds are generally trade winds from the east/northeast, often with light downslope land breezes at night (UH Hilo Dept. of Geography 1998; Giambelluca et al. 2013).

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. 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, and both Act 17 of the 2018 Hawai‘i Legislature and Title 11, Chapter 200.1 now require analysis of sea-level rise and greenhouse gases in environmental impact statements. In terms of climate, it is possible, and even likely, that warmer temperatures and larger and more frequent tropical storms and hurricanes will affect the Hawaiian Islands in the future. In addition, as discussed in Section 3.1.2, accelerating sea level rise is expected.

The project site is located on the flank of Kilauea, an active volcano, in the District of Puna, in the *ahupua‘a* of Wa‘awa‘a, on lava flows dated at between 750 and 1,500 years ago. It is about 1,000 feet southeast of an 1840 lava flow. A littoral cone created by the 1840 flow at the shoreline is located

approximately a half mile to the northwest (Wolfe and Morris 1996). Soil in the area is Opihikao extremely rocky muck (3-25% slopes), part of the Opihikao series of well-drained thin organic soils that have developed over pahoehoe bedrock. They are found from sea level to 1,000 feet in elevation and are rapidly permeable, with slow run-off, and a slight erosion hazard (U.S. Soil Conservation Service 1973). This soil is within subclass VIIs, which means it has limitations that make it unsuitable for cultivation and restrict its use to pasture, range, woodland or wildlife.

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 project span. Several towns and villages in Puna, including Pāhoa and Kalapana (as well as Kapoho, now covered by lava), are within Zone 2.

The Island of Hawai'i experiences high seismic activity and is at risk from earthquake damage (USGS 2000), especially to structures that are poorly designed or built, as the 6.7-magnitude quake of October 2006 and the 6.9-magnitude quake of May 2018 demonstrated. The property is moderately sloped and there are no issues with steep or unstable slopes. 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 order to deal with the potential for larger and more frequent tropical storms that could be part of a changing climate, the home has been designed to withstand hurricane force winds. Electricity would be provided primarily by rooftop solar photovoltaic panels. A rooftop solar water heater would supply hot water. Propane would be used as backup for electrical power and hot water. These features would help minimize the greenhouse gas emissions from use of the residence. The implications of climate change and resulting sea level rise and coastal erosion are dealt with in the next section. In general, geologic conditions do not impose undue constraints on the proposed action. The applicants understand that there are hazards associated with homes in this geologic setting and have made the decision, like tens of thousands of other residents of the island, that a home in this area 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). The flood zones for this region were recently mapped, and digital maps are available from the Department of Land and Natural Resources at http://gis.hawaiinfip.org/fhat/ (Figure 4). The entire property is classified in Flood Zone X, areas with minimal flood hazards, including tsunami inundation.

Figure 4. Flood Zone Map

Flood Hazard Assessment Report

www.hawaiinfip.org

Property Information

COUNTY:	HAWAII
TMK NO:	(3) 1-4-028:008
WATERSHED:	KAAHAKINI
PARCEL ADDRESS:	ADDRESS NOT DETERMINED PAHOA, HI 96778

Notes:

Flood Hazard Information

FIRM INDEX DATE:	SEPTEMBER 29, 2017
LETTER OF MAP CHANGE(S):	NONE
FEMA FIRM PANEL:	1551661201F
PANEL EFFECTIVE DATE:	SEPTEMBER 29, 2017

THIS PROPERTY IS WITHIN A TSUNAMI EVACUTION ZONE: YES
FOR MORE INFO, VISIT: http://www.scd.hawaii.gov/

THIS PROPERTY IS WITHIN A DAM EVACUATION ZONE: NO
FOR MORE INFO, VISIT: http://dlnreng.hawaii.gov/dam/

0 100 200 ft

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

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

FLOOD HAZARD ASSESSMENT TOOL LAYER LEGEND
(Note: legend does not correspond with NFHL)

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

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

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

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

OTHER FLOOD AREAS

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

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

Coastal Erosion, Coastal Hazards and Sea Level Rise

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. Hwang (2005) recommended that all hazards facing coastal areas – not just erosion – should be considered when planning for zoning in Hawai‘i. In a USGS-sponsored study, Fletcher et al. (2002) portrayed generalized hazards assessments for long sections of Hawai‘i's coastlines. There are individual ratings for Tsunami, Stream Flooding, High Waves, Storms, Erosion, Sea Level Change, and Volcanic/ Seismic, culminating in an Overall Hazard Assessment. Based on Tsunami and High Waves, most of the Puna Coastline is rated 5 or 6 out of 7 for Overall Hazard. The Wa‘awa‘a area is rated 5.

Because the proposed use of a single-family residence on this coastal property has an expected useful lifetime of 40 to 70 years, it is important to examine the potential for future sea level rise. Sea level rise also factors into future rates of coastal retreat and erosion. An overall global (or eustatic, meaning not attributable to local factors) rise in sea level of 3.3 feet by the end of the 21st century was proposed by Fletcher (2010) and others. More recent scientific assessments (e.g., Rahmstorf et al. 2012) posit 4 feet as a reasonable upper bound. Some recent research that concentrates on the potential for Antarctic melting to contribute more to sea level than generally modeled envisions as much as an additional 3 feet of sea level rise (DeConto and Pollard 2016). Not only the magnitude of sea level rise but also the timing is the subject of debate. According to the Hawai‘i Climate Change Mitigation and Adaptation Commission (HCCMAC) (2017:v):

> While the IPCC's "business as usual" scenario, where GHG emissions continue at the current rate of increase, predicts up to 3.2 feet of global sea level rise by year 2100 (IPCC 2014), recent observations and projections suggest that this magnitude of sea level rise could occur as early as year 2060 under more recently published highest-end scenarios...

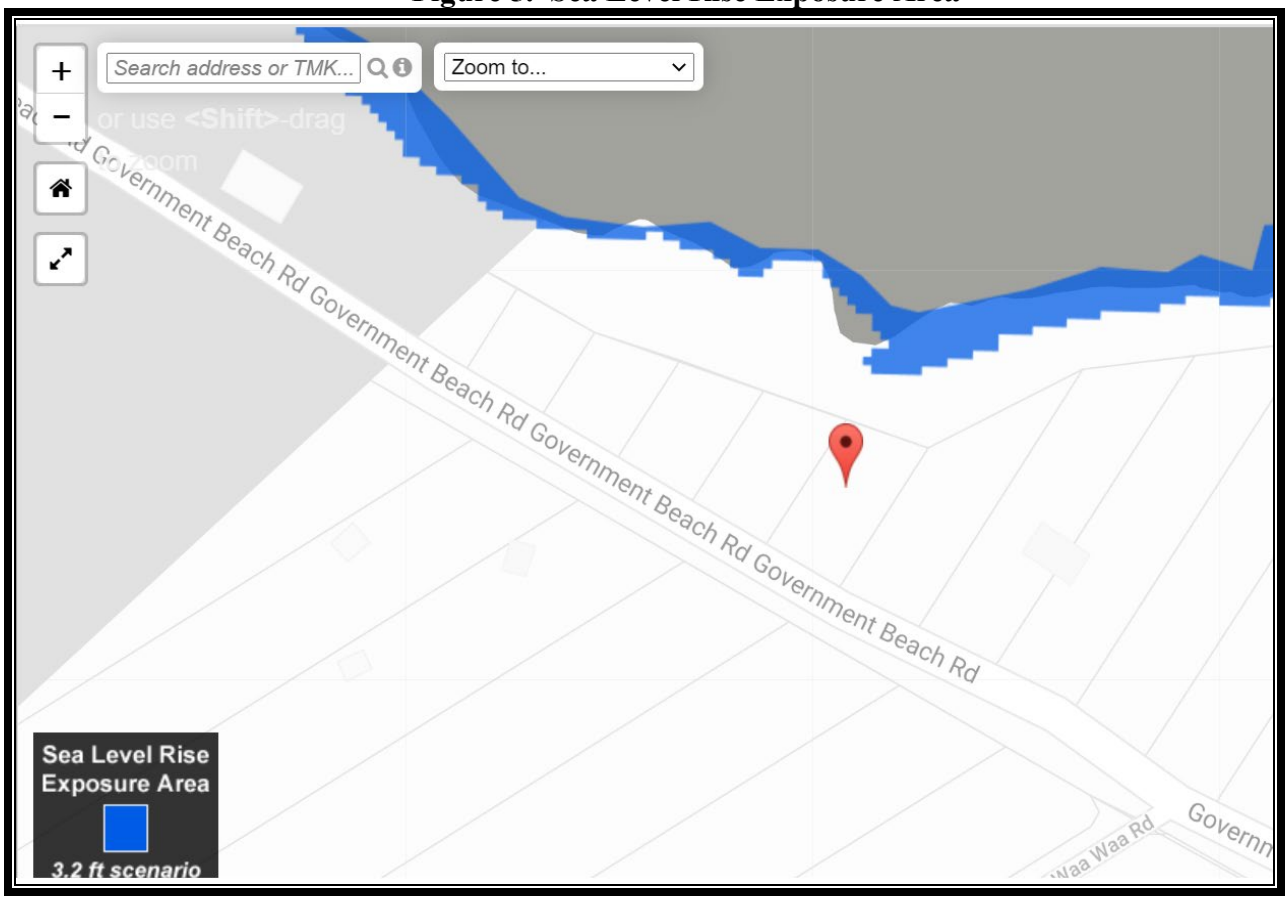
Relative sea-level rise is a result of the combined eustatic water rise and land subsidence. In some locations, the effects of eustatic sea level rise can be magnified substantially. The 1975 Kalapana earthquake on Kilauea's rift caused land in Kapoho to drop 0.8 feet (based on Hawaiian Volcano Observatory (USGS) data in Hwang et al. (2007:6). This episodic, seismic-induced subsistence is difficult to estimate over human-scale time periods. On the basis of InSAR (Synthetic Aperture Radar Interferometry) remote sensing data, Hwang et al. (ibid.) stated that the coastline at Kapoho (prior to the 2018 eruption that completely covered the area) was subsiding at a continuous rate of between 0.31-0.67 in/yr. Rates of subsidence at the subject property are certainly much lower as a result of its distance from Kilauea's tectonically active rift zone, as well as its position on the west side of the rift zone, where land is supported by the bulk of Mauna Loa. A rate in the middle of this estimate, or a little less than 0.5 in/yr., is probably conservative. A highly conservative estimate of overall sea level change by the year 2070, accounting for a eustatic rise of 5 feet and local tectonic sinking of about 2, is 7 feet. The greatest rate of SLR will take place during the second half of this century according to recent modeling (e.g., Cazenave and Le Cozannet 2014). Sea level rise exposure maps from the State of Hawai‘i indicate that the property

and especially the chosen home location is not at risk from near-term sea level rise (see sea level rise exposure area in Figure 5). Even fairly large rises in sea level of the type that would essentially require the relocation of much of downtown Hilo and Honolulu would not affect the home in its proposed location.

Single Family Residence 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 in the form of a Coastal Erosion Study for any property for which construction is proposed. Such a study integrates on-site quantitative measurements by a credentialed specialist, inspection of available aerial and satellite imagery taken over a period of time, and a review of geological literature.

A Coastal Erosion Study that also considered other coastal hazards was prepared for the property by T.E. Scheffler, Ph.D., and J.P. Lockwood, Ph.D. The full report is attached as Appendix 3 and summarized briefly below. The reader is referred to the report for additional detailed description, maps and photos.

Figure 5. Sea Level Rise Exposure Area



Symbol indicates property location. Source: https://www.pacioos.hawaii.edu/shoreline/slr-hawaii/

The study began with an evaluation of the topography and geology of the property. Government Beach Road runs at an elevation between 30 and 40 feet above sea level. The Roehrig property slopes seaward from the road. The *mauka* two-thirds of the property is a mix of pāhoehoe and a‘ā lavas, where the uneven ground is heavily covered with hala and coconut trees. The *makai* third is topographically lower and is covered with naupaka. This vegetative front extends *makai* beyond the property boundary to the edge of an abrupt cliff of 3 to 6 feet in height, which represents the legal shoreline.

A view westward of the coastline fronting the Roehrig property is shown in Figure 6a. Normal surf does not reach above the coastal cliff in the background. However, rounded and sub-angular boulder rubble as well as very well-rounded cobbles shown in the foreground attest to the impact of storm waves over this zone. The vegetation is another indication of these impacts, defining the official “shoreline” at the property and the 40-60 foot zone of “beach”.

The coast of this part of the Puna District faces the open ocean with no submerged barriers such as offshore reefs or sand bars to buffer it. The submarine slope is approximately 1,300 feet/mile for a distance of roughly 6 miles, descending into the deep water Puna Canyon. The extremely long fetch of waves crossing the Pacific creates a situation where big, long period swells rising to significant heights slam into the island’s flank. Large waves reaching the coast are predominantly related to tradewind conditions, though the coastline is also exposed directly to large North Pacific swells. The Wa‘awa‘a coastline faces approximately north, the direction from which the largest waves come. North Pacific swells can reach significant heights of 20 feet or more and are a major contributor to coastal erosion and storm damage in vulnerable areas. The mean range of tidal change (MN) is 1.67 feet with a Great Diurnal Range of 2.4 feet.

Tim Scheffler, Ph.D., visited the property on March 22, 2021; 3 hours were spent making field observations, surveying with Brunton pocket transit and measuring tape, and obtaining site photography. The field observations were taken as the tide reached a high of 0.9 feet. The ocean was characterized by moderate to large swells (6-8 feet), which had generated a high surf advisory for the island’s east-facing shores. This prevented detailed observation of coastal lava layers on the sea cliff.

The lava flow underlying most of the Property is pāhoehoe, but slow cliff retreat over centuries reveals that this pāhoehoe overlies ‘a‘ā , along a sharp contact (Figure 6b). The coastal sea cliff is composed of the dense, “blue rock” core of this ‘a‘ā unit. This forms a surface resistant to erosion despite heavy scouring of the storm wave impact zone. The flow morphology grades upward into densely welded and moderately oxidized ‘a‘ā breccia. These welded breccias are in turn overlain by discontinuous loose rubble zones up to 10 feet thick, which are the rocks here most vulnerable to erosion.

Figure 6. Coastal Photos

6a. View of Beach Reserve with Roehrig property in background, view to west. ▲

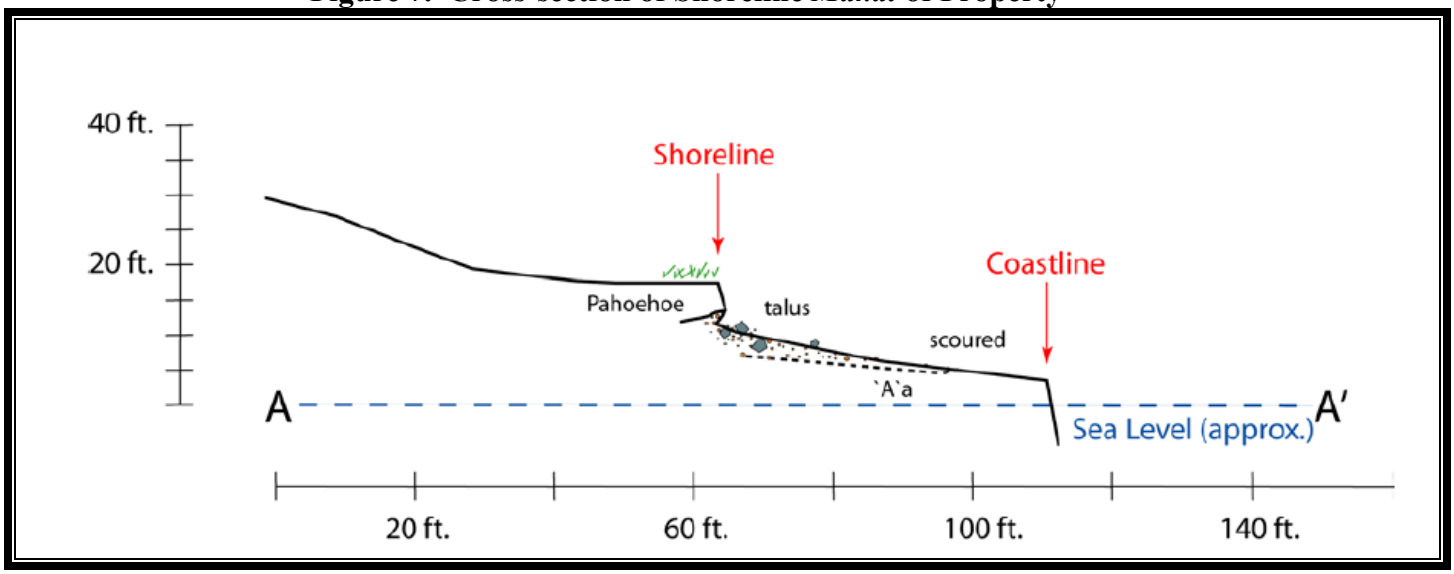
▼ 6b. Property line, legal shoreline (from shoreline survey) and flow contact line (red-dashed).

Atop the looser 'a'ā breccia lies the surface pāhoehoe flow, which consists of a single 2-3 meter thick flow unit where exposed along the shoreline cliff. The pāhoehoe flow is too thin to contain pyroducts ("lava tubes") beneath the property. The interface of these two flow-types largely defines the geomorphology of the area. The weak joint between the 'a'ā and pāhoehoe allows pāhoehoe "skin" to be peeled back, thus creating the beach bench. Sub-rounded storm-tossed boulders, remains of the upper pāhoehoe lip, overlie the a'ā .These large blocks are slowly crumbling in the face of extreme wave run-up.

The beach, per se, is a slightly sloping (12-15 degrees) accumulation of well-worn cobbles and boulders overlying the basal substrate of 'a'ā described above. The toe of this 'a'ā shelf, or beach bench, is mostly scoured clean of debris by storm waves. It ends abruptly at the water's edge, which at low tide is about 2-3 feet above sea level. Debris accumulates against the rear of this bench, in the recess created by the cliff. The majority of this rubble talus is material eroded from the surface of the 'a'ā bench heavily worn by the ocean and occurring as smaller very-well rounded clasts. The cliff is highly resistant to erosion, even by powerful marine wave action, as there is little jointing or fracturing of its interior. Large sub-rounded to sub-angular detached boulders at its base, intermingled with the more heavily weathered storm tossed 'a'ā debris, indicate that minor sea-cliff erosion is occurring. However, this occasional weathering and the stochastic block failures do not seem to contribute to any significant rate of retreat of the cliff.

These relationships are illustrated in Figure 7, a scaled schematic profile of the beach bench, cliff face and property. During the occasional storms that generate waves at the cliff face, the talus material serves as a sort of revetment and protective shield to direct impacts on the cliff face. This is likely one factor in the relative lack of evidence for active erosion along this edge.

Figure 7. Cross-section of Shoreline *Makai* of Property



The inspection of digital aerial photographs from 1954, 1965, 1977 and 2019 showed no measurable change in position of the overall coastal sea-cliff or of the vegetation line since the earliest 1954 photos. The large scale (and thus limited resolution) of the aerial photographs inspected does not allow quantifying fine-scale morphological changes of the shoreline or sea-cliff. Given the maximum 600 dpi resolution of the images, a single pixel represents around 10 feet, so changes of less than 10 feet cannot be detected. Given these confounding variables, any shoreline determinations must rely more heavily upon primary indicators – as discussed above, mainly active erosion indicators such as freshly cut cliff faces or presence of angular erosional debris. The geologists also broadened the examination to include comparisons over this time of the prominent lava fingers to the east. These also do not seem to have undergone any significant change in the last half century. There is no visible indication that either the shoreline vegetation or the width of the 'a'ā bench has changed over the 67 year period since the first aerial photographic record began. Nor are there measurable changes in sea cliff (coastline) position. It appears that the maximum amount of coastal erosion fronting the property is 10 feet or less. **The Average Annual Erosion Rate (AAER) of the shoreline at the property over the past 67 years is thus estimated to be a maximum of 0.15 feet per year.**

If erosion occurred at the maximum rate calculated for the past nearly 70 years, 70 years from now there would be additional erosion causing a retreat of 10.5 feet or less. If sea level rises by 3 to 5 feet over this period, there could be additional erosion because of the area of wave attack would move forward and upward within the zone between the water's edge and the shoreline, which itself lies about 20 feet above sea level. Even under these circumstances, the proposed location of the Roehrig home would not appear to be vulnerable to coastal erosion, as it would be 70 feet from the shoreline and 110 feet from the water's edge. The combination of the buffering Beach Reserve lot, the substantial distance to the shoreline from the proposed home, the elevation of the proposed home at approximately 30 feet above sea level, and the hard rock lava surface indicates that shoreline erosion is not a significant risk for the proposed home.

3.1.3 Water Quality

The house would be set back a minimum of 70 feet from the shoreline and no grading activities would occur *makai* of this area. No streams, springs, or anchialine ponds are found on or near the proposed home site or any affected area.

With home construction, the primary activity with potential to affect water quality is grading. Overall, the proposed improvements will require relatively little grading due to the compact arrangement of the proposed home, driveway and utility areas. Grubbing and grading will occur in the areas of the driveway and parking/turnaround area; the water catchment tank, house site; construction staging area, and the trenches required for the septic system. Extracted material from the trenching will be used to refill trenched areas and to blend the areas with the surrounding topography so as to avoid the need for any off-site disposal of material. The total area of grading is less than 0.2 acres.

A County grading permit will be required. Grading will include Best Management practices (BMPs) to minimize the potential for sedimentation, erosion and pollution of coastal waters. The applicants will ensure all earthwork and grading is conducted 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) Any additional best management practices required by the Board of Land and Natural Resources.

The applicants will require that the construction contractor implement the following BMPs:

- Keeping the total amount of land disturbance to a minimal area, which will be delineated to the construction contractor prior to the commencement of any onsite work. The *makai* limits of grading will be marked and fenced at the construction areas to avoid any possible disturbance to the ground or vegetation within *makai* area during construction activities.
- No concrete truck washout or equipment servicing will be allowed on site.
- The contractor will take special precautions so as to not allow any sediment to leave the work areas, particularly towards the sea. Prior to the start of construction, contractors will implement erosion control measures, including silt fences along the lower margin of grading, silt barriers (snakes) around stockpiles etc., to prevent any sediment from leaving the construction areas, especially towards the ocean.
- Construction activities with the potential to produce potential stormwater run-off will not be allowed during periods of unusually heavy rains or storm conditions.
- Graded areas will be replanted or stabilized as soon as possible following grading activity.

The general Puna Coast, including the specific Wa'awa'a area, already supports hundreds of homes and there are no reported water quality problems from these uses. Upon its completion, the home would appear similar to the homes on shoreline lots in the area, and it 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 human settlement of Hawai'i, the natural vegetation of this part of this part of Puna shoreline was mostly coastal forest and strand vegetation, dominated by naupaka (*Scaevola taccada*), hala (*Pandanus tectorius*), 'ōhi'a (*Metrosideros polymorpha*), nanea (*Vigna marina*) and various sedges and coastal herbs (Gagne and Cuddihy 1990). The site was systematically inspected for plants by Dr. Ron Terry in January 2021. Special attention was paid during several field visits to potential endangered species, particularly *Ischaemum byrone,* a State and federally listed endangered grass known to grow in the general area.

As illustrated in the photos in Figure 3, aside from a roadside fringe of non-native species and a *makai* area with *naupaka* (*Scaevola taccada*), over most of its extent, the project site is dominated by the native hala (*Pandanus tectorius*) and coconut palms (*Cocos nucifera*). Most of the other species present are non-native species, and all of the natives are very common in Puna and throughout the State of Hawai'i. No *Ischaemum byrone* or any other rare, threatened or endangered plant species was found on or near the property. A list of all species detected on the property is found in Table 1.

Environmental Setting: Fauna

Typical expected birds in this part of Puna include common myna (*Acridotheres tristis*), northern cardinal (*Cardinalis cardinalis*), spotted dove (*Streptopelia chinensis*), Japanese white-eye (*Zosterops japonicus*), and house finch (*Carpodacus mexicanus*). 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. The property itself is unlikely habitat, because it is away from the shoreline and densely vegetated. They are found in the shoreline area *makai* of the property.

Site visits identified no species of native forest birds, which in general are unlikely to use the project site due to its low elevation, alien vegetation and lack of adequate forest resources. However, two native forest birds are likely to make use of the general area. The Hawaiian hawk (*Buteo solitarius*) was formerly listed federally as endangered, and is still listed by the State of Hawai'i. It generally prefers 'ōhi'a forest habitat but is known to breed successfully in both native and non-native forests. It occurs throughout the island of Hawai'i from sea level to 8,530 feet in elevation. Hawks often forage in forests near agricultural tracts and nest in tall trees of a variety of species. Most nesting occurs in native 'ōhi'a trees, although hawks may also nest in non-native trees, including eucalyptus, ironwood, mango, coconut palm and macadamia. Nest construction is protracted, beginning up to two months before the first egg is laid and continuing into the nestling period. Egg-laying generally occurs from March to June, and fledging from July to September. Both sexes contribute to nest-building. Clutch size is nearly always one, but clutches of two and three have been reported. Both sexes incubate, although females perform most of the brooding of nestlings; males provide most of the food to chicks and female. Both adults feed fledglings, which are dependent on adults for up nine months. When nests are present, grading, tree removal and other construction activities can disturb them. Given the vegetation context with only fairly short-stature hala and coconut trees, as well as the location between two existing homes, there is almost no possibility that hawk nesting occurs on very near the property.

Although a number of other native forest birds occur in the uplands of Puna above 3,000 feet in elevation, the only one that might occasionally be in this area is the 'amakihi (*Chlorodrepanis virens*). This endemic honeycreeper has developed some degree of immunity to mosquito-borne diseases and can be found in lowland 'ōhi'a forests and sometimes ironwood groves in Puna. Bird survey work on the eastern end of the Island of Hawai'i documented in Spiegel et al. (2006) indicate that in many lowland forests, 'amakihi are the most common and widespread native birds and are significantly associated with 'ōhi'a. Most other

Table 1. Plant Species Observed on Property

Scientific Name	Family	Common Name	Life Form	Status
Ageratum conyzoides	Asteraceae	Ageratum	Herb	A
Asplenium nidus	Aspleniaceae	‘Ekaha	Fern	I
Casuarina equisetifolia	Casuarinaceae	Ironwood	Tree	A
Cecropia obtusifolia	Cecropiaceae	Guarumo	Tree	A
Cocos nucifera	Arecaceae	Coconut	Tree	A
Cordyline fruticosa	Agavaceae	Ti	Shrub	A
Commelina diffusa	Commelinaceae	Honohono	Herb	A
Desmodium intortum	Fabaceae	Desmodium	Vine	A
Desmodium triflorum	Fabaceae	Tick clover	Herb	A
Digitaria ciliaris	Poaceae	Henry’s crabgrass	Herb	A
Emilia fosbergii	Asteraceae	Pualele	Herb	A
Fimbristylis cymosa	Cyperaceae	Mau‘u ‘aki‘aki	Sedge	I
Melochia umbellata	Sterculiaceae	Melochia	Tree	A
Melinis minutiflora	Poaceae	Molasses grass	Grass	A
Morinda citrifolia	Rubiaceae	Noni	Tree	A
Nephrolepis multiflora	Nephrolepidaceae	Sword fern	Fern	A
Paederia foetida	Rubiaceae	Maile pilau	Vine	A
Pandanus tectorius	Pandanaceae	Hala	Tree	I
Panicum maximum	Poaceae	Guinea grass	Grass	A
Pennisetum purpureum	Poaceae	Napier grass	Grass	A
Phymatosorus grossus	Polypodiaceae	Laua‘e	Fern	A
Pluchea carolinensis	Asteraceae	Sourbush	Shrub	A
Psidium guajava	Myrtaceae	Guava	Tree	A
Scaevola taccada	Goodeniaceae	Naupaka	Shrub	I
Schefflera actinophylla	Araliaceae	Octopus tree	Tree	A
Sphagneticola trilobata	Asteraceae	Wedelia	Herb	A
Urochloa mutica	Poaceae	California grass	Herb	A

E= Endemic, I = Indigenous, A = Alien. One unknown sedge (Cyperaceae) observed.

native forest birds are only found in the outside the mosquito belt (generally above 4,000 feet in elevation), where native plant resources are still present and *Culex* mosquitos are absent or scarce.

As with all of the island of Hawai‘i, several listed seabirds may overfly the Wa‘awa‘a area between the months of May and November, including the endangered Hawaiian petrel (*Pterodroma sandwichensis*), the endangered band-rumped storm petrel (*Oceanodroma castro*), and the threatened Newell’s shearwater (*Puffinus auricularis newelli*). These seabirds hunt over the ocean during the day and fly to higher elevations at night to nest. The Hawaiian petrel was formerly common on the Island of Hawai‘i. This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea, as well as at the mid-to-high elevations of Hualālai. It has within recent historic times been reduced to relict breeding colonies located at high elevations on Mauna Loa,

Kohala and, possibly, Hualālai. The Hawaiian petrel (as well as the band-rumped storm petrel) generally nest on the Big Island well above 5,000 feet in elevation. Some Hawaiian petrel nests have recently been found at lower elevations on Kohala volcano. Both the Newell's shearwater and Hawaiian petrel are known to burrow under ferns on forested mountain slopes. These burrows are used year after year, usually by the same pair of birds. Although capable of climbing shrubs and trees before taking flight, they need an open downhill flight path through which they can become airborne. Once abundant on all the main Hawaiian islands, most Newell's shearwater colonies are today found in the steep terrain between 500 to 2,300 feet on Kaua'i. Band-rumped storm petrels have recently been discovered to be nesting on the Mauna Loa side of the saddle between this mountain and Mauna Kea. Although each of these seabirds may fly over on their way to and from mountain nesting areas and the open ocean, no suitable nesting habitat for any of them is present on the property.

The primary cause of mortality in these seabird species in Hawai'i is thought to be predation by alien mammals at the nesting colonies. Collision with man-made structures is another significant cause. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with manmade structures and, if not killed outright, become easy targets of predatory mammals including cats and mongooses.

It is highly likely that Hawaiian hoary bats (*Lasiurus cinereus semotus*), the only native Hawaiian land mammals, are sometimes present on the property. They have been found throughout most areas on the island of Hawai'i. Bats may forage for flying insects on the property on a seasonal basis and may also roost in trees and large shrubs. Bats are often visible while they are feeding on flying insects near dusk and dawn at various locations around the island of Hawai'i. The presence of these bats can also be verified by echolocation detectors. If a bat is detected during a night's study, this merely indicates that they were present in the area. Conversely, the absence of bat detections does not indicate an absence of bats, which may have been absent for only a night, a week, or a season, or may have simply gone undetected. Determination of bat populations or usage patterns requires much more sophisticated, long term studies. No bats were observed in our surveys, which took place in daylight and did not use any detection equipment. For the purposes of this assessment, it is assumed that Hawaiian hoary bats are present at least some of the time, as they have been frequently seen and detected in forests with hala and coconuts. Hawaiian hoary bats are vulnerable to disturbance during the summer pupping season and require special mitigation, as discussed below.

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. There are no native terrestrial reptiles or amphibians in Hawai'i. No reptiles were seen but there may be species of skink (Family: Scincidae) and gecko (Gekkonidae) present. The highly invasive coqui frog (*Eleutherodactylus coqui*) is present in the area. No invertebrate survey was undertaken as part of the survey, but in general, no rare invertebrates would be expected from this property.

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

Some grading will be required, but as discussed in Section 3.1.3, the location of the home has been chosen to entirely avoid the most sensitive location on the property, the naupaka patch inland of the shoreline. While several dozen hala trees would require removal for the driveway, turnaround area and home, there is ample room on the property for additional hala to be planted, utilizing the abundant hala *keiki*. The project includes minimal landscaping emphasizing the natural hala/naupaka vegetation and replaces hala trees that need to be removed for the driveway and home site in areas that have had or will have invasive trees removed. The owners will continue to monitor for the reemergence of the common invasive tree species such as octopus tree (*Schefflera actinophylla*), guava (*Psidium guajava*), trumpet tree (*Cecropia obtusifolia*) and melochia (*Melochia umbellata*). Once removed, these trees will be replaced with hala trees or naupaka, as appropriate.

Because of the minor nature of the project and the lack of sensitive terrestrial ecosystems and threatened or endangered plant species, and the negligible effect to the lowland hala ecosystem, construction and use of the single-family residence are not likely to cause adverse biological impacts.

The following measures will be implemented to help avoid impacts to endangered native birds and the Hawaiian hoary bat:

- To avoid potential seabird downing through interaction with outdoor lighting, no construction or unshielded equipment lighting will be used after dark between the months of April and October. Minimal exterior lighting will be included, and it will be shielded in strict conformance with the Hawai'i County Outdoor Lighting Ordinance (Hawai'i County Code Chapter 9, Article 14). Lighting will be constrained to utilize only low light-emitting fixtures using blue-deficient filtered LED lights with a Correlated Color Temperature (CCT) of 2700 Kelvin or less, shielded to protect both transiting seabirds and dark skies.
- To minimize impacts to the endangered Hawaiian hoary bat, trees taller than 15 feet will not be removed or trimmed during the bat birthing and pup rearing season (June 1 through September 15).

The following measures will assist in preventing the spread of invasive species:

- The applicant will balance cut and fill and utilize the existing soil and rock material on the property for the driveway base and house pad. No soil fill will be imported. Any rock fill will come from a clean source that is monitored for invasive species such as fire ants.
- All heavy equipment will be cleaned of excess soil and debris prior to entering the property to minimize the risk of spreading invasive species.

It should be noted that no ōhi'a trees are present and there should be no risk of spreading the Rapid 'Ōhi'a Death pathogen. The precautions for preventing effects to water quality during construction listed above in Sections 3.1.3 and 3.1.6 will reduce adverse impact on aquatic biological resources in coastal waters to negligible levels.

3.1.5 Air Quality and Noise

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 the island when this volcano is erupting, which it currently is. Noise on the site is fairly low and is derived from natural sources (such as surf, birds and wind), nearby homes and passing traffic.

Impacts and Mitigation Measures

Low-density, low-intensity residential use should not result in deleterious impacts on air quality and the acoustical environment. Brief and minor adverse effects would occur during construction, and there will be occasional noise from the backup generator. However, the only sensitive noise receptors in the vicinity are residences producing similar impacts, and given the small scale of the project, noise mitigation does not appear to be necessary. Given the small scale and short duration of any noise impacts, coupled with the lack of sensitive receptors, noise mitigation would not be necessary.

3.1.5 Scenic Resources

Environmental Setting

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. The General Plan specifically lists as examples of natural beauty a shoreline area about one mile to the north (Honolulu Landing) at TMK 1-4-003:019, and three areas at Kahuwai about one mile to the south (the black sand beach at Kapela Bay, Makaukiu Point and the shoreline) at TMK 1-4-003:013. There are also Exceptional Trees protected by County ordinance present on the Old Government Road in the form of a mango grove that lines both sides of the roadway. The area near the project site was inspected as part of the biological research, and it does not contain mango trees (see photos in Figure 2). Coastal views from the Government Beach Road are mostly obstructed by hala vegetation along the lot front.

Impacts and Mitigation Measures

The home will be subtly visible from the sea in the midst of the hala grove and from the road through existing and newly planted hala trees. The home will be modest in size and consistent with the

Conservation District rules (Hawai'i Administrative Rules 13-5), which require subtle and sensitive colors and architectural styles, minimal height, and landscaping utilizing almost exclusively native and Polynesian species. Replacement of the roadside fringe of weedy vegetation with *hala* will improve the visual character along the road. No scenic areas discussed in the General Plan will be affected.

Minimal exterior lighting will be included. It will be constrained to utilize only low light-emitting fixtures using blue-deficient filtered LED lights with a Correlated Color Temperature (CCT) of 2700 Kelvin or less, shielded to protect dark skies and transiting seabirds. The overall effect would be a landscape in harmony with the rural landscape of Puna.

3.1.7 Hazardous Substances, Toxic Waste and Hazardous Conditions

Based on onsite inspection and the lack of any known former and current uses on the project site, 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 applicants proposes the following:

- Unused materials and excess fill (if any) 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;
    - 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; and
    - All spills will be cleaned up and properly disposed of immediately after discovery.

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 where the project site is located 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. Preliminary totals for Puna from the 2020 Census indicate a population of 51,704 (*Hawai‘i Tribune Herald*, Nov. 3, 2021), indicating a substantial increase but at a slower rate. 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 seeking more 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 of the subdivisions have become essentially bedroom communities for Hilo's workforce, as evidenced by the heavy flow of Hilo-bound traffic during the AM rush hour.

The Wa‘awa‘a area is part of the Hawaiian Beaches Census Designated Place (CDP). In the 2010 Census, Hawaiian Beaches contained a population of 4,280, with an average household size of 2.91 persons. The population was 31.2% White, 14.4% Asian, 14.4% Native Hawaiian or Pacific Islander, and 35.8% two or more races (http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml#none). The bulk of the population in this CDP is in the Hawaiian Beaches/Hawaiian Shores subdivisions several miles north of the project area. The immediate community surrounding the property is referred to as the Wa'awa'a Residential Subdivision. Created in the 1960s, it contains 170 lots, most of which are 3 acres in size, with smaller lots fronting the ocean. Wa'awa'a can be characterized as sparsely developed with largely unimproved gravel and dirt roads and scattered houses, with about a quarter of the properties having homes. There is no County water or sewer service available. Electrical service does not extend past the Hawaiian Shores subdivision to Wa'awa'a. Residents of the area elect to live in this remote setting for the privacy and self-sufficient lifestyle. The property is bordered by the shoreline reserve property to the north, by the Government Beach Road to the south, and by a single-family residence to the west, and an unoccupied private lots to the east.

The growing population in Puna, including such areas as Hawaiian Shores and Hawaiian Beaches, induces a high demand for coastal recreation in Puna. Despite the long coastline, there are few beaches in Puna, and areas such as Kapoho, Pohoiki and Kehena experience heavy use. In most locations, however, ocean recreation is much more scattered and consists primarily of fishing from the cliffs and enjoying limited bathing in tidepools. There is relatively little use of the rough and irregular shoreline in this area. The nearest *mauka-makai* shoreline public accesses from the Government Beach Road is at the northwestern corner of the Wa‘awa‘a Subdivision, about 750 feet from Roehrig lot, within a 78.33-acre parcel (TMK 1-4-003:018). This property is owned by the State of Hawai‘i, which is a portion of the

Nānāwale Forest Reserve. This parking spot and trail provide access to the Forest Reserve coastline to the west as well as the shoreline Beach Reserve property to the east that is held in common by the Waʻawaʻa Subdivision owners. This strip provides a setback from the shoreline and an area for residents and the public to walk, fish or gather. Fishers and gatherers are often seen on this long shoreline lot fishing for *papio* or *menpachi* or gathering *opihi*.

Illegal dumping is a severe problem on this portion of Old Government Road, especially in the area around Puʻu One (Sand Hill). Periodically, the road margins and parts of adjacent properties become covered with hundreds of tons of cars, appliances, household rubbish and even animal waste. This unsightly mess has unpleasant odors and negatively impacts the health of humans and wildlife through creating a breeding environment for mosquitoes and other insects, rats and pathogens, as well as causing a physical safety hazard through jagged metal and glass. The chronic dumping lowers the quality of life and decreases property value for residents. There have been many volunteer and County-organized cleanups to deal with this problem, but ultimately, it is the presence of a critical mass of vigilant residents in the many subdivided lots that will discourage dumping.

Impacts and Mitigation Measures

The residence and associated improvements will not adversely affect population or demand for services. No adverse socioeconomic impacts would occur from adding another home to this slowly growing neighborhood. Building the home will employ construction workers and have a small but positive economic impact for the County of Hawaiʻi. The residence and associated improvements will not adversely impact recreation, as access along the shoreline will not be affected. In the current socioeconomic context, every additional resident guarding against illegal dumping and illegal activity and cleaning up when necessary assists in keeping the area safer and cleaner.

3.2.2 Cultural and Historic Resources

An archaeological assessment survey of the project was conducted and is attached as Appendix 2. As part of assessing cultural resources, early consultation for the EA for general issues but also listing cultural resources was conducted with the Office of Hawaiian Affairs, the Lower Puna Councilperson, the Sierra Club, Malama O Puna, and several neighbors. A more focused cultural consultation was also undertaken, which is documented in Appendix 4 and summarized below.

Historical and Cultural Background

The first inhabitants of Hawaiʻi 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 Hawaiʻi were underway by A. D. 300, although recent work suggests that Polynesians may not have arrived in Hawaiʻi until at least A. D. 1000 (Kirch 2011). The first voyagers 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 2011; Pogue 1978). Societal

order was maintained by their traditional philosophies and by the conical clan principle of genealogical seniority (Kirch 2011). 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 2011).

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 Kalaniopu'u (A. D. 1736-1758), Kamehameha I was born in North Kohala.

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 Roehrig property is located within the *ahupua'a* of Wa'awa'a, in the traditional *moku-o-loko* or district of Puna, which comprises some fifty *ahupua'a* on the eastern/windward shores of Hawai'i Island. The meaning of the name Wa'awa'a is not translated in *Place Names of Hawai'i* (Pūku'i et al. 1974, although it may be noted that wa'awa'a is the Hawaiian word for furrowed. Most *ahupua'a* encompassed *mauka* agricultural and forest resources and *makai* fisheries, so that residents 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. Although the *mauka* boundary of Wa'awa'a Ahupua'a extends to only roughly 230 feet in elevation, the upper reaches of the *ahupua'a* were formerly covered by a dense growth of *'ōhi'a lehua* trees, indicating its likely extent into the lower limits of the upland forested zone or *wao akua* as it exists within this portion of Puna.

The Pre-Western contact population of the Puna District lived in small settlements along the coast where they subsisted on marine resources and agricultural products. As McGregor stated in reference to the lava flows that periodically alter the district, "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). The villages of Puna, McEldowney 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).

Located along the coast, the property falls within the Coastal Settlement Zone (Zone I) as modeled by McEldowney (1979:15-18), where families often lived clustered around sheltered bays (McEldowney 1979). In their refinement of the model as it applies to Puna, Burtchard and Moblo (1994) 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 *'a'ā* 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).

The rugged, young state of the lava flows here were not a limiting factor for the cultivation of sweet-potato or *'uala*, which requires practically no soil to flourish. Its propagation is discussed in detail by many nineteenth and early twentieth century visitors to the district, who describe seeing the *'uala* growing from mounds of lava stones. In the following passage, published under the title "Hawaii-Nei" in *Harper's Magazine*, Charles Nordhoff (1873a:382-402) described the vegetation of Puna and mention early commercial coffee production in the district. Nordhoff also provided observations of the narrow coastal trail "across unceasing beds of lava" that "was actually hammered down to make it smooth enough for travel" in some places (1873a:401). According to Nordhoff, "most of the lava is probably very ancient, though some is quite recent, and ferns and guava bushes and other scanty herbage grow through it" (ibid.). Nordhoff's narrative continued:

> ...after a descent to the sea-shore, you are rewarded with the pleasant sight of groves of cocoa-nuts and umbrageous arbors of pandanus, and occasionally with a patch of green. Almost the whole of the Puna coast is waterless...
>
> It will surprise you to find people living among the lava, making potato patches in it, planting coffee and some fruit trees in it, fencing in their small holdings, even, with lava blocks. Very little soil is needed to give vegetation a chance in a rainy season, and the decomposed lava makes a rich earth. But, except the cocoa-nut, which grows on the beach, and seems to draw its sustenance from the waves, and the sweet-potato, which does very well among the lava, nothing seems really to thrive. (ibid.).

In another installment titled "Hawaii-Nei-II", Nordhoff (1873b:544-559) wrote of the lack of fresh water in Puna and how Dr. Coan had told him about how Native Hawaiians collected freshwater for his use during his missionary tour "from the drippings of dew in caves" (1873b:550). For, "wells are here out of the question, for there is no soil except a little decomposed lava, and the lava lets through all the water which comes from rains" compounded by the lack of mountain streams (ibid.). Nordhoff also presented the following observations of the communities in Puna as well as traditional sweet potato planting methods:

> There are no fields, according to our meaning of the word. Yet formerly the people in this district were numbered by thousands: even yet there is a considerable population, not unprosperous by any means. Churches and schools are as frequent as in the best part of New England. Yet when I asked a native to show me his sweet-potato patch he took me to the most curious and barren-looking collection of lava you can imagine, surrounded too, by a very formidable wall made of lava, and explained to me that by digging holes in the lava where it was a little decayed, carrying a handful of earth to each of these holes, and planting there in a wet season, he got a very satisfactory crop. Not only that, but being desirous of something more than a bare living, this man had planted a little coffee in the same way, and had just sold 1600 pounds, his last crop. (ibid.)

Although *'uala* was cultivated widely, Handy et al said that it did not appear to have been a staple food of Puna, a district "most famous for its breadfruit" (1991:190). Handy opined:

> . . . Despite the fact that sweet potatoes were planted almost universally and many patches are still maintained, the Puna natives seem to regard this vegetable with little interest, probably because Puna people prided themselves upon and relished their breadfruit, and also because potato was nowhere and at no time the staple for this rainswept district. (1940:165)

Breadfruit (*'ulu*) was a *kinolau* (physical manifestation) of the goddess Haumea, the "patron of childbirth," and the principal staple food of Puna, where it was most famous (Beckwith 1970:283; Handy et al. 1991). Careful and gentle propagation was required, which entailed the removal and replanting of the root sucker cutting while ensuring it remained within its original, undisturbed soil casing. With respect to *'ulu* as a sustainable food source, Handy et al. explained that, "except in Puna, Hawaii, breadfruit was

wholly secondary to taro and sweet potato as a staple. I am told that in Puna in a good year, breadfruit may be eaten for 8 months of the year, beginning with May" (1991:152).

Although *'ulu* appears to have been the preferred source of sustenance for residents of Puna, taro (*kalo*) rivaled it as a staple food source. Puna's lack of flowing streams made growing wetland *kalo* impossible. Despite this freshwater stream deficit, Puna received plentiful rainfall throughout the year, which made the cultivation of dryland *kalo* possible, even along the coast as far north as Hilo (Handy 1991). Handy et al. related that, "the wet and sometimes marshy pandanus forests from Kapoho through Poho-iki to 'Opihikao used to be planted with taro in places" (1991:541). The method of planting dryland taro in the lowland forests of Puna is described by Handy et al. as the "*pa-hala* (pandanus clearing) method" (1991:104). It had the advantage of not requiring the constant weeding necessitated by better soils. The Pa-hala planting process is as follows:

> Make holes in the *'a'a* (broken lava) by taking out some of the stones. Be sure that the place chosen is in a *pu hala* grove, to save the labor of hauling *hala* branches into the patch later on. Fill the hole with whatever weeds can be found and leave them there for six weeks or more. The weeds will rot and make soil. When the weeds have rotted away, the taro *huli* are wrapped in *lau hala* (*hala* leaves) to keep them moist and are planted. When there or four leaves have appeared on each *huli*, then that is the time to cut down the *pu hala* to let in the sun. The branches of the *hala* are cut off and the patch covered with them until this is not a trace of the taro to be seen. This is left until sufficiently dry to set on fire. The fire does not hurt the taro much as the *huli* are already well rooted. The *hala* reduced to ashes, give the taro the needed nourishment and they grow so tall that a man can be hidden under their leaves (Handy et al. 1991:104–105).

Hala was valued for its fragrance and harvested for more utilitarian purposes. The inhabitants of Puna were recognized for their skilled *lauhala* (*hala* leaf) weaving. The dried leaves were used to plait *lauhala* mats for thatching onto house rafters and walls in a method typically employed in Puna and the neighboring district of Hilo in the absence of *pili* grass. Plaited *lauhala* was also used for pillows, fans, floor coverings, canoe sails, baskets, and occasionally as clothing (Handy et al. 1991). According to Fornander (1918-1919), two styles of *lauhala* mats were associated with Puna; the *makali'i*, a braided, small-stranded mat, and the *puahala* or *hīnano*, made from the male pandanus blossom. The latter was highly valued, and "...is only made in Puna where the hala tree is very abundant. It is a regular article of trade among the natives who greatly prize it as a choice mat to sleep on" (Summers 1999:17). *Hala* had many other significant uses and came to be identified with the people of Puna.

In addition to *hala*, *kalo*, *'ulu*, and *ti* mentioned above, other crops such as coconut (*niu*) and *'awa* were cultivated in Puna. *Niu* thrived in coastal Puna and is frequently mentioned in historical accounts. With respect to varieties, Handy et al. (1991) list only two: the *niu hiwa* (particularly used for ceremony, medicine, and cooking), and the *niu lelo* (used primarily for nonreligious purposes). Water from the *niu* was palatable and flavorful. It could also be utilized on a spiritual level by priests practicing divination. The raw meat was edible and could be scraped out of the shell with a large *'opihi* to be eaten as is or incorporated into the preparation of various sweets including *haupia* (*haukō*), *kūlolo, and pi'epi'e 'ulu*. Besides being utilized for human consumption, coconut meat could also be used to feed animals.

Puna was a region famed in legendary history for its associations with the goddess Pele and god Kāne. Because of the 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 by many as the most beautiful place in the islands. 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.

Many *ʻōlelo noʻeau* (traditional sayings) speak of Puna, and most mention the land – which could at any time be covered in steaming lava left in Pele's furious wake – and the air, which was sweetly scented with the heavenly fragrances of *hala*, *maile*, and *lehua* blossoms. The following *ʻōlelo noʻeau* are from Mary Kawena Pūkuʻi (1983):

> *Ka makani hali ʻala o Puna.*
> The fragrance-bearing wind of Puna
> Puna, Hawaiʻi, was famed for the fragrance of *maile*, *lehua*, and *hala*. It was said that when the wind blew from the land, fishermen at sea could smell the fragrance of these leaves and flowers. (p. 158)
>
> *Ke one lauʻena a Kāne.*
> The rich, fertile land of Kāne.
> Puna, Hawaiʻi, was said to have been a beautiful, fertile land loved by the god Kāne. Pele came from Kahiki and changed it into a land of lava beds, cinder, and rock. (p.191)

The fragrant breezes of Puna were also celebrated in Hawaiian *mele* (songs). One such mele, *Ke Haʻa Lā Puna i ka Makani*, accompanied the very first recorded *hula* of the Pele and Hiʻiaka saga (Kanahele and Wise 1989). A tale of jealousy and spite is recounted in the legend *Hopoe the Dancing Stone*, published by Westervelt (1916). Pele called upon each of her sisters to fetch her dream lover Lohiʻau from Kauaʻi. Knowing Pele's tempestuous temper, each feared possible repercussions and refused to go. After being denied by all but one sister, Pele rumbled her home, the volcano, sending out burning smoke and vapors, impatiently beckoning her very last option. Hiʻiaka finally relented, leaving behind her dear friend Hōpoe, a skilled and graceful hula dancer who had spent much time teaching Hiʻiaka old Hawaiian hula. Before Hiʻiaka could return, Pele's impatient fury caused her to shake the earth with great ferocity and heaved her lava in a torrent of devastation, annihilating Hiʻiaka's *ʻōhiʻa lehua* forest, obliterating much of Puna, and finally cornering Hōpoe as she lingered by the sea:

> Hopoe was the last object of Pele's anger at her younger sister, but there was no escape. The slow torrent of lava surrounded the beach where Hopoe waited death. She placed the garlands Hiiaka had loved over her head and shoulders. She wore the finest skirt she had woven from lauhala leaves. She looked out over the death-dealing seas into which she could not flee, and then began the dance of death. (Westervelt 1916:94)

In her death, Hōpoe was transformed. She was rebirthed as a stone, carefully balanced alongside the sea where she could continue her graceful dance throughout the centuries when touched by the soft breeze or the rumbling of the earth. And Hi'iaka, her heart bitter with her sister's betrayal, brought Lohi'au back to Pele, faithfully as she swore she would.

Many other stories, chants and songs deal with legendary events in Puna that still bring meaning to the landscape today. Some of them dealt with *'aumakua*, which are certain animals, trees, flowers, insects, and natural phenomena who were half god and half human and communicated through mediums, possessed by their spirits. Of special significance are *'aumakua manō* (shark deities) who are frequently venerated in Hawai'i.

A traditional *mo'olelo* (story), "The Heart Stirring Story of Ka-Miki" (*Kaao Hooniua Puuwai no Ka-Miki*), originally appeared in *Ka Hoku o Hawai'i* (a Hawaiian language newspaper) between 1914 and 1917. The story tells of two supernatural brothers, Ka-Miki and Maka-'iole, who were skilled *'ōlohe* (competitors/fighters) and their travels around Hawai'i Island by way of the ancient trails and paths (*ala loa* and *ala hele*), seeking competition with other *'ōlohe*. Among several tales involving Puna, during an expedition through the uplands, Ka-Miki and Maka-'iole encountered a man named Pōhakuloa who was intensely working on a large *koa* log. They were headed to Kea'au 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. It was at this point that Pōhakuloa realized that these two men were not only extraordinarily skilled but also spiritually protected, and he admitted his defeat. Pōhakuloa wished to prepare a meal and drink of *'awa* with his newfound friends, and solicited the help of his brother in law, an *'ōlohe* chief named Kapu'euhi. However, Kapu'euhi had plans of his own. He intended to compete with and conquer the brothers but was defeated by them instead. Kapu'euhi was infuriated by his defeat, and by Pōhakuloa's refusal to aid in retaliation against Ka-Miki and Maka-'iole.

Kapu'euhi invited the brothers back to his house to partake in a meal and a particularly potent type of *'awa*, scheming to get them drunk. Unbeknownst to Ka-Miki and Maka-'iole, this was common practice for Kapu'euhi, who often housed weary travelers, intoxicated them with *'awa*, then killed them and stole their belongings. Kapu'euhi waged a bet with the brothers; if they couldn't drink five cups of the *'awa*, then he would throw them out and they would be at the mercy of the Puna forest. Ka-Miki and Maka-'iole agreed and counteracted his bet with one of their own; if they were able to drink five cups, they would throw Kapu'euhi out of his own house. The brothers prayed and chanted to their ancestral goddess and were able to consume the entire quantity of *'awa* without getting drunk. As agreed upon, Kapu'euhi was thrown out. Stunned, and angered that he was thwarted once again, Kapu'euhi requested assistance from Kaniahiku (a much feared Puna *'ōlohe* 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 Hawai'i* October 28, 1915; translated by Maly 1998:20), which Maly suggests is symbolic of controlling those regions.

Together, Kapu'euhi 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 *'awa* grove of Mauānuikananuha. Once Ka-Miki and Ka-'iole 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 Maka'iole were overcome, and left for dead by Kapu'euhi, 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 'awa grove. Another attempt by Kaniahiku to kill the brothers was made, however, Ka-uluhe's protection over them was too strong, and she failed (Maly 1998).

The *'ōlelo no'eau* of Puna, and the stories of Ka-Miki and Ka-'iole, Pele and Hi'iaka and Hōpoe, and other legendary beings illustrate the intricate and deep connection the people of Puna had with their forests, a link still cherished by many.

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 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 the western world 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 played a large role 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 2004). 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 [ʻŌlaʻa] and the more fertile districts of Hawaii.

Ellis and the ABCFM missionaries travelled along the coast of the *ahupuaʻa* of Kahuwai (where they rested and then addressed the people of the place), Waʻawaʻa and Nānāwale (with no mention or description), and then then turned *mauka* toward a village in the woods of Honolulu Ahupuaʻa (Ellis 2004:294). On August 8, 1823, the Ellis and the missionaries left Honolulu and visited the village of Waiakahiula, which is now the site of the Hawaiian Beaches subdivision, west 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 soon after six a.m. and, travelling slowly towards the sea-shore, reached Waiakeheula 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 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 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.

In 1835, the United States Exploring Expedition under the direction of Commander Charles Wilkes toured Hawai‘i Island and traveled through the Puna District. Wilkes produced a map of Puna that illustrated the coastal round-the-island trail or *ala loa* and showed forests covering the lands *mauka* of the property (see Figure 13 of Appendix 2). Construction of the Government Road through Puna, which extends immediately adjacent to the southern boundary of the property, and is also referred to as the Puna Trail, began in the 1840s (Maly 1999). In many places the new road overlaid the older *ala loa*. Work on the road was funded in part by government appropriations, and through the labor or financial contributions of area residents and prisoners working off penalties. Wilkes description of the trail through Puna attests to its extremely rugged condition:

> 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).

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. 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. In the *Māhele*, Wa‘awa‘a Ahupua‘a was retained as Government Land. No claims were made for *kuleana* within Wa‘awa‘a Ahupua‘a during the *Māhele* (Waihona ‘Āina database).

In conjunction with the Māhele ‘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.

A total of four land grants were sold in the mauka half of Wa‘awa‘a Ahupua‘a: Royal Patent Grant Nos. 997 ‘āpana 1 and 2 to Haole in 1852, 1363 to Pakaka in 1854, and 2687 ‘āpana 2 to Manamana in 1860 (Table 1 and Figure 15). Hawai‘i Registered Map No. 1684 prepared in October 1893 by Loebenstein (see Figure 16 of Appendix 2) depicts the project area within Grant No 3687 in an expanse of “open country below gov’t road” along the coastline. The project area is shown immediately makai of the “Government Road,” the alignment of which is coterminous with the current trajectory of the Government Beach Road,

and just makai of Grant No. 997 ‘āpana 1 located on the opposite edge of the roadway. There appears to have been very little activity, including agriculture, subsequent to these grants.

During the development of the grants in the area, Puna’s population had suffered a sharp decline. Within a quarter of a century, Puna’s population declined by more than half, from 4,800 in 1835 to 2,158 in 1860 (Anderson 1865). In 1868 volcanic activity emanating from Mauna Loa volcano devastated Hawai‘i 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 Puna District population fell further to a mere 1,043 in 1878, and it reached an unsurpassed low of 944 persons by 1884 (Thrum 1885 and 1886).

Post-Māhele historical accounts of Puna were mostly authored by visitors to the Hawaiian Islands and generally take the form of travelogues. These writings demonstrate a considerable transformation from the almost exclusive traditional native subsistence lifestyle discussed in earlier chronicles to a new way of life. As discussed in Appendix 3, such accounts include those of famous travelers Mark Twain and Isabella Bird, as well as lesser known authors such as Henry Whitney, George Chaney and John Roy Musick. Many mention the Government Beach Road, which evolved from earlier trail routes and was under construction as a true road by the 1840s. The road remained the preferred route of travel between Hilo and the outlying areas of Puna until 1895, when the Kea‘au-Pāhoa Road (now Highway 130) was established to access the growing inland population centers and agricultural areas (Maly 1999:6). A small settlement at Maku‘u reached after traveling through miles of hala groves is frequently mentioned.

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 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 ‘Ōla‘a (Kea‘au) 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. The scattered geography of suitable agricultural lands in Puna (the product of scattered areas with ash-based soils) hindered the growth of the sugar industry. 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 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 ‘Ōla‘a Sugar Mill, the town of Pāhoa, and in lower Puna. 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). The railroad in this area lasted until 1948.

The route of the railroad in this part of Puna was well inland. The railroad did not induce population gain or economic booms in isolated shoreline hamlets, as it did in the inland towns of Keaʻau and Pahoa. The railroad was actually so far *mauka* that it did not penetrate into the Waʻawaʻa Ahupuaʻa. The thin, sticky, rocky, acidic soils did not encourage sugar cane cultivation. Nonetheless, some agriculture was practiced in Waʻawaʻa in this era. Between 1890 and 1931 the area from Waʻawaʻa to Pualaʻa (likely including Grant No. 3687 to R. A. Lyman) was ranched by the Lyman Estate. The lease for cattle was transferred to Kamau in 1931. Other inland portions of the *ahupuaʻa* may have seen limited sugarcane cultivation by the Puna Sugar Company.

Lumber also became a big business in Pahoa for a little over a decade. Although the lumber industry did not last, the roots of the town of Pahoa were established during this period.

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* ravaged 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 large-scale agricultural trends in parts of Puna, Waʻawaʻa remained undeveloped. The 1924 USGS Makuu quadrangle shows just a single structure *makai* of the Government Beach Road along the coast of Waʻawaʻa Ahupuaʻa during the early twentieth century. The modern world began to intrude in May of 1958, when the Puna Investment Co. received final approval from the Hawaiʻi County Planning and Traffic Commission to subdivide a large portion of Waʻawaʻa Ahupuaʻa, extending from the coast to the *mauka* boundary of Grant No. 3687, into 177 residential farm lots (including the Roehrig property), the area now known as the Waʻawaʻa Residential Subdivision (Hilo Tribune-Herald 1958). Lacking electricity and water, these lots were not quickly developed. The 1965 USGS Kapoho quadrangle and an aerial photograph taken on February 6 of that same year indicate that by that time the subdivision roads had been bulldozed, but that none of the parcels had yet been developed. During the mid-1960s, the lands to the northwest of the project site were subdivided into the Hawaiian Beaches, Hawaiian Parks, and Hawaiian Shores subdivisions. This appears to have triggered construction on many lots between these subdivisions and Kapoho. In the last several decades hundreds of residences have been constructed on the subdivided lots in various parts of Waʻawaʻa, with the coastal lots approaching buildout more slowly. Despite development, traditional Hawaiian fishing practices in the area have continued and even thrived, as discussed in the *Consultation* section below.

Archaeological Investigations and Resources

As discussed in the archaeological assessment survey contained in Appendix 2, based on the specific location, terrain, and small size of the property, the archaeological expectations were limited. The results of the background research and the review of prior archaeological work indicated that the primary areas of

Pre-Western contact habitation along this section of the Puna coast were located several miles to the east and west. Nearby Historic-era habitation may have occurred *mauka* of the property, on the opposite side of the Government Beach Road (at Grant No. 997 to Haole). Feature types previously recorded at coastal parcels within Wa‘awa‘a Ahupua‘a included modified depressions, excavated pits, modified outcrops, mounds, terraces, retaining walls, enclosures, platforms, a trail, and a possible cairn that were used for Precontact and early Historic habitation, agriculture, and burial purposes, as well as walls that were created for Historic ranching activities. Most of these previously recorded features were located much farther inland. Those nearest the property were temporary habitation and agricultural features. Also, if any entrances to lava tubes are present, it was recognized that they might contain human skeletal remains (Rechtman 2009).

Fieldwork for the current study was conducted on October 15, 2020 by Lauren Kepa‘a and Matthew R. Clark (Principal Investigator). Fieldwork consisted of an intensive (100%) coverage survey of the entire surface of the project area utilizing systematic east-west pedestrian transects with fieldworkers spaced at roughly three-meter intervals. The entire project area was accessible at the time of the survey, and the boundaries were clearly identifiable in the field; vegetation cover slightly limited ground visibility. No cultural material of any kind was identified within or near the property during the fieldwork.

Effect to Archaeological Resources

Given the absence of archaeological resources, the archaeologists concluded that the development of the proposed single-family residence would not impact any historic properties. Therefore, the proposed determination of effect for the proposed project is “no historic properties affected.” Furthermore, their recommendation was that no further work needs to be conducted within the Roehrig property prior to or during project implementation. However, in the unlikely event that archaeological resources are discovered during ground disturbing activity associated with the proposed development, the applicants or contractors must cease work in the area of the discovery and the State Historic Preservation Division (SHPD) must be contacted pursuant to HAR 13§13-280-3. The archaeological assessment survey was submitted by DLNR-OCCL to SHPD via the HI-CRIS system following completion of the Draft EA and acceptance of the CDUA for processing, which by SHPD interpretation of its regulations is the earliest possible submittal point. The Final EA will report on the status of SHPD review.

Cultural Resources and Practices: Consultation

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

As stated in the OEQC Guidelines for Assessing Cultural Impacts, the goal of seeking interviews is to identify and help determine the significance of potential cultural resources, practices, and beliefs associated with the affected study area, along with potential cultural impacts and appropriate mitigation as

necessary. This EA first describes results from an extensive history of consultation concerning resources derived from interviews for other single-family residences in the Conservation District and other projects located between Waʻawaʻa and Makuʻu on the Puna coast (Ewart and Luscomb 1974; Glennon et al 2018; Ketner and Rechtman 2011; Rechtman 2011; 2013; Rechtman and Bautista 2009). The EA then discusses consultation specifically for the Roehrig residence and weaves together the current and previous findings to better inform the identification of cultural resources and practices and impacts to them.

When a single-family residence was proposed by Joan Shafer for a shoreline property about a quarter-mile west of the Roehrig property about a decade ago, Rechtman and Bautista (2009) conducted an interview with Jesse Kaʻawaloa. Mr. Kaʻawaloa is from a family with strong genealogical ties to the area, having descended from Hawaiians residing in Kalapana dating from pre-Māhele and likely Pre-Western contact times. His recollection of the general area extends back to the 1950s, when he was a small boy walking the trails and roads to his auntie and uncle's house in Waʻawaʻa to go fishing and swimming in the warm pond. He explained that even before the Hawaiian Beaches Subdivision was created, coastal Waʻawaʻa was a great place to fish and gather limu and opihi. Access to Waʻawaʻa from his home in Kalapana was by way of trails and the Old Government Road. Jesse stated, "when we were young we used to walk the whole way," stopping only to swim in the warm pond, of which he said, "the pond was great! It was the only warm pond with white sand, but the owners started charging 10 cents then they raised it to 25 cents that's when we stopped coming because a quarter was a lot of money in those days." When asked how he felt about the construction of the Shafer single-family dwelling, Jesse indicated that as long as the house was not an "eyesore," that ocean access was never denied to people wanting to fish, and that no cultural sites were impacted, it would be acceptable. Later, when an inadvertent burial in a hidden cave was found during biological survey of the Shafer property, several members of a Native Hawaiian cultural organization known as the Kanaka Council were asked to inspect the area and provide their advice about the proposed preservation treatment for the burial and cave. They worked with the landowner so that she truly understood her *kuleana* with respect to the preserved *iwi* and their environs. They also stated that as long as cultural resources and traditional coastal access were protected, they did not object to building a home. To this day, the burial remains completely protected and fishers and gatherers are not impeded as they traverse and utilize the shoreline areas in front of the Shafer property.

Another single-family residence proposed by Françoise Bourzat a few miles to the northwest in Keonepoko Ahupuaʻa involved consultation (Glennon et al 2018) with several individuals knowledgeable about the area. Hidi Boteilho, a *kamaʻāina* and Vice Principal of Keonepoko Elementary School, recounted a *moʻolelo* (tale) that dealt with battle involving an *aliʻi* of Puna named Pahoa that occurred *mauka* of the property, near the location of Keonepoko Elementary School. Hidi stated that she was unaware of any traditional customs or practices associated with the Bourzat property itself. Also consulted for this residence was Piʻilani Kaʻawaloa, a Hawaiian cultural practitioner from Kupahuʻa in Puna. Piʻilani was an active community member in the Puna District who held positions in several important cultural organizations and was a recognized cultural expert for the Keonepoko area. Her knowledge of Puna came from her long residence here and stories passed down in her *ʻohana* (family). She explained that this knowledge was a *kuleana* (responsibility) given to her at a young age from her *kūpuna* (ancestors). She spoke of several significant events that occurred in the area, the genealogy of the people here, and also various *moʻolelo.* When asked about traditional practices associated with the Bourzat

property, Piʻilani shared that her *ʻohana* and friends continue to fish in that area. Although the fishing grounds along this coast are normally accessed by boat, local fisherman also used four-wheel drive roads to the coast. She added that the Keonepoko area is a popular fishing grounds for *moi* (threadfish) and *āholehole* (Hawaiian flagtail). Piʻilani recalled that *kūʻula* (fishing shrines) existed at various places along the Puna coast, including one in the Keonepoko area, the location of which she was unsure. When asked about her thoughts on the proposed Bourzat home construction, Piʻilani stated that any development has the potential to disturb the cultural landscape. Although she noted that the landscape has already been affected by a number of factors, including natural disasters, Piʻilani shared that development or construction projects within Keonepoko should consider the possibility of encountering *iwi kupuna*. She also described a series of caves and lava tubes that extend throughout this portion of the Puna District and noted that these caves had been used to obtain fresh water and for burial purposes. Piʻilani mentioned another traditional Puna burial practice in which *lua* (pits) were lined with *kukui* before placing the *iwi* within. In light of the information shared, including the large size of the property, she suggested that a cultural monitor should be present to observe all ground disturbing activities.

Another property in Keonepoko where David Yermian wished to build a single-family residence was also the subject of interviews with knowledgeable Puna residents (Rechtman 2013). Mark Lindsey Franklin was a 40-year resident of lower and upper Puna. He was of Hawaiian ancestry, and his family roots also extended to Maui, where his *ʻohana* are cultural practitioners involved in the preservation of traditional lands. Mark was an expert in native flora and was working on a project to identify and protect remnant stands of ʻiliahi (sandalwood) on Mauna Kea. He was also an active member of Malama o Puna, a Hawaiʻi non-profit corporation and volunteer service organization that is focused on environmental protection, education, and preservation. Mr. Franklin met with an interviewer at the project site and related that he had fished in the area, accessing the coastline along an old road located to the northwest of the property. After walking the entire property, he suggested that given the past disturbances to the property and the widespread growth of invasive species, the proposed development would be a welcome addition as long as the invasive vegetation could be controlled and replaced with a landscape of native species. Interviewers also spoke to William Makanui about the Yermian property. Mr. Makanui was formerly a project manager for the Department of Hawaiian Home Lands and was responsible for the establishment of farm lots, agricultural lots, and water systems in the inland portions of Makuʻu Ahupuaʻa, located 4 to 6 miles to the southwest of the project site. He was not aware of any specific resources in the immediate vicinity of the Yermian property, but he pointed out the cultural concerns related to protection of any identified caves and burial sites.

Further northwest along the coast at Makuʻu, a number of interviews have been conducted with residents of this area or their descendants in association with various proposed projects. Almost 50 years ago, Ewart and Luscombe (1974) talked to residents about a plan, never carried out, to make a coastal highway from Kapoho in Puna to Keaukaha in Hilo. Mrs. Mary Ann Kamahele recalled in an interview that a few hundred yards to the east of the Kamahele property was Opunaha, a canoe landing spot, as well as Kula, a koʻa (fishing ground) where āholehole were caught. Later cultural impact assessments for single-family residences at or near Makuʻu (e.g., Ketner and Rechtman 2011) were able to conduct interviews with Richard Ha, a grandson of Mrs. Kamahele, about practices during the 1960s when he was a boy:

> We could not wait to go down the beach. Once she took us kids to catch ʻohua—baby manini. She used a net with coconut leaves as handles that she used to herd the fish into the net. I don't recall how she dried it, but I remember how we used to stick our hands in a jar to eat one at a time. They were good. She would get a few ʻopihi and a few haukeuke and we spent a lot of time poking around looking at this sea creature and that.
>
> Between the ocean in the front and the taro patch, ulu trees, bananas and pig pen in the back, there was no problem about food. I know how Hawaiians could be self-sufficient because I saw it in action.
>
> The house was full of rolls of stripped lauhala leaves. There were several lauhala trees and one was a variegated type. I don't recall if it was used for lauhala mats but it dominated the road to the house. There were lauhala mats all over the place, four and five thick.

When asked about the proposed development of various homes in and around the Makuʻu area, Richard has indicated that if the landowner adhered to the Conservation District rules and the treatment plans for the archaeological and burial sites, development of proposed single-family residences would be fine. Another informal consultation was conducted by Ketner and Rechtman (2011) with Melani Dominguez at her home in Keaʻau in association with a proposed shoreline home for John and Maureen Gapp. Melani had strong genealogical ties to the area, having descended from Hawaiians residing in Makuʻu dating from at least Māhele times. Her personal recollection of the Makuʻu area extended back to the late 1970s, when she was a small girl. She recalled picking limu and fishing with her grandmother Theresa Kamahele at her property on TMKs: 3-1-5-10:009 and 010. She also remembered hearing about a menehune trail that meandered through their property *mauka/makai*. When asked how she felt about the construction of the single-family dwelling on the Gapp property (which was closer to Hawaiian Paradise Park), Ms. Dominguez indicated that she would feel alright about the proposed development as long as no cultural sites are impacted.

In addition to distilling the information from previous nearby consultations, cultural resource specialists ASM Affiliates conducted consultation specifically for the proposed Roehrig single-family residence. The consultation record is contained in Appendix 4 and summarized below.

A notice describing the proposed home and its location was published in the Office of Hawaiian Affairs (OHA) newspaper *Ka Wai Ola* (April 1, 2021) and the *Hawaiʻi Tribune Herald* (March 9, 2021). To date, no response has been received from the public notices. In addition, ASM staff made efforts via email or phone to contact six individuals known to have genealogical ties, long-standing residency, or knowledge of cultural and or historical properties in Waʻawaʻa Ahupuaʻa specifically for this project. These included Ikaika Marzo, Ryan McCormack, Hidi Botelho, Leila Kealoha, Linda Saffery, and Keone Kalawe. All but Ms. Saffery were able to be contacted; the section below presents some observations made by the four individuals who graciously provided interviews.

Ryan McCormack shared that there are *waʻa* (canoe) traditions associated with Waʻawaʻa, specifically in the area known as Honolulu Landing. He noted that *hālau waʻa* (canoe sheds) can be found along this

portion of the Puna coastline. Ryan recalled that students from Kua O Ka Lā public charter school used to visit the Wa‘awa‘a area as part of their curriculum. Aside from traditions associated with the broader Wa‘awa‘a Ahupua‘a, he did not note any specific cultural practices associated with the property. Ryan also recommended that ASM staff speak to Leila Kealoha and Keone Kalawe. Hidi Botelho recalled fishing along the Wa‘awa‘a coastline once before as a child, although this was not her *‘ohana’s* preferred spot to gather marine resources. She noted that it may be preferred for other *‘ohana*. She stated that if there is a reasonable setback from the coastline to allow for the perpetuation of traditional marine resource gathering, there would likely be minimal to no impact on traditional gathering practices. Hidi recommended ASM staff speak to Leila Kealoha. Leila requested and received maps of the project area. She said she aware of hala trees in the area, and recommended that ASM staff contact Keone Kalawe and Linda Saffery. Keone shared that he was aware of some *‘ohana* platform burials on the *mauka* side of Government Beach Road in Wa‘awa‘a, as well as burials located near the sand dunes by Kapoho. He was not aware of any burials or other valued resources and traditional and customary practices occurring on or near the property itself.

Summary of Cultural Resources and Practices on or near Roehrig Property

Several conclusions were reached regarding cultural resources and practices in the general Puna coastline by ASM Affiliates cultural consultants based on the environmental and cultural context and current and previous interviews. Hawaiian cultural practitioners have long gathered and continue to gather *lauhala* (pandanus leaves) from the Puna District. It is from the hala plant that various items of cultural importance and ornamental value were woven: *hīna‘i* (burial baskets); *moena* (mats); *uluna* (pillows); and cordage. Additionally, *hala* is a key bio-cultural feature that has and continues to be synonymous with Puna District. Another constant through history has been the tradition of fishing and collecting food and other resources from the ocean, shoreline and nearby groves. This orientation to the shoreline and the traditional practices developed in Hawai‘i are still passed down from generation to generation. Fishers and gatherers employ knowledge of their ancestors to select fishing locations, proper bait, and techniques. Fishers throw net, fish by rod and reel, or spear fish at different locations along the shoreline including the Wa‘awa‘a area to catch *āholehole*, *‘āweoweo*, *kala*, *kole*, *kūmū*, *manini*, *mamo*, *moana* and many other types of fish. They catch *pūhi* to fish for *‘ulua* along the cliffs. In addition, the traditional collection of *‘ōpihi*, *‘a‘ā ma*, and *limu* along the rocky shoreline is still practiced. Lauhala and lei material are also gathered. Some also fish by boat out of Hilo (and previously, and perhaps in the future, out of Pohoiki) for *akule*, *kawele‘ā*, *mahimahi*, *ono*, *‘ōpakapaka*, and other species. Traditional Hawaiian fishing practices, shoreline gathering practices, and ocean access are protected by State law. Some parts of Puna contain legendary hills, stone formations or islands with legendary significance. Finally, the Puna coast area is well known to contain *iwi kupuna* and consultees have repeatedly stressed that landowners should take a proactive approach for the care and preservation of human remains.

The small Roehrig property does not contain any caves, famed groves of trees, legendary rock formations, springs, or similar natural resources with specific cultural importance. No specific traditional cultural practices were identified to exist or have taken place within the property itself. Meticulous archaeological survey demonstrated the absence of historic properties and *iwi kupuna*. Like the entire Wa‘awa‘a subdivision, hala trees are abundant on the property, and while some would be removed, when planted

hala are counted, there may actually be more in the future than currently. In any case, hala is a widespread resource that is readily available in the Puna area, including on much of the 1,275 acres directly adjacent to the subdivision in the Nānāwale Forest Reserve and adjacent County property. In terms of shoreline resources, the *makai* boundary of the Roehrig property does not actually extend to the shoreline; there is a long, narrow Beach Reserve lot between all the residential lots and the sea, where all fishing and gathering occur. This lot is accessed by a short, well-worn trail through the Nānāwale Forest Reserve only 750 feet to the west. Knowledgeable individuals consulted for this and other single-family residence projects noted the importance of unhindered coastal access for traditional cultural practices.

Impacts and Mitigation Measures for Cultural Resources

Cultural practices that occur in the form of shoreline fishing and gathering on the narrow Beach Reserve lot between the Roehrig property and the sea would not be affected by the construction or occupation of the home. The home will be set back 70 feet from the shoreline, which is itself on the lot *makai*. The applicants are fully committed to not hindering in any active or passive manner lateral shoreline access for fishing, gathering or any other cultural purpose. The project does not involve effects on shoreline processes or the resources utilized by those fishing and gathering in the area. There will continue to be abundant areas for gathering of hala for use in customary crafts and practices. No *iwi kupuna* or access to them will be affected. Given these facts, it is reasonable to conclude that 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.

3.3 Public Roads, Services and Utilities

3.3.1 Roads and Access

Existing Environment, Impacts and Mitigation Measures

The access to the property would be via a proposed driveway on Government Beach Road. This lightly traveled, single-lane paved road connects several miles to the east to County Highway 132 at "Four Corners" and to Kahakai Boulevard several miles to the west. The addition of a driveway for the property would not cause any traffic impacts. Sight distance is adequate for speeds of 30 MPH or less.

3.3.2 Public Utilities and Services

Environmental Setting, Impacts and Mitigation Measures

Electrical power to the home would be provided primarily by rooftop solar photovoltaic panels. A rooftop solar water heater would supply hot water. A propane gas tank would support a gas stove and oven, as well as a back-up generator and water heater. Telecommunications would be provided by cell service and satellite receivers. No poles or lines are required.

Domestic water would be supplied from rooftop catchment with a 10,000-gallon tank, which the abundant rainfall on the site makes possible (see Figure 3 for location). The proposed rooftop catchment and storage are expected to be more than adequate to meet the home's demand, based on the applicants' expected use of less than 300 gallons per day (with no need for irrigation), as well providing sufficient reserve capacity to meet the fire-flow requirements for the planned residence.

Wastewater would be treated with a septic system in conformance with requirements of the State Department of Health that would have a tank capacity of 1,000 gallons and a 320-sf absorption field (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.

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. The applicants acknowledge and understand that this lot, along with the great majority of lots in the Puna District, is not located within a mile of emergency services.

3.4 Secondary and Cumulative Impacts

The adverse effects of building a single-family residence in this area are limited very minor and temporary disturbance to traffic, air quality, noise, and visual quality during construction. There are no traffic issues associated with the driveway on the Government Beach Road, which has very light levels of traffic. There are no substantial government or private projects in construction or planning in the 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 3.1.7, 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
Plan Approval and Grubbing, Grading, and Building Permits
Driveway Access Permit

State of Hawai'i:

Conservation District Use Permit
Wastewater System Approval

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 residence would be in balance with the natural, cultural and social environment of the County, would create temporary construction jobs for local residents, 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 would not have a substantial adverse effect on the environment and would not diminish the valuable natural resources of the region. The home would be compatible with the existing rural single-family homes and recreational uses on the *makai* side of the subdivision and residential, farming and grazing uses on the *mauka* side. 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 determined that no archaeological sites were present. Cultural practices in the area consist of fishing and gathering on the adjacent narrow shoreline lot, which will be unaffected by the proposed residence.

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 proposed home site 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 neighboring uses within the subdivision 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 located about 30 feet above sea level, a minimum of 70 feet back from the shoreline, in an area that is clearly out of the flood zone, and it 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 helps the area retain a rural character. Through provision of housing and expansion of a market for local goods and services, it improves the quality of life and economy. The lot shares the same volcanic and seismic hazard as much of Puna. Owing to the home's proposed location on the lot, substantial coastal hazard would be avoided. No rare species, coastal resources or historic sites will be adversely affected. Effects to native vegetation in the form of clearing for the home site will be mitigated by continuing removal of invasives and replanting of hala. The construction of a single-family home is not inconsistent with the Puna CDP.

3.6.2 Hawai'i County Zoning and Special Management Area

The entire property is zoned by the County of Hawai'i as within the Agricultural District, minimum lot size of 3 acres (A-3a), 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 (SMA). An SMA Assessment Application (SMAA) has been prepared and will be submitted to the Hawai'i County Planning Department in order to specifically address SMA-related issues. With the SMAA Application, the Planning Director will make the determination that the proposed development of the single-family residence and related uses are not considered "development" under Special Management Area Rules and Regulations of the County of Hawai'i, Section 9-4 (10) (B) and, therefore, exempt from SMA Use Permit requirements; or, alternatively, that Minor SMA Use Permit is required to allow the proposed use. In order to meet the County's application processing requirements, the submittal of the SMA Assessment Application generally follows after the State DLNR's acceptance of the Draft EA. A copy of the County's SMA determination will be provided to the DLNR, Office of Conservation and Coastal Lands upon receipt from the County Planning Department.

The application will contain detailed information on the project and will summarize the applicants' position on the consistency of the project. The following is a brief summary of the project's effects on the resources of the SMA that are relevant to an EA.

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, and would not result in any substantial adverse impact on the surrounding environment. The house site is set back sufficiently from the shoreline as to not be exposed to coastal hazards or restrict any shoreline uses such as hiking, fishing or water sports. Views towards the property will not be adversely impacted, as the lot is one of many residential lots in the area and a subtly placed home is consistent with neighborhood views. The property contains mostly native vegetation, and although removal of hala trees is necessary to create a building pad and driveway, an equal number of hala trees or greater will be replanted in areas formerly occupied by invasives, which the owner has

removed with prior permission from DLNR. on-native and several common native plants. Standard seasonal clearing and lighting mitigation will be employed to ensure no adverse impacts to threatened or endangered animals. There will be no adverse effect on the economy. The property is not situated over any natural drainage system or water feature that would flow into the nearby coastal ecosystem. No floodplains are present in the affected 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, there should be no impacts on marine resources. No historic sites are present and none will be adversely affected. No effects to cultural resources and practices will occur, and the cultural use of the shoreline area for fishing and gathering uses will be accommodated.

3.6.3 Conservation District

The State Land Use (SLU) District for the Roehrig property is Conservation. Although the SLU District Boundary Map available through the State of Hawai'i GIS System depicts a small portion of the property with the Agricultural district, a recent (November 8, 2021) Boundary Interpretation and map provided by the SLU Commission Office determined that the entire property is within the Conservation District (see determination letter in Appendix 1a, and portion of map in Figure 8). The Office has determined that the boundary between the two districts lies *mauka* of the Government Beach Road. The property lies within the Resource subzone,for which a single-family residence is an identified use, according to Hawai'i Administrative Rules (HAR) §13-5-15.

The applicants have prepared a Conservation District Use Application (CDUA), to which this EA is an appendix. The CDUA contains a detailed evaluation of the project's consistency with the criteria of the Conservation District permit process. Briefly, the following consistency criteria should be noted:

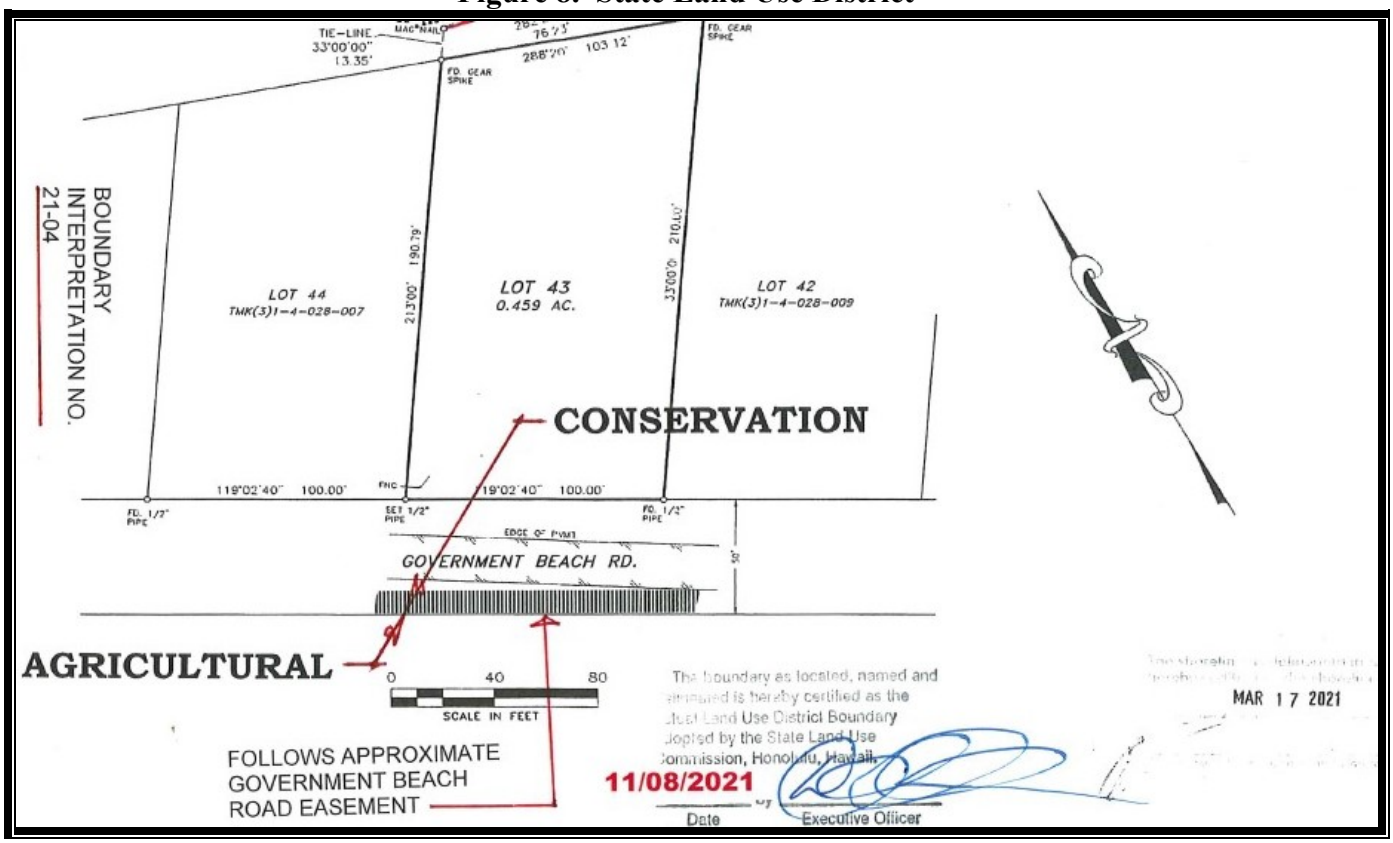
1. The proposed land use is consistent with the purpose of the Conservation District;

The development of the single-family residence is in conformance with the purpose of the Conservation District. It is an identified use within the Conservation District, requiring a Board Permit for such use. The proposed use will not impact the public's ability to access and utilize the narrow Beach Reserve shoreline lot that contains the shoreline and is the site for fishing and gathering. 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."* Single-family residences are an identified use in the Resource subzone under HAR 13-5-24, R-8. This identified use, which conforms to the design standards in 13-5-41 as applicable, will ensure the sustained use of the natural resources in the project area by mitigating potential impacts as outlined in this document.

Figure 8. State Land Use District



Source: Hawai'i State Land Use Commission, Boundary Interpretation 21-04, November 8, 2021, map portion (see Appendix 1a)

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 use complies with provisions and guidelines contained in Chapter 205A, Hawai'i Revised Statutes (HRS), entitled *Coastal Zone Management*, as discussed in detail 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 context and the relatively minor nature of the project, no valuable natural resources would be substantially impacted. Several common native plants are present, including naupaka, hala and bird's nest fern, of which only a portion will be affected. New individuals of these species will be replanted or will naturally regrow. Impacts to the island wide-ranging endangered Hawaiian hoary bat will be avoided through timing of vegetation removal. No effect on any coastal ecosystem will occur, because of the wide setback to the shoreline along with planned precautions for preventing soil runoff during construction. The proposed action will also have no impact on the public's current or traditional 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 other single-family residential uses in the area. As presented in detail in Section 1, the plan consists of an approximately 2,356-square foot, 2-bedroom, 2-bath, single-story structure with a living room, kitchen and dining area, pantry, lanai, breezeway and garage. The home will feature roof-mounted solar photovoltaic and solar water heating panels, rainfall water catchment and storage, propane gas for cooking and backup water heating and electric power, a gravel driveway, and an individual wastewater system. The Total Development Area (TDA) for the residence, per the Conservation District Rules (Title 13-5, HAR, Exhibit 4), is 2,573 sf. The maximum height above existing grade will be 20'2". The project includes minimal landscaping emphasizing the natural hala/naupaka vegetation that will replace in number any hala trees that need to be removed for the driveway and home site within areas that have had or will invasive trees removed. The proposed home site would be subtly placed in the middle of the lot, partially hidden from the Government Beach Road by existing and new planted hala trees. The proposed home site is not located in a flood zone nor would it affect one. Despite the relatively high volcanic hazard, which is shared by all of Puna and much of the Island of Hawai'i, geologic conditions do not impose undue constraints on the proposed action, and the home will meet or exceed all seismic hazard standards. The house location is in a slightly elevated, relatively level portion of the property that is outside the native coastal vegetation zone of naupaka, avoiding effects on shoreline resources and processes. The house would be set back a minimum of 70 feet from the shoreline, and will not be affected directly by coastal hazards, sea level rise or the slow retreat of shoreline cliffs. No protected scenic views are located nearby or would be affected in any way. The proposed use matches other single-family uses in the area. Due to the small size of the lot, the home will be visible, but not obtrusive. It will not be visible from the nearest State highway (State Highway 130). Only very minor exterior lighting is planned, and it will be shielded and will consist blue-deficient lighting such as filtered LED lights or amber LED lights, with a Correlated Color Temperature (CCT) of 2700 Kelvin. This will protect dark skies and reduce the risk that the threatened or endangered seabirds may be attracted to and then disoriented by the lighting. 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 nearby properties or how these properties are utilized, which are for single-family residences. This land use will be attractive and compatible with the area.

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 use of the subject property for a single-family residence – particularly given the ongoing, permitted removal of invasive trees and replanting of hala – 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.

An individual wastewater system compliant with Department of Health regulations and adherence to best management practices to minimize or completely avoid water pollution will ensure that the proposed single-family residence will not be detrimental to the public health, safety, and welfare.

PART 4: DETERMINATION, FINDINGS AND REASONS

4.1 Determination

The applicants expect 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). This determination will be reviewed based on comments to the Draft EA, and the Final EA will present the final determination.

4.2 Findings and Supporting Reasons

Chapter 11-200.1-13, Hawai'i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

> (a) In considering the significance of potential environmental effects, agencies shall consider and evaluate the sum of effects of the proposed action on the quality of the environment.
>
> (b) In determining whether an action may have a significant effect on the environment, the agency shall consider every phase of a proposed action, the expected impacts, and the proposed mitigation measures. In most instances, an action shall be determined to have a significant effect on the environment if it may:

1. *Irrevocably commit a natural, cultural, or historic resource.* No valuable natural or cultural resource would be committed or lost. Several common native plants are present, including naupaka, hala and bird's nest fern, of which only a portion will be affected. New individuals of these species will be replanted or will naturally regrow An archaeological inventory survey determined that there are no historic sites. No valuable cultural resources and practices such as shoreline access, fishing, gathering, hunting, or access to ceremonial sites would be adversely affected in any way.

2. *Curtail the range of beneficial uses of the environment.* No restriction of beneficial uses would occur by residential use on this lot, as the hala forest that would require some tree removal is widespread in the area, and the applicants would be planting as many hala trees as they remove. Shoreline uses on the adjacent narrow shoreline lot would not be affected.

3. *Conflict with the State's environmental policies or long-term environmental goals established by law*. 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 environmentally benign and minor, and it is thus consistent with all elements of the State's long-term environmental policies.

4. *Have a substantial adverse effect on the economic welfare, social welfare, or cultural practices of the community and 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. Cultural practices would not be affected.

5. *Have a substantial adverse effect on public health.* An individual wastewater system compliant with Department of Health regulations and adherence to best management practices to minimize or completely avoid water pollution will ensure that the proposed single-family residence will not be detrimental to public health.

6. *Involve adverse secondary impacts, such as population changes or effects on public facilities*. The small scale of the proposed project would not produce any noticeable secondary impacts, such as population changes or effects on public facilities.

7. *Involve a substantial degradation of environmental quality*. The project is minor and environmentally benign, and thus it would not contribute to environmental degradation.

8. *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions.* The adverse effects of building a single-family residence in this area are limited very minor and temporary disturbance to traffic, air quality, noise, and visual quality during construction.. There are no traffic issues associated with the driveway on the Government Beach Road, which has very light traffic levels. There are no substantial government or private projects in construction or planning in the area, 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.

9. *Have a substantial adverse effect on a rare, threatened, or endangered species, or its habitat.* The site has been surveyed for threatened and endangered plants, and none are present. Other than the Hawaiian hoary bat, an island wide-ranging species that will experience no adverse impacts due to mitigation in the form of timing of vegetation removal, 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. Only very minor exterior lighting is planned, and it will be shielded and will consist blue-deficient lighting such as filtered LED lights or amber LED lights, with a Correlated Color Temperature (CCT) of 2700 Kelvin.

This will reduce the risk that transiting threatened or endangered seabirds may be attracted to and then disoriented by the lighting.

10. *Have a substantial adverse effect on air or water quality or ambient noise levels.* No substantial effects to air, water, or ambient noise would occur. Erosion and sedimentation impacts will be avoided by implementation of Best Management Practices during grading, which will occur in a very limited area. Brief, temporary noise effects would occur during construction, but sequential house construction is a normal fact of life in rural Puna subdivisions and does not represent an undue impact to neighbors, who themselves underwent the same process. No parks, medical facilities, or other sensitive uses are nearby.

11. *Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, sea level rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters.* The proposed home site is not located in a flood zone nor would it affect one. In general, geologic conditions do not impose undue constraints on the proposed action, although, as with all of the Puna District, there is substantial volcanic hazard. The house will meet or exceed all seismic hazard standards. The house would be set back a minimum of 70 feet from the shoreline, and at an elevation of about 30 feet above sea level, it is unlikely to be affected directly by sea level rise or the very slow retreat of shoreline cliffs. The project has adapted to climate change by accounting for the potential for larger storms, through minimizing hard surfaces that generate runoff and removing nearby tall invasive trees. The applicants understand 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. *Have a substantial adverse effect on scenic vistas and viewplanes, during day or night, identified in county or state plans or studies.* No protected scenic views are located nearby or would be affected in any way. The proposed use is consistent with other single-family residential uses in the area, including the adjacent home on the west, another home one lot away to the east, and homes across the street. Due to the small size of the lot, the home will be visible, but not obtrusive. It will not be visible from the nearest State highway (State Highway 130). Only very minor exterior lighting is planned, and it will be shielded and will consist blue-deficient lighting such as filtered LED lights or amber LED lights, with a Correlated Color Temperature (CCT) of 2700 Kelvin. This will protect dark skies and reduce the risk that the threatened or endangered seabirds may be attracted to and then disoriented by the lighting.

13. *Require substantial energy consumption or emit substantial greenhouse gases*. Negligible amounts of energy input and greenhouse gas emission would be required for construction and occupation of the residence. The residence is designed as a single structure with efficient use of energy and materials and natural ventilation and lighting. Electrical power to the home would be provided primarily by rooftop solar photovoltaic panels. A rooftop solar water heater would supply hot water. Even with a propane gas tank to support cooking and the back-up generator and water heater, energy use and greenhouse gas emissions from use of the home would be minimal.

REFERENCES

Beckwith, M. 1970. *Hawaiian Mythology*. Honolulu: University of Hawai'i Press.

Best, G. 1978. *Railroads of Hawai'i*. San Marino, CA: Golden West Books.

Cazenave, A., Le Cozannet, G. 2014. *Sea level rise and its coastal impacts*, Open-Access *American Geophysical Union Journal of Earth's Future*, DOI: 10.1002/2013EF000188.

Coan, T. 1882. *Life in Hawaii: An Autobiographic Sketch of Mission Life and Labors 1835-1881*. Randolph, New York.

DeConto, R.M. and D. Pollard. 2016. "Contribution of Antarctica to past and future sea-level rise" *Nature* 531, 591–597 (31 March 2016). doi:10.1038/nature17145.

Dorrance, W., and F. Morgan. 2000. *Sugar Islands: The 165-Year Story of Sugar in Hawaii*. Honolulu: Mutual Publishing Co.

Ellis, W. 1963. *Journal of William Ellis*. Honolulu: Advertiser Publishing Co., Ltd.

Ewart, N., and M. Luscomb. 1974. *Archaeological Reconnaissance of Proposed Kapoho-Keaukaha Highway, District of Puna, Island of Hawai'i*. Manuscript 020574. B.P. Bishop Museum, Honolulu. Prep. for Sam O. Hirota, Inc. and County of Hawai'i, Department of Public Works.

Fletcher, C. H., Grossman, E. E, Richmond, B. M. and Gibbs, A. E. 2002. *Atlas of Natural Hazards in the Hawaiian Coastal Zone*. U.S. Geological Survey, Geologic Investigations Series Map I-2761, scale 1:50,000.

Fletcher, C. H., Boyd, R., Neal, W. J., and Tice, V. 2010. *Living on the Shores of Hawaii – Natural Hazards, the Environment, and our Communities.* Honolulu: University of Hawai'i Press.

Fornander, A. 1918-1919. *Hawaiian Antiquities and Folklore (Vol. 5)*. Memoirs of the Bernice Pauahi Bishop Museum. Honolulu: Bishop Museum Press.

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

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

Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte. 2014. Online Rainfall Atlas of Hawai'i. *Bull. Amer. Meteor. Soc*., doi: 10.1175/BAMS-D-11-00228.1.

Glennon, G., and L. Brandt, A. Santos and R. Rechtman. 2018. A Cultural Impact Assessment for the Proposed Residential Development of TMK: (3) 1-5-009:053. Prep. for Françoise Bourzat and Aharon Grossbard. Appendix 3 in Geometrician Associates, 2019, *Final Environmental Assessment Grossbard/Bourzat Single-Family Residence in the Conservation District at Keonepoko*. Hilo, Hawai'i.

Handy, E.S.C., E.G. Handy (with M. Pukui). 1991. *Native Planters in Old Hawaii: Their Life, Lore and Environment.* B.P. Bishop Museum Bulletin 223 (rev. ed.). Honolulu: Department of Anthropology, Bishop Museum Press.

Hawaiʻi Climate Change Mitigation and Adaptation Commission. 2017. *Hawaiʻi Sea Level Rise Vulnerability and Adaptation Report*. Prepared by Tetra Tech, Inc. and the State of Hawaiʻi. Department of Land and Natural Resources, Office of Conservation and Coastal Lands, under the State of Hawaiʻi Department of Land and Natural Resources Contract No: 64064.

Hawaiʻi County Planning Department. 2005. *General Plan, County of Hawaiʻi*. Hilo.

Hawaiʻi County Planning Department. 2008. *Puna Community Development Plan*. Hilo.

Hommon, R. 1986. Social Evolution in Ancient Hawaiʻi. IN Kirch, P. (editor), *Island Societies*: *Archaeological Approaches to Evolution and Transformation*:55-88. Cambridge: Cambridge University Press.

Hwang, D. J., 2005. *Hawaii Coastal Zone Mitigation Handbook: Hawaii Coastal Zone Management Program. DBEDT, State of Hawaii.*

_____. 2007. *Coastal Subsidence at Kapoho, Puna, Island and State of Hawaii*. Private report for Hawaiʻi County Planning Department.

Kanahele, P. and D. Wise. 1989. *Ka Honua Ola (The Living Earth): An Introduction to Pele and Hiʻiaka with Annotated Bibliography*. The Center for Hawaiian Studies at the University of Hawaiʻi at Mānoa.

Ketner, A., and R. Rechtman. 2011. *Cultural Impact Assessment for Proposed Development Activities on TMK 3-1-5-010:032, Makuʻu Ahupuaʻa, Puna District, Island of Hawaiʻi*. RC Report RC-0723. Prep. for John and Maureen Gapp. Appendix 3 in Geometrician Associates, 2012, *Final Environmental Assessment Gapp Single-Family Residence in the Conservation District at Makuʻu*. Hilo, Hawaiʻi.

Kirch, P.V. 2011. "When did the Polynesians Settle Hawaiʻi? A Review of 150 Years of Scholarly Inquiry and a Tentative Answer." *Hawaiian Archaeology* 12:3-26.

Maly, K. 1998. *Puna, Ka ʻĀina I Ka Hikina A Ka Lā" A Cultural Assessment Study – Archival and Historical Documentary Research and Oral History Interviews For the Ahupuaʻa of ʻAhalanui, Laepāoʻo, and Oneloa (with Pohoiki), District of Puna, Island of Hawaiʻ*i. Report HiPu-15b (073198). Prepared for David Matsuura, A & O International Corporation, Oneloa Development. Hilo, Hawaiʻi.

_____. 1999. *The Historic Puna Trail—Old Government Road (Keaʻau Section): Archival-Historical Documentary Research, Oral History and Consultation Study, and Limited Site Preservation Plan, Ahupuaʻa of Keaʻau, Puna District, Island of Hawaiʻi (TMK:1-6-01 various parcels)*. Prepared by Kumu Pono Associates Report HiAla-17 (011199). Prepared for Na Ala Hele Program, Hawaiʻi State Division of Forestry and Wildlife.

McGregor, D. 2007. *Nā Kuaʻāina: Living Hawaiian Culture*. Honolulu: University of Hawaiʻi Press.

Moore, J. G. 1970. "Relationship between subsidence and volcanic load, Hawaii." *Bulletin of Volcanology* 34:562-576.

Nordhoff, C. 1873a. "Hawaii Nei" *Harper's Magazine*. No. CCLXXIX. August 1873. Volume XLVII.

_____. 1873b. "Hawaii Nei II." *Harper's Magazine* No. CCLXXX. September 1873.Volume XLVII.

Pogue, J. 1858 [1978]. *Moolelo Hawaii*. Hale Paipalapala Aupuni, Honolulu (Rev. Ed.).

Pukui, M.K. 1983. '*Olelo No'eau.* Bishop Museum Special Publication 71. Honolulu: Bishop Museum Press.

Pukui, M.K., S.H. Elbert, and E.T. Mookini. 1976. *Place Names of Hawaii.* Honolulu: University of Hawai'i Press.

Rahmstorf, S., M. Perrette, and M. Vermeer. 2012. "Testing the robustness of semi-empirical sea level projections." *Climate Dynamics* 39: 861-875, doi:10.1007/s00382-011-1226-7.

Rechtman, R. 2011. *Cultural Impact Assessment Associated with the Proposed Construction of a Single-Family Dwelling in the Wa'awa'a Subdivision (TMK: 3-1-4-028:007).* Appendix 3 in Geometrician Associates, 2013, *Final Environmental Assessment Magsalin Single-Family Residence in the Conservation District at Wa'awa'a*. Hilo, Hawai'i.

Rechtman. R. 2013. *A Cultural Impact Assessment for the Single-Family Development of TMK: 3-1-5-09:035*. Prep. for David Yermian. Appendix 4 in Geometrician Associates, 2013, *Final Environmental Assessment Yermian Single-Family Residence in the Conservation District at Keonepoko Iki*. Hilo, Hawai'i.

Rechtman, R. and O. Bautista. 2009. *Cultural Impact Assessment Associated with the Proposed Construction of a Single-Family Dwelling in the Wa'awa'a Subdivision (TMK: 3-1-4-028:001*). Appendix 2 in Geometrician Associates. 2010. *Final Environmental Assessment, Joan Shafer Single-Family Residence in the Conservation District at Wa'awa'a*. Hilo, Hawai'i.

Spiegel, C.S., and P.J. Hart, B.L. Woodworth, E.J. Tweed and J.J. Lebrun. 2006. "Distribution and abundance of forest birds in low-altitude habitat on Hawai'i Island: evidence for range expansion of native species." *Bird Conservation International* 16:175–185.

Summers, C. 1999. *Material Culture*. The J.S. Emerson Collection of Hawaiian Artifacts. Honolulu: Bishop Museum Press.

Thrum, T. 1885. *Hawaiian Almanac and Annual for 1885, A Hand Book of Information On Matters Relating to the Hawaiian Islands, Original and Selected, of Value to Merchants, Planters, Tourists and Others*. Thos. G. Thrum, Honolulu.

_____. 1886. *Hawaiian Almanac and Annual for 1887, A Hand Book of Information on Matters Relating to the Hawaiian Islands, Original and Selected, of Value to Merchants, Planters, Tourists and Others*. Honolulu: Press Publishing Company.

U.S. Council on Environmental Quality (CEQ). 2016. *Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews*. Guidance dated August 1, 2016, signed by C. Goldfuss, CEQ.

U.S. Dept. of Commerce, Economics and Statistics Administration, Bureau of the Census, 2011, http://factfinder.census.gov/.

U.S. Fish and Wildlife Service (USFWS). 2004. Recovery Plan for the Nēnē or Hawaiian Goose (Branta sandvicensis). Region 1, USFWS. Portland, Oregon.

_____. 2012. Endangered Species in the Pacific: Hawaiian Goose/*Branta sandvicensis*/Nēnē. Available at: http://www.fws.gov/pacificislands/fauna/HIgoose.html. Accessed March 2015.

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

U.S. Soil Conservation Service. 1973. *Soil Survey of Island of Hawai'i, State of Hawai'i.* Washington: U.S. GPO.

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

University of Hawai'i at Manoa, Sea Grant College Program. 2014. *Climate Change Impacts in Hawai'i - A summary of climate change and its impacts to Hawai'i's ecosystems and communities*. UNIHI-SEAGRANT-TT-12-04.

Wilkes, C. 1856. *Narrative of the United States Exploring Expedition During the Years 1838–1842, Under the Command of C. Wilkes, U.S.N.* Vol. Volume IV. New York: G.P. Putnam and Co.

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

Wolfe, E.W Wise, W.S., and Dalrymple, G.B. 1997. *The geology and petrology of Mauna Kea volcano, Hawaii – a study of post shield volcanism*. US Geological Survey Professional Paper 1557.

Environmental Assessment

Roehrig Single-Family Residence in the Conservation District in Wa‘awa‘a

APPENDIX 1a
Comments in Response to Early Consultation

[This page intentionally left blank]

Mitchell D. Roth
Mayor

Lee E. Lord
Managing Director

Robert R.K. Perreira
Acting 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

January 13, 2021

Ron Terry, Principal
Geometrician Associates
10 Hina Street
Hilo, HI 96720

Dear Mr. Terry:

RE: Early Consultation for Environmental Assessment for Proposed Single Family Residence in the Conservation District Puna District Island of Hawai'i TMK: (3) 1-4-028:008

In regard to your request dated January 4, 2021, for the above-entitled matter, 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.

C~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 Assistant Fire Chief Ian Smith at (808) 932-2907.

Sincerely,

ROBERT R. K. PERREIRA
Acting Fire Chief

RRKP:cf

Mitchell D. Roth
Mayor

Paul K. Ferreira
Police Chief

Kenneth Bugado J
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

January 19, 2021

Mr. Ron Terry, Principal
Geometrician Associates
10 Hina Street
Hilo, HI 96720

Dear Mr. Terry:

Subject: Early Consultation for Environmental Assessment for Proposed Single Family Residence in the Conservation District, Puna District, Island of Hawaii; Tax Map Key: (3rd) 1-4-028:008

Upon reviewing the provided documents, our staff does not anticipate any significant impact to traffic and/or public safety concerns.

Thank you for allowing us the opportunity to comment.

Should you have any questions, please contact Captain John Briski, Puna District Commander, at (808) 965-2716.

Sincerely,

JAMES B. O'CONNOR
ASSISTANT POLICE CHIEF
AREA I OPERATIONS BUREAU

JB:lli/21HQ0029

From: Cory Harden <333cory@gmail.com>
Sent: Saturday, February 6, 2021 9:06 PM
To: BIZ Geometrician <rterry@hawaii.rr.com>
Subject: Re: Early consultation for EA for single family residence on TMK 1-4-028:008 (Wa`awa`a Residential Lots)

Belatedly, sorry...please look at ensuring public access to the shore, and at hazards from sea level rise. thx,Cory

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

February 18, 2021

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

via email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District located at Puna District, Island of Hawaii; TMK: (3) 1-4-028:008 on behalf of Christopher & Wendy **Roehrig**

Thank you for the opportunity to review and comment on the subject matter. In addition to our previous comments dated February 11, 2021, enclosed are comments from the Division of Forestry & Wildlife on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Enclosures
cc: Central Files

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

January 19, 2021

MEMORANDUM

TO: **DLNR Agencies:**
X Div. of Aquatic Resources (kendall.l.tucker@hawaii.gov)
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
X Office of Conservation & Coastal Lands (sharleen.k.kuba@hawaii.gov)
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)

FROM: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District
LOCATION: Puna District, Island of Hawaii; TMK: (3) 1-4-028:008
APPLICANT: Geometrician Associates, LLC on behalf of Christopher & Wendy **Roehrig**

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **February 10, 2021.**

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

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

Signed: [signature]

Print Name: DAVID G. SMITH, Administrator

Date: Feb 18, 2021

Attachments
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII

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

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
DEPUTY DIRECTOR - WATER

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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
1151 PUNCHBOWL STREET, ROOM 325
HONOLULU, HAWAII 96813

February 11, 2021

MEMORANDUM

Log no. 2992

TO: RUSSELL Y. TSUJI, Administrator
Land Division

FROM: DAVID G. SMITH, Administrator
Division of Forestry and Wildlife

SUBJECT: Division of Forestry and Wildlife Comments on the Early Consultation for Environmental Assessment for a Proposed Single-Family Residences in the Conservation District in Puna, Hawai'i

The Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) has received your inquiry regarding review of the early consultation for the Environmental Assessment for a proposed single family residences in the conservation district in Puna on the island of Hawai'i, TMKs: (3) 1-4-028:008. The proposed project includes constructing a 1,764 square foot, 2-bedroom, 2-bath, single story structure on a 0.459 acre property of previously undeveloped land.

The State listed Hawaiian Hawk or 'Io (*Buteo solitarius*) is known to occur in the project vicinity. DOFAW recommends surveying the area to ensure no Hawaiian Hawk nests are present if trees are to be cut. 'Io nests might be present during the breeding season from March to September.

The State listed Hawaiian Hoary Bat or 'Ōpe'ape'a (*Lasiurus cinereus semotus*) has the potential to occur in the vicinity of the project area and may roost in nearby trees. If any site clearing is required this should be timed to avoid disturbance during the bat birthing and pup rearing season (June 1 through September 15). If this cannot be avoided, woody plants greater than 15 feet (4.6 meters) tall should not be disturbed, removed, or trimmed without consulting DOFAW.

To prevent the spread of Rapid 'Ōhi'a Death (ROD), if 'ōhi'a trees are present and will be removed, trimmed, or potentially injured DOFAW requests that the information and guidance at the following website be reviewed and followed: https://cms.ctahr.hawaii.edu/rod.

DOFAW recommends minimizing the movement of plant or soil material between worksites, such as in fill. Soil and plant material may contain invasive fungal pathogens (e.g. Rapid 'Ōhi'a Death), vertebrate and invertebrate pests (e.g. Little Fire Ants), or invasive plant parts that could harm our native species and ecosystems. We recommend consulting the Big Island Invasive Species Committee at (808) 933-3340 in planning, design, and construction of the project to learn of any high-risk invasive species in the area and ways to mitigate spread. All equipment, materials, and personnel should be cleaned of excess soil and debris to minimize the risk of spreading invasive

species. Gear that may contain soil, such as work boots and vehicles, should be thoroughly cleaned with water and sprayed with 70% alcohol solution to prevent the spread of Rapid ʻŌhiʻa Death and other harmful fungal pathogens.

DOFAW recommends using native plant species for landscaping that are appropriate for the area (i.e. climate conditions are suitable for the plants to thrive, historically occurred there, etc.). Please do not plant invasive species. DOFAW recommends consulting the Hawaiʻi-Pacific Weed Risk Assessment website to determine the potential invasiveness of plants proposed for use in the project (https://sites.google.com/site/weedriskassessment/home).We recommend that you refer to www.plantpono.org for guidance on selection and evaluation for landscaping plants.

We note that artificial lighting can adversely impact seabirds that may pass through the area at night by causing disorientation. This disorientation can result in collision with manmade artifacts or grounding of birds. For nighttime lighting that might be required, DOFAW recommends that all lights be fully shielded to minimize impacts. Nighttime work that requires outdoor lighting should be avoided during the seabird fledging season from September 15 through December 15. This is the period when young seabirds take their maiden voyage to the open sea. For illustrations and guidance related to seabird-friendly light styles that also protect the dark, starry skies of Hawaiʻi please visit: https://dlnr.hawaii.gov/wildlife/files/2016/03/DOC439.pdf.

We appreciate your efforts to work with our office for the conservation of our native species. Should the scope of the project change significantly, or should it become apparent that threatened or endangered species may be impacted, please contact our staff as soon as possible. If you have any questions, please contact Koa Matsuoka, Protected Species Habitat Conservation Planning Associate at (808) 587-4149 or koa.matsuoka@hawaii.gov.

Sincerely,

DAVID G. SMITH
Administrator

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

February 11, 2021

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

via email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District located at Puna District, Island of Hawaii; TMK: (3) 1-4-028:008 on behalf of Christopher & Wendy **Roehrig**

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

At this time, enclosed are comments from the (a) Engineering Division, (b) Office of Conservation & Coastal Lands, and (c) Land Division-Hawaii District on the subject matter. Should you have any questions, please feel free to contact Darlene Nakamura at (808) 587-0417 or email: darlene.k.nakamura@hawaii.gov. Thank you.

Sincerely,

Russell Tsuji

Russell Y. Tsuji
Land Administrator

Enclosures
cc: Central Files

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

January 19, 2021

MEMORANDUM

FROM:

~~TO:~~ **DLNR Agencies:**
X Div. of Aquatic Resources (kendall.l.tucker@hawaii.gov)
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
X Office of Conservation & Coastal Lands (sharleen.k.kuba@hawaii.gov)
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)

TO: ~~FROM:~~ Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District
LOCATION: Puna District, Island of Hawaii; TMK: (3) 1-4-028:008
APPLICANT: Geometrician Associates, LLC on behalf of Christopher & Wendy **Roehrig**

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **February 10, 2021.**

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

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

Signed: _____

Print Name: Carty S. Chang, Chief Engineer

Date: Feb 3, 2021

Attachments
cc: Central Files

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/Russell Y. Tsuji
Ref: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District
Location: Puna District, Island of Hawaii
TMK(s): (3) 1-4-028:008
Applicant: Geometrician Associates, LLC on behalf of Christopher & Wendy Roehrig

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 Special Flood Hazard Area (high risk areas). State projects are required to comply with 44CFR regulations as stipulated in Section 60.12. Be advised that 44CFR reflects the minimum standards as set forth by the NFIP. Local community flood ordinances may stipulate higher standards that can be more restrictive and would take precedence over the minimum NFIP standards.

The owner of the project property and/or their representative is responsible to research the Flood Hazard Zone designation for the project. Flood Hazard Zones are designated on FEMA's Flood Insurance Rate Maps (FIRM), which can be viewed on our Flood Hazard Assessment Tool (FHAT) (http://gis.hawaiinfip.org/FHAT).

If there are questions regarding the local flood ordinances, please contact the applicable County NFIP coordinating agency 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) 241-4896.

Signed: _____
CARTY S. CHANG, CHIEF ENGINEER

Date: Feb 3, 2021

DAVID Y. IGE
GOVERNOR OF HAWAII

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

2021 JAN 21 A 11: 20

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 19, 2021

MEMORANDUM

TO: **DLNR Agencies:**
X Div. of Aquatic Resources (kendall.l.tucker@hawaii.gov)
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
X Office of Conservation & Coastal Lands (sharleen.k.kuba@hawaii.gov)
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)

FROM: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District
LOCATION: Puna District, Island of Hawaii; TMK: (3) 1-4-028:008
APPLICANT: Geometrician Associates, LLC on behalf of Christopher & Wendy **Roehrig**

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **February 10, 2021.**

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

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

Signed: _____

Print Name: Trevor Fitzpatrick

Date: 2/10/2021

Attachments
cc: Central Files

DAVID Y. IGE
GOVERNOR OF
HAWAII

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

ROBERT K. MASUDA
FIRST DEPUTY

M. KALEO MANUEL
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: TF

COR: HA 21-81

Ron Terry - Principal
Geometrician Associates
10 Hina Street
Hilo, HI 96720

FEB 10 2021

SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District.
Located at 14-3543 Government Beach Road, Pahoa, HI 96778
Waawaa Subdivision, Waawaa, Puna, Island of Hawaii
TMK: (3) 1-4-028:008

Dear Mr. Terry:

The Office of Conservation and Coastal Lands (OCCL) thanks you for your letter and its attachments regarding the subject matter. According to the information in the letter, your client is proposing to construct a single-family residence that currently consists of approximately 1,764 sq. ft, 2-bedrooms, 2-bathrooms, and will be a single-story structure with a lanai. The home will feature solar photovoltaic, rainfall catchment water supply, a driveway, and an individual wastewater system meeting or exceeding all regulatory requirements. Additionally, the letter notes that the owner removed most of the invasive trees located on the front portion of the property. On behalf of your client, you are requesting input, comments, or concerns regarding the proposed project that should be addressed in the environmental assessment.

The OCCL regulates land uses in the State Land Use Conservation District through the issuance of Conservation District Use Permits and Site Plan Approvals to help conserve, protect, and preserve important natural and cultural resources. Based on the information you have provided; it appears that a portion of the parcel with the TMK: (3) 1-4-0028:008 lies within the Resource Subzone of the State Land Use Conservation District. It appears that a single-family residence is an identified land use in the Resource Subzone that may be applied for pursuant to Hawaii Administrative Rules (HAR), §13-5-24 R-7 SINGLE FAMILY RESIDENCE (D-1) *A single family residence (SFR) that conforms to the design standards outlined in this* chapter. The design standards can be found in HAR, Chapter 13-5 as Exhibit 4, Single Family Residential Standards. The single-family residential use would require the filing of a Conservation District Use Application (CDUA) for a Board Permit and all required attachments, such as but not limited to an environmental assessment. To allow, modify, or deny the proposed land use would

be at the discretion of the Board of Land and Natural Resources (BLNR). The OCCL requests that a coastal erosion study be included with the CDUA as the lot appears to be close to the coast and has the potential to be affected by erosion and subsidence. Your client may also want to consider locating and identifying the removed trees on their proposed landscaping plan. Applications can be found at https://dlnr.hawaii.gov/occl/forms-2/ .

Should you have any questions, please feel free to contact Trevor Fitzpatrick of the Office of Conservation and Coastal Lands at 798-6660 or trevor.j.fitzpatrick@hawaii.gov .

Sincerely,

Sam Lemmo

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

CC: Chairperson
Hawaii Land Division Office
County of Hawaii, Planning Department

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

January 19, 2021

MEMORANDUM

TO: **DLNR Agencies:**
X Div. of Aquatic Resources (kendall.l.tucker@hawaii.gov)
__Div. of Boating & Ocean Recreation
X Engineering Division (DLNR.ENGR@hawaii.gov)
X Div. of Forestry & Wildlife (rubyrosa.t.terrago@hawaii.gov)
__Div. of State Parks
X Commission on Water Resource Management (DLNR.CWRM@hawaii.gov)
X Office of Conservation & Coastal Lands (sharleen.k.kuba@hawaii.gov)
X Land Division – Hawaii District (gordon.c.heit@hawaii.gov)

FROM: Russell Y. Tsuji, Land Administrator *Russell Tsuji*
SUBJECT: Early Consultation for Environmental Assessment for Proposed Single-Family Residence in the Conservation District
LOCATION: Puna District, Island of Hawaii; TMK: (3) 1-4-028:008
APPLICANT: Geometrician Associates, LLC on behalf of Christopher & Wendy **Roehrig**

Transmitted for your review and comment is information on the above-referenced subject matter. Please submit comments by **February 10, 2021.**

If no response is received by the above date, we will assume your agency has no comments. Should you have any questions about this request, please contact Darlene Nakamura at darlene.k.nakamura@hawaii.gov. Thank you.

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

Signed: [signature]

Print Name: GORDON C. HEIT

Date: 2/3/21

Attachments
cc: Central Files

DAVID Y. IGE
GOVERNOR

JOSH GREEN
LIEUTENANT GOVERNOR

LAND USE COMMISSION
STATE OF HAWAI`I

DANIEL E. ORODENKER
EXECUTIVE OFFICER

November 8, 2021

James M. Leonard
56 Laukona Street
Hilo, Hawaii 96720

Dear Mr. Leonard:

Subject: BOUNDARY INTERPRETATION No. 21-04
Tax Map Key: 1-4-028: 008, Roehrig Property,
Waawaa, Puna, Hawai`i

Pursuant to your email request dated May 13, 2021, and a certified shoreline survey map dated March 17, 2021, for the subject parcel, please be advised that we have determined the subject parcel is within the State Land Use (SLU) Conservation District.

Our determination is based on the commission's record currently on file at our office, the certified shoreline survey map you provided, and especially the location of the SLU District Boundaries on the official SLU Map H-73, Kapoho Quadrangle. It is also our understanding that the intent of the SLU Agricultural / Conservation District Boundary follows mauka side (southern side) of the Government Beach Road.

We enclosed a copy of your survey map entitled, *"Map Showing Parcel 4, Being a Portion of R. P. 1466, L. C. Aw. 2896, Ap. 4 to Kamakea"*, with the approximate certification of the SLU Urban / Agricultural District Boundaries for your reference. Should you require clarification or further assistance, please feel free to call Fred Talon of my staff at 587-3822.

Sincerely,

DANIEL E. ORODENKER
Executive Officer

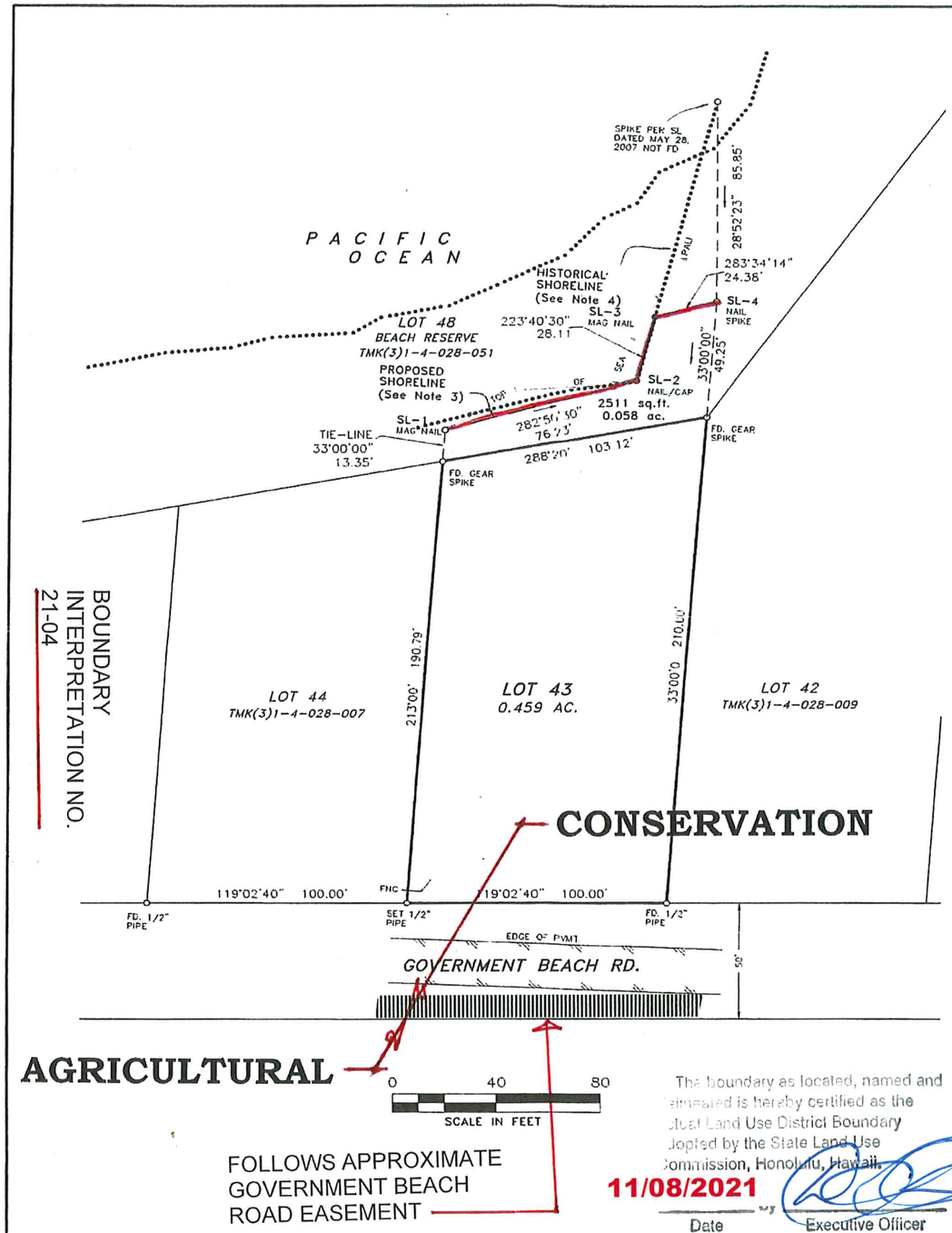
Enclosure:

c:
Tiger Mills, Acting Administrator, Office of Conservation & Coastal Lands, Department of Land and Natural Resources, (w/enclosure)
Zendo Kern, Planning Director, Planning Department, County of Hawai`i (w/enclosure)
Dawn Matney, Tax Maps and Records, Supervisor, Department of Finance, County of Hawai`i (w/enclosure)
Lisa Nahoopii, GIS Analyst, County of Hawai`i (w/enclosure)

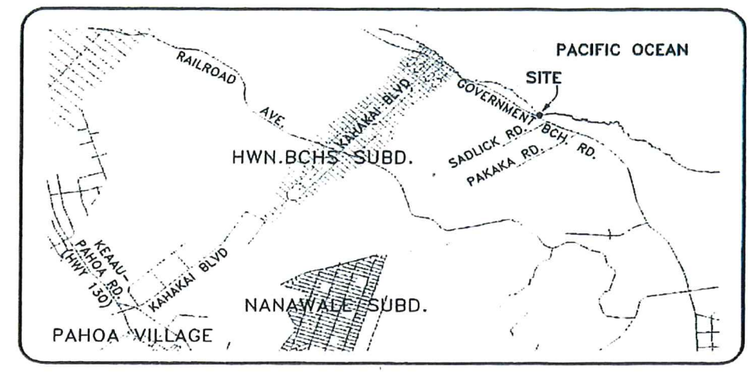
235 SOUTH BERETANIA STREET ❁ SUITE 406 ❁ HONOLULU, HAWAI`I 96813 ❁ TEL (808) 587-3822 ❁ Fax (808) 587-3827 ❁ EMAIL: luc@dbedt.hawaii.gov
Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

Shoreline Survey

of Lot 43, of the Waawaa Subdivision
Being All of Grant 3687 to R.A Lyman,
Grant 1363 to Pakaka,
Grant 997, Apana 1 to Haole and
Grant 997 Apana 2 to Haole,
Situated at Waawaa, Puna,
Island and County of Hawaii, Hawaii
TMK(3) 1-4-028:008



BOUNDARY INTERPRETATION NO. 21-04



VICINITY MAP
NO SCALE

Property Situs:
14-3543 Government Beach Rd.
Pahoa, HI 96778

Owners:
Christorpher J. Roehrig, Wendi L. Roehrig
64-629 Kolohala Pl.
Kamuela HI 96743

NOTES:

1. Field survey dated August 22, 2020.
2. Boundary courses are record per Waawaa Subdivision, approved May 9, 1958 by Planning and Traffic Commission as SUB# 1252.
3. Shoreline defined as the highest wash of the waves as determined from sea pali and vegetation.
4. Historical shoreline dated May 28, 2007 is shown for reference. It was not adopted as it (a) falls further makai of the proposed shoreline, and (b) does not depict top of sea pali as a shoreline definition as prescibed in HAR 13-22-16(b)(6).

The boundary as located, named and delineated is hereby certified as the Coastal Land Use District Boundary adopted by the State Land Use Commission, Honolulu, Hawaii.

11/08/2021
Date — Executive Officer

MAR 17 2021

DANIEL BERG
LICENSED PROFESSIONAL LAND SURVEYOR
No. 11245
HAWAII, U.S.A.

This work was prepared by me or under my direct supervision.

Daniel L. Berg
PLS 11245

dlb & Associates
LAND SURVEYING • MAPPING • CONSULTING
P.O.Box 49-2281 Keaau, HI. 96749
Ph.966-4206 Fx.82-6830
www.dlbandassoc.com

Date Revised January 24, 2021
Sheet 1: Map
Project: J2020-249
15x21

[This page intentionally left blank]

Environmental Assessment

Roehrig Single-Family Residence in the Conservation District in Wa‘awa‘a

APPENDIX 2
Archaeological Inventory Survey

[This page intentionally left blank]

An Archaeological Assessment of Lot 43 of the Waʻawaʻa Subdivision

TMK: (3) 1-4-028:008

Waʻawaʻa Ahupuaʻa
Puna District
Island of Hawaiʻi

DRAFT VERSION

Prepared By:

Lauren M. U. Kepaʻa
and
Matthew R. Clark, M.A.

Prepared For:

Kit Roehrig
64-629 Kolohala Place
Kamuela, Hi 96743

November 2020

ASM affiliates

Archaeology • History • Anthropology • Architectural History

Hilo Office: (808) 969-6066 Fax: (808) 443-0065
507-A E. Lanikaula Street, Hilo, HI 96720

Honolulu Office: (808) 439-8089 Fax: (808) 439-8087
820 Mililani Street, Suite 700, Honolulu, HI 96813

ASM Project Number 35970.00

An Archaeological Assessment of Lot 43 of the Waʻawaʻa Subdivision

TMK: (3) 1-4-028:008

Waʻawaʻa Ahupuaʻa
Puna District
Island of Hawaiʻi

ASM affiliates

EXECUTIVE SUMMARY

At the request of Kit Roehrig (landowner), ASM Affiliates conducted an Archaeological Inventory Survey (AIS) of a 0.459-acre project area located on Tax Map Key (TMK): (3) 1-4-028:008 within the Waʻawaʻa Residential Subdivision in Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi. A Conservation District Use Application (CDUA) is being prepared for the proposed development of a single-family dwelling on the parcel (in accordance in Hawaiʻi Revised Statues (HRS) Chapter 343), and this document is intended to inform that application process. This study was undertaken in accordance with Hawaiʻi Administrative Rules (HAR) 13§13–284, and complies with the *Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports* as contained in HAR 13§13–276. Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawaiʻi Planning Department. According to HAR 13§13-284-5(b)(5)(A), when no archaeological sites are found during an AIS, the results of the AIS shall be reported as an Archaeological Assessment.

Fieldwork for the current study was conducted on October 15, 2020 by Lauren Kepaʻa and Matthew R. Clark (Principle Investigator). Fieldwork consisted of an intensive (100%) coverage survey of the entire surface of the project area utilizing systematic east-west pedestrian transects with fieldworkers spaced at roughly three-meter intervals. The entire project area was accessible at the time of the survey, and the boundaries were clearly identifiable in the field; vegetation cover on slightly limited ground visibility.

No cultural resources of any kind were identified within the current project area as a result of the fieldwork. Thus, it is the conclusion of this study that the proposed development of a single-family dwelling on the subject parcel will have no effect on any historic properties. With respect to the historic preservation review process of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawaiʻi Planning Department, our recommendation is that no further work needs to be conducted prior to or during project implementation. In the unlikely event that significant archaeological resources are discovered during the proposed development activities, work shall cease in the area of the discovery and DLNR-SHPD shall be contacted pursuant to HAR 13§13-280-3.

CHAPTERS

Page

1. INTRODUCTION 1
PROJECT AREA DESCRIPTION 5
2. BACKGROUND 8
CULTURE-HISTORICAL CONTEXT 8
WAʻAWAʻA AHUPUAʻA AND THE GREATER PUNA DISTRICT 9
Select *Moʻolelo* of Waʻawaʻa and the Greater Puna District 14
Traditional Agricultural and Gathering Practices of Waʻawaʻa and Puna 26
Early Historic Accounts of Waʻawaʻa, the Lava Flow of 1840, and the Early Development of the *Alanui Aupuni* (1823-1847) 31
The Legacy of the *Māhele ʻĀina* of 1848 36
Royal Patent Land Grants and Land Patent Grants Sold in Waʻawaʻa Ahupuaʻa 37
Boundary Commission Testimony (1862-1876) 43
Nā Inoa ʻĀina and Places of Interest in Waʻawaʻa Ahupuaʻa 44
Waʻawaʻa Ahupuaʻa During the Late Nineteenth and Early Twentieth Centuries, Later Historic Accounts, and a Concise History of the Waʻawaʻa Residential Subdivision 47
PREVIOUS ARCHAEOLOGICAL STUDIES 52
3. PROJECT AREA EXPECTATIONS 54
4. FIELDWORK, CONCLUSION, AND RECOMMENDATIONS 55
REFERENCES CITED 56

FIGURES

Page

1. Project area location. 2
2. Tax Map Key plat (3) 1-4-028 showing location of current project parcel (008). 3
3. Google Earth™ satellite image showing project area location (outlined in red). 4
4. Southern boundary of project area along the edge of the Government Beach Road, view to the northwest. 5
5. Geological units in the current project area (Sherrod et al. 2007). 6
6. Soils within the project area (Soil Survey Staff 2019). 6
7. Northwestern, coastal portion of project area, view to the northwest. 7
8. Typical vegetation pattern in *makai* portion of the project area, view to the southwest. 7
9. Typical vegetation in *mauka* portion of project area, view to the northwest. 8
10. Hawaiʻi Registered Map No. 2060 (Donn 1901)showing location of the project area (shaded red) within Waʻawaʻa Ahupuaʻa (shaded yellow) and the Puna District (shaded gray). 13

11. Man standing in a Puna *pū hala* grove in 1888 (Brigham and Stokes 1906:28)..... 29
12. An engraving prepared by Lahainaluna School students Kaleohano and Nuʻuanu of the lava flow entering the ocean at Nānāwale as published in *The Polynesian* (Kaleohano and Nuuanu 1840)..... 33
13. Portion of Hawaiʻi Registered Map No. 424 prepared in 1841 during the United States Exploring Expedition showing approximate location of the current project area. 34
15. Land Grants sold within Waʻawaʻa Ahupuaʻa..... 39
16. Hawaiʻi Registered Map No. 1684 prepared by A.B. Loebenstein in June 1893 showing project area location (outlined in red) within Waʻawaʻa Ahupuaʻa..... 40
17. Newspaper clipping from January 22, 1894 (The Hawaiian Star 1906)..... 41
18. An 1894 map showing approximate location of the project area (shaded red) within Grant No. 3687 to R.A. Lyman (www.kipukadatabase.com)..... 41
19. Approximate location of project area (shaded red) within the government remnant portion of Waʻawaʻa (www.kipukadatabase.com). 42
20. Portion of Hawaiʻi Registered Map No. 1883 prepared by A.B. Loebenstein in 1895 showing project area location (outlined in red) within Waʻawaʻa Ahupuaʻa..... 43
21. Locations of place names in and associated with Waʻawaʻa Ahupuaʻa compiled from Historic maps..... 45
22. Portion of Hawaiʻi Registered Map No. 568 prepared by J.M. Lydgate in 1875 showing approximate location of the project area in relation to the *Alanui Aupuni*. 48
23. Portion of Hawaiʻi Registered Map No. 2191 prepared in December 1902 as surveyed by E.D. Baldwin and prepared by T.E. Cook showing the project area location (outlined in red)..... 49
24. Portion of the 1924 USGS Makuu quadrangle with project area outlined in red. 50
25. Portion of 1965 USGS Kapoho quadrangle with the project area outlined in red..... 51
26. 1961 USGS aerial photograph showing the location of the project area (outlined in red). 51
27. Previous archaeological studies conducted in the vicinity of the project area..... 53

TABLES

Page

1. Grant parcels purchased within Waʻawaʻa Ahupuaʻa..... 39
2. List of place names/places of interest in Waʻawaʻa noted on historical maps..... 46

1. INTRODUCTION

At the request of Kit Roehrig (landowner), ASM Affiliates conducted an Archaeological Inventory Survey (AIS) of a 0.459-acre project area located on Tax Map Key (TMK): (3) 1-4-028:008 within the Waʻawaʻa Residential Subdivision in Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi (Figures 1, 2, and 3). A Conservation District Use Application (CDUA) is being prepared for the proposed development of a single-family dwelling on the parcel (in accordance in Hawaiʻi Revised Statues (HRS) Chapter 343), and this document is intended to inform that application process. This study was undertaken in accordance with Hawaiʻi Administrative Rules (HAR) 13§13–284, and complies with the *Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports* as contained in HAR 13§13–276. Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawaiʻi Planning Department. According to HAR 13§13-284-5(b)(5)(A), when no archaeological sites are found during an AIS, the results of the AIS shall be reported as an Archaeological Assessment. 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 and a description of the findings, followed by recommendations and a determination of effect for the proposed project.

Figure 1. Project area location.

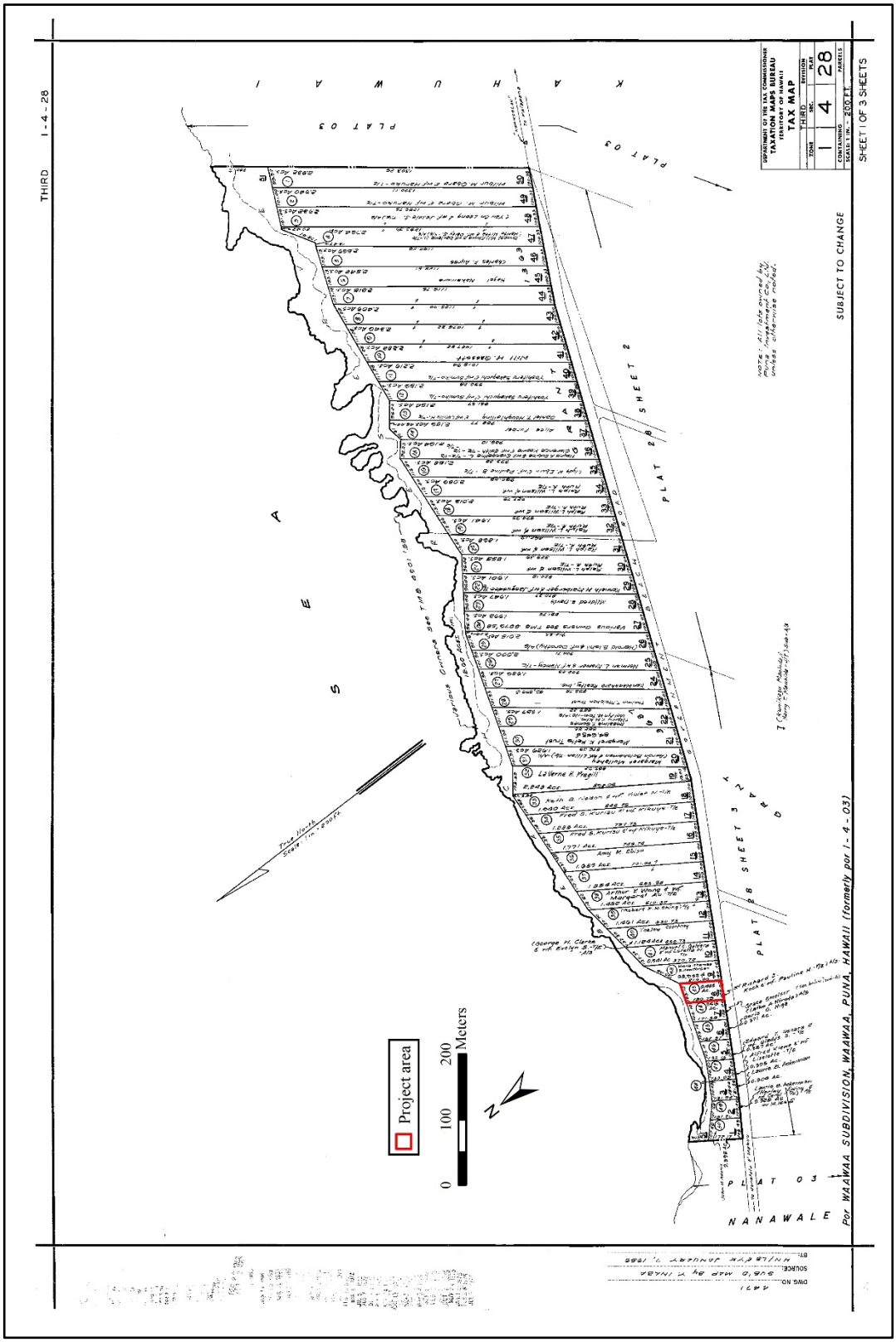


Figure 2. Tax Map Key plat (3) 1-4-028 showing location of current project parcel (008).

Figure 3. Google Earth™ satellite image showing project area location (outlined in red).

PROJECT AREA DESCRIPTION

The project area is situated within Waʻawaʻa Subdivision, which encompasses the entire *makai* portion of Waʻawaʻa Ahupuaʻa along the Puna coast of Hawaiʻi Island between Nānāwale and Kahuwai *ahupuaʻa* (see Figure 1). The project area (TMK: (3) 1-4-028:008), also identified as Lot 43 of the Waʻawaʻa Subdivision, is located in the northwestern portion of the subdivision between the Government Beach Road and the coast at an elevation of 8 to 15 meters (26 to 49 feet) above sea level. It is bounded to the west by a recently developed residential parcel (Lot 44), to the east by an undeveloped residential parcel (Lot 42), to the south by the Government Beach Road, and to the north by a thin, 12.6-acre conservation-zoned oceanfront parcel (jointly owned by all of the subdivision lot owners) that extends along the entire coast of the Waʻawaʻa Subdivision. The project area is accessed from the Government Beach Road (Figure 4), and at the time of the current fieldwork all four corners of the parcel had been recently marked by a surveyor with lathe and flagging tape.

The underlying geology of this portion of the Puna District is generally formed of *pāhoehoe* lava flows, mapped as Puna Basalt (Sherrod et al. 2007), that originated from Kīlauea Volcano between 750 and 1,500 years ago (labeled Qp3 in Figure 5). Soils that have formed on these lava flows are classified as dry Opihikao highly decomposed plant material on 2 to 20 percent slopes (Figure 6). These shallow, well-drained soils are formed of highly decomposed plant material overlying *pāhoehoe* bedrock (Soil Survey Staff 2017). Terrain within the project area is characterized by a gentle *makai* (northeast) slope which terminates at a low *pali* (cliff) overlooking a wave-swept *pāhoehoe* bedrock shelf (Figure 7).

The climate in the vicinity of the project area is generally warm and wet with temperatures ranging between 70° to 77° Fahrenheit throughout the year, and a mean annual rainfall of approximately 2,620 millimeters (103 inches) (Giambelluca et al. 2014). Vegetation within of the project area is dominated by a dense growth of beach *naupaka* (*naupaka kahakai*; *Scaevola sericea*) near the coast (Figure 8), which transitions to a growth of primarily *hala* (screw pine; *Pandanus odoratissimus*) interspersed with *niu* (coconut; *Cocos nucifera*), *lauaʻe* (*maile*-scented fern; *Phymatosorus grossus*), *ʻamaʻumaʻu* (*Sadleria cyatheoides*), and *kupukupu* (sword fern; *Nephrolepis exaltata*), scattered *kī* (ti; Cordyline fruticose), wedelia (*Sphagneticola trilobata*) nearer to the Government Beach Road (Figure 9).

Figure 4. Southern boundary of project area along the edge of the Government Beach Road, view to the northwest.

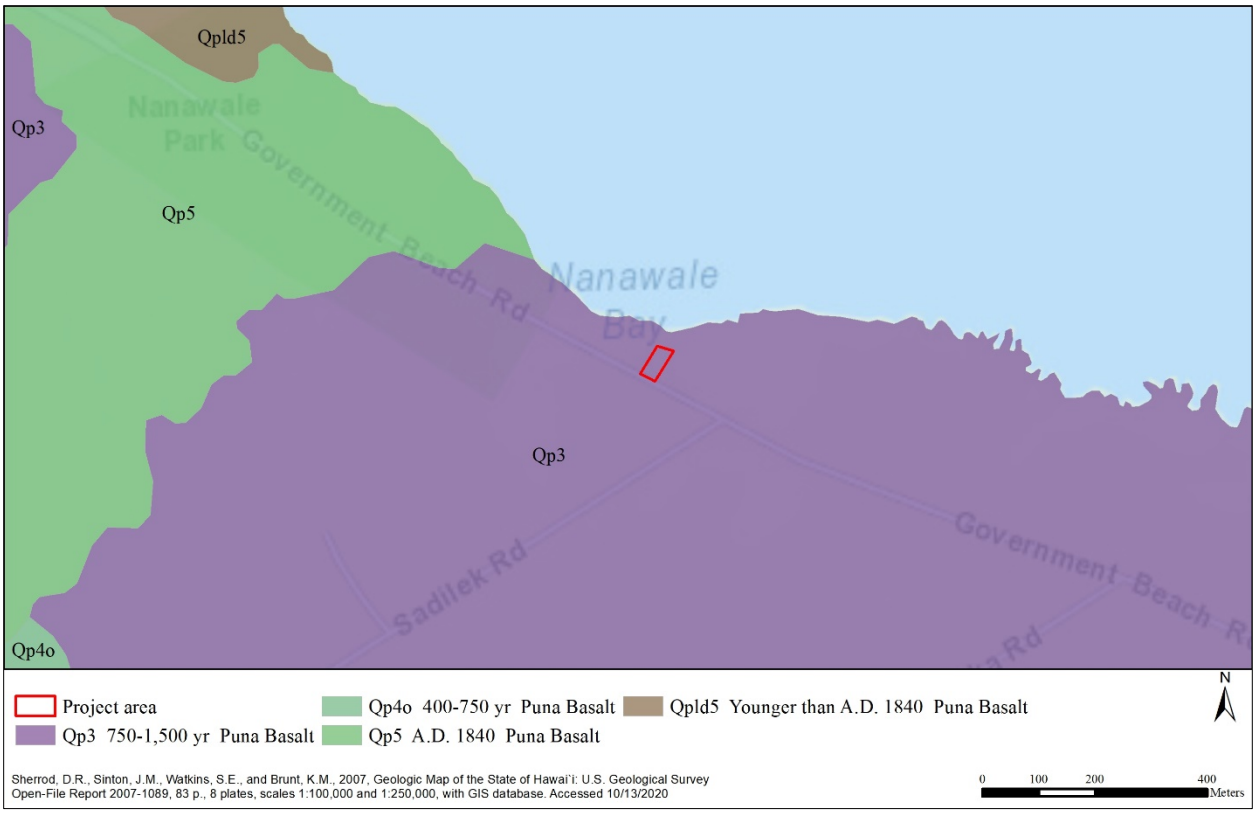


Figure 5. Geological units in the current project area (Sherrod et al. 2007).

Figure 6. Soils within the project area (Soil Survey Staff 2019).

Figure 7. Northwestern, coastal portion of project area, view to the northwest.

Figure 8. Typical vegetation pattern in *makai* portion of the project area, view to the southwest.

Figure 9. Typical vegetation in *mauka* portion of project area, view to the northwest.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the current project area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the Puna region that includes specific information regarding the known history of Waʻawaʻa Ahupuaʻa and the project area is presented. This is followed by a discussion of relevant prior archaeological studies conducted in the vicinity of the project area.

CULTURE-HISTORICAL CONTEXT

The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes a presentation of a generalized model of Hawaiian Prehistory containing legendary references to and a discussion of the general settlement patterns for Puna. The discussion of prehistory is followed by a summary of historical events in the district that begins with the arrival of foreigners in the islands and then continues with the history of land use in Puna in the vicinity of Waʻawaʻa after contact. The summary includes a discussion of the changing lifeways and population decline during the early Historic Period, a review of land tenure in the study *ahupuaʻa* during the *Māhele ʻĀina* of 1848, and the subsequent transition into a residential subdivision in the last half of the twentieth century.

A Generalized Model of Hawaiian Prehistory

While the question of the timing of the first settlement of Hawaiʻi by Polynesians remains unanswered, the current archaeological consensus derives from various sources of information (i.e., archaeological, genealogical, mythological, oral-historical, radiometric). With data from advances in palynology and radiocarbon dating techniques, Kirch (2011) and others (Athens et al. 2014; Wilmshurst et al. 2011) have argued that Polynesians arrived in the Hawaiian Islands, sometime between A.D. 1000 and A.D. 1200 and expanded rapidly thereafter. Other versions of the peopling of the islands, including various native Hawaiian traditions, place the event earlier in time—and as early as the creation of the world (e.g., Beckwith 1951; Liliuokalani 1978; Malo 1951). What is more widely accepted is the answer to the question of where Hawaiian populations came from and the transformations they went through on their way to establishing a uniquely Hawaiian culture. The initial migration to Hawaiʻi is believed to have occurred from Kahiki (the ancestral homelands of Hawaiian gods and people) with long-distance voyages occurring fairly regularly through at least the thirteenth century. It has been generally reported that the sources of the early Hawaiian populations

originated from the southern Marquesas Islands (Emory in Tatar 1982). In these early times, Hawai‘i’s inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). This was a period of widespread 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). According to Fornander (1969), the Hawaiians brought from their homeland certain Polynesian customs and belief: the major gods Kāne, Kū, Lono, and Kanaloa; the *kapu* system of law and order; and the concepts of *pu‘uhonua* (places of refuge), *‘aumakua* (ancestral deity), and *mana* (divine power).

As currently understood, the settlement of the islands involved a gradual shift in residential patterns from seasonal, temporary habitation, to the permanent dispersed habitation of both coastal and upland areas. Following the initial settlement period, areas with the richest natural resources became populated and perhaps crowded, and the population began expanding to the Kona (leeward side) and more remote areas of the island (Cordy 2000). As the population grew, so did social stratification, which was accompanied by major socioeconomic changes and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were eventually settled, and the more marginal leeward areas were being developed. During this expansion period, additional migrations to Hawai‘i occurred from Tahiti in the Society Islands. Rosendahl (1972) has proposed that settlement at this time was related to the seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites focused on agriculture were occupied during the winter months. An increasing reliance on agricultural products may have caused a shift in social networks as well, which increasingly supported the exchange of upland agricultural products for marine resources. Hommon (1976) argues that kinship links among coastal settlements became less important than those with the *mauka-makai* (upland-coastal) settlements. This shift is believed to have resulted in the establishment of the *ahupua‘a* system sometime during the A.D. 1400s (Kirch 1985), which added another component to an already well-stratified society.

WA‘AWA‘A AHUPUA‘A AND THE GREATER PUNA DISTRICT

The current project area is situated in Wa‘awa‘a Ahupua‘a on the windward slopes of Kīlauea Volcano within the traditional *moku* of Puna, one of six *moku* of Hawai‘i Island (Figure 10). Wa‘awa‘a is one of roughly 50 *ahupua‘a* in Puna and extends inland from the coast where it terminates at Kahuwai and Nānāwale *ahupua‘a*, two *ahupua‘a* that also flank Wa‘awa‘a to the east and west, respectively. In one *‘ōlelo no‘eau* (Hawaiian proverbs and sayings) recorded by Mary Kawena Pūku‘i (1983:301), the *moku* is described as “*Puna, mai ‘Oki‘okiaho to Mawae*,” which she translates as “Puna, from ‘Oki‘okiaho to Mawae.” Handy et al. (1991:539-542) further describe the *moku* of Puna:

> The land division named Puna—one of the six chiefdoms of the island of Hawaii said to have been cut (*‘oki*) by the son and successor of the island’s first unifier, Umi-a-Liloa—lies between Hilo to the north and Ka‘u to the south, and it projects sharply to the east as a great promontory into the Pacific. Kapoho is its 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. . .

The *ahupua‘a* was traditionally the principal land division that functioned for both taxation purposes and furnished its residents with nearly all of the fundamental necessities. *Ahupua‘a* are land divisions that typically incorporated all of the ecozones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). Although the *ahupua‘a* land division typically incorporated all of the ecozones, their size and shape varied greatly (Cannelora 1974). Hawaiian scholar and historian Samuel Kamakau (1976:8-9) summarizes the types of ecozones that could be found in a given *ahupua‘a*:

> Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*‘ano*). The part directly in back and in front of the summit

> proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and makai of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. Makai of this region the trees are tall, and this is the *wao lipo*. Makai of the *wao lipo* is the *wao ʻeiwa*, and makai of that the *wao maʻukele*. Makai of the *wao maʻukele* is the *wao akua*, and makai of there is the *wao kanaka*, the area that people cultivate. Makai of the *wao kanaka* is the *ʻamaʻu*, fern belt, and makai of the *ʻamaʻu* the *ʻapaʻa*, grasslands.
>
> A solitary group of trees is a *moku laʻau* (a "stand" of trees) or an *ulu laʻau*, grove. Thickets that extend to the *kuahiwi* are *ulunahele*, wild growth. An area where *koa* trees suitable for canoes (*koa waʻa*) grow is a *wao koa* and *mauka* of there is a *wao laʻau*, timber land. These are dry forest growths from the *ʻapaʻa* up to the *kuahiwi*. The places that are "spongy" (*naele*) are found in the *wao maʻukele*, the wet forest.
>
> Makai of the *ʻapaʻa* are the *paheʻe* [*pili* grass] and *ʻilima* growths and makai of them the *kula*, open country, and the *ʻapoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *ʻae kai*, the water's edge.
>
> That is the way *ka poʻe kahiko* [the ancient people] named the land from mountain peak to sea.

Although the *mauka* boundary of Waʻawaʻa Ahupuaʻa extends to only roughly 230 feet in elevation, the upper reaches of the *ahupuaʻa* were formerly covered by a dense overgrowth of *ʻōhiʻa lehua* (*Metrosideros polymorpha*) trees, indicating its likely extent into the lower limits of the *wao akua* as it exists within this portion of Puna. The transition from the *wao akua* towards the *makai* extent of Waʻawaʻa is abrupt, and aside from the cultivatable lands termed by Kamakau (1976) as the *wao kanaka*, appear to swiftly transition to *kahakai* lands encompassing the current project area. Within Waʻawaʻa, and all other *ahupuaʻa*, the *makaʻāinana* (commoners; *Lit*. people that attend the land) who lived on the land had rights to gather resources for subsistence and tribute (Jokiel et al. 2011). As part of these rights, the *ahupuaʻa* residents were also required to supply resources and labor that supported the royal communities of regional and/or island kingdoms. The *ahupuaʻa* became the equivalent of a local community, with its own social, economic, and political significance, and served as the taxable land division during the annual *Makahiki* procession (Kelly 1956). During this annual procession, the highest chief of the land sent select members of his retinue to collect *hoʻokupu* (tribute and offerings) in the form of goods from each *ahupuaʻa*. The *makaʻāinana* who resided in the *ahupuaʻa* brought their share of *hoʻokupu* to an *ahu* (altar) that was symbolically marked with the image of a *puaʻa* (pig). *Ahupuaʻa* boundaries, in most instances, were established along rational lines, following mountain ridges, hill, rivers or ravines, however, Chinen (1958:1) reports that "oftentimes only a line of growth of a certain type of tree or grass marked a boundary; and sometimes only a stone determined the corner of a division." *Ahupuaʻa* were ruled by *aliʻi ʻai ahupuaʻa* or chiefs who controlled the *ahupuaʻa* resources; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land (Malo 1951). *Ahupuaʻa* residents were not bound to the land nor were they considered the property of the *aliʻi*. If the living conditions under a particular *ahupuaʻa* chief were deemed unsuitable, the residents could move freely in pursuit of more favorable conditions (Lam 1985). This structure safeguarded the well-being of the people and the overall productivity of the land, lest the chief loses the principal support and loyalty of his or her supporters. *Ahupuaʻa* lands were in turn, managed by an appointed *konohiki* or lesser chief-landlord, who oversaw and coordinated stewardship of an area's natural resources (Lam 1985). In some places, the *poʻo lawaiʻa* (head fisherman) held the same responsibilities as the *konohiki* (Jokiel et al. 2011). When necessary, the *konohiki* took the liberty of implementing *kapu* (restrictions and prohibitions) to protect the *mana* of the area's resources from physical and spiritual depletion.

Many *ahupuaʻa* were further divided into smaller land units termed *ʻili* and *ʻili kūpono* (often shortened to *ʻili kū*). *ʻIli* were created for the convenience of the *ahupuaʻa* chief and served as the basic land unit, which *hoaʻāina* (native tenants) often retained for multiple generations (Jokiel et al. 2011; MacKenzie 2015). As the *ʻili* themselves were typically passed down in families, so too were the *kuleana* (responsibilities, privileges) that were associated with it. The right to use and cultivate *ʻili* was maintained within the *ʻohana*, regardless of any change in title of the *ahupuaʻa* chief (Handy et al. 1991). Malo (1951) recorded several types of *ʻili*: the *ʻili paʻa*, a single intact parcel and the *ʻili lele*, a discontinuous parcel dispersed across an area. Whether dispersed or wholly intact, the *ʻili* land division required a cross-section of available resources, and for the *hoaʻāina*, this generally included access to agriculturally fertile lands and coastal fisheries. While much of the same resource principles applied to the *ʻili kūpono*, these land units were politically independent of the *ahupuaʻa* chief. This designation was applied to specific areas containing resources that were highly valued by the ruling chiefs, such as fishponds (Handy et al. 1991).

The *ali‘i* who presided over the *ahupua‘a* (*ali‘i-‘ai-ahupua‘a*), in turn, answered to an *ali‘i ‘ai moku*, or chief who claimed the abundance of the entire *moku or* district (Malo 1951). On Hawai‘i Island, there are six traditional *moku*: Kona, Ka‘ū, Puna, Hilo, Hāmākua, and Kohala. Although *moku* contained multiple *ahupua‘a*, they were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). Other land units were also used. In what is now South Kohala, for example, the *kalana* was a division of land that was smaller than a *moku* but composed of several *ahupua‘a* and *‘ili ‘āina*. The term *‘okana* was also sometimes used interchangeably with *kalana* (Lucas 1995; Pukui and Elbert 1986), but Kamakau (1976), equates a *kalana* to a *moku* and states that *‘okana* is merely a subdistrict.

This form of district subdividing was integral to Hawaiian life and structurally supported the resource management planning by *ali‘i* and *konohiki*. As knowledge of place developed over the centuries and was passed down intergenerationally by direct teaching and experience, detailed information of an area’s natural cycles and resources were retained and well-understood. Decisions were based on generations worth of highly informed knowledge and sustainably adapted to meet the needs of a growing population. This highly complex land management system mirrors the unique Hawaiian culture that coevolved with these islands.

As Wa‘awa‘a encompasses both *mauka* agricultural and forest resources and *makai* fisheries, residents 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 while also supporting the ruling *ali‘i* of the *moku*. In Puna, a few small communities were initially established along sheltered bays with access to fresh water and rich marine resources. The communities shared extended familial relations, and there was an occupational focus on the collection of marine resources, and the Precontact population of the *moku* resided in small settlements clustered around sheltered bays along the coastline where they subsisted on marine resources supplemented by agricultural products. According to McEldowney (1979), there were six villages present along the coast between Hilo and Cape Kumukahi (Kea‘au or Hā‘ena, Maku‘u, Waiakahiula, Honolulu, Kahuwai, and Kula or Koa‘e. The current project area is located between the villages of Honolulu and Kahuwai. Each in Puna 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)

Located along the coast, the project area falls within the Coastal Settlement Zone (Zone I) 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 (1994) elaborate on McEldowney’s (1979) 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 *‘a‘ā* 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. (Burtchard and Moblo 1994:26)

In addition to *mauka-makai* trails, one of the primary trail networks utilized during the Precontact to early Historic Period was the *alaloa* (literally meaning the long road or trail), which served as an idealized route of travel that theoretically circled the entire island. The *alaloa* provided access to all of the island’s districts and their respective *ahupua‘a*, facilitating commodity exchange between otherwise isolated adjacent coastal communities such as those in the vicinity of the current project area, as well as more upland regions (Mills 2002). The concept of the *alaloa* as a

trail that circled the entire island likely developed over time as local trails in different areas connected to each other to form a cohesive trajectory of travel. Kirch (1985) notes that while heavy loads could be carried by canoe between coastal areas, the 175-mile long *alaloa* and the expansive terrestrial trail network that it accessed, allowed people, information, and material goods to travel overland to virtually any location on the island, providing an important network of Precontact/early Historic Period communication. As related by Cordy, long-distance travel between *ahupuaʻa* was rare until post-1800, as communities relied almost entirely on resources procured from their own land unit. Cordy elaborates:

> The common use of the ala loa was for interaction between people of adjacent communities. The residents of the ahupuaʻa prior to the 1800s rarely travelled far from their ahupuaʻa. Farming, fishing, and gathering of forest resources were usually done within the bounds of their own ahupuaʻa. Most marriage partners came from the same ahupuaʻa or from nearby lands. Many small sets of ahupuaʻa commonly interacted in the past. The main means of travelling between these communities was on the ala loa.
>
> Longer distance travel by commoners, although less frequent, would also have been along the ala loa, its upland branches, across the mountain trails, or by canoe. Some of this traffic may have been for the overlord chiefs and the rulers, such as the bringing in of daily food supplies and water.
>
> Travel along the ala loa also was done for chiefly affairs. Messengers were sent along trails or by canoe to call in other chiefs for meetings, to call for tribute, to summon warriors in for battle, to gather in laborers to build public works projects such as temples, and so on. (Cordy in Mills 2002:151)

The *alaloa* extends from ʻŪpolu Point in North Kohala, through Kaʻū, and into the Puna District and served as the principal interaction route between people of adjacent coastal communities, and as previously mentioned, was also used (albeit less frequently) for long distance travel, for chiefly affairs, and for tax collection during the annual *Makahiki* season (Cordy 1994; Mills 2002; Mills and Irani 2000; National Park Service 2009). As related by the National Park Service's *Ala Kahakai* National Trail program:

> Travel along the ala loa was often done for chiefly affairs. Messengers (kukini, or swift runners) were sent along the trails or by canoe to call in other chiefs for meetings, to call for tribute, to summon warriors in for battle, to gather in laborers to build public works projects such as temples, and to spy on rival chiefs. Occasionally, the ruler and the court circled the island to check on the state of affairs of production, population, or potential rivals, or to rededicate temples. This circuit might be at a brisk pace, or leisurely movement from one of the favored royal centers to another over the period of several months. The highest chiefs (Aliʻi nui) traveled the ala loa to reach their own residences and smaller courts in their own ahupuaʻa, which they occasionally used when not at the royal court. (National Park Service 2009:15)

The significance of the *alaloa*, that served as the primary route of travel across the lands across the Puna District (and thus Waʻawaʻa Ahupuaʻa) prior to the subsequent construction and widespread use of the *Alanui Aupuni*, or Government Road system; see below), is imbued in its association with significant, traditional events in Hawaiʻi's history, in particular the *Makahiki* procession. The *Makahiki* involved a series of rituals, prayers, offering, and processions asking Lono to bestow plenty in the coming year Hommon (2013). Ritual activities were centered on the *hale o Lono* temples, but also occurred throughout each island's districts:

> Other religious ceremonies and special sporting events were held honoring Lono, the god of Agriculture. For tax collection, a procession of priests, attendants, and athletes carried a wooden image of Lono clockwise around the island on the ala loa in a circuit of 23 days. In theory, the procession halted at the ahu or altar of each ahupuaʻa, collected tribute, and traveled on. In practice, several of the 600 ahupuaʻa most likely gathered their tribute in one place to expedite the collection. (National Park Service 2009:15)

Over time, as the populations of desirable coastal locations increased, early Hawaiians expanded their settlements into upland regions and more marginal areas of Puna. As competition for resources intensified, so too did political competition that resulted in conflict and further expansion into upland areas as political exiles sought asylum in remote places and hidden lava tubes (Burtchard and Moblo 1994). Although the boundaries of the Puna District are strictly political, the lands encompassed by it possess a unique environment that played a large role in determining the boundaries and shaping its history from the time of Polynesian settlement to the modern day. Barrère (1959:15) summarizes the Precontact geopolitics of the Puna District as follows:

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.

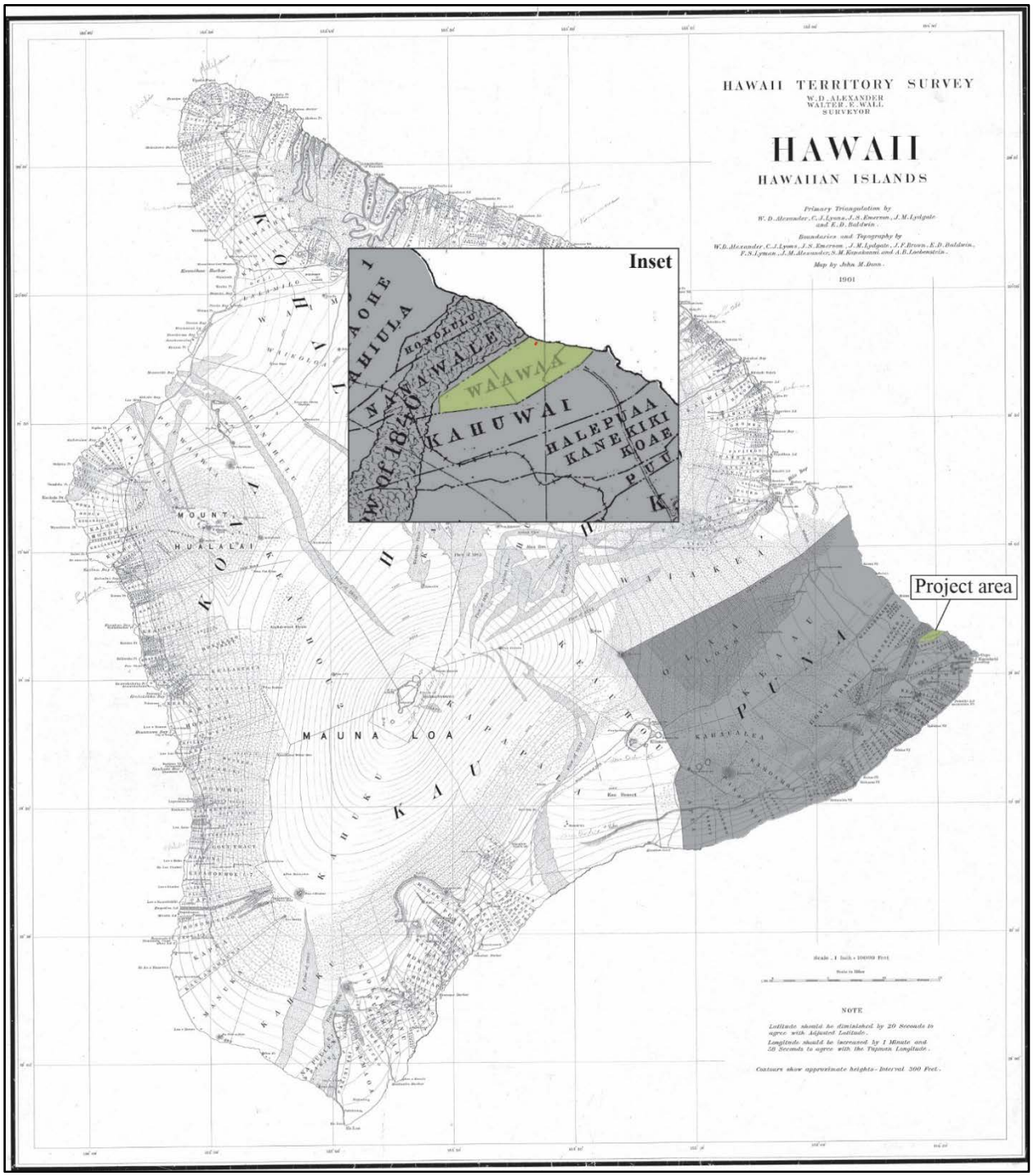


Figure 10. Hawai‘i Registered Map No. 2060 (Donn 1901)showing location of the project area (shaded red) within Wa‘awa‘a Ahupua‘a (shaded yellow) and the Puna District (shaded gray).

Select *Moʻolelo* of Waʻawaʻa and the Greater Puna District

Prior to first contact with Europeans in the late eighteenth century and the development of a written Hawaiian language, the history of ancient Hawaiʻi was transmitted orally from generation to generation. After the arrival of the first missionaries in 1820, Hawaiian culture underwent major transformations, one of which included the adoption of the written language. Although oral traditions were still maintained, many natives and foreigners began writing down versions of these oral traditions, which provide invaluable insight into Hawaiʻi's past by recording elements of Hawaiian culture such as historical figures, beliefs, traditions, *wahi pana* (legendary places), *inoa ʻāina* (place names), and *moʻolelo* (legendary accounts, stories, and myths), *mele* and *oli* (songs and chants), and *ʻōlelo noʻeau*; all of which contribute to an in-depth understanding of the people, their culture and place. Traditional *moʻolelo* specifically associated with Waʻawaʻa are limited, but the *moku* of Puna features prominently in numerous stories. The examples presented below illustrate the legacy of Puna and its intimate relationship with exalted deities such as the goddess Pele, her sister Hiʻiaka, and the god Kāne, enumerate the legends of Puna *aliʻi*, famed *Moaniʻala* and *Uahipele* winds, and discuss the names of traditional *ʻaumakua manō* (family/personal shark ancestral gods).

Pelehonuamea in Puna

Most closely associated with the powerful and temperamental volcanoes of Hawaiʻi, Pele was perhaps both feared and respected equally by the people of the islands. Nimmo (1990:44) related that, "although the actual worship of Pele was most important in the districts of Hawaiʻi 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 Hawaiʻi, although her mythology was apparently widespread throughout the Hawaiian Islands and members of her family were important in ritual throughout the archipelago" (ibid.). 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. It is said that before Pele migrated to Hawaiʻi from Kahiki, there was "no place in the islands. . . more beautiful than Puna" (Pukui 1983:11).

King David Kalākaua (1972) indicated that active worship of Pele was ongoing between the 12th and 19th centuries, and that the abolition of the *kapu* system in the late 19th century had little to no effect on this practice, which remains ongoing. In addition to being revered as a goddess, Pele was also worshipped as an *ʻaumakua* (ancestor god/guardian spirit) by her descendants. According to Nimmo, "most Hawaiians living in the volcano areas of Hawaiʻi, the districts of Kaʻū, Puna, and Kona, at the time of European contact traced their ancestry to Pele" (1990:43). Pele appears throughout Hawaiian mythology and history; tales of Pele's migration from Kahiki to Hawaiʻi abound. According to Beckwith:

> The Pele myth is believed to have developed in Hawaiʻi, where it is closely associated with aumakua worship of the deities of the volcano, with the development of the hula dance, and with innumerable stories in which odd rock or cone formations are ascribed to contests between Pele and her rivals, human or divine. The myth narrates the migration or expulsion of Pele from her distant homeland and her effort to dig for herself a pit deep enough to house her whole family in cool comfort or to exhibit them in their spirit forms of flame and cloud and other volcanic phenomena. (1970:168)

According to one version of the migration legend, Pele, daughter of Haumea and Moemoe-a-aulii, was tempted with the urge to travel. Nestling her favorite sister (who was born in the shape of an egg), Hiʻiaka-i-ka-poli-o-Pele, safely under her armpit, Pele traveled to the Hawaiian islands with aid from her brothers Pu-ahiuhiu (whirlwind), Ke-au-lawe/Ke-au-miki (tide), and Ke-au-ka (current). She landed on the island of Kauaʻi, and became enamored with a young chief named Lohiʻau. She then continued her journey through the islands in an attempt to secure a location where she could dig a home for her and her new lover (Beckwith 1970). Beckwith (ibid.:172) presents a *moʻolelo* that recounts the migration of Pele and company from Kahiki to Hawaiʻi:

No Kahiki mai ka wahine o Pele	"The woman Pele comes from Kahiki,
Mai ka aina mai o Polapola	From the land of Polapola,
Mai ka punohu a Kane mai ke ao lapa i ka lani	From the ascending mist of Kane, from the clouds that move in the sky
Mai ka opua lapa i Kahiki	From the pointed clouds born at Kahiki.
Lap aku i Hawaiʻi ka wahine o Pele	The woman Pele was restless for Hawaiʻi.
Kalai i ka waʻa o Honua-ia-kea	'Fashion the canoe Honua-ia-kea,
Ko waʻa, o kalai Honoua-mea o holo	As a canoe, O Kamohoaliʻi, for venturing to the island.
Mai ke au hele aʻe, ue aʻe ka lani	Completed, equipped, is the canoe of the gods,

A i puni mai ka moku, a e aʻe kini o ke ʻkua	The canoe for (Pele)-of-the-sacred-earth to sail in.
Iawai ka hope, ka uli o ka waʻa?	From the straight course the heavenly one turned
I na hoaliʻi a Pele a e hue, e	And went around the island, and the multitude of the gods stepped ashore.
Me la hune ka la, kela hoʻonoho kau hoe	ʻWho were behind at the stern of the canoe?ʼ
O luna o ka waʻa, o Ku ma laua o Lono	ʻThe household of Pele and her company,
Holo i honua aina, kau aku	Those who bail, those who work the paddles,
I hoʻolewa ka moku, aʻe aʻe Hiʻiaka naʻi au ke ʻkua	On the canoe were Ku and Lono.ʼ It came to land, rested there,
Hele aʻe a komo I ka hale o Pele	The island rose before them, Hiʻiaka stepped ashore
Huahuaʻi Kahiki lapa uila	seeking for increase of divinity,
Uila Pele e huaʻi e	Went and came to the house of Pele.
Huaʻina hoi e	The gods of Kahiki burst into lightening flame with roar and tumult, Lightning flames gushed forth, Burst forth with a roar.”

Kalākaua (1972:140) estimated the arrival of Pele and Hiʻiaka to have occurred during the reign of Kamiole, or more specifically, in approximately A.D. 1175, and noted that “every tradition refers to them as deities at the time of their arrival at Hawaiʻi.” When Pele arrived on the shores of Puna, she discovered that a fire god by the name of ʻAi Lāʻau already had jurisdiction of Hawaiʻi Island:

> When Pele came to the island Hawaiʻi, she first stopped at a place called Ke-ahi-a-laka in the district of Puna. From this place she began her inland journey towards the mountains. As she passed on her way there grew within her an intense desire to go at once and see Ai-laau, the god to whom Kilauea belonged, and find a resting-place with him as the end of her journey. She came up, but Ai-laau was not in his house. Of a truth he had made himself thoroughly lost. He had vanished because he knew that this one coming toward him was Pele. He had seen her toiling down by the sea at Ke-ahi-a-laka. Trembling dread and heavy fear overpowered him. He ran away and was entirely lost. When Pele came to that pit she laid out the plan for her abiding home, beginning at once to dig up the foundations. She dug day and night and found that this place fulfilled all her desires. Therefore, she fastened herself tight to Hawaiʻi for all time. (Westervelt 1916:3)

Kalākaua related that Pele’s “favorite residence was the vast and ever-seething crater of Kīlauea, beneath whose molten flood, in halls of burning adamant and grottoes of fire, she consumed the offerings of her worshippers and devised destruction to those who long neglected her or failed to respect her prerogatives” (1972:139). Hoʻoulumāhiehie (2006) indicated that on her way to Kīlauea, Pele initially carved out a crater called Malama just inland of her landing place at Keahialaka. However, Pele was dissatisfied with this crater, and proceeded to feverishly excavate two more craters called Puʻulena and Pohoiki, both of which she was also displeased with and abandoned as she continued her pursuit for a suitable home.

Hōpoe the Dancing Stone

A tale of jealousy and spite is recounted in the legend *Hōpoe the Dancing Stone*, published by Westervelt (1916). Pele called upon each of her sisters to fetch her dream lover Lohiʻau from Kauaʻi. Knowing Pele’s tempestuous temper, each feared possible repercussions and refused to go. After being denied by all but one sister, Pele rumbled her home, the volcano, sending out burning smoke and vapors, impatiently beckoning her very last option. At long last, her youngest sister, Hiʻiaka appeared to her, adorned in beautiful lei made by her dearest friend Hōpoe who she had abandoned at the seashore upon hearing her sister’s call. Hōpoe was a skilled and graceful *hula* dancer, and had spent much time teaching Hiʻiaka old Hawaiian *hula* until she became exceptional herself. She also taught her how to make beautiful flower *lei*, and the pair very much enjoyed their time together.

The irascible Pele demanded that Hiʻiaka travel to Kauaʻi to fetch Lohiʻau and sent her on her way with stern instructions. Hiʻiaka was not to take him as her own husband, she was not to touch him, and she was to take no longer than 40 days on her journey. While Hiʻiaka agreed to her sister’s demands, she realized that in her absence, Pele would become incensed with a burning and vehement fury and destroy whatever she desired. So Hiʻiaka set forth two stipulations; her beloved *ʻōhiʻa* and *lehua* groves were to be spared from destruction, and Pele was to protect Hōpoe in her absence. Pele agreed to Hiʻiaka’s requests, and Hiʻiaka departed on her journey to retrieve Pele’s lover. In a

sympathetic act, Pele bestowed a share of her power upon Hiʻiaka so that she would be protected against the supernatural dangers she would undoubtedly meet along the way.

Hiʻiaka hadn't ventured very far when she realized that the volcano had begun to smoke thickly, trailing towards Hōpoe's home of Keaʻau. It was long before the smolder of smoke burst into a scorching fire. Filled with a sense of dread and sensing that her sister had betrayed her promise, Hiʻiaka continued her journey. Days passed slowly, utterly too slowly for Pele, but Hiʻiaka finally found Lohiʻau. By this time, Pele was furious. She shook the earth with great ferocity and heaved her lava in a torrent of devastation, annihilating Hiʻiaka's *ʻōhiʻa lehua* forest, obliterating all of Puna, and finally cornering Hōpoe as she lingered by the sea:

> Hopoe was the last object of Pele's anger at her younger sister, but there was no escape. The slow torrent of lava surrounded the beach where Hopoe waited death. She placed the garlands Hiiaka had loved over her head and shoulders. She wore the finest skirt she had woven from lauhala leaves. She looked out over the death-dealing seas into which she could not flee, and then began the dance of death. (Westervelt 1916:94)

In her death, Hōpoe was transformed. She was rebirthed as a stone, carefully balanced alongside the sea where she could continue her graceful dance throughout the centuries when touched by the soft breeze or the rumbling of the earth. And Hiʻiaka, her heart bitter with her sister's betrayal, brought Lohiʻau back to Pele, faithfully as she swore she would.

The Legend of Kuapākaʻa and the Wind-Gourd of Laʻamaomao

Two famed winds of Puna, the *Moaniʻala* and *Uahipele*, are enumerated in a traditional *moʻolelo* featuring the famous wind-gourd Laʻamaomao, which was said to contain all the winds of Hawaiʻi. Originally published by Moses Kuaea Nakuina (2005), the legend relates the story of Pākaʻa, son of Laʻamaomao and Kūanuʻuanu and the highly trusted, personal attendant and favorite of the *aliʻi ʻai moku* Keawenui a ʻUmi, grandson of celebrated *aliʻi nui* ʻUmi a Līloa. Pākaʻa succeeded his father as *kahu* (personal attendant) of Keawenui a ʻUmi, and had charge over many belongings, and he dutifully served the the *aliʻi* by keeping a close and careful watch over his material possessions. But Pākaʻa's greatest and most cherished responsibility was the keeping of a highly treasured personal possession: a very special and sacred *ipu* (gourd) passed down to him from his mother. Originally, the *ipu*, known as the wind-gourd of Laʻamaomao, belonged to Pākaʻa's grandmother. Nakuina (ibid.: 14-15) explained the gifting of the *ipu* to Pākaʻa and the instructions from his mother:

> Then Laʻamaomao lifted the lid of a large calabash and took out a small, long, highly polished gourd in a woven bag. The gourd was covered securely. She [Laʻamaomao] turned to her keiki and said, "I'm giving you this gourd which belonged to your extraordinary kupunawahine for whom I was named. Her bones are inside the gourd. While she was alive, she controlled all the winds of the islands—she had them under a supernatural power. She gathered all the winds and put them into this gourd, where they're still kept. She memorized one by one the names of all the winds of Hawaiʻi to Kaʻula. On windless days, she could remove the cover and call out the name of a wind, and the wind in this gourd would blow. This gourd, called 'the wind gourd of Laʻamaomao,' was famous.
>
> Before she died, she entrusted me to put her bones inside this gourd and care for them until I had a child. Then I was to give the gourd to the child to watch over. You're my only child, so now I'm giving the gourd to you. You must look after it according to the wishes of your extraordinary kupunawahine.
>
> You must care for this gourd because it had been handed down from the kupuna. This gourd has great value—you may not think so now, but when you sail with the aliʻi and arrive at an area where no wind blows and the canoes are becalmed, say that the winds are at your command; all you have to do is call, and the winds will blow.
>
> "When you're laughed at, remove the lid of the gourd and call for a wind. The wind will blow and bring the canoes to shore. The aliʻi will be grateful to you, and you'll be loved and valued by him."
>
> Before Pākaʻa sailed off, Laʻamaomao taught him the names of all the winds, along with the prayers, songs and chants concerning them, and when she was done, Pākaʻa had memorized everything. Then he took the wind gourd and tied it with a cord he had made, prepared his other things for the voyage, and left home.

Pākaʻa settled into his role as *kahu*, and he became the utmost favorite of Keawenui a ʻUmi. However, the favoritism of Pākaʻa inspired considerable virulence and collusion against him by two men, Ho-okele-i-Hilo and

Hoʻokele-i-Puna. The pair conspired to entrap Pākaʻa in scandal by spreading untruths about him to Keawenui a ʻUmi and slandered his name in an effort to undermine Pākaʻa's prestige in the eyes of his *haku* (master). Keawenui a ʻUmi was incensed, and relinquished all of Pākaʻa's gifted lands and authority, transferring all power to the two antagonistic men who had usurped Pākaʻa's power with their cruel deception. Utterly hurt by Keawenui a ʻUmi's naivety to the slander that had befallen his name, Pākaʻa gathered some of the belongings of his former *haku*, placed them inside his special family heirloom, departed from Waipiʻo, and eventually made a life for himself on Molokaʻi. While on Molokaʻi, Pākaʻa fathered a son, Kūapākaʻa whom he groomed the way his own father had groomed him, to one day serve the man who would one day become his *haku* and avenge Pākaʻa's enemies.

Meanwhile, the true character of the two schemers who deposed Pākaʻa of his esteemed position began to surface, and Keawenui a ʻUmi grew regretful of his decision to scorn his former *kahu* in their favor. The tale continues with Keawenui a ʻUmi's frantic and persistent search for Pākaʻa, with whom he had been communicating with in dreams. Pākaʻa and Kūapākaʻa knew that the *aliʻi* would come searching for them, and strategically positioned themselves in their canoe where they fished for *uhu* (parrot fish) in the dark of morning off the shore of Molokaʻi. Keawenui a ʻUmi's party approached the pair, but unsuspected their true identity, especially because Pākaʻa had assumed the guise of a hunched-over deaf fishermen. The six fleets of men and chiefs from each district on Hawaiʻi Island approached Pākaʻa and Kūapākaʻa, led by the *aliʻi* of Puna, Huaʻā:

> Then the canoe of Huaʻā passed by, and Kūapākaʻa called out loudly: "Huaʻā goes by, our aliʻi of Puna. He's not an aliʻi, but a kaukaualiʻi, the thorny eyes of the lau hala of Puna. Since he enjoys the bounty of Puna, he's called an aliʻi." (Nakuina 2005:32)

With each passing fleet, Kūapākaʻa continued to hurl insults, incensing each district *aliʻi*, who continued past the father and son allowing Keawenui a ʻUmi's bevy closer and closer to them. Just before dawn, as Keawenui a ʻUmi's party approached, Kūapākaʻa chanted to his *haku* at the request of his father. His chant was rivaled by a chant from the Kuhina Nui, Kahikuokamoku, who was part of Keawenui a ʻUmi's party and unaware of the youth's true identity. Kūapākaʻa, in an effort to lure Keawenui a ʻUmi's party onshore so he could isolate Ho-okele-i-Hilo and Hoʻokele-i-Puna, continued his chants implicating impending stormy weather. However, Kahikuokamoku challenged his prophecy, arguing the impossibility of poor weather, and refused to come ashore. Furthermore, Kahikuokamoku challenged Kūapākaʻa's knowledge of Hawaiʻi Island's winds, for how could a young native boy from Molokaʻi possibly understand and foretell that strong winds would be heading towards them from Hawaiʻi Island and cause havoc enough that they would be forced upon the shore. In response, Kūapākaʻa drew upon his heirloom gourd and his ancestral knowledge, and began chanting his warning of destruction (bolded and italicized emphasis added):

> Hurry, hurry,
> The source of the storms of Hilo,
> Is the wind called ua kea,
> Shearing off the edges of a hale and breaking it up,
> Kēpia is of Hilo of the upright cliffs,
> Uluau is of Waiākea,
> Ulumano, ʻAwa, Puʻulena,
> **Moaniʻala are of Puna,**
> The winds of Kuamoaʻe have gathered,
> My Moaʻe, the wind that is swelling,
> Apaiahaa is at Kanakaloloa,
> Hau is of Kapalilua,
> ʻEka is of Kona,
> Kipu is of Kahuā,
> ʻEʻelekoa is of Uli,
> Kīpuʻupuʻu is of Waimea,
> ʻŌlauniu is of Kekaha,
> Paʻalaʻa is in the ocean,
> Nāulu is of Kawaihae,
> A wind that comes
> And dashes the milo leaves of Makaopau,
> Kalāhuipuaʻa, ʻĀpaʻapaʻa is of Kohala's upland cliffs,
> The wind that flies about like vapor,
> Puʻukolea is of Kapaʻau,
> Holopoʻopoʻo is of Waipiʻo,

‘Aeloa is of Hāmākua,
Kona is the wind of the sky
Above the ‘Alenuihāhā sea,
You should come ashore,
The spray of the sea flies up,
The spray of the wind, a storm is coming (Nakuina 2005:39–40)

Keawenui a ‘Umi was rapt with attention at the youth’s enumeration, so Kūapāka‘a continued chanting the winds of Hawai‘i:

At Ka‘ū’s windy cape is Ka ‘Īlio a Lono,
The paddle is dipped into the sea of Kāiliki‘i,
At Puna’s foundation turns the sun, the light,
Go and feel the wind of Kumukahi,
Hilo’s wind-blown rain at sea,
The rain is seaward, over the hala of Leleiwi,
The spray of rain is at Hāmākua,
Hāmākua is the bridge to the cliffs,
At Kohala-iki is the Moa‘e wind, the Moa‘e blows,
Kona awakens with the Kēhau breeze,
Kona’s burden diminishing with the Kēhau breeze,
Keawenuia‘umi, come ashore, a storm is coming. (ibid.:40)

He continued:

There, there are the winds rising from the earth,
The ‘Āpa‘apa‘a is of *Kohala*,
The rainy wind called Nāulu is of *Kawaihae*,
The Kīpu‘upu‘u is of *Waimea*,
A cold wind that hurts the skin,
A wind that whips the kapa of that land about,
Tossing up dust before it,
Frightening the procession of travelers,
‘Ōlaniu is the wind,
Pili-a is of Kanikū,
A‘e is of Kala‘au,
Pohu and ‘Eka are the winds of Kona,
Ma‘a‘akuulapu is of Kahalu‘u,
Pilihala is of Ka‘awaloa,
Kēhau is of Kapalilua,
Piuohooilo is of Ka‘ū,
Ho‘olapa is of Kamā‘oa,
Kuehulepo is of Nā‘ālehu
Uahipele is of Kīlauea,
‘Awa is of Leleiwi,
Pu‘ulena is of Waiākea,
Uluau is of Hilo-pali-kū,
Koholālele is of Hāmākua,
Holopo‘opo‘o is of Waipi‘o,
The tip of that wind,
The tip of this wind,
They will twist into a whirlwind,
The bundle of bones at the back of the canoe exhaling,
Breaking off the buoy floating at the front;
Taking the load from the swamped canoe,
The small canoe will be swamped,
Destroyed with the large canoe,
The ali‘i will die, the kahuna will die,
The weak will die, the strong will die,

The dark wisemen, the bright wisemen,
They will search out, they will confer
To locate the stars of the wave,
O Hōkūʻula, O Hōkūlei,
They will swim singly, they will swim by twos,
Yesterday was a calm day,
A crowd of fishermen was at sea,
The paddling of the good canoes,
The strength of the hoewaʻa,
The wisdom of the hoʻokele,
Don't go far out to sea, ē dear ones,
Stop here, those from Hawaiʻi,
Come here over the sea surface,
You will be possessed on Oʻahu,
There will be darkness only on calm Oʻahu,
Yesterday was calm, today will be stormy;
KeawenuiaʻUmi, come ashore, a storm is coming. (ibid.:41-42)

After Kūapākaʻa's recital of the winds of Hawaiʻi, Oʻahu, Kauaʻi, Maui, and Kaʻula, Keawenui a ʻUmi became unsettled with suspicion that the boy's forecast would be realized. Perturbed at the possibility of meeting certain death in the face of violent weather, Keawenui a ʻUmi consulted with his two advisors, and thus the ultimate targets of the trickery, who adamantly insisted that Kūapākaʻa was lying and that they should depart. Kūapākaʻa continued chanting his warning, enumerating upon the winds of Maui and Molokaʻi in an effort to beguile them onshore, but Keawenui a ʻUmi's party still retained suspicion and were not sure if they were being duped. Kahikuokamoku demanded the youth's name, but Kūapākaʻa denied him, arguing that he would reveal his name once the men landed, but they did not comply, and instead the canoes sailed off to Oʻahu.

Soon after their departure, and upon the command of his father, Kūapākaʻa chanted:

Ē winds that I've called,
Blow here, those of Kaʻula and Kauaʻi first,
Those of Oʻahu and Hawaiʻi from the sides,
Those of Maui and Molokaʻi last,
Blow true, and overtake the canoe fleet
Of Keawenuiaʻumi, the aliʻi. (ibid.:63)

And with this utterance, every wind that had escaped Kūapākaʻa's lips through chant ravaged the atmosphere, wreaking utter havoc upon Keawenui a ʻUmi's fleet. Soon, the survivors and their *aliʻi* made their way back to Molokaʻi to escape the mayhem, and were led safely to shore by Kūapākaʻa and his father, who continued to play the role of the unassuming fisherman. Keawenui a ʻUmi was cold and wet from the escapade, and Kūapākaʻa was concerned for his well-being:

By evening, all the canoes had landed, but Keawenuiaʻumi remained on the platform of his double-hulled canoe because he had no dry kapa or malo to wear since all his clothing had been lost at sea. Kūapākaʻa saw his haku shivering on the canoe, so he went to speak to his father: "I pity my haku because he's suffering from the cold. He just sits there in a wet malo on the canoe, without any kapa covering."
Pākaʻa took out one of Keawenuiaʻumi's malo which he had cared for when he was the aliʻi's kahu; he gave it to his keiki: "Here's one of your haku's malo. Take it to him. Ask him to remove the wet malo he's wearing and bring it back here. Tell him that this malo you give him is yours."
Kūapākaʻa took the dry malo and offered it to Keawenuiaʻumi saying, "Here's my insignificant malo for you. Please remove your wet one."
Keawenuiaʻumi gave his wet malo to Kūapākaʻa, and the keiki gave the aliʻi the dry one. Keawenuiaʻumi noticed the dry malo looked very much like one of his own. He said to Kūapākaʻa, "Perhaps this is one of my malo—it looks like one of mine."
The keiki said, "The malo is mine. My mother beat the kapa for it and I was saving it until I could wear it in public as an adult. But now it's yours, my haku."
After the aliʻi had taken off his wet malo and put on the dry one, he placed the wet one in the keiki's care.

> The keiki returned with it and when he reached the door of Pākaʻa's hale, his father asked him, "Where is your haku's malo?"
> "Here it is."
> "Hang it at the door of my hale, so that the ʻāʻipuʻupuʻu can no longer come in here."
> "I've hung it at the door."
> Pākaʻa said, "Now only you can enter here because you've been made sacred for your haku by the handling of his kapa. From now on, you'll distribute the food in here to the ʻāʻipuʻupuʻu who come, because they can longer enter." (ibid.:66-67)

The scenario repeated with Pākaʻa giving Kūapākaʻa a beautifully-scented *kapa* that he had cared for over the years for Keawenui a ʻUmi. Although suspicious, the *aliʻi* presumed the tale told to him by the boy was true, that it was a *kapa* of the same fragrance as his but from Wailau, Molokaʻi and not in fact one of his own. Being that Keawenui a ʻUmi had lost everything in the storm, Kūapākaʻa continued to care for his *haku*, who was still clueless as to the boy's true identity. He dutifully attended to his every need, just as his father Pākaʻa had in previous years. Meanwhile, Pākaʻa continued to craft his revenge plot on Hoʻokele-i-Hilo and Hoʻokele-i-Puna, and in order to facilitate this, his son let loose the winds of his gourd to keep the weather just unstable enough so Keawenui a ʻUmi would not be able to leave the island. Four months later the weather became agreeable once more, and Keawenui a ʻUmi and his men readied their canoes for sailing. That night, Kūapākaʻa chanted to each of the six district *aliʻi* and their men to awaken from their slumber and ready themselves for sailing to Kaʻula:

> Get up, Puna,
> Puna, land fragrant with hala,
> From the heights to the seashore grass. (Nakuina 2005:75)

Kūapākaʻa continued his attempt at awakening each *aliʻi*, chanting for each land and mentioning each chief by name as a last resort to rouse them. For Puna, he chanted:

> Ge up, get up, it's day, there's light,
> The sun emerges at Kumukahi,
> Shining like Makanoni,
> Puna whose bowers are fragrant with hala,
> From the heights of Akoakoa,
> Puna is a proud land for her people,
> Get up, get up, Puna,
> The land of Huaʻā. (Nakuina 2005:77)

Although Huaʻā rose at the sound of Kūapākaʻa's beckoning, he became irate when he realized it was still evening and exclaimed:

> "Kā! Here it's still evening and we're being awakened. The keiki is strange. It's not this keiki's duty to drive us from our hale."
>
> He said angrily, "You're wahaheʻe, ē ke keiki. Who says the lā (sun) emerges at Kumukahi when it's still evening?"
>
> Kūapākaʻa said, "Lā does appear. The native son waits at the cape of Kumukahi and when the sun sets, he lies down for a while but doesn't sleep. He gets up when the ʻōpelu runs, and goes down to the seashore, boards his canoe, hoists his lā (sail), and sets off. Thus, lā does appear at Kumukahi when it's still evening."
>
> "You're right, ē ke keiki," said the gathering of kānaka. "Huaʻā is forced to rise because lā appears in his land both night and day." (Nakuina 2005:77-78)

Once all district *aliʻi* and their men were awakened, all fleets departed Molokaʻi at the urging of Kūapākaʻa who instructed them to set sail to Kaʻula in search of his father, explaining to them that he and Keawenui a ʻUmi would shortly follow. However, Kūapākaʻa did not wake his *haku*, and allowed him to sleep in. When day broke, Keawenui a ʻUmi requested that Kūapākaʻa accompany him to Kaʻula to search for Pākaʻa, which he agreed to do as this was part of his father's plan. As part of Pākaʻa's conspiracy to exact revenge on his enemies, he had instructed his son to load the double-hulled canoe of the *aliʻi* with a hollowed-out tree trunk secretly filled with food, drink, palm fronds, and a large stone to be used as an anchor.

Meanwhile, the district *aliʻi* were en route to Kaʻula, and stalled in the waters of Oʻahu to wait for their *aliʻi*, but he never arrived. Exhausted from their journey, the men fell asleep. When they awoke, they unexpectedly found that they had drifted to Hawaiʻi Island, and found themselves on the shores of Kawaihae. In the meantime, Keawenui a

‘Umi, his men, and Kūapāka‘a were voyaging to Ka‘ula, with Ho‘okele-i-Hilo and Ho‘okele-i-Puna steering the canoe, oblivious to their imminent, discretely planned demise. To carry out the final segment of the grand scheme, Kūapāka‘a allowed the winds out of La‘amaomao, and the weather became severe. He anchored the canoe with his big rock and encouraged the men to ride out the storm in place, arguing that it would be better than fighting the bad weather. The bitter wind and rain chilled the men to the bone, and they began to show signs of hypothermia. Just before they reached the verge of death, Kūapāka‘a then revealed the hidden trove of food secreted away in the hollowed-out tree trunk. He gave palm fronds for protection and food and drink for strength to everyone on board except his father’s enemies, Ho‘okele-i-Hilo and Ho‘okele-i-Puna, who inevitably succumbed to the cold and perished.

As the weather cleared and became pleasant, Kūapāka‘a assumed the role of the now-deceased steersmen, and set sail for Ka‘ula. However, that night when everyone was sleeping, the boy opened his wind-gourd yet again, and the winds wafted them to Hawai‘i Island where they landed at Kawaihae. Once there, joy and excitement overcame Keawenui a ‘Umi and his party, and they rushed to lovingly greet their families while Kūapāka‘a was utterly forgotten, abandoned, and alone. Eventually, word of a canoe race that the boy participated in reached the ears of Keawenui a ‘Umi by a messenger, and it was realized that Kūapāka‘a’s neglect had been inadvertent, as it was mistakenly presumed that the youth had been taken in and cared for. As part of the wager for the canoe race against Keawenui a ‘Umi’s favorite fishermen, it was agreed that should Kūapāka‘a reign victorious, the losers be baked in an *imu* (underground oven). During their conversation, Kūapāka‘a informed his *haku* that he intended to make true on his wager and kill the men. But he was met with opposition from Keawenui a ‘Umi, who did not want to see his men perish. Eventually, a deal was made in which Kūapāka‘a would fetch Pāka‘a from Moloka‘i if Keawenui a ‘Umi agreed that the fishermen be put to death.

Though Pāka‘a longed to serve his *haku* once more, he refused to travel back to Hawai‘i Island without having his land, position as navigator, and other rights restored. When Keawenui a ‘Umi was informed of this, he immediately consented, eager to reconcile. Only once Keawenui a ‘Umi agreed to restore everything that had been revoked from Pāka‘a, did his beloved *kahu* return to him to serve him faithfully for the rest of his days.

The Pōhaku of Kumukahi

The Dancing Stone of Hōpoe is not the only physical evidence of Pele’s wrath found in Puna. In the tale of *Pele and the Chiefs of Puna*, Westervelt (1916) recounted the tale of Pele’s vengeful spirit against Kumukahi. a tall, strong, and handsome Puna chief, who relished playing traditional Hawaiian games. In the middle of playing one day, he was approached by an elderly woman who commanded he allow her to play. Not realizing that the old woman was actually Pele, who he had only seen in her younger and more alluring form, the chief mocked her scornfully. Pele’s temper flared at his contempt and she pursued him as he fled to the ocean. Cornered, Kumukahi was swallowed by a torrent of lava unleashed by Pele who also heaped fractured lava upon him. His fortune, much like Hōpoe, was to remain eternally as a great *pōhaku* (stone) at the seashore where he marked the easternmost extremity of Hawai‘i known today as Cape Kumukahi.

Seven other storied stone monoliths are present in the immediate vicinity of Cape Kumukahi. June Gutmanis (1986) was informed by Mary Kawena Pūku‘i that these named stones are the physical forms of Kumukahi’s former wives: Makanoni (“speckled face”) marked the beginning of a cool season and the end of summer, Kanono (“very-red-sunburn”) indicated the first day of winter when struck by the rising sun, and Paupoulu (“skirt-made-of-breadfruit-bark”) implied the beginning of summer when struck by the rising sun. Additionally, there are several other stones nearby that represent Kumukahi’s other wives: Hanakaulua (“Take-plenty-of-time-to-work”), Haehae (“Rent-assunder”); Haula (“Fall Leaves”), and Kahinaakala, (“Sunrise”) (ibid.). These stones are less explicit in their functions, but allegedly also mark astronomical events such as solstices and equinoxes.

Kumukahi and the rocky point that bears his name are featured in another legend, as told by Pūku‘i (Green and Beckwith 1926). Kumukahi is portrayed as a god and kin of Pele who made the easternmost point on Hawai‘i Island his home, upon his and Pele’s from their home in Tahiti. Kumukahi was a shapeshifter, able to transmogrify from a mortal man to a *kolea* (plover) at will and could inhabit spirit mediums (*haka*) inducing miracles to occur. It was to this god, embodied by “a red stone at the extreme end of the point” that offerings were left by the sick seeking healing, and likewise by those paying reverence to the sun (Beckwith 1970:119). For those who were ill and wished to obtain healing, a very specific protocol for presenting offerings is required:

> . . . As it is essential for such an offering that the extreme point [of Kumukahi] be reached and before sunrise, the patient had to be paddled early in the morning in a canoe, accompanied by a priest and carrying an offering in the shape of a whole pig if the patient can afford it, otherwise a fish called *nukunuku-puaa*, or “pig-snout,” together with squid, *olena* root, *awa* drink, and other articles all wrapped in *ti* leaves. At the exact point of the reef, the priest holds the offering and chants,

E hoopakele i na pulapula mai no ino mai,	Deliver your progeny from evil
A e hoopomaikai mai, i nap ono a pau	And bless in all good things.

> Then the offering is dropped quickly into the water and the canoe paddled swiftly away. Neither priest nor patient could look back, else "he has his labor for his pains," (Green and Beckwith 1926:188-189)

The significance of Kumukahi as a *wahi pana*, or sacred place, is also evident in its incarnation as a *leina a ka ʻuhane* (leaping place for souls) where the death of the physical body results in the separation of its spirit which is subsequently accompanied by its *ʻaumākua* (family or personal ancestral gods) on a journey to the underworld. It is there that the *ʻaumākua* help guide their keep into either Milu (a place of darkness also referred to as *ka lua o Milu*) or Wākea (a place of light). Beckwith (1970) described this leaping place for souls thusly:

> . . . There is a place of the dead, reached at some leaping place, with which is connected a branching tree as roadway of the soul. Elaborations enter into these basic ideas as a result of the part conceived to be played by the aumakua in protecting and sheltering the soul and leading it to its aumakua world.
>
> The worst fate that can befall a soul is to be abandoned by its aumakua and left to stray, a wandering spirit (kuewa) in some barren and desolate place, feeding upon spiders and night moths. Such spirits are believed to be malicious and to take delight in leading travelers astray; hence the wild places which they haunt on each island are feared and voided. . . (ibid.:154)

The Heart Stirring Story of Ka-Miki

The name of a land division sometimes indicates its importance, records its history, or reveals something about its resources or population. A traditional *moʻolelo*, "The Heart Stirring Story of Ka-Miki" (*Kaʻao Hoʻoniua Puʻuwai no Ka-Miki*), originally appeared in the Hawaiian language newspaper *Ka Hōkū o Hawaiʻi* between 1914 and 1917. This *moʻolelo* was likely authored during the late 1800s through early 1900s by noted Hawaiian scholars John Wise and J.W.H.I. Kihe. Maly, who translated their story, noted:

> While "Ka-Miki" is not an ancient account, the authors 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…While the personification of all the identified individuals and their associated place names may not be entirely "ancient," the site documentation within the "story of Ka-Miki" is of both cultural and historical value. (Maly 1999b:23-24)

The story tells of two supernatural brothers, Ka-Miki and Maka-ʻiole, who were skilled *ʻōlohe,* and their travels around Hawaiʻi Island by way of the ancient trails and paths (*alaloa* and *ala hele*), seeking competition with other *ʻōlohe.* The two brothers were born to Pōhaku-o-Kāne (male) and Kapaʻihilani (female), who were the *aliʻi* of the lands of Kohanaiki and Kaloko, North Kona. Upon the mysterious and premature birth of Ka-Miki, he was placed in the cave of Pōnahanaha and given up for dead. He was eventually saved and raised by his ancestress, Ka-uluhe-nui-hihi-kolo-i-uka, a manifestation of the goddess Haumea, at Kalamaʻula, an area located on Hualālai. Ka-miki was later joined by his elder brother Makaʻiole where their ancestress Ka-uluhe-nui trained her grandsons into *ʻōlohe*, or experts skilled in fighting, wrestling, debating, riddle solving, and running, and taught them how to use their supernatural powers. Given the lengthy nature of this account, special attention is given to the portion of the story that takes place in the forested uplands of Puna.

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. It was at this point, that Pōhakuloa 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 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 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, Kapuʻeuhi 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" Maly (1998:20), which may perhaps be 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 Makaʻiole 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 she failed.

Ka-Miki and Ka-ʻiole realized that Kapuʻeuhi 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 was also captured, in an attempt to free him from Ka-Miki.

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.

ʻAumakua Manō of Kohala

Beckwith (1917:503) related that the worship of *ʻaumakua* (family or personal ancestral gods) was directed towards certain stones, animals, trees, flowers, insects, and natural phenomena who are "half god, half, human, who utter their counsels through the lips of some medium, who becomes for the moment possessed with their spirit." Though *ʻaumakua* embodied by animals are greatly varied, including birds such as *ʻio* (hawks), *pueo* (owls), reptiles such as *moʻo* (lizards), and marine animals like *honu* (turtles), *manō* (sharks) were commonly venerated as *ʻaumakua manō*. Emerson (1892:8) argues that the "shark was perhaps the most universally worshipped of all the *aumakuas*, and, strange to say, was regarded as peculiarly the friend and protector of all his faithful worshippers."

ʻAumākua (plural form of *ʻaumakua*) served as intermediaries that played an important role in guiding the soul of a departed family member in the afterlife and were capable of leading it into either the desirable and peaceful realm of Wākea or the miserable depths of Milu. To ensure a peaceable afterlife, it was, therefore, vital to maintain good relations with one's *ʻaumākua*. Emerson (1892:22-23) elaborated on *ʻaumākua* forms, practices of veneration, and consequenses of accidental disrespect by its *kahu* (keeper):

> Every family had its *aumakua*, to whom each individual owed allegiance and worship, and from whom he expected aid and guidance in all the affairs of life. So long as a person devoutly observed the *kapus*, fulfilled his vows, and rendered due worship, the *aumakua* was his best friend and protector. But let him fail in any of these particulars, thereby becoming *hewa* [wrong, or guilty], he incurred its wrath and displeasure, which was visited upon him by pain and sickness. The *kahuna* must then be called in to determine which of the *aumakuas* was offended and for what cause, and to atone for the fault by the proper prayer and offerings. One of the grave faults that a person might commit was "*pepehi aumakua*," that is, injuring or destroying any animal of the class held sacred by his family. This fault [*hewa*] was never done intentionally, and, when commited by an unlucky accident, the offender was bound to make a feast of such articles as *awa*, a pig, fowls, squid, the

> fishes called *aholehole*, *anae*, *kala*, *kumu*, and *palani*, together with *kalo*, potatoes, bananas and sugar cane as an offering to the offended god…
>
> As the children inherited the *aumakuas* of both father and mother, the tendency was for every family to have a large number of *aumakuas*. It is claimed, that the primary idea of the word *aumakua* is the spirit of an ancestor, deified and rendered potent for good or evil, by the long continued *hoomanamana* of its posterity. The spirits of those who had become famous for skill or power would very naturally after death receive the worship of those their craft or profession. Many of these *aumakuas* still retain the shadowy form of a human spirit. Others have been transformed into various animal forms, or, as some people prefer to consider it, manifest themselves through those animals. Other have taken up their abode in trees, stones, and other objects.

Of particular note are shark *ʻaumākua* who are frequently worshipped in coastal areas of Hawaiʻi. Beckwith explained that:

> Their worship is handed down from father to son, a special keeper (*Kahu*) being intrusted with their care. They are invoked with particular prayers and have temples erected for their worship. Their special function is to aid in the food supply of the household—generally by giving the fisherman good luck at sea—and to protect him from drowning. They are, in fact, regarded as spirits of half-human beings which, rendered strong by prayer and sacrifice, take up their abode in some shark body and act as supernatural counselors to their kin, who accordingly honor them as household divinities. (1917:508)

They are considered as both a friend and protector of their *kahu*, yet at the same time rank as *kauwā* (slaves/servants) because of their obligatory servitude (Beckwith 1917; Emerson 1892). Ancestral deity worship is considered a quintessential spiritual practice of the Native Hawaiians of old, and it stands today as a heritable custom, belief, and connection to the past preserved by rich oral traditions many of which are associated with mythological tales. While the thirteen *ʻaumākua manō* enumerated by Emerson (in Beckwith 1917:511-512) below for Puna do not appear to be directly associated with Waʻawaʻa, they are nonetheless examples of those belonging to the *moku* of Puna as a whole:

> ***Ke-alii-holo-i-ka-moana*** (the chief sailing over the ocean) (k) lives in *Kekaha*, *Puna*, from *Ka-lai-o-kawili* in *Apua* district to *Ka-lai-o-wili-ea in Panau-nui*. "He began life a human child living on land, was a *kaukau-alii* (low chief) under *Iwakakaoloa*, the blind chief of *Puna*. He was an expert fisherman, frequenting the sea in a canoe. At death, wrapped in *Kapa-ahu-na-lii*, he was cast into the sea at *Kealakomo* and became a shark-god of the class called *akua-noho* who were supposed to ʻdwell with or be over men as guardians.
>
> ***Ka-pani-la*** (the shutting out of the sun) (k) is so named "because his enormous bulk would obscure the sun should he come to land. He is the largest of the sharks. His usual haunts extended from the point *Ka-lae-o-lamaulu* in *Kapoho*, *Puna*, to *Kumukahi* point in *Kapele.*"

ʻŌlelo Noʻeau of Puna

The oral traditions of Hawaiʻi are perhaps best preserved in *ʻōlelo noʻeau*, which have been passed down throughout the generations. Many *ʻōlelo noʻeau* speak of Puna, a land covered in inky lava left in Pele's furious wake and the atmosphere, which was sweetly scented with the heavenly fragrances of *hala*, *maile*, and *lehua* blossoms. The following proverbs illustrate the character of Puna in great detail, and appear below as they were interpreted and published in *ʻŌlelo Noʻeau, Hawaiian Proverbs & Poetical Sayings* by Pūkuʻi (1983):

> *Haʻalele i Puna na hoaloha e.*
> Left in Puna are the friends.
> Said of one who has deserted his friends. Originally said of Hiʻiaka when she left Puna.
> (50)
>
> *Haoʻe na ʻale o Hōpoe i ka ʻino.*
> The billows of Hōpoe rise in the storm.
> His anger is mounting. Hōpoe, Puna, has notoriously high seas.
> (57)
>
> *He moku ʻāleuleu.*
> District of ragamuffins.

Said by Kamehameha's followers of Ka'ū and Puna because the people there, being hard-working farmers, lived most of the time in old clothes.
(90)

Lilo i Puna i ke au a ka hewahewa, ho'i mai ua piha ka hale i ke akua.
Gone to Puna on a vagrant current and returning, finds the house full of imps.
From a chant by Hi'iaka when she faced the lizard god Pana'ewa and his forest full of imps in a battle. It was later used to refer to one who goes on his way and comes home to find things not to his liking.
(216)

Ka ua Līhau o Pāhoa.
The Līhau rain of Pāhoa.
The icy cold rain of Pāhoa, Puna, Hawai'i
(170)

Mai ka lā 'ō'ili i Ha'eha'e a hāli'i i ka mole o Lehua.
From the appearance of the sun at Ha'eha'e till it spreads its light to the foundation of Lehua.
Ha'eha'e is a place at Kumukahi, Puna, Hawai'i, often referred to in poetry as the gateway of the sun.
(224)

Pō'ele ka 'āina o Puna.
The land of Puna is blackened [by lava flows].
(292)

Ka makani hali 'ala o Puna.
The fragrance-bearing wind of Puna
Puna, Hawai'i, was famed for the fragrance of *maile*, *lehua*, and *hala*. It was said that when the wind blew from the land, fishermen at sea could smell the fragrance of these leaves and flowers.
(158)

Puna maka kōkala.
Puna of the eyelashes that curve upward like the thorns of the pandanus leaves.
The placenta of a newborn was buried under a pandanus tree so that the child's eyelashes would grow long like the pandanus thorns.
(301)

Ka ua moaniani lehua o Puna.
The rain that brings the fragrance of the *lehua* of Puna.
Puna is known as the land of fragrance.
(172)

Ma'ema'e Puna i ka hala me ka lehua.
Lovely is Puna with the *hala* and the *lehua*.
Refers to Puna, Hawai'i.
(221)

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.
(301)

Nani Puna pō i ke 'ala.
Beautiful Puna, heavy with fragrance.
Praise for Puna, Hawai'i, where the breath of *maile*, *lehua*, and *hala* blossoms are ever present.
(248)

Puna, kai nehe i ka ulu hala.
Puna, where the sea murmurs to the *hala* grove.
(300)

Niuniu Puna, pō i ke 'ala.
Puna is dizzy with fragrance.
Puna is a land heavily scented with the blossoms of *hala* and *lehua*.

(252)

‘Ulu pilo.
Stinking breadfruit.
A term of contempt for the *kauwā* of Puna, Hawai‘i, comparing them to rotted breadfruit.
(314)

‘Awa kau lā‘au o Puna.
Tree-growing *‘awa* of Puna.
Tree-grown *‘awa* of Puna was famous for its potency. It was believed that birds carried pieces of *‘awa* up into the trees where it would grow.
(29)

Puna, ‘āina ‘awa lau o ka manu.
Puna, land of the leafed *‘awa* planted by the birds.
(300)

Ke one lau‘ena a Kāne.
The rich, fertile land of Kāne.
Puna, Hawai‘i, was said to have been a beautiful, fertile land loved by the god Kāne. Pele came from Kahiki and changed it into a land of lava beds, cinder, and rock. (ibid.:191)
Ka wahine ‘ai lā‘au o Puna.
The tree-eating woman of Puna.
(177)

Lohi‘au Puna i ke akua wahine.
Puna is retarded by the goddess.
Refers to Pele, ruler of volcanoes. The lava flows she pours into the district retard the work and progress of the people.
(217)

Maka‘u ka hana hewa i ka uka o Puna.
Wrongdoing is feared in the upland of Puna.
Wrongdoing in the upland of Puna brings the wrath of Pele.
(228)

Weliweli Puna i ke akua wahine.
Puna dreads the goddess.
Puna dreads Pele. Said of any dreaded person.
(321)

Traditional Agricultural and Gathering Practices of Wa‘awa‘a and Puna

Despite its appearance as a desolate landscape under constant threat of the fires of Pele, Puna remained a dynamic land of rebirth that was capable of sustaining an abundance of life through traditional farming practices of crops like *kalo* and the collection of various forest resources. Gathering practices conducted in woodland areas included the collection of bark from *māmaki* (*Pipturus* sp.), *wauke* (*Broussonetia papyrifera*), and *olonā* (*Touchardia latifolia*), whose fibers were prepared and fashioned into *ahu‘ula* (feathered cloaks), *lei hulu* (feathered *lei*), and *mahi‘ole* helmets that were used exclusively by those of royal bloodline. The forested areas of Puna also provided habitat for several now-extinct birds including the *mamo* (black Hawaiian honey creeper; *Drepanis pacifica*) and *‘ō‘ō* (black honey eater; *Moho nobilis*). Feathers of these birds are known to have been obtained through *kāpili manu* (bird-catching) by *ka po‘e lawai‘a manu* (the people who fished for birds) and *po‘e kia manu* (those who caught birds with *pīlali*, or birdlime made from the hardened *kukui* sap).

Bird-catching was a specialized form of hunting that provided highly-valued feathers to craft specialists, who transformed them into high status goods that included *lei*, *kāhili* (royal insignial plumes), *‘ahu ‘ula* (capes and cloaks), *mahiole*, and *‘akua hulu manu* (feathered images of gods) (Brigham 1899, 1903, 1918; Buck 1944, 1957; Emerson 1894) plaiting them with fibers, thread, and cord of plants such as *olonā*. The *ali‘i* controlled the collection of feathers through specific requests (Kamakau 1992), as tribute during the *Makahiki*, and through a “standing order” (*palala*) for this item of *ho‘okupu* (Malo 1951). Kamakau relates that the *ali‘i* of Kona longed for control over La‘a, the traditional name of ‘Ōla‘a (now Kea‘au) Ahupua‘a for the prized black and yellow feathers of the *mamo* and *‘o‘ō*. It is likely that the collection of bird feathers by *maka‘āinana* also occurred throughout the more forested areas of Waikā and neighboring *ahupua‘a* on a part-time basis as well based on similar habitat. As Menzies (1920:82-83) explains,

birds like *ʻōʻō* and *mamo* which possessed black and yellow feathers, were caught by natives who used berry bait along with *pīlali*, or birdlime made of *kohu* (hardened *kukui* sap) to catch birds:

> A third set seemed to have no other occupation than that of catching small birds for the sake of their feathers, especially those of a red, yellow or black colour. These feathers are in great estimation. It is with them that a great portion of the rents are annually paid to the chiefs by the lower class of people, who thus employ themselves by catching the birds with bird lime. They do this by spreading a little of it here and there on the boughs, and placing two or three red berries near it which the birds are very fond of. As they perch to eat them, they are entangled with the bird-lime, but the natives are very cautious of not exterminating the birds by killing all that are in this manner caught. Many of them after being stripped of their most valuable feathers are again set at liberty and run the chance of being fleeced in the same way next year.

The *ʻōʻō* "was a black bird with a body tuft of crocus yellow feathers near each wing joint and with a few near the tail" (Buck 1957:217), and was one species of bird highly sought after and valued by natives of Puna for its feathers and potentially also as a form of sustenance. Tufts of feathers that were gathered from the near the wing of the *ʻōʻō* "were termed ʻeʻe, those on the rump were puʻe. . . and those by the tail were puapua" (Buck 1957:217, 224). Brigham further explained:

> . . . The general color is a brilliant black which brings the yellow tufts into fine contrast. All the black figures and lines in the feather work are of this plumage, and it was largely used in the grand kahilis. As the bird was a favorite article of food, and as the larder of hunters in the mountains was poorly stocked, it seldom survived capture, and yet this bird has remained in comparative abundance while the mamo, whose orange feathers alone were taken, has become extinct. . . (1899:10)

The *mamo*, an incredibly rare species found only on Hawaiʻi Island, was "also black with a few feathers of a deeper yellow above and below the black tail feathers and on the thighs" (Buck 1957:217). Like the *ʻōʻō*, feathers collected from various parts of the *mamo* held specific names and Buck related that those deriving from "above and below the tail were termed koʻo mamo and the short ones from the thighs were ʻae mamo" (Buck 1957:224).According to Brigham:

> . . . It is probably nearly extinct, collectors of late years having failed to find it. In 1890 I saw three in a sandal-wood tree under which I was camping on the slopes of Mauna Hualalai on Hawaii (to which the species is confined) at an elevation of 7000 ± feet. . . The general plumage is not of so rich a black as the oo, while the lower part of the body, the rump, thighs, anterior margin of wings and tail coverts are of a rich orange. Among Hawaiian birds the mamo is facile princeps. Its name has been applied to all royal war-cloaks very much as "beaver" has clung to a soft hat no longer made of the fur of the Castor fiber. . . To distinguish these feathers when faded from the oo is not always easy, but the orange of the former is separated from the black base by a marked white space, and the tips of the oo feathers are thinner and larger. (1899:10-11)

In more coastal areas, other crops such as *ʻuala* (sweet potato; *Ipomoea batatas*) were cultivated. The barrenness of surrounding lava flows was not a limiting factor for the cultivation of *ʻuala*, which requires practically no soil to flourish. Abbot (1992:30) relates that typically "*ʻuala* were grown in *puʻe* (mounds) that formed a *māla* (patch), usually surrounded by stone walls" and planted during the full moon, or during the six first days of the new moon. Handy (1940) relates that throughout Puna, the *maka koali* variety grew wild and served as sustenance during famine and also served raw to pigs. The typical preparation of *ʻuala* for consumption was similar to *kalo* and entailed either steaming in an *imu* and eaten whole or mashed as *poi ʻuala* (Abbott 1992; Handy 1940). Although *poi ʻuala* soured quickly, it was "regarded by Hawaiians as dietetically superior to taro poi, but it is less relished" (Handy 1940:149). Additionally, a dish known as *palula* was also made from the green leaves of the *ʻuala* plant after being cooked. Although *ʻuala* was cultivated widely, Handy suggested that it did not appear to have been a staple food of Puna, a district which was "most famous for its breadfruit" (ibid.:190). Handy opined:

> At Keaau, the northernmost settlement on the coast of Puna below Waiakea in Hilo, Ellis. . . saw sweet potatoes cultivated in plantations together with taro and sugar cane. We may infer that similar cultivations were typical of the other sections along this northeast section of Puna. The sandy soil southeast of Honolulu must have been utilized for sweet potatoes. . . Despite the fact that sweet potatoes were planted almost universally and many patches still maintained, the Puna natives seem to regard this vegetable with little interest, probably because Puna people prided themselves upon and relished their breadfruit, and also because potato was nowhere and at no time the staple for this rainswept district. (ibid.:165)

Handy et al. also related an interesting occurrence in Puna relating to the travel of *ali‘i* through the district and the creative methods natives of the district devised to maintain veneration to each *ali‘i* and their respective *kapu* yet not sacrifice their agricultural pursuits:

> It was considered proper, with respect to a high chief's *kapu*, that when he traveled, the plantations of the people should lie to his right. Actually along the trail through the coastal area of Puna they were on both sides of the path. So the ingenious men of some communities made portable plantations. They wove very thick, coarse mats of pandanus leaf, laid these on racks, put earth on top, and in the earth planted sweet potatoes. When the *ali‘i* traveled southward, the rack with its garden of sweet potatoes was put on the inland side of the trail so that it was on the right hand of the *ali‘i*. When he returned, traveling northward, the portable garden was placed on the seaward side of the road, and was still on his right hand. (1991:542)

Breadfruit (*‘ulu*; *Artocarpus* sp.) is a *kinolau* (physical manifestation) of the goddess Haumea, the "patron of childbirth," and served as the principle staple food of Puna where it was most famous (Beckwith 1970; Handy et al. 1991). Careful and gentle propagation was required, which entailed the removal and replanting of the root sucker cutting while ensuring it remained within its original, undisturbed soil casing. With respect to *‘ulu* as a sustainable food source, it was surmised that "except in Puna, Hawaii, breadfruit was wholly secondary to taro and sweet potato as a staple. I am told that in Puna in a good year, breadfruit may be eaten for 8 months of the year, beginning with May " Handy et al. (1991:152).

Although *‘ulu* appears to have been the preferred source of sustenance for residents of Puna, *kalo* (taro; *Colocasia esculenta*) rivaled it as a staple food source. Puna produced several cultivars of *kalo* including *O‘opu Kai*, *Ipu o Lono*, *Maka‘ōpio*, *Lehua Kuikawao*, *Lehua ‘Ele‘ele*, *‘Ala o Puna*, and *Uahi a Pele* (Handy 1940; Pukui and Elbert 1986). Puna's lack of flowing streams made growing wetland *kalo* impossible; however, despite this freshwater stream deficit, Puna received plentiful rainfall throughout the year which made the cultivation of dryland *kalo* possible, especially in clearings (*waena*) within *‘ōhi‘a* forests (Handy 1940). Handy et al. (1991:541) related that, "the wet and sometimes marshy pandanus forests from Kapoho through Poho-iki to ‘Opihikao used to be planted with taro in places." The method of planting dryland *kalo* in the lowland forests of Puna was described by Handy et al. as the "*pa-hala* (pandanus clearing) method" (ibid.:104) and was advantageous for it did not require the constant weeding necessitated in better soils. The *pāhala* planting process was described as follows:

> . . .Make holes in the *‘a‘a* (broken lava) by taking out some of the stones. Be sure that the place chosen is in a *pu hala* grove, to save the labor of hauling *hala* branches into the patch later on. Fill the hole with whatever weeds can be found and leave them there for six weeks or more. The weeds will rot and make soil. When the weeds have rotted away, the taro *huli* are wrapped in *lau hala* (*hala* leaves) to keep them moist and are planted. When there or four leaves have appeared on each *huli*, then that is the tame to cut down the *pu hala* to let in the sun. The branches of the *hala* are cut off and the patch covered with them until this is not a trace of the taro to be seen. This is left until sufficiently dry to set on fire. The fire does not hurt the taro much as the *huli* are already well rooted. The *hala* reduced to ashes, give the taro the needed nourishment and they grow so tall that a man can be hidden under their leaves. (Handy et al. 1991:104–105)

The *pa-hala* method of cultivating dryland *kalo* in Puna could also be practiced on grass-covered slopes rather than directly atop lava; however, cultivation in grassy areas did require burning off the surface organics prior to planting (Handy 1940). Additionally, *kalo* could be opportunistically planted in depressions left by toppled over *hāpu‘u* fern trunks found at higher elevations, such as lands *mauka* of the current project area Handy et al. (1991).

The pandanus tree known as *pū hala* or *hala* (*Pandanus odoratissimus*; Figure 11) was valued for its fragrance and harvested for more utilitarian purposes. The inhabitants of Puna were recognized for their skilled *lauhala* (pandanus leaf) weaving. The dried leaves were used to plait *lauhala* mats for thatching onto house rafters and walls in a method typically employed in Puna and the neighboring district of Hilo in the absence of *pili* grass. Plaited *lauhala* was also used for pillows, fans, floor coverings, canoe sails, baskets, and occasionally as clothing (Handy 1940; Handy et al. 1991; Summers 1999). According to Fornander (1918-1919), two styles of *lauhala* mats were traditionally associated with Puna; the *makali‘i*, a braided, small-stranded mat, and the *puahala* or *hīnano*, made from the male pandanus blossom. The latter was highly valued, and ". . .is only made in Puna where the hala tree is very abundant. It is a regular article of trade among the natives who greatly prize it as a choice mat to sleep on" (Summers 1999:17).

William T. Brigham, former Director of the Bernice Pauahi Bishop Museum, described witnessing the natives of Puna weaving the mats for which the district was famous, as follows:

> Puna was a famous region for hala mats, and in 1864, the author, when journeying through the district with that noble missionary the Reverend Titus Coan, saw many a party in the curious open caves (caused by a breakdown of the lava crust in some of the many streams of lava, ancient and recent, that form much of the surface of Puna) busily engaged in weaving mats, a work for which the comparative coolness and dampness of the caves was most suited. (Brigham and Stokes 1906:29)

Hala was significant on a spiritual level as well. Handy and Pūkuʻi (1998a) conveyed the significance of the *hala*, which played a role in the protection of a newborn baby's placenta (*ʻiewe*). *Hala* groves were abundant in Puna and concealing the *ʻiewe* high up in the leaves thereby preventing it from being pilfered. The people of Puna were sometimes referred to as *maka kōkala* (thorny eyes) by the inhabitants of the neighboring *moku* of Kaʻū, correlating the spiny leaves of the *hala* with the long eyelashes of the baby whose *ʻiewe* it was sheltering, providing a "bright keen look" (Handy and Pukui 1998a; Pukui and Elbert 1986:160). Maly related, "to this day, Puna is known for its growth of *hala*, and the floors and furniture of some of the old households are still covered with fine woven mats and cushions. Weaving remains an important occupation of many native families of Puna." Maly (1998:6).

Figure 11. Man standing in a Puna *pū hala* grove in 1888 (Brigham and Stokes 1906:28).

In addition to these resources, other crops such as *niu* (coconut) thrived in coastal Puna and "has always had the greatest continuous planting area for coconuts in the Hawaiian islands; today old coconut groves are scattered everywhere along the wet lava-covered coastal plain" (Handy 1940:193). With respect to varieties, Handy et al. (1991) listed only two: the *niu hiwa* (particularly used for ceremony, medicine, and cooking), and the *niu lelo* (used primarily for nonreligious purposes). Water from the *niu* was palatable and flavorful. It was also utilized on a spiritual level by priests practicing divination. The raw meat was edible, and could be scraped out of the shell with a large *ʻopihi* (limpet) to be eaten as is or incorporated into the preparation of various sweets including *haupia* (*haukō*), *kūlolo, and piʻepiʻe ʻulu*. Besides being utilized for human consumption, coconut meat could also be used to feed animals:

> In some localities in Puna, pigs were taught to open their own coconuts. When the owners of the pigs expected to be absent for some time, they husked a quantity of the nuts, leaving a strip of husk on each one about two inches in width. When a pig wanted to open a nut, he grasped it by this strip of husk and dashed it against a rock. Thus the pigs were assured of fresh food until the owners returned. (Handy 1991:174)

The meat of the coconut could also be crafted into fresh coconut oil; Handy et al. describe the process thusly:

> In Puna, *manoʻi* or coconut oil was made as follows: The fresh gratings, with *maile* or other *kupukupu* (any odoriferous plant) to give fragrance, were placed in a container in the hot sun. When

> the oil separated away from it, the mass was squeezed through *ahuawa* and the refuse (*oka*) thrown away. The oil was used for anointing the body and hair and washing the hair. (1991:192)

Niu also provided husk fibers to plait sennit *ʻaha* (cordage) to be used for lashing house timbers, adzes, and canoe parts, making food containers (*ʻumeke*) and the main body of the *pahu hula* drum. The shell could be cut in half to be used for drinking, medicinal, or ceremonial cups, using leaf stems and midribs to clean pig intestines, make brooms, shrimp snares, and for stringing *kukui* nuts to be burned as candles, plaiting leaflets to make fans and playing balls for children, and using the end of the leaf as *kapu* markers along the coastline or to frighten fish out from under ocean ledges (Handy et al. 1991). The method of propagating *niu* involved burying a sprouted nut on top of an octopus (*heʻe*) at a hole deep enough to bury it completely. The buried *heʻe* was purported to "give the root a spread and grip like its own and to produce nuts that were bulbous like its head or body (*pu*)" (ibid.:172).

Uhi (yam; *Dioscorea alata*) was cultivated throughout Puna and served to supplement more primary sources of sustenance such as *kalo* and *ʻuala* during times of famine. Unlike *kalo*, the *uhi* did not make fine *poi*, and as such was steamed in an *imu* and consumed in its whole form rather than being mashed. In addition to being a supplementary form of nourishment, the *uhi* also possessed value medicinally and it was a beneficial treatment of a wide variety of ailments. Within Puna specifically, the white-fleshed *poni* and *alela* varieties were cultivated, the former of which was purple-skinned, as well as the *keʻokeʻo* and *ulaula* varieties the former of which was only utilized for food purposes and the latter which was consumed both as food and could be dually utilized for its medicinal value (Handy 1940). Handy (ibid.) described a method of planting *uhi* in ʻŌlaʻa, Puna:

> The following old Hawaiian method of planting *uhi* in Hamakua and Olaa was described to me by Judge George Tucker of Olaa whose Hawaiian forbears taught him yam culture. On the ground in the forest a great bin of tree-fern trunks (*hapuu*) was built 3 to 4 feet high on the sides, the fern trucks being laid horizontally. The bin was filled with decaying fern leaves and other rubbish. The seedling tubers (*hua uhi*) were then stuck in the rubbish a few inches below the surface. No earth was put in, but as the rubbish in the bin decayed and sank, more rubbish was heaped on top. Fully matured tubers grown by this method are said to have weighed up to 50 pounds. . .
>
> . . . Another interesting practice in planting yams on steep hillsides and the sides of gulches on the Hamakua coast and in North Hilo was to dig a vertical hole in the side of the slope, 2 to 3 feet deep, and place a large flat stone in it. The hole was then filled with earth and decaying leaves, and the seed yam planted near the top of the hole. The rock at the bottom of the hole prevented the tuber, which grew downward, from growing deep into the ground and forced it to spread out. When time for digging, the earth on the side of the hill or gulch was simply dug away and the tubers extracted. (169–170)

Also utilized as a famine food is the *pia* (Polynesian arrowroot; *Tacca leontopetaloides*), which Abbott (1992) relates was commonly grown in close proximity to *loʻi kalo* (wetland taro). Within Puna specifically, *pia* was likely cultivated but also grew wild Handy (1940).

Other sources mention the gathering of *māmaki* (*Pipturus* spp.) from the *wao lāʻau* (upland forests) of Puna, a practice which may also have occurred in the *mauka* portion of Waʻawaʻa as well. While *wauke* (paper mulberry; *Broussonetia papyrifera*) was commonly used for *kapa* (tapa) production, *kapa* was also made from the bark of the wild *māmaki* (primarily on Hawaiʻi Island) and was known for being quite exceptional, though considered second best in comparison (Brigham 1911; Kamakau 1976). *Kapa wauke* paled in comparison to *kapa māmaki*, which was exceedingly soft and strong and used to make items such as *malo* (loincloth), *pāʻū* (skirt), *kīhei* (shawl covering), and *kapa moe* (sleeping *kapa*) (Handy and Pukui 1998b; Kamakau 1976; Neal 1965). However, unlike the former, *kapa māmaki* could not withstand getting wet, making it a poor choice for items that would need to be washed. According to Kaaiakamanu and Akina (1922), the strength of *māmaki* wood also made it a prime choice for *kapa* beater implements.

Puna boasted three types of *kapa māmaki* specifically associated with the district: *kapa oʻu holo wai o Laʻa*, *kapa palaʻā*, and *kapa ʻeleuli o Puna*. Theʻ Ōlaʻa region of Puna specifically was famed for its *kapa ʻoʻu holo wai o Laʻa*, a special *kapa* dyed differently on both sides which was associated with the patron of *hula*, the goddess Laka (Fornander 1918-1919; Kent 1986). This *kapa* was utilized during Hawaiian *kuni* divination ceremonies which entailed the burning of *maunu* (bait consisting of the body refuse of the victim including saliva, hair, and/or nails) wrapped in *kapa ʻoʻu holo wai o Laʻa* in order to bring death upon the *kahuna* (sorcerer) who was responsible for the praying to death of the victim (Alexander 1891). *Kapa palaʻā* was another type of *kapa māmaki* directly associated with Puna which was dyed a reddish-brown color using the *palaʻā* (lace fern; *Sphenomeris chinensis*) which grew

abundantly throughout the district (Pukui and Elbert 1986). A rare, gray-colored perfumed kapa called *kapa ʻeleuli o Puna* was also a product of the district.

In addition to being used to make *kapa*, the *māmaki* was also an essential ingredient in traditional medicinal preparations and its fruit, seeds, and leaves were used to treat various ailments in adults, children including weakness and general debility, thrush, digestion issues, cuts and sores, and the fruit and seeds were eaten by expectant mothers beginning at five months along in their pregnancies (Gutmanis 2015; Kaaiakamanu and Akina 1922). Additionally, Krauss (1993) relates that fresh *māmaki* leaves were placed in an *ipu* (bottle gourd; *Lagenaria* sp.) with hot stones and covered with fresh water where they could be steeped until drunk as a cleansing tonic.

ʻAwa (kava; *Piper methysticum*), a plant described as the "cherished narcotic" of the Hawaiian people was grown along the lower edges of the forests or in forest clearings and was traditionally utilized by all socioeconomic classes for pleasure, relaxation, and ceremonial purposes (Handy 1940). *ʻAwa* was an important element in the treatment of both physical and spiritual ailments in living subjects by *kahuna* (priests) and was identified as a crucial ingredient in ritualistic use in which its procurement and preparation were handled with the utmost care. To consume *ʻawa* required careful preparation: first its roots were chewed (pounded in later years) into balls (*mana* or *mana ʻawa*) and then strained with the stem fibers of the *ahuʻawa*. Of all the districts of Hawaiʻi Island, Puna was the most renowned for its *ʻawa*, producing the famous yellow-barked *ʻawa kau lāʻau* (also ka *ʻawa lāʻau o Puna*, or parasitic tree *ʻawa*, which was particularly strong (ibid.). Emerson reported that Pele's sister, Hiʻiaka, witnessed "two birds. . . sipping together in loving content of the water that had collected in the crotch of a tree, in which also was growing an awa plant.—Such nature-planted awa was farmed as being the most toxic of any produced in Puna" (1915:14). The scene inspired Hiʻiaka to create the following *mele* of Puna's famed ʻ*awa*:

O ka manu mukimuki,	O bird that sips with delight
Ale lehua a ka manu	the nectar-bloom of lehua,
O ka awa ili lena	Tasting the yellow-barked awa
I ka uka o Ka-liʻu;	That climbs in Ka-liu's uplands;
O ka manu haʻihaʻi lau awa o Puna:-	O bird that brews from this leafage
	Puna's potentest awa grows
Aia i ka laau o ka awa ona o Puna,	Aloft in the crotch of a tree;-
O Puna, hoʻi, e-e!	Most potent this awa of Puna!
(ibid.)	

Early Historic Accounts of Waʻawaʻa, the Lava Flow of 1840, and the Early Development of the *Alanui Aupuni* (1823-1847)

Following the death of Kamehameha I in 1819, the Hawaiian religious and political systems underwent a radical transformation; Kaʻahumanu proclaimed herself "*Kuhina nui*" (Prime Minister), and within six months the ancient *kapu* system was overthrown. In October of 1819, seventeen Protestant missionaries had set sail from Boston to Hawaiʻi. They arrived in Kailua-Kona on March 30, 1820 to a society whose spiritual system has just been overturned. Many of the *aliʻi*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western-style and adopted their dress and religion. As missionaries began to introduce Christian concepts and beliefs they also set forth the process of rendering a once purely oral language into written form and literacy was quickly taken up as a national endeavor (Nogelmeier 2010). Soon, many *aliʻi* were rewarding these early missionaries with land and positions in the Hawaiian government. During this period, the demands of the *aliʻi* to cut sandalwood overburdened the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *aliʻi* who were no longer under any traditional constraints (Kuykendall and Day 1976; Oliver 1961). The lack of control of the sandalwood trade soon led to the first Hawaiian national debt, as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawaiʻi went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry.

Some of the earliest written descriptions of Puna come from the accounts of the first Protestant Missionaries to visit the island These written accounts left by early visitors to the Island of Hawaiʻi offer insight into what life may have been like for the residents of the district. 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. Walking southwest to northeast along the southeastern shore of the District of Puna on the *alaloa* with his missionary companions Asa Thurston and Artemas Bishop, Ellis' writings contain descriptions of residences and practices that are applicable to the general project 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* [*māmaki*] and other tapas of Ora [ʻŌlaʻa] and the more fertile districts of Hawaii. (Ellis 1827:264)

Continuing their journey westward along the Puna coast from Kapoho, Ellis' party journeyed over the rugged lava through the *ahupuaʻa* of Kahuwai, Waʻawaʻa, and Nānāwale as they headed to Honolulu just northwest of the current project area:

> . . . Our way now lay over a very rugged tract of country. Sometimes for a mile or two we were obliged to walk along on the top of a wall four feet high and about three feet wide, formed of fragments of lava that had been collected from the surface of the enclosures which these walls surrounded. We were, however, cheered with a beautiful prospect; for the land, which rose gradually towards the mountains to a few miles to the westward of us, presented an almost enchanting appearance. The plain was covered with verdure; and as we advance, a woody eminence, probably some ancient crater, frequently arose from the gently undulated surface, while groups of hills, clothed with trees of various foliage, agreeably diversified the scene. The shore, which was about a mile to the eastward of us, was occasionally lined with the spiral pandanus, the waving cocoa-nut grove, or the clustering huts of the natives. At half-past four we reached Kahuwai, where we sat down and took some refreshment, while Makoa was engaged in bringing the people of the place together. About one hundred and fifty assembled around the door, and were addressed. After conversing some time, we travelled in an inland direction to Honoruru [Honolulu], a small village situated in the midst of a wood, where we arrived just at the setting of the sun. (Ellis 1827:294-295)

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 Hawaiʻi in 1832, and the Reverend 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; the smallest total district population on the island of Hawaiʻi. In 1836, Coan traveled to Puna and recorded the following observations of the lava covered coastline and verdant uplands:

> Its shore line, including its bends and flexures, is more than seventy miles in extent. For three miles inland from the sea it is almost a dead level, with a surface of pahoehoe or field lava, and *a-a* or scoriaceous lava, interspersed with more or less rich volcanic soil and tropical verdure, and sprinkled with sand-dunes and a few cone and pit-craters. . . Everywhere the marks of terrible volcanic action are visible. The whole district is so cavernous, so rent with fissures, and so broken by fiery agencies, that not a single stream of water keeps above-ground to reach the sea. All the rain-fall is swallowed by the 10,000 crevices, and disappears, except the little that is held in small pools and basins, waiting for evaporation. The rains are abundant, and subterranean fountains and streams are numerous, carrying the waters down to sea level, and filling caverns, and bursting up along the shore in springs and rills, even far out under the sea. Some of these waters are very cold, some tepid, and some stand at blood heat, furnishing excellent warm baths. There are large caves near the sea where we enter by dark and crooked passages, and bathe by torchlight, far underground, in deep and limpid water.
>
> Puna has many beautiful groves of the cocoa-palm, also breadfruit, pandanus, and ohia, and where there is soil it produces under cultivation besides common vegetables, arrowroot, sugar-cane, coffee, cotton, oranges, citrons, limes, grapes, and other froots [sic]. On the highlands, grow wild strawberries, cape gooseberries, and the ohelo, a delicious berry resembling our whortleberry. (Coan 1882:39-40)

On May 30, 1840, a lava flow originating from Kīlauea Volcano issued from a subterranean crack roughly 12 miles inland from the shores of Nānāwale along the western boundary of Waʻawaʻa west of the current project area. By June 3rd the flow reached the coast where it flowed into the sea for three consecutive weeks (Figure 12). James Jackson Jarves, who was traveling from Hilo to Puna and was present in Waiakahiula Ahupuaʻa at the time, and described the trajectory of the lava flow as covering "two ʻlandsʼ only, according to the Hawaiian division of territory, those of Nanawale and Kanahikio; both sparsely populated, and quite barren" (1843:272). He also described the scene at the coast of Nānāwale:

> A mile to the east of us, at Nanawale, the lava had entered the sea, and was throwing up steam and smoke so furiously, that it had every appearance of a new crater. Hastening to it, we found it presented the same appearance as above, except that it had overflowed the old line of coast, and pushed itself fifteen hundred feet or more into the sea, forming three bold promontories, or crater-shaped hills, parallel to each other, and a few hundred feet apart. Between these the lava flowed a short distance beyond. . . Towards the sea, their sides were still so hot at to form vapor at every wash of the waves. . . (1843:268)

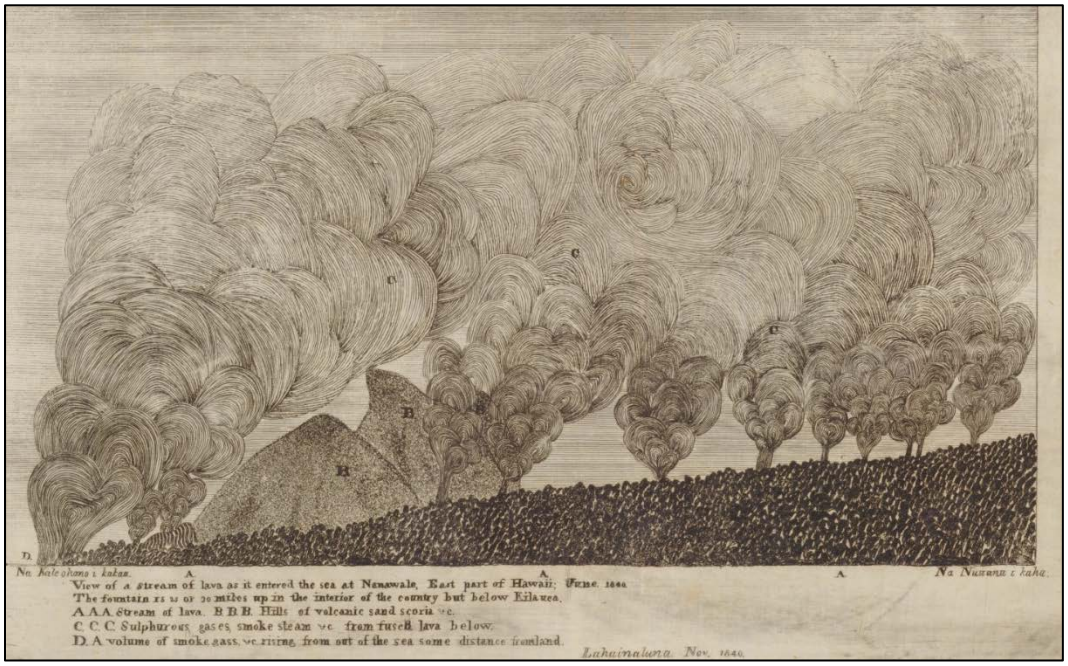


Figure 12. An engraving prepared by Lahainaluna School students Kaleohano and Nuʻuanu of the lava flow entering the ocean at Nānāwale as published in *The Polynesian* (Kaleohano and Nuuanu 1840).

Coan, who was absent from the island at time, described eyewitness accounts retold to him:

> . . . The atmosphere in all directions was filled with ashes, spray, gases, etc., while the burning lava as it fell into the water was shivered into millions of minute particles, and being thrown back into the air fell in showers of sand on all the surrounding country. The coast was extended into the sea for a quarter of a mile, and a pretty sand beach and new cape were formed. Three hills of scoria and sand were also formed in the sea, the lowest about two hundred and the highest about three hundred feet.
>
> For three weeks this terrific river disgorged itself into the sea with little abatement. Multitudes of fishes were killed, and the waters of the ocean were heated for twenty miles along the coast. The breadth of the stream where it fell into the sea, is about a half a mile, but inland it varies from one to four or five miles in width, conforming, like a river, to the fall of the country over which it flowed. The depth of the the stream will probably vary fro ten to two hundred feet, according to the inequalities of the surface over which it passed. During the flow night was converted into day on all eastern Hawaii; the light was visible for more than one hundred miles at sea; and at the distance of forty miles fine print could be read at night. (Coan in Hitchcock 1909:189-190)

Just one year later in 1841, Coan assessed the population of the Puna District. He determined that 4,371 of Puna's inhabitants resided near the shore, with just several hundred living inland. In that same year, Commander Charles Wilkes of the United States Exploring Expedition toured the Hawaiian Islands and remarked upon not only the surprisingly substantial population of natives he encountered in the vicinity of Nānāwale and the current project area, but also upon the region's unexpected agricultural bounty which appeared to be of no consequence to the surrounding barren terrain:

> 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 of 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. (Wilkes 1845:201-202)

Upon examining the landscape which had been consumed by the 1840 flow, Wilkes commented upon the appearance of the district (Figure 13) and mentioned three new sand hills (Figure 14) that had been formed at the coast in Nānāwale as a result of the eruption:

> The width of the lava stream was found to be three-fourths of a mile. The portion of it nearest the sand-hills is in a very confused and rugged state, and there are some large accumulations in mounds, that have been forced up by pressure from above and beneath. It is said to have passed over the ancient village of Nanavalie [Nānāwale], and left upon its site and cultivated grounds a deep layer of rock. The natives told us that they had remained till the last moment, hoping the torrent might be stayed or turned aside, and thus save their houses. It however swept on, and they had barely time to remove the few articles they possessed. . . (Wilkes 1845:203)

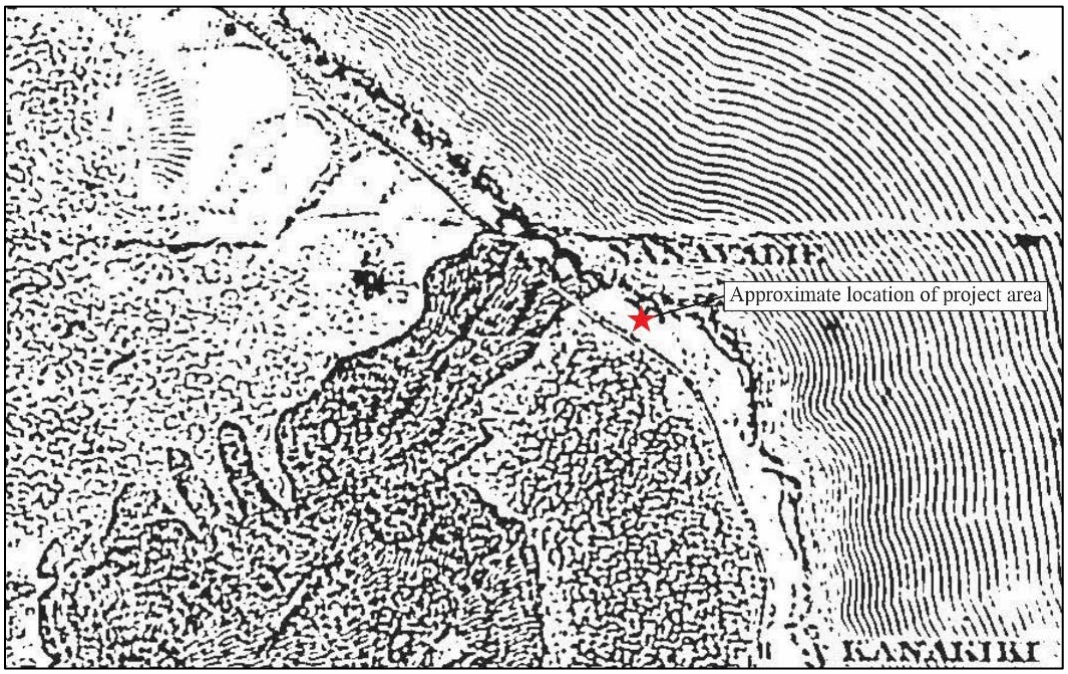


Figure 13. Portion of Hawai'i Registered Map No. 424 prepared in 1841 during the United States Exploring Expedition showing approximate location of the current project area.

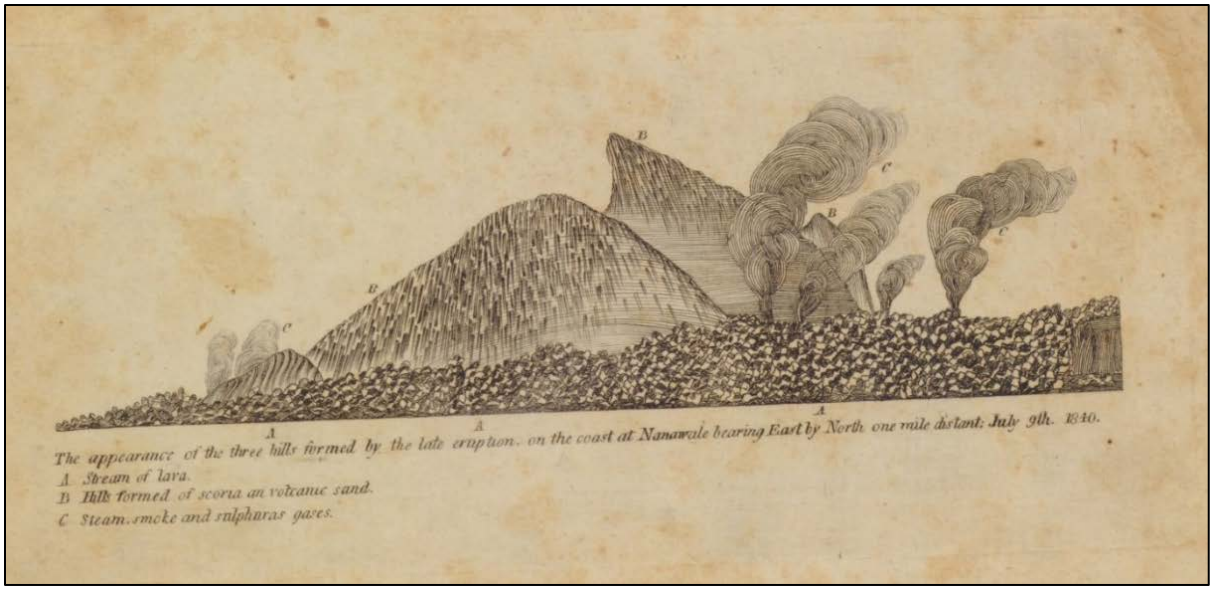


Figure 14. An engraving showing the three sand hills formed by the eruption at the coast in Nānāwale (The Polynesian 1840).

Although the *alaloa*, later referred to as the Puna Trail, is not explicitly mentioned by name in historic accounts from the earlier part of the nineteenth century, it nevertheless served as the route taken by early explorers through the district such as Ellis, Coan, Jarves, and Wilkes. The introduction of horses to Hawaiʻi and their increasingly widespread use throughout the nineteenth century ultimately led to a transition in traditional transportation methods and eased arduous, long-distance travel, facilitating access to "mission stations, landings, and key areas of resource collection" (National Park Service Ala Kahakai National Historic Trail 2009). As a result, narrow footpaths such as the *alaloa* and *mauka-makai* trails largely fell into disuse, and were replaced by straighter, wider, and more level paths that could accommodate donkeys, horses, and carts, while also providing a more direct trajectory between destinations (Mills 2002), resulting in the development of a western-style Government Road (*Alanui Aupuni*).

Construction of the Government Road along the northeastern coast of Hawaiʻi Island, through Puna (which extends immediately adjacent to the southern boundary of the current project area) where it is also referred to as the Puna Trail, began in the 1840s (Maly 1999a). In many places the new road overlaid the older, nearshore *alaloa*. Work on the road was funded in part by government appropriations, and through the labor or financial contributions of area residents and prisoners working off penalties. Another account provided by Wilkes during his journey through Puna illustrates the extremely rugged condition of the Puna Trail in the vicinity of the project area in Nānāwale during the 1840s:

> 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 [Nanawale] 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 1845:205)

In 1846, Chester S. Lyman, "a sometime professor" at Yale University visited Hilo, Hawaiʻi, and stayed with Titus Coan. Traveling the almost 100 mile long stretch of the "Diocese" of Mr. Coan, Lyman reported that the district of Puna had somewhere between 3000-4000 inhabitants. Entering Puna from Hilo, Lyman traveled from Keaʻau along a coastal path "on a lava bed immediately on the margin of the sea" (1925:95) towards Koae, southeast of the current project area. Lyman offered the following observations:

> Our course the first part of the way lay about S.E. thro' a level, lava country with very light soil. The people are necessarily poor. A bare subsistence is all they can obtain & scarcely that. Probably there are not $10 in money in all Puna & it is tho't that not over 1 in 500 has a single cent. The sight of some of these potatoe patches w'd make a discontented N.E. farmer satisfied with his lot. Yet I have no where seen the people apparently more contented & happy. And Mr C[oan] testifies that in morals they far surpass the natives of the more fertile districts. They have neither time nor means to be vicious. (Lyman 1925:94)

The Legacy of the *Māhele ʻĀina* of 1848

By the mid-nineteenth century, the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. By 1840 the first Hawaiian constitution had been drafted and the Hawaiian Kingdom shifted from an absolute monarchy into a constitutional government. Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, the King (Kamehameha III) and his high-ranking chiefs decided to separate and define the ownership of all lands in the Kingdom (King n.d.). This change was further promoted by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be taken from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the King, the chiefs and *konohiki*, and their tenants (the *makaʻāinana* or common people). In 1845 the legislature created the "Board of Commissioners to Quiet Land Titles" (more commonly known as the Land Commission. All land claims, whether by chiefs for entire *ahupuaʻa* or by tenants for their house lots and gardens, had to be filed with the Land Commission within two years of the February 14, 1846, but the deadline was extended several times for chiefs and *konohiki* (Soehren 2005).

The King and some 245 chiefs (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). Once the King and his chiefs accepted the principles of the Privy Council, the *Māhele ʻĀina* (Land Division) was completed in just forty days (on March 7, 1848). The names of all of the *ahupuaʻa* and *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*, that paid tribute to the ruling chief and not to the chief of the *ahupuaʻa*) of the Hawaiian Islands and the chiefs who claimed them, were recorded in the *Māhele* Book (Soehren 2005). As this process unfolded, King Kamehameha III, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. Accordingly, the day after the division with the last chief was recorded in the *Buke Māhele* (*Māhele* Book), King Kamehameha III commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike the King, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their awards. The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land," while the lands retained by Kamehameha III became known as "Crown Land," and the lands received by the chiefs became known as "*Konohiki* Land" (Chinen 1958:vii; 1961:13). All lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed. This process expedited the work of the Land Commission. During this process, Waʻawaʻa Ahupuaʻa was retained as Government Land.

Native tenants of the lands that had been distributed among the Crown, the various *Konohiki*, and the Government could claim and acquire title to parcels that they actively lived on or farmed. The Board of Commissioners oversaw the program and administered these *kuleana* parcels as Land Commission Awards. Claims for *kuleana* had to be submitted during a two-year period that expired on February 14, 1848 to be considered. All of the land claimants were required to provide proof of land use and occupation, which took the form of volumes of native registry and testimony. The claims and awards were numbered, and the LCAw. numbers, in conjunction with the volumes of documentation, remain in use today to identify the original owners and their use of the *kuleana* lands. The work of hearing, adjudicating, and surveying the claims required more than the two-year term, and the deadline was extended several times for the Land Commission to finish its work (Maly 2000). In the meantime, as the new owners of the lands on which the *kuleana* were located began selling parcels to foreigners, questions arose concerning the rights of the native tenants and their ability to access and collect the resources necessary for sustaining life. The "Enabling" or "*Kuleana* Act," passed by the King and Privy Council on December 21, 1849, clarified the native tenants' rights to the land and resources, and the process by which they could apply for fee-simple interest in their *kuleana*. The work of the Land Commission was completed on March 31, 1855. A total of 13,514 *kuleana* were claimed by native tenants throughout the islands, of which 9,337 were awarded (Maly 2000). No *kuleana* parcels were awarded within Waʻawaʻa Ahupuaʻa, thus, there are none situated within the current project area.

Royal Patent Land Grants and Land Patent Grants Sold in Waʻawaʻa Ahupuaʻa

In conjunction with the *Māhele*, the King also 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* of 1848 should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of the Government Lands. Unlike in the *kuleana* claims, where claimants stated their use of the land, the grant records are silent regarding the grantees' intended use. The Royal Patent deeds and survey notes do contain some limited information about geographical features of the grant lands, and describe boundary markers, such as rock piles and vegetation, but they generally do not say anything about improvements to the land or land use.

Although the *Māhele ʻĀina* and the selling of government lands in the form of grants during the middle to late 1800s was directed at encouraging native tenants onto fee-simple parcels of land from which they could earn a living, it actually resulted in the land becoming a commodity to be bought and sold (Kelly 1969). Those with money could buy land, and those without, could not. As one Hawaiian writer put it, "if anyone of us becomes assistants of the chiefs, his pay for the most part is in goods; the most of the dollars are for the foreign chiefs… foreigners come on shore with cash, ready to purchase land; but we have not the means to purchase lands; the native is disabled like one who has long been afflicted with a disease upon his back…we are not prepared to compete with foreigners" (Kenui et al. 1845:119). The majority of the Hawaiian population at this time was still participating in a subsistence economy, while foreigners had access to extensive monetary resources. As a result, many Hawaiian families, who were new to land ownership and the market economy, were dispossessed of their homes and fields, and foreigners were able to buy up large tracts of land. The *Kuleana* Act of August 6, 1850, even prohibited the landless *makaʻāinana* from conducting economic activities on unassigned government lands from which they had previously secured a living. These lands were increasingly falling into the hands of foreigners through government leases.

A total of four land grants were sold in the *mauka* half of Waʻawaʻa Ahupuaʻa: Royal Patent Grant Nos. 997 *ʻāpana* 1 and 2 to Haole in 1852, 1363 to Pakaka in 1854, and 2687 *ʻāpana* 2 to Manamana in 1860 (Table 1 and Figure 15). The *makai* portion of Waʻawaʻa, encompassing 437 acres, was characterized as Government remnant land, and the boundaries of the entire *ahupuaʻa* were surveyed and mapped by A.B. Loebenstein in 1893 (Figure 16). A description of Waʻawaʻa's government remnant boundaries as surveyed by Loebenstein were published in a Copy of Survey Furnished (C.S.F. No. 596) description as follows:

> Beginning at the East corner of this, at the foot of the Kokolau ridge, & the lower edge of the Government road, the initial point bearing N. 64°31' W "true", distant 122 feet from the large rock with a ▲, marking the Haw'n Gov't Survey ▲2nd Station "Kokolau," – the boundary runs
>
> 1-S.58°31'W. "true" 5910 ft. along Kahuwai. L.C.A. 1713-Kamamalu, to the centre one of three large piles of stones, a rock marked ▲ under the centre pile. Thence
>
> 2-N. 34°40'W. " 3824. Along apana 2 of Gr. 2687 Manamana, to the north angle thereof, a rock marked ▲ under the centre pile of three large piles of stones. Thence
>
> 3-N.57°48'E. " 2755. The boundary running along the edge of the lava flow of 1840,-to the west angle of apana 1 of Gr. 997-Haole. Thence
>
> 4-S.61°52'W. " 1056. Along said Grant to the South angle thereof, thence
>
> 5-N.20°38'E " 645. " " " " East " " at upper edge of the Gov't road, thence
>
> 6-N.58°10'W. " 930, along said grant to the north angle thereof in the hollow at the edge of the gov't road at the edge of the lava flow of 1840, thence
>
> 7-S.79°48'E. " 3420, along the seacoast, the boundary following the winding of thereof at high water mark, to the North angle of Grant 1363 – Pakaka, at a projecting point of the sea coast just West of the old canoe landing & the spring
>
> 8-S.39°54'W. " 1136, along said grant to the Puhala at the end of the stone wall which marks the West angle of said grant, thence
>
> 9-S.71°25'E. "true" 1965 ft. along said grant to the Initial Point.
>
> Containing an area of 437.00 acres.

> Reserving through said Government Remainder a right of way, to lead from the Government Road to the ancient pathway extending from the East angle of the Manamana grant to the lava flow of 1840.
>
> Reserving furthermore the present Gov't Road & a strip of 25 feet in width on either side thereof.
>
> The aforesaid area of 437.acres does not include the coconut grove said to be apana 2 of Grant 997 – Haole, the North angle of which bears from the Haw'n Gov't Survey ▲2nd Station "Kokolau," N. 89°35'W. "true" distant 3605 ft.
>
> A.B. Loebenstein Surveyor
> June 24th 1893

The government remnant land of Waʻawaʻa Ahupuaʻa was offered for public auction on February 28, 1894 by James A. King, the Minister of the Interior for the Provisional Government of Hawaiʻi (Figure 17). These lands, which include the project area, were purchased as Land Patent Grant No. 3687 in 1894 for $437.00 by missionary descendant and former Commissioner of Boundaries for Hawaiʻi Island, Rufus Anderson Lyman (see Table 1 and Figure 15). Conveyance of the government remnant of Waʻawaʻa as a Land Patent Grant rather than a Royal Patent Grant (with respect to previously sold plots in the *mauka* portion of the *ahupuaʻa*) is the direct result of the omittance of the word "Royal" following the illegal overthrow of the Hawaiian Kingdom government on January 17, 1893. As specified in Loebenstein's survey notes, Lyman's grant included the entire *makai* portion of Waʻawaʻa (Figure 18), presumably excepting the previously designated land grants sold to Haole and Pakaka as Royal Patent Land Grant Nos. 997 *ʻāpana* 1 and 2 and 1363, although survey notes annotated on Lyman's grant map in the Land Patent Grant documentation (Figure 19) only specifies the exclusion of the coconut tree grove associated with *ʻāpana* 2 of Haole's grant:

> Reserving through said Gov't remainder a right of way, to lead from the Government road, to the ancient pathway extending from the east angle of the Manamana grant to the lava flow of 1840.
>
> Reserving furthermore the present Government road, and a strip 25ft in width on either side thereof. The aforesaid area of 437 acres does not include the cocoanut grove, said to be apana 2 of Grant 779 Haole, the north corner of which bears from the Hawn' Gov't Survey ▲2nd Station, Kokolau N. 89°55' W. true distance 3600 feet.

Hawaiʻi Registered Map No. 1684 prepared in October 1893 by Loebenstein (see Figure 16) depicts the project area within Grant No 3687 in an expanse of "open country below gov't road" along the coastline. The project area is shown immediately *makai* of the "Government Road," the alignment of which is coterminous with the current trajectory of the Government Beach Road, and just *makai* of Grant No. 997 *ʻāpana* 1 located on the opposite edge of the roadway. A trail labeled "ancient trail of Kahuwai paved road" can be seen extending *makai* from the southwestern corner of Waʻawaʻa Ahupuaʻa in an area labeled "heavy ohia forest on aa." Slightly *mauka* of the boundary delineating the *mauka* portion of Waʻawaʻa encompassing the entirety of Grant No. 2687 *ʻāpana* 2 and the *makai*, government remnant section identified as Lyman's grant, the trail diverges with one branch extending slightly southeast along the southern boundary of Waʻawaʻa for a short distance before becoming undetectable. Alternatively, the other branch continues northeast through an area labeled "pahoehoe covered with grass & puhala" into the *mauka* third of Lyman's grant parcel before diverging again into two separate trail routes leading *makai* towards the Government Road at a waterhole labeled "Keana o Maui." One of these trail segments extends in a northerly direction and partially bisects Grant No. 997 *ʻāpana* 1 before terminating at the *mauka* edge of the Government Road. Alternatively, the other trail segment continues in a more easterly direction past Grant No. 997 *ʻāpana* 2 and terminates at the *mauka* edge of the Government Road which roughly parallels the southern boundary of Grant No. 1363 in the eastern corner of Waʻawaʻa.

A later map, prepared by Loebenstein in 1895 one year after the purchase of Lyman's grant (Figure 20), depicts Waʻawaʻa in far less detail than his previous map (see Figure 16). However, it does illustrate what appears to be a modification of the *mauka-makai* "ancient trail of Kahuwai paved road" as extending in a relatively straight line to the coast rather than branching northwest and southeast towards Land Grant Nos. 9971 *ʻāpana* 1 and 1363. Furthermore, this map shows another trail leading from "Lae a Kumu" at the coastline *mauka*, where it extends towards the ancient trail of Kahuwai adjacent to the Government Road before continuing due south across the *ahupuaʻa* boundary and into the "Kokolau Woods" of Kahuwai.

Table 1. Grant parcels purchased within Waʻawaʻa Ahupuaʻa.

Grant No.	*Grantee*	*Year*	*Acreage*	*Price*
997:1 and 2	Haole	1852	15.66	$8.00
1363	Pakaka	1854	55.5	$21.00
2687:2	Manamana	1860	367	$73.40
3687*	R.A. Lyman	1894	437	$437.00

***Grant includes the current project area**

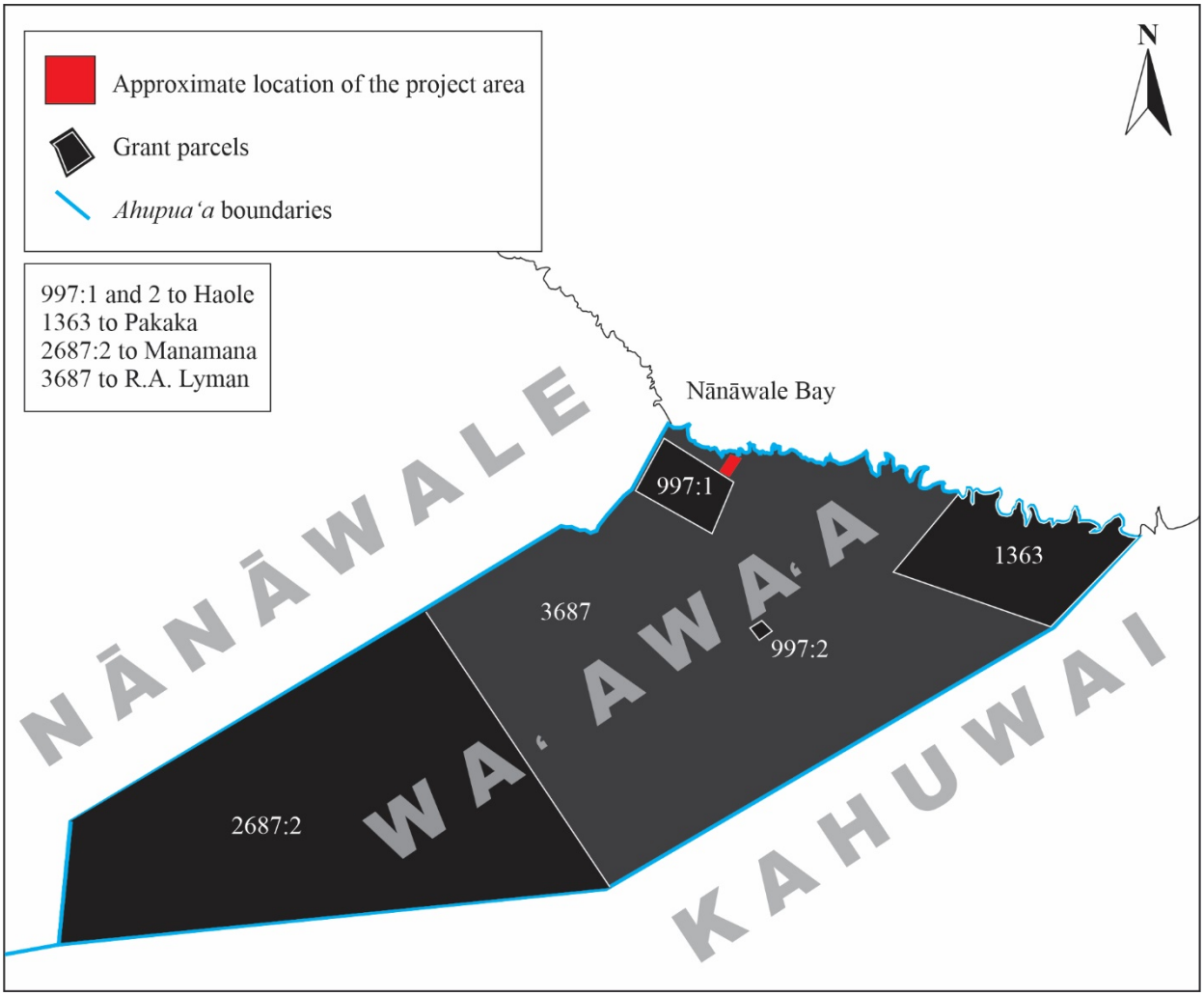
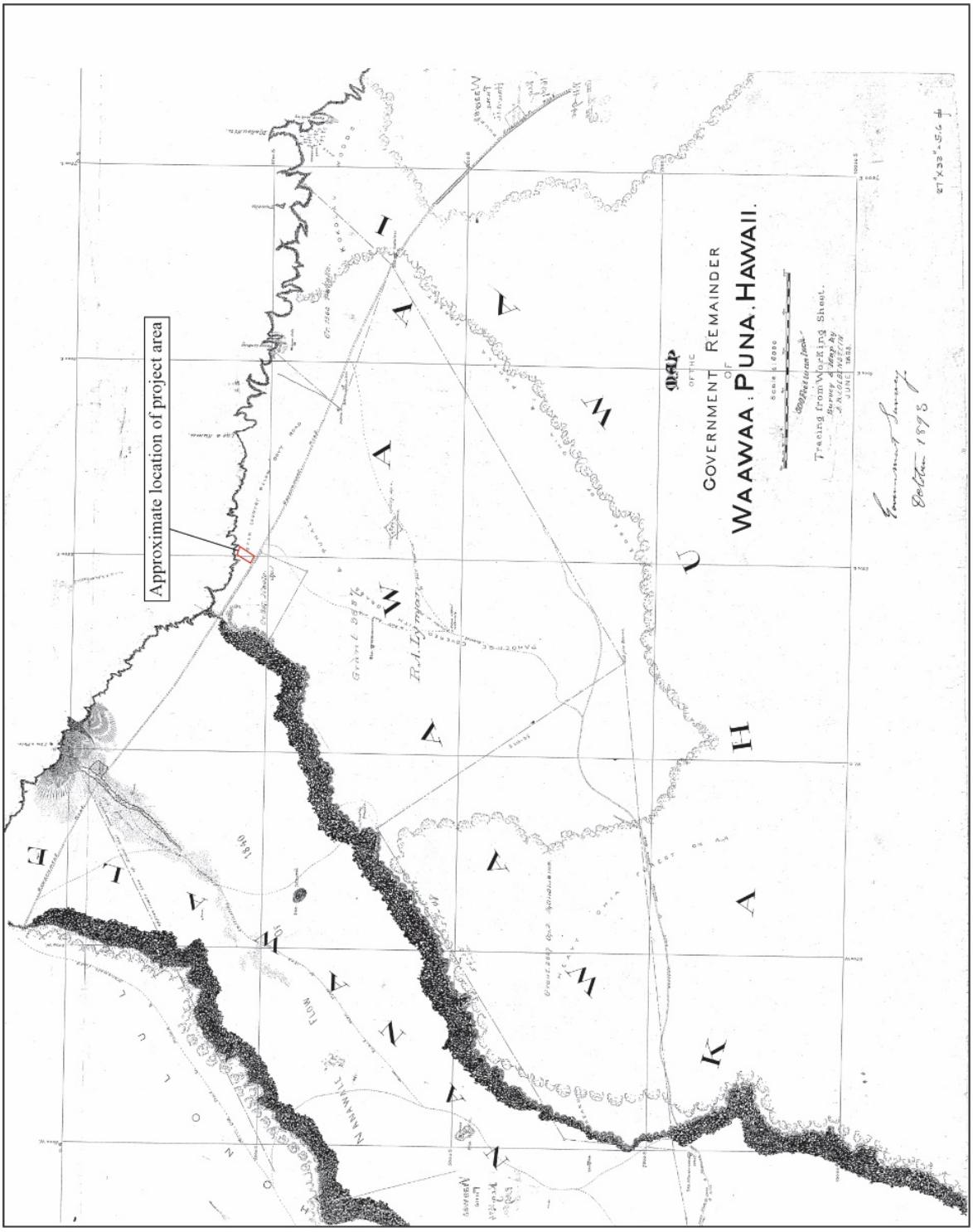
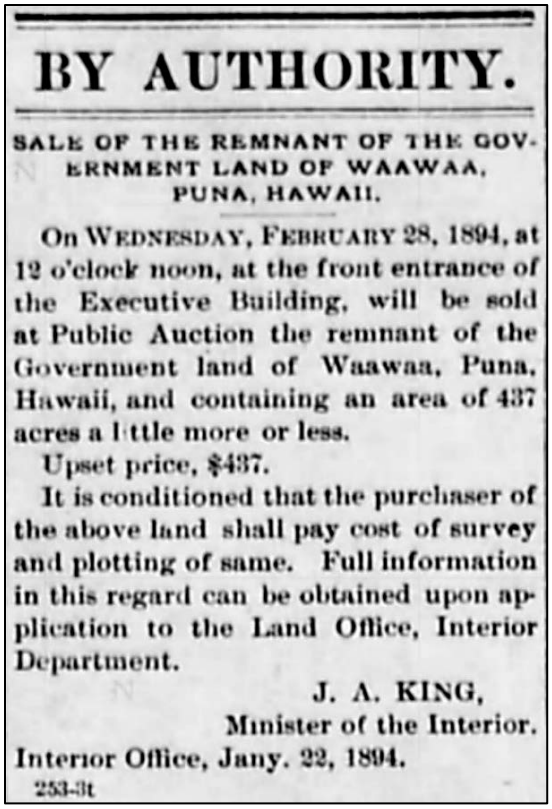


Figure 15. Land Grants sold within Waʻawaʻa Ahupuaʻa.


Approximate location of project area
MAP
OF THE
GOVERNMENT REMAINDER
OF
WAAWAA, PUNA, HAWAII.
Scale 1:6000
Tracing from Working Sheet.
Survey & Map by
A. B. Loebenstein
JUNE 1893
Government Survey
Dated 1893
R.J. Lymans
Grant 8287
Grant 8287
Grant 8287



BY AUTHORITY.

SALE OF THE REMNANT OF THE GOVERNMENT LAND OF WAAWAA, PUNA, HAWAII.

On WEDNESDAY, FEBRUARY 28, 1894, at 12 o'clock noon, at the front entrance of the Executive Building, will be sold at Public Auction the remnant of the Government land of Waawaa, Puna, Hawaii, and containing an area of 437 acres a little more or less.

Upset price, $437.

It is conditioned that the purchaser of the above land shall pay cost of survey and plotting of same. Full information in this regard can be obtained upon application to the Land Office, Interior Department.

J. A. KING,
Minister of the Interior.

Interior Office, Jany. 22, 1894.

253-3t

Figure 17. Newspaper clipping from January 22, 1894 (The Hawaiian Star 1906)

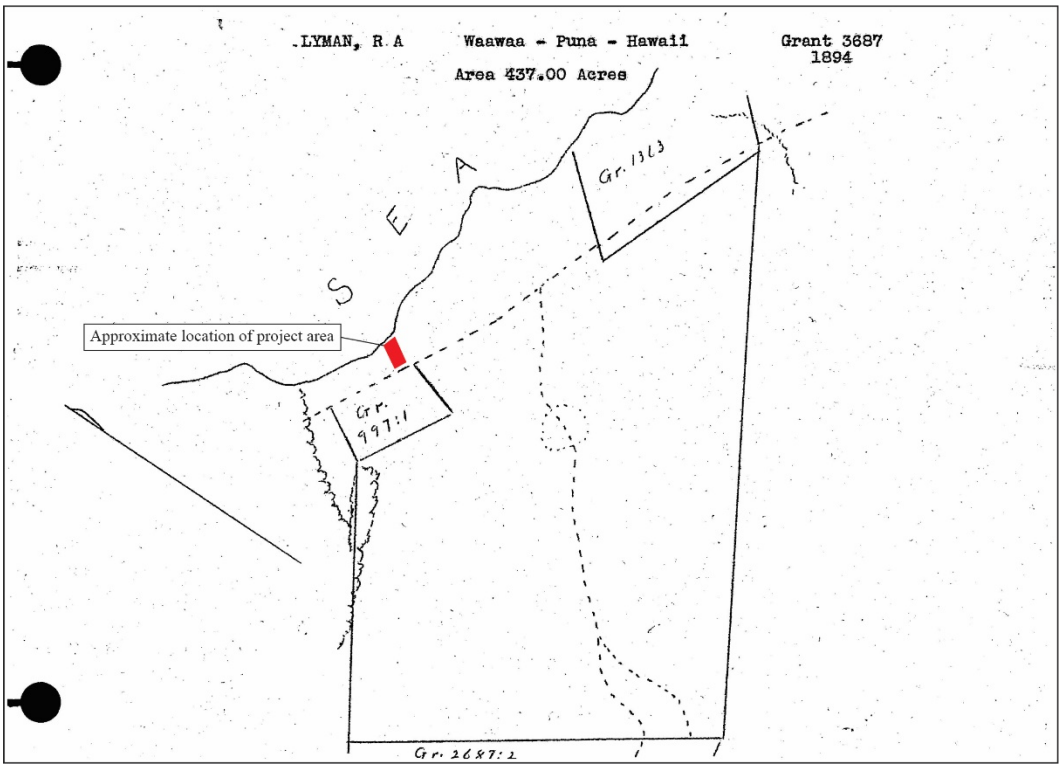


Figure 18. An 1894 map showing approximate location of the project area (shaded red) within Grant No. 3687 to R.A. Lyman (www.kipukadatabase.com).

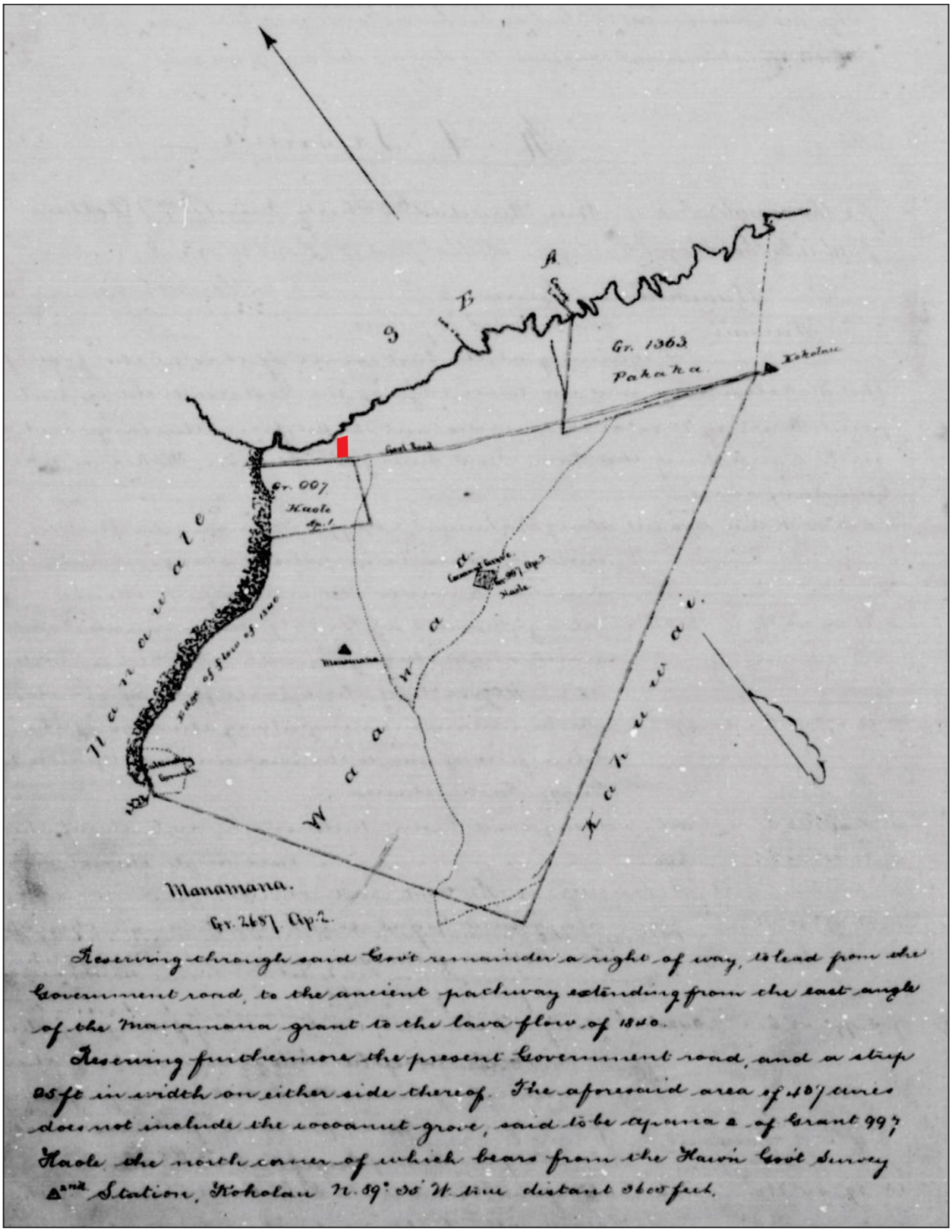


Figure 19. Approximate location of project area (shaded red) within the government remnant portion of Wa‘awa‘a (www.kipukadatabase.com).

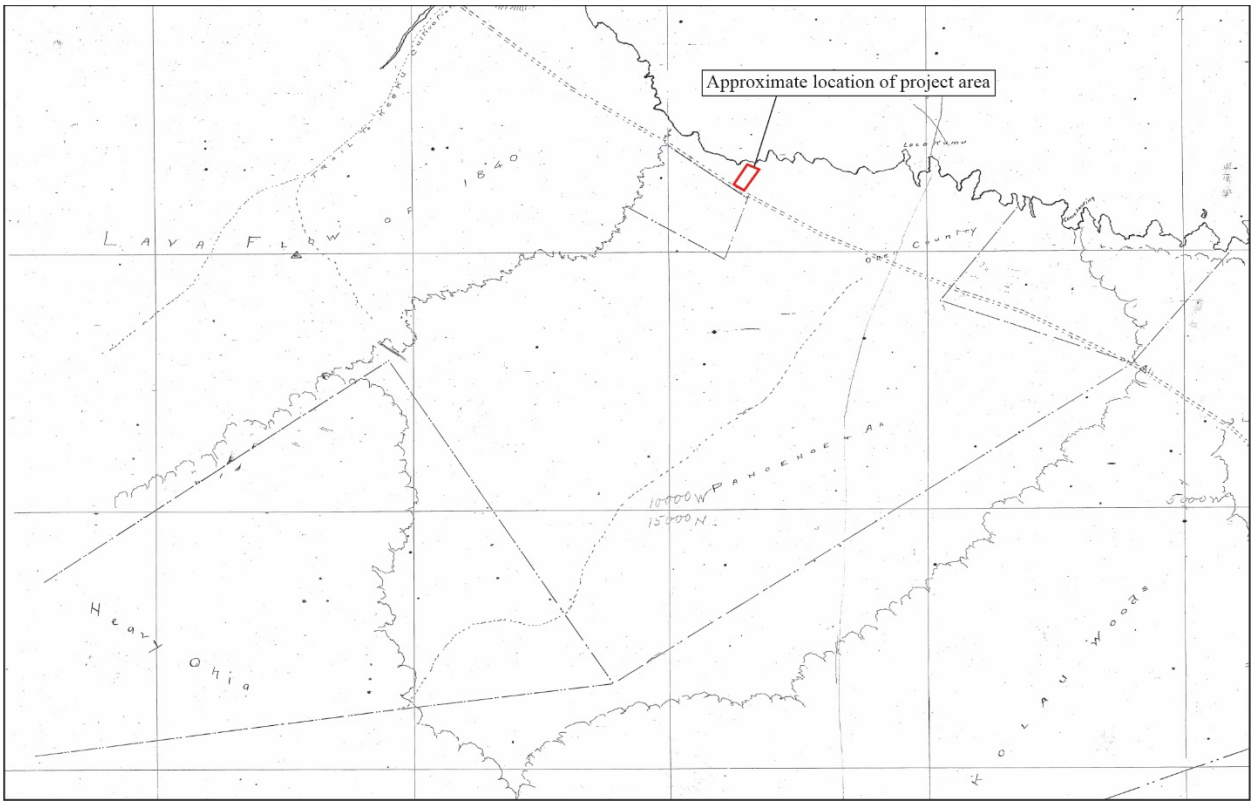


Figure 20. Portion of Hawai‘i Registered Map No. 1883 prepared by A.B. Loebenstein in 1895 showing project area location (outlined in red) within Wa‘awa‘a Ahupua‘a.

Boundary Commission Testimony (1862-1876)

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Hawaiian Kingdom to legally set the boundaries of all the *ahupua‘a* that had been awarded as a part of the *Māhele*. Subsequently, in 1874, the Commissioners of Boundaries were authorized to certify the boundaries for lands brought before them. The primary informants for the boundary descriptions were old native residents of the lands, many of which had also been claimants for *kuleana* during the *Māhele*. This information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and transcribed in English. Although hearings for most *ahupua‘a* boundaries were brought before the Boundary Commission and later surveyed by Government employed surveyors, in some instances, the boundaries were established through a combination of other methods. In some cases, *ahupua‘a* boundaries were established by conducting surveys on adjacent *ahupua‘a*. In cases where the entire *ahupua‘a* was divided and awarded as Land Claim Awards and or Government issued Land Grants (both which required formal surveys), the Boundary Commission relied on those surveys to establish the boundaries for that *ahupua‘a*. Although these surveys aided in establishing the boundaries, they lack the detailed knowledge of the land that is found in the Boundary Commission hearings.

While the boundaries for Wa‘awa‘a do not appear to have ever been brought before the Boundary Commission, testimony for the adjacent *ahupua‘a* of Kahuwai was provided to the Boundary by two individuals, Kamahele and Kahula, on February 29, 1876 at the Hilo courthouse (Boundary Commission 1876:403-405). Although both men accompanied D.B. Lyman on the survey of Kahuwai’s boundaries, Kahula’s testimony is less detailed concerning Wa‘awa‘a and thus, is not presented below. Conversely, Kamahele’s testimony provides insights regarding the traditional landscape of Wa‘awa‘a in the vicinity of the project area. Kamahele, a native of Kahuwai, testified to the boundaries of Kahuwai as learned from the former *konohiki* of the *ahupua‘a*, Kapou (underlining, italicization, and bolding added for emphasis):

> I was born at **Kahuwai**, **Puna**, **Hawaii** at the time of going after sandalwood at **Ohaikea**. Have always lived there and am a *kamaaina* of the land. I went with D.B. Lyman. . . when he surveyed the land. It was some years since. I do not remember how long. Kapou (now dead) was the *kamaaina* who pointed out the boundaries at that time, and the land was surveyed to the boundaries pointed out. Kapou was a middle aged man, and was the *konohiki* of the land. I knew part of the

> boundaries before, but had never been all around the land with the *kamaaina*, and had the boundaries pointed out to me.
>
> The land of **Halepuaa** bounds this land at the shore on the *Puna* side, and the boundary between them is at a place called **Ka**. Kapahe‘e’s purchase on **Halepuaa** bounds it there, *mauka* of that Kanalaeole’s land bounds it. We surveyed across the land from one side to the other at **Govt road**, and surveyed up this side along boundary of **Waawaa**. Place called **Ponelu** [Po‘onelu] is the boundary at shore between this land and **Waawaa**, thence the boundary runs *mauka* along Pakaka’s purchase on **Waawaa** & **Govt Road**, and *mauka* to a place called **Kawakahikukui**. There we returned to **Govt road** and surveyed up old trail in middle of land to **Heakeo** a point at lava flow of 1840; There we surveyed across the land to boundary of **Nanawale** on **Hilo** side of this land, and built a pile of stones there on boundary. The land of **Waawaa** ends a little *mauka* of Pakakas purchase, and then land of **Nanawale** bounds this land on the **Hilo** side, at place called **Keakuapio** where the old trails from **Nanawale** and this land join, and from this point to **Heakeo** the trail is boundary of this land. Altogether we surveyed across land to boundary of the land of **Kanehiki** to *hau* grove called **Mauu**. Part of *hala* was covered by lava flow. We built a pile of stones on the boundary. . . From **Heakeo** we surveyed up old trail on boundary between this land and **Nanawale** across the lava flow to place on the **Hilo** side of the flow called **Naakiolaola** where old trail from the **Hilo** side of **Nanawale** joins this road; Thence *mauka* the land of **Nanawale** is the road, and the land of **Kahuwai** lays on the **Puna** side of road, and land of **Waiakahiula** on **Hilo** side to place called **Kawaimaohiohi** the *mauka* end of this land. There used to be water there, and *maohiohi* [perhaps *mā‘ohi‘ohi*, Hawaiian mint] is now growing there. We arrived to a stone and marked it, at this point the land of **Nanawale** again spreads out and cuts this land off. We surveyed across the land at place called **Pahoa** to cocoanut tree called **Kanaana**, and marked the tree. I do not remember whether we surveyed across the land anywhere between **Heakeo** and **Wainaohiohi** or not. Manamana owned a piece of land at the *mauka* end of **Kahuwai**. This land had ancient fishing rights extending out to sea.
>
> Cross-examined
>
> Kahula went with us when we surveyed the land.

Nā Inoa ‘Āina and Places of Interest in Wa‘awa‘a Ahupua‘a

Toponymy or the study of *inoa ‘āina* (Hawaiian place names) provides additional information about a place and its history. *Inoa ‘āina* are recorded and recounted in a variety of Hawaiian oral arts including, *oli* (chants), *mele* (songs), *mo‘olelo* (stories), *nane* (riddles) and *‘ōlelo no‘eau* (proverb and poetical expressions). Since the introduction of the written language, place name information has been recorded in ethnographic surveys, historic maps, and a number of early historical documents including *Māhele ‘Āina* records, Boundary Commission testimonies, and maps available from the Hawai‘i Department of Accounting and General Services and the United States Geological Survey Kikiloi (2010) asserts that the recovery of traditional place names “help to transform once-empty geographic spaces into cultural places enriched with meaning and significance.” Place names serve as vehicles of ancestral memory, and when we remember the old name of a place, we remember the words of the *kūpuna* (ancestors), and we recall the wisdom of their teachings (Olivera 2009). Renee Pualani Louis, a Native Hawaiian place name research scholar contends that:

> [place names] are powerful cognitive mechanisms that unfold the richness of the Hawaiian landscape incorporating a plethora of cultural values and are a convergence of the Hawaiian cultural, social, political, and economic order. They are often understood with the mo‘olelo (historical account) that accompanies them and usually only by those with its genealogical proximity. As such, they provide a key to the lives and imaginations of Hawaiians. They indicate a holistic and harmonious relationship with the environment and are constant reminders of past events, cautionary tales, and epic tragedies. Knowledge of their meaning provides insight on the importance these place names had in shaping Hawaiian cultural identities. Sharing the names and meanings of places was a conscious act of cultural regeneration. Hawaiian incorporated their culture into the islandscape and used place names as storied symbols in their cartographic tradition. (Louis 2008:1–2)

The following section is a presentation and brief discussion of *inoa ‘āina* that were compiled throughout the course of this study and is by no means intended to be comprehensive. Rather, the place names presented below should

spark ongoing discussion regarding the meanings/interpretations of the names and the stories of these places. Table 2 presents place names and other various places of interest that were compiled from Historic maps (see Figures 16, 19, and 20) and the historical documents described in the sections above. The spelling of Hawaiian place names is provided as included in the original source, followed a lexicolology column to provide a suggested spelling that includes *ʻokina* and *kahakō*. Figure 21 depicts these place names on a map in relation to the project area. The *Hawaiian Dictionary* by Pukui and Elbert (1986) was the primary source used for the interpretive translations where applicable to *inoa ʻāina*.

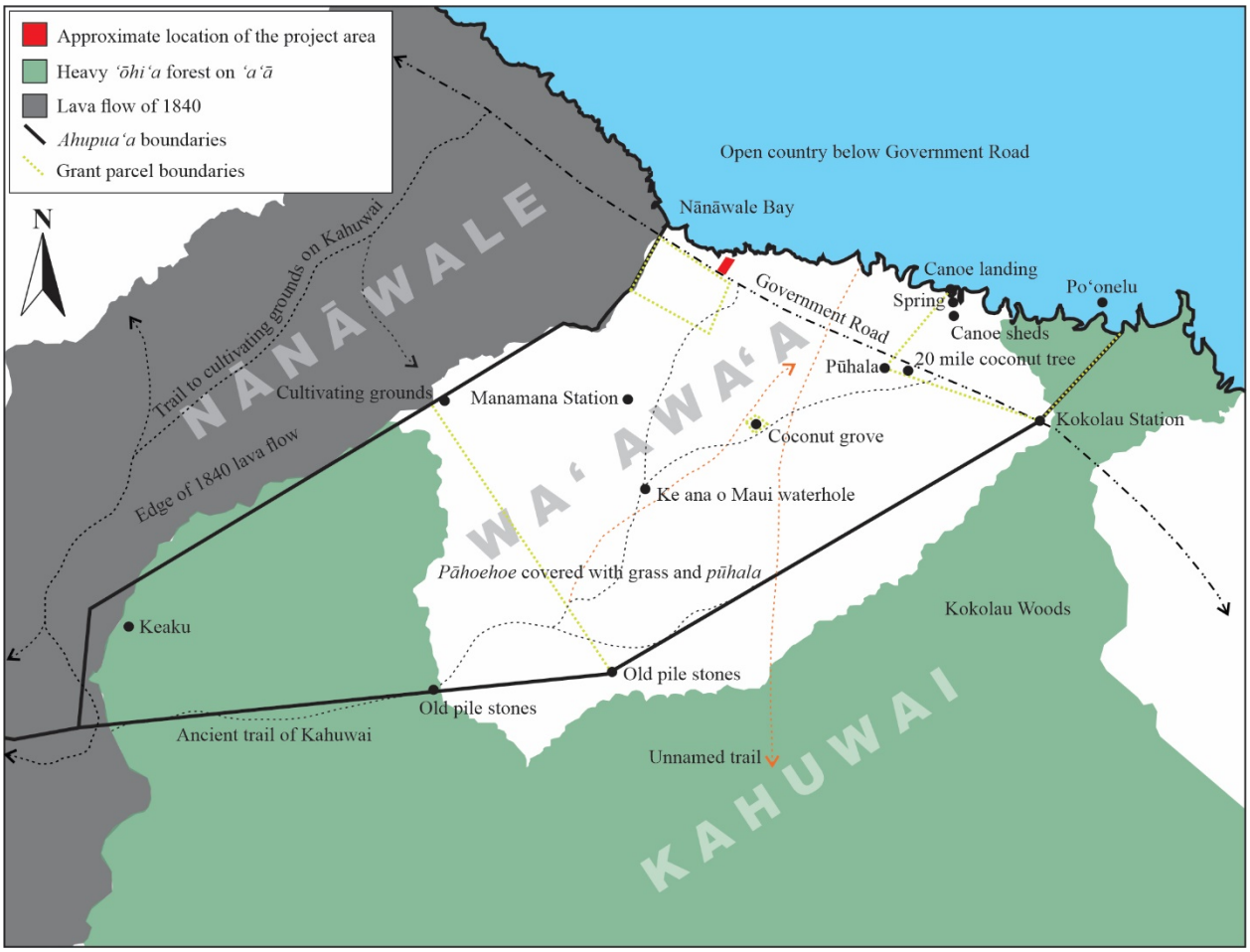


Figure 21. Locations of place names in and associated with Waʻawaʻa Ahupuaʻa compiled from Historic maps.

A total of twenty places of interest were identified within Waʻawaʻa Ahupuaʻa including nine within Land Grant No. 3687, three of which are representative of *inoa ʻāina* (see Table 2 and Figure 21), Although none of these are located within the current project area, they are instead situated in either the immediate or general vicinity. The three *inoa ʻāina* present within Land Grant No. 3687, Keana o Maui, Kokolau Woods, and Lae a Kumu, are representative of a waterhole, a heavily forested *ʻōhiʻa* forest that spans portions of both Kahuwai and Waʻawaʻa, and a point at the coastline, respectively. The most proximate of the additional places of interest within the confines of the grant parcel is the Government Road alignment, which extends adjacent to the southern boundary of the project area. Several other more traditional transportation routes including the "Ancient trail of Kahuwai" and its associated branches, as well as what appears to be a later modification to the trail, are also depicted. One branch of the ancient Kahuwai trail terminates at the Government Road near the southeastern corner of the current project area. Other place names present within the grant parcel refer to a triangulation station (Manamana Station), a pile of stones marking the *ahupuaʻa* boundary between Kahuwai and Waʻawaʻa, and an area referred to as "Cultivating grounds" along the boundary between Waʻawaʻa and Nānāwale *ahupuaʻa* accessed by a "Trail to cultivating grounds on Kahuwai" extending southeast from Nānāwale, a branch of which also extends along the *mauka* portion of Waʻawaʻa and passes through its southwestern corner. Throughout the rest of Waʻawaʻa, the maps also indicate the full extent of the "Kokolau Woods" in the mauka portion of the ahupuaʻa as well as an area in the woods labeled "Keaku," as well as a grove of

coconut trees associated with Grant No. 997 *ʻāpana* 2, a single coconut tree marking the 20 mile point of the Government Road leading from Hilo adjacent to a *pū hala* tree marking the southwestern corner of Grant No. 1363, another triangulation station (labeled "Kokolau"), and an additional pile of stones marking the boundary between Kahuwai and Waʻawaʻa. Also depicted are the locations of canoe sheds, a canoe landing, and a freshwater spring associated with Grant No. 1363 situated in the northwestern portion of the *ahupuaʻa* along its boundary with Kahuwai.

Table 2. List of place names/places of interest in Waʻawaʻa noted on historical maps.

Place Name	*Lexicology*	*Literal Translation*	*Interpretation*
20 mile coconut tree	-	-	Coconut tree marking mile 20 along the Government Road
Ancient Trail of Kahuwai Paved Road	-	-	Branching trail leading *makai* from junction of "trail to cultivating grounds on Kahuwai" at the southwestern corner of Waʻawaʻa Ahupuaʻa. One branch terminates along boundary between Waʻawaʻa and Kahuwai, the other branches at "keana o Maui waterhole" with both segments terminating at the Government Road.
Canoe Landing	-	-	Canoe landing located in small bay at northwestern corner of Grant No. 1363 to Pakaka
Canoe Sheds	-	-	Canoe sheds located in northwestern portion of Grant No. 1363 to Pakaka
Coconut grove	-	-	Coconut grove associated with Grant No. 997 *ʻāpana* 2 to Haole
Cultivating Grounds	-	-	Area of cultivation located in northwestern corner of Grant No. 3687 to Lyman adjacent to 1840 lava flow and northern boundary of Waʻawaʻa
Government Road	-	-	Constructed in 1840s, overlaid older *alaloa*/Puna Trail
Keana o Maui	*Ke ana o Maui*	Cave of Maui	Waterhole located at a junction of the "ancient trail of Kahuwai"
Keaku	Unknown	Unknown	Unidentified area within *ʻōhiʻa* forest near *mauka* boundary of Waʻawaʻa along edge of 1840 flow
Kokolau	*Kokolau*/ *Koʻokoʻolau*	-	Triangulation station.
Kokolau Woods	*Kokolau*/ *Koʻokoʻolau*	-	*ʻŌhiʻa* forest on *ʻaʻā* comprising the northeastern corner and *mauka* portion of Waʻawaʻa. Kokolau may be an alias of *koʻokoʻolau* (*Bidens* sp.), an endemic medicinal plant
Lae a Kumu	*Lae a Kumu*	Cape of Kumu	Refers to point on coast northeast of the current project area
Manamana Station	*Manamana*	-	Triangulation station possibly associated with Grant No. 2687 to Manamana
Old pile stones	-	-	Boundary marker between Waʻawaʻa and Kahuwai situated at edge of *ʻōhiʻa* forest along Grant No. 2687 *ʻāpana* 2 to Manamana
Old pile stones	-	-	Boundary marker marking boundary between Grant No. 2687 to Manamana and Grant No. 3687 to Lyman along Waʻawaʻa/Kahuwai *ahupuaʻa* boundary
Ponelu	*Poʻonelu*	Fat head	Boundary at shore between Waʻawaʻa and Kahuwai
Pūhala	*Pū hala*	Pandanus tree	*Pū hala* tree located at southwestern corner of Grant No. 1363 to Pakaka
Spring	-	-	Unnamed freshwater spring located between canoe landing and canoe sheds in northwestern portion of Grant No. 1363 to Pakaka
Trail to cultivating grounds on Kahuwai	-	-	Branching *mauka-makai* trail extending through 1840 lava flow in Nānāwale from Government Road along the top edge of Waʻawaʻa and into Kahuwai Ahupuaʻa. Branches southeast towards Waʻawaʻa across flow and leads to "cultivating grounds" in northwestern corner of Grant No. 3687 to Lyman.
Unnamed trail	-	-	Appears to be a modification of the "Ancient trail of Kahuwai"

Waʻawaʻa Ahupuaʻa During the Late Nineteenth and Early Twentieth Centuries, Later Historic Accounts, and a Concise History of the Waʻawaʻa Residential Subdivision

Throughout the Precontact and early Historic Period, the current project area and vicinity surrounding it appears to have only been sparsely inhabited. Historic descriptions of Waʻawaʻa are mostly limited to accounts of individuals traveling over the Puna Trail from Hilo into the Puna District through Nānāwale towards Kahuwai, and thus through Waʻawaʻa. Although these accounts do not explicitly reference Waʻawaʻa by name, they do describe the environs of the *ahupuaʻa* which are useful for gleaning insight into the characteristics of the project area vicinity during the late nineteenth and early twentieth centuries. One such account entitled "Hawaii-Nei" provided by American author Charles Nordhoff (1873a), was published in *Harper's Magazine* in 1873. Nordhoff provided observations of the narrow coastal trail extending "across unceasing beds of lava" that "was actually hammered down to make it smooth enough for travel" in some places, and also noted that "most of the lava is probably very ancient, though some is quite recent, and ferns and guava bushes and other scanty herbage grow through it" (ibid.:401). Nordhoffs narrative continued thusly:

> . . . after a descent to the sea-shore, you are rewarded with the pleasant sight of groves of cocoa-nuts and umbrageous arbors of pandanus, and occasionally with a patch of green. Almost the whole of the Puna coast is waterless. . .
>
> It will surprise you to find people living among the lava, making potato patches in it, planting coffee and some fruit trees in it, fencing in their small holdings, even, with lava blocks. Very little soil is needed to give vegetation a chance in a rainy season, and the decomposed lava makes a rich earth. But, except the cocoa-nut, which grows on the beach, and seems to draw its sustenance from the waves, and the sweet-potato, which does very well among the lava, nothing seems really to thrive. (ibid.:401).

In another installment titled "Hawaii-Nei-II" Nordhoff (1873b) speaks again of the lack of fresh-water in Puna and that Dr. Coan had told him about how Native Hawaiians collected freshwater for his use during his missionary tour "from the drippings of dew in caves" (ibid.:550). For, "wells are here out of the question, for there is no soil except a little decomposed lava, and the lava lets through all the water which comes from rains" compounded by the lack of mountain streams (ibid.). Nordhoff also presented the following observations of the communities in Puna as well as traditional sweet potato planting methods:

> There are no fields, according to our meaning of the word. Yet formerly the people in this district were numbered by thousands: even yet there is a considerable population, not unprosperous by any means. Churches and schools are as frequent as in the best part of New England. Yet when I asked a native to show me his sweet-potato patch he took me to the most curious and barren-looking collection of lava you can imagine, surrounded too, by a very formidable wall made of lava, and explained to me that by digging holes in the lava where it was a little decayed, carrying a handful of earth to each of these holes, and planting there in a wet season, he got a very satisfactory crop. Not only that, but being desirous of something more than a bare living, this man had planted a little coffee in the same way, and had just sold 1600 pounds, his last crop. (ibid.:550)

Isabella Bird visited Hilo in 1873 and published her experiences in *The Hawaiian Archipelago: Six Months Among the Palm Groves, Coral Reefs, & Volcanoes of the Sandwich Islands* Bird (1875). Her firsthand accounts of her journey from Hilo to Puna are dreamy and romanticized. In the following excerpt, she provides a vivid depiction of the stark contrast between the districts and describes what is presumed to be the 1840 lava flow and the environs of the general vicinity of Waʻawaʻa near the turn of the century:

> At some distance from Hilo there is a glorious burst of tropical forest, and then the track passes into green grass dotted over with clumps of the pandanus and the beautiful Eugenia. In that hot dry district the fruit was already ripe, and we quenched our thirst with it. The "native apple," as it is called, is of such a brilliant crimson colour as to be hardly less beautiful than the flowers. . . We were always near the sea, and the surf kept bursting up behind the trees in great snowy drifts, and every opening gave us a glimpse of deep blue water. The coast the whole way is composed of great blocks of very hard black lava, more or less elevated, upon which the surges break in perpetual thunder.
>
> Suddenly, the verdure ceased, and we emerged upon a hideous scene, one of the many lava flows from Kilauea, an irregular branching stream, about a mile broad. It is suggestive of feartul work on the part of nature, for here the volcano has not created but destroyed. The black tumbled

> sea mocked the bright sunshine, all tossed, jagged, spiked, twirled, thrown heap on heap, broken, rifted, upheaved in great masses, burrowing in ravines of its own making, full of broken bubble caves, and torn by a-a streams. Close to the track crystals of olivine lie in great profusion, and in a few of the crevices there are young plants of a fern which everywhere has the audacity to act as the herald of vegetation. (Bird 1875:360-361)

It was not long after the time of Bird's journey through Puna that the *Alanui Aupuni* was modified, although it still remained the primary form of transportation to and from the Puna District and frequently mentioned in the Historic accounts of travelers to the district (Maly 1998). In 1875, Kaua'i native and journalist, Henry Martyn Whitney journeyed along the *Alanui Aupuni* (labeled "Puna road" in Figure 22) from Hilo into Puna, through the luxuriant, *'ōhi'a*-filled Pana'ewa forest before reaching "groves of the pandanus, and at Kaea [Kea'au] the ocean appears and the houses in Puna. Cocoanut trees here begin to form a prominent part of the landscape, clustered in groups of hundreds and thousands" (Whitney 1875:79). In 1892, a petition for the continuance of the road through the Puna District southeast to Kaimū was initiated. According to Loebenstein,, the portion of the *Alanui Aupuni* extending from Hilo into Puna was easily passable particularly in the vicinity of the current project area and related that "a bullock cart can run over the pahoehoe as far as the 19th mile now" (Advertiser 1892).

In 1898, American author and lawyer John Roy Musick arrived to the shores of Hawai'i aboard the *SS. Australia*. Upon traveling into the Puna District from Hilo, Musick provided an account of the Puna Road and described the groves of *pū hala* studded with coconut trees that characterize the landscape in the vicinity of the project area as well as the natural curiosities left behind in the wake of the 1840 lava flow in Nānāwale:

> The Puna district which joins the district of Hilo on the south is one of the most interesting in Hawaii. The general appearance from the road is sterile, especially at the southern part, where there are considerable tracts covered with lava-rock, supporting only the scantiest vegetation. The northern part of the district is covered with dense lauhala forest and is thinly inhabited. About eighteen miles from Hilo the country begins to improve, and away from the main road, upon the slopes of the mountain, there are many acres of excellent land suitable for coffee-growing. The southeastern part of Puna is celebrated for its groves of coconuts. In 1840 the lava-flow from the volcano, after pursuing an underground course for many miles, suddenly burst forth in the woods and rushed down to the sea, overwhelming small villages in its course. The lava-flows have left many strange figures in the forest. (Musick 1898:170)

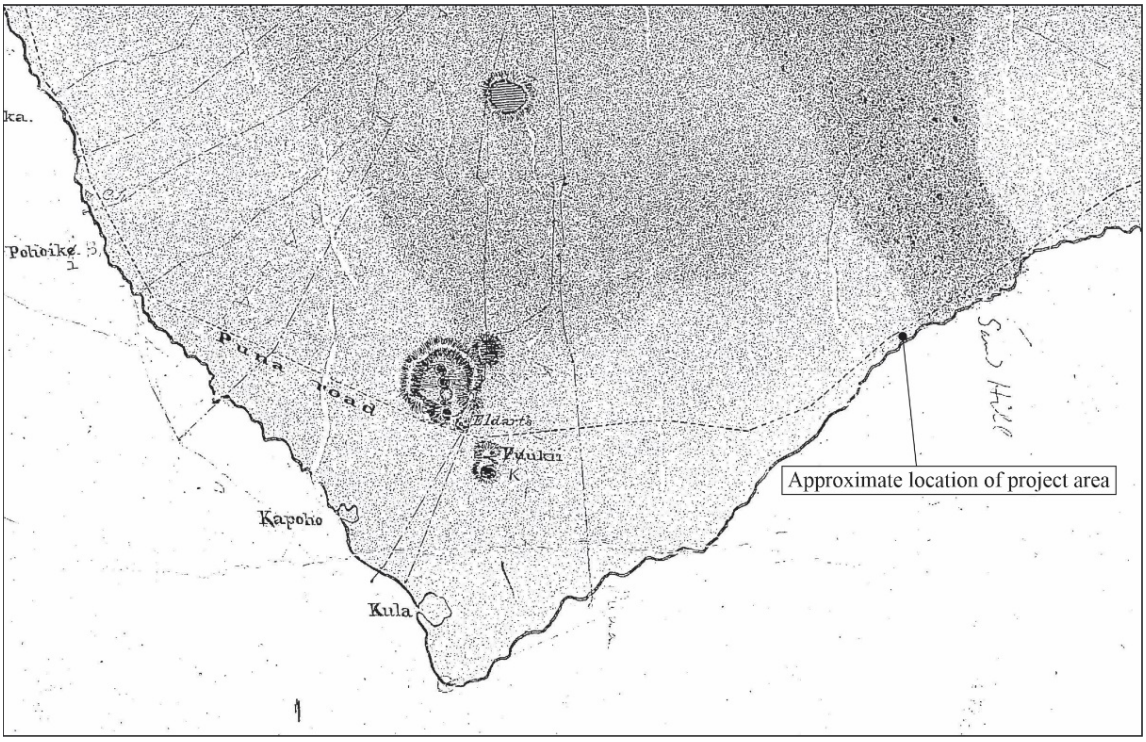


Figure 22. Portion of Hawai'i Registered Map No. 568 prepared by J.M. Lydgate in 1875 showing approximate location of the project area in relation to the *Alanui Aupuni*.

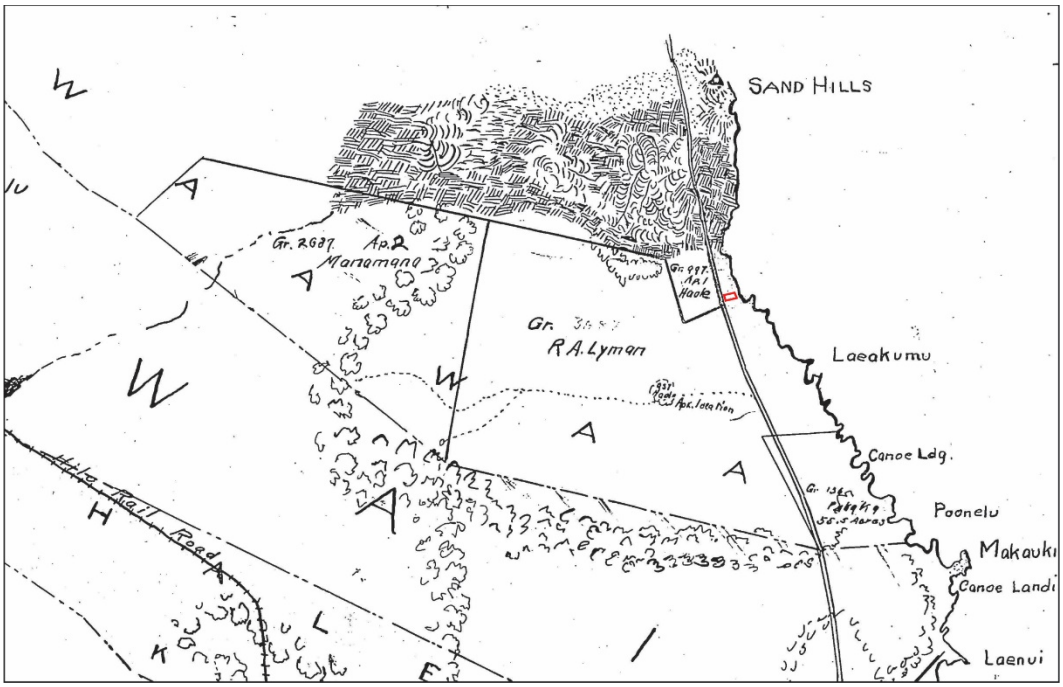


Figure 23. Portion of Hawai‘i Registered Map No. 2191 prepared in December 1902 as surveyed by E.D. Baldwin and prepared by T.E. Cook showing the project area location (outlined in red).

Throughout the early twentieth century, the coast of Puna remained an area oft-traversed by travelers journeying over the *Alanui Aupuni* to and from Hilo. An account published in a 1904 edition of the *Hilo Daily Tribune* recounted one such journey from Kaimū into Hilo by a “ride of twenty-three miles brings you back to Hilo, all of it over lava, most of it through a sterile country, but with one small burst of a real paradise of tropical luxuriance, a mile of tall forest and jungle, which looks more like Brazil than Hawaii (Hilo Daily Tribune 1904). Twenty-five years after his initial visit, William T. Brigham once again visited Puna where he noted a drastic decline in the population of the district and the changes brought about by the sugar industry and development of new roads:

> A quarter of a century later in traveling the same road with a younger companion the scene was greatly changed: the caves were there, the hala trees were there, but the inhabitants had gone, and for sixty miles there was nothing but a few deserted churches and some aged breadfruit trees to tell that once people had lived there. Fifteen years later the scene had again changed owing to the opening of roads and the cultivation of sugarcane, but the present inhabitants were not the old natives, and the mat making is only here and there continued when there is a chance to sell to the foreigner. (Brigham and Stokes 1906:29)

In 1908 an earthquake shook the district of Puna. This quake was worse than the one one that accompanied the eruption of Mauna Loa in 1868, and according to one newspaper account it caused many of the rock walls in Puna to collapse:

> At one place along the old puna trail a new wall was being built. It was three or four feet thick and four or five feet high, and contained many stones weighing two or three hundred pounds. This wall was thrown down and the stones in many places hurled eight or nine feet. Practically every stone wall in Puna was thrown down. The whole population of Puna is now at work rebuilding walls.
>
> The earthquake was much more severe in the part of Puna between Kilauea and Kapoho, which is near the 1840 flow, than it was from there on to Hilo. A number of old natives who have lived there all their lives say it was the severest earthquake they have ever experienced, much severer than that of 1868. (The Honolulu Advertiser 1908)

Another visitor, American author Henry Kinney (1913) published a comprehensive historical account of his journey through Puna during the early 1900s in his book titled *The Island of Hawaii*. Kinney’s account acts as a virtual expedition through the district and includes detailed descriptions of roadways, natural geologic landmarks, and places of industry:

> The district of Puna may, for the sake of clearness, be divided into two sections, the Olaa region, the north half, and Puna proper. The former consists of the great Olaa sugar plantation, and forest which has been partially cleared, while some tracts are used for cattle. The middle part of the district, with Pahoa as the center, is used for extensive lumber operations. The remainder, Puna proper, is covered by forest and old lava flows, most of them covered with vegetation. . . Where the road from the station runs into the road to Pohoiki at a right angle, a road continues northward through KOAE, a particularly pretty Hawaiian village, and extends for about mile, when it continues as a good trail on to the beach, where, beyond some towering and hills, lies Honolulu, which consists of only a couple of huts. Hence a trail runs along the coast to the Shipman ranch, below Olaa Mill. It passes a few huts, called by courtesy the villages of Waiakahiula and Makuu. Trails lead from these to Pahoa (Kinney 1913:83)

Throughout the latter part of the nineteenth century land use within Waʻawaʻa Ahupuaʻa began to change drastically, and Yent and Ota (1982:11) noted that the "native agricultural system began to decline around 1840 as the population declined." The inland portions of the *ahupuaʻa* (portions of Grant No. 2687 and 3687) appear to have been used for cattle ranching and possibly sugarcane cultivation. Between 1890 and 1931 the area from Waʻawaʻa to Pualaʻa (likely including Grant No. 3687 to R. A. Lyman) was ranched by the Lyman Estate. The lease for cattle was transferred to Kamau in 1931 (Yent and Ota 1982). Other portions of the *ahupuaʻa* may have been used for sugarcane cultivation. The Puna Sugar Company operated in the vicinity of the current project area from 1900 until the 1980s (Haun and Henry 2004). The current project area does not seem to have been used for either purpose. The 1924 USGS Makuu quadrangle shows a single structure *makai* of the Government Beach Road along the coast of Waʻawaʻa Ahupuaʻa during the early twentieth century (Figure 24).

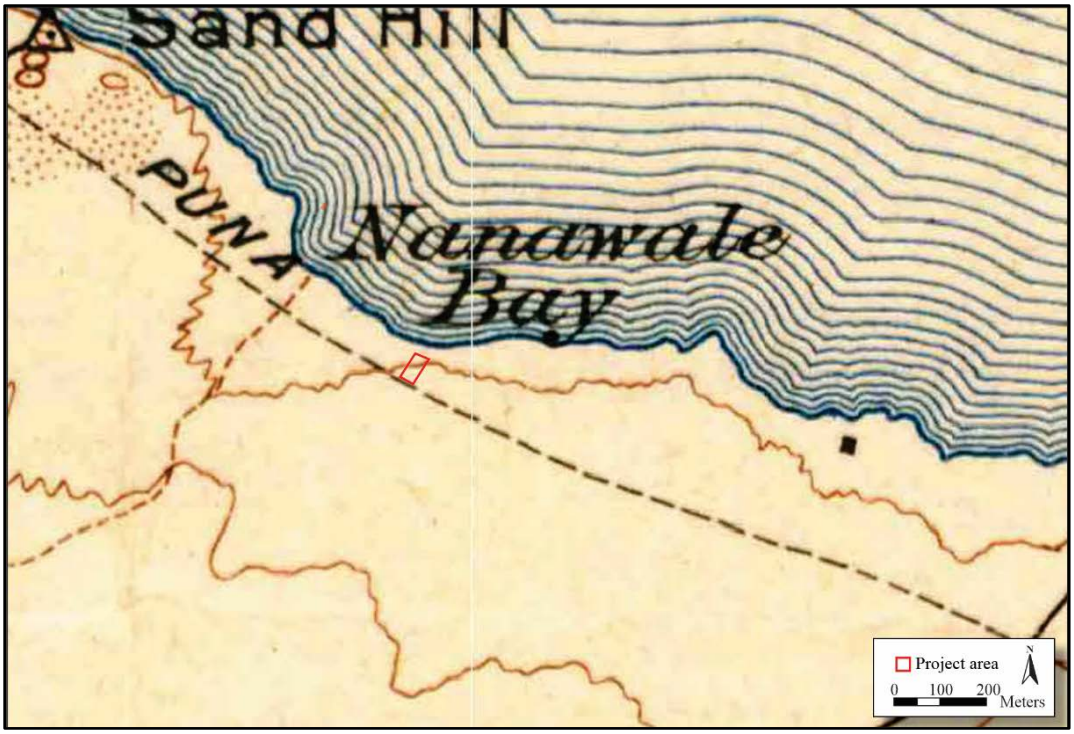


Figure 24. Portion of the 1924 USGS Makuu quadrangle with project area outlined in red.

This changed during the second half of the twentieth century when, in May of 1958, the Puna Investment Co. received final approval from the Hawaiʻi County Planning and Traffic Commission to subdivide a large portion of Waʻawaʻa Ahupuaʻa, extending from the coast to the *mauka* boundary of Grant No. 3687, into 177 residential farm lots (including the subject parcel) now known as the Waʻawaʻa Subdivision (Hilo Tribune-Herald 1958). Lacking electricity and water, these lots were not quickly developed. The 1965 USGS Kapoho quadrangle, and an aerial photograph taken on February 6 of that same year, indicate that by that time the subdivision roads had been bulldozed, but that none of the parcels had yet been developed (Figures 25 and 26). Many of the coastal lots within the subdivision have only been developed only relatively recently, and most of those developments have been accompanied by archaeological studies, the results of which are summarized below.

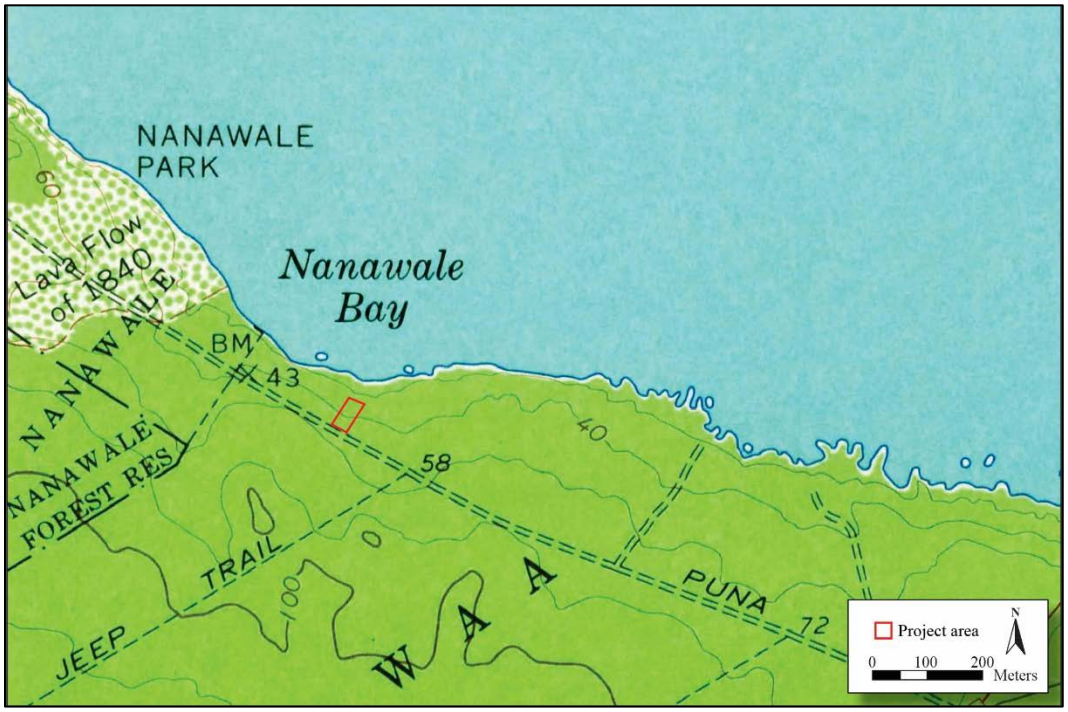


Figure 25. Portion of 1965 USGS Kapoho quadrangle with the project area outlined in red.

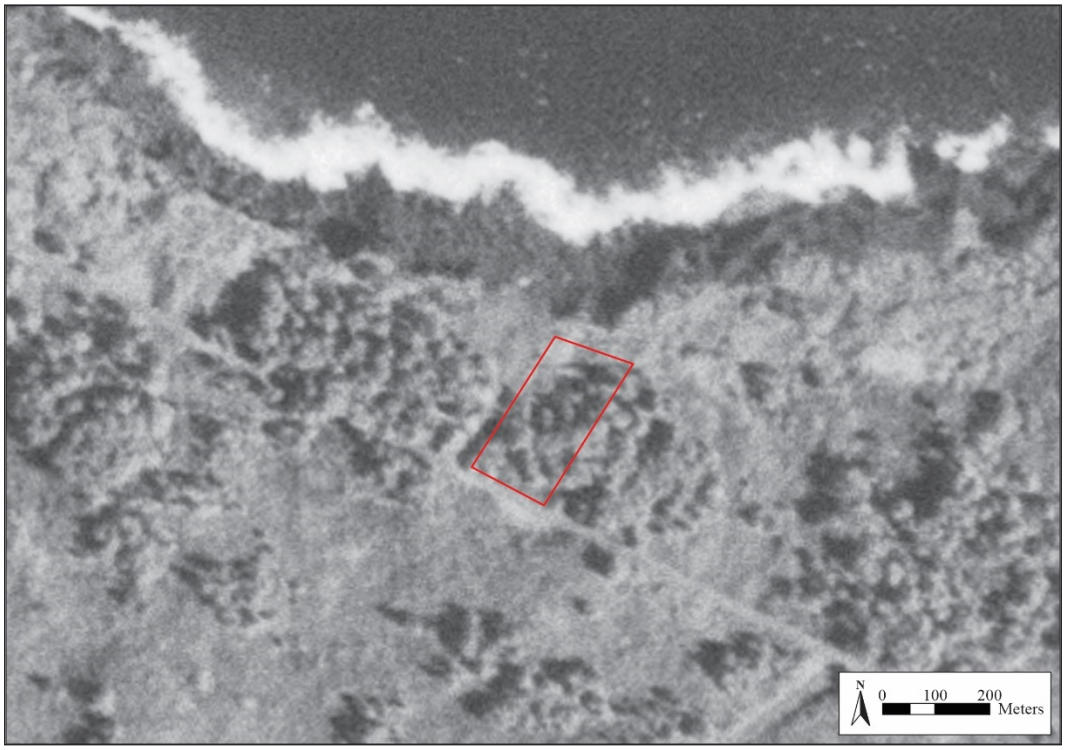


Figure 26. 1961 USGS aerial photograph showing the location of the project area (outlined in red).

PREVIOUS ARCHAEOLOGICAL STUDIES

Archaeological studies previously conducted in Waʻawaʻa Ahupuaʻa in the vicinity of the current project area have been limited to coastal lots within Waʻawaʻa Subdivision (Figure 27). The parcels on either side of the current project area were both previously surveyed for cultural resources (Clark and Rechtman 2011; Corbin 2008; O'Shaughnessy 2008), as were seven lots further to the southeast (Clark 2018; Clark and Rechtman 2006; Haun and Henry 2002, 2004, 2010; Kirkendall and Hunt 1990) and two lots further to the northwest (Clark and Rechtman 2008; Rechtman 2008, 2009). Collectively these prior studies have identified several feature types along the coast of Waʻawaʻa Ahupuaʻa, including modified depressions, excavated pits, modified outcrops, terraces, walls, enclosures, platforms, a trail, a lava tube, and a possible cairn. These features have been interpreted as having functions related to Precontact to early Historic Period habitation, agriculture, and burial, as well as Historic Period ranching. The findings of each of the studies listed above are briefly summarized below in chronological order below.

Kirkendall and Hunt (1990) conducted an archaeological inventory survey of the inland (agriculturally zoned) portions of two coastal parcels within the Waʻawaʻa Subdivision (TMKs: (3) 1-4-028:041 and 042) located to the southeast of the current project area (see Figure 27). As a result of their survey a single archaeological site (Temporary Site 1) containing 14 distinct features (Features A-N) was recorded. The identified features included two platforms (Features A and L), a modified outcrop (Feature B), four enclosures (Feature C, I, M, and N), three walls (Features D, F, and G), a walkway (Feature E), a historic roadway (Feature H), and two modified depressions (Features J and K). Six of these features (Features A, E, G, H, J, and K) were located within TMK: (3) 1-4-028:041, while the remaining 8 features were located within TMK: (3) 1-4-028:042. Kirkendall and Hunt (1990) interpreted Temporary Site 1 as a residential complex with extensive agricultural features surrounding it. They noted that, "the two platforms, Features A and L are likely house platforms, with adjacent animal enclosures," and that "the agricultural features are primarily unfaced depressions in the a'a [with] rock having been removed and piled on the sides or used for walls" (Kirkendall and Hunt 1990:7), and suggested that the depressions were used for the cultivation of sweet potato and taro. They also noted that the walkway (Feature E) was likely older than the Historic roadway (Feature H), and that Feature B, based on its large size and construction, likely functioned as a *heiau* (Kirkendall and Hunt 1990:7).

Haun and Henry (2002) conducted an archaeological inventory survey of a parcel (TMK: (3) 1-4-028:038) located to the southeast of the current project area (see Figure 27). The survey identified five sites containing a total of 37 features. The recorded sites included a ranch wall (Site 23389), three agricultural complexes (Sites 23390, 23391, and 23393), and a habitation terrace (Site 23392). Feature types identified at the three sites included twenty-four planting depressions, five modified outcrops, three terraces, two enclosures, a wall, a platform, and a possible cairn. In addition to these features, Haun and Henry (2002) also identified a portion of a Historic road, but did not assign a site number to it.

Haun and Henry (2004) conducted an archaeological inventory survey of two adjoining parcels (TMKs: (3) 1-4-028:033 and 034) located to the southeast of the current project area (see Figure 27). The survey identified six sites containing a total of 42 distinct features. The recorded sites included two permanent habitation complexes (Sites 23997 and 23998), a ranch wall (Site 23999), a permanent habitation enclosure (Site 24000), a burial platform (Site 24001), and an agricultural complex (Site 24002). Feature types identified at these sites consisted of fourteen excavated pits, eight enclosures, eight modified outcrops, six terraces, five walls, and one platform. The agricultural features were similar to those recorded on TMK: (3) 1-4-028:038 by Haun and Henry (2002), which Haun and Henry suggest may have been enclosed by walls during the Historic Period to keep cattle out. Excavations within the features interpreted as foundations for habitation structures (comprised of eight enclosures, two terraces, and several wall segments) yielded primarily volcanic glass flakes, charcoal, and marine shell, but also produced a glazed ceramic fragment indicating Historic use of the features. A charcoal sample collected from Site 23998 Feature A by Haun and Henry (2004) and submitted for radiocarbon analysis indicated that the feature may have been initially occupied sometime between 1530 and 1630 A.D. Excavation at the Site 24001 platform revealed a vaulted crypt containing human skeletal remains.

Clark and Rechtman (2006) conducted an archaeological inventory survey of one of the parcels (TMK: (3) 1-4-028:041) previously studied by Kirkendall and Hunt (1990) to the southeast of the current project area (see Figure 27). All of the features recorded by Kirkendall and Hunt (1990) in the *mauka* portion of that parcel were relocated by Clark and Rechtman (2006), and additional features were recorded in the seaward portion. The identified feature types included five modified depressions, a modified outcrop, a wall, a raised walkway, a terrace, and two enclosures that were assigned to five archaeological sites including two agricultural complexes (Site 25516 and 25520), a core-filled wall (Site 25517), a raised trail (Site 25518), and a habitation complex (Site 25519). The sites were interpreted as representing Precontact to early Historic Hawaiian use of the project area for habitation and agricultural purposes.

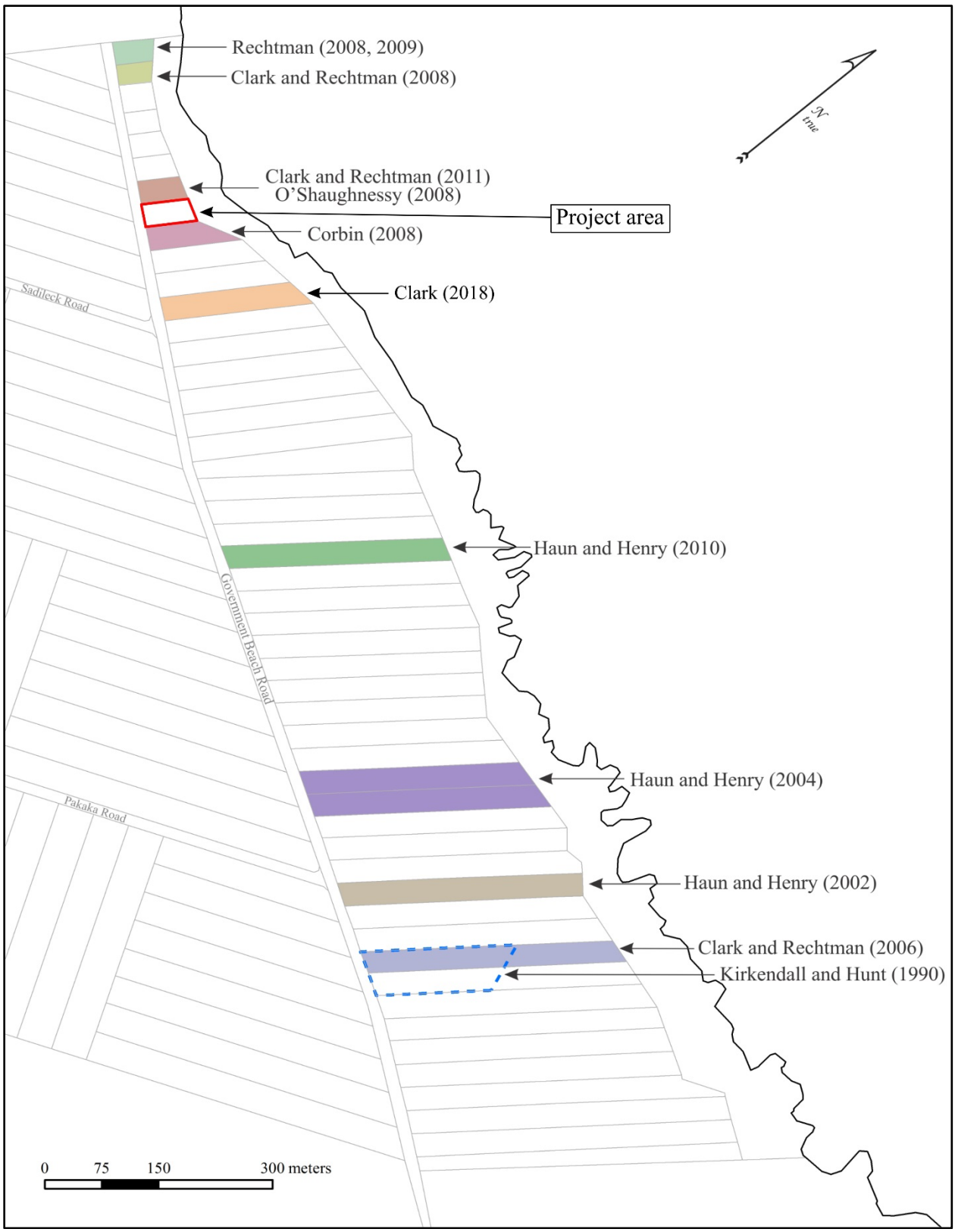


Figure 27. Previous archaeological studies conducted in the vicinity of the project area.

Corbin (2008) conducted an archaeological inventory survey of a parcel (TMK: (3) 1-4-028:009) located adjacent to the southeastern boundary of the current project area (see Figure 27). As a result of the study Corbin recorded a single archaeological site (Site 26465) containing three features (Features A, B, and C) including a stone platform (Feature A) interpreted as a temporary habitation or viewing structure, a stone clearing mound (Feature B), and a C-shaped wall (Feature C) that may have been a wind break or a planting feature. Feature A was completely dismantled by Corbin (2008), revealing that most of the platform was actually natural bedrock, and that it lacked any associated cultural debris. Corbin (2008:16) concluded that all of the features within the parcel were likely related to the agricultural use of the area during the Precontact Period.

Rechtman (2008) surveyed the easternmost coastal parcel in Waʻawaʻa Subdivision (TMK: (3) 1-4-028:001; see Figure 27) and initially reported no findings. Subsequent to the completion of the archaeological fieldwork, an opening to a small lava tube was discovered beneath an area of dense *naupaka* ground cover. The lava tube was explored and found to contain a single set of poorly preserved human skeletal remains (Rechtman 2009). This inadvertent discovery was reported to DLNR-SHPD, and a burial treatment plan was prepared.

Clark and Rechtman (2008) prepared an archaeological assessment for TMK: (3) 1-4-028:002 located to the northwest of the current project area (see Figure 27). No archaeological sites were identified on that parcel, but a potential site consisting of a pile of cobbles was noted and excavated. The results of the excavation indicated that the pile was likely a modern construction, and therefore not an archaeological resource.

Haun and Henry (2010) conducted an archaeological inventory survey of a parcel (TMK: (3) 1-4-028:023) located to the east of the current project area (see Figure 27). That study identified two archaeological sites (Sites 28138 and 28139) containing a total of nineteen features. Site 28138 consisted of a rectangular-shaped platform located near the Government Beach Road that was tested and found to contain human skeletal remains within an oval-shaped, stone-lined crypt. Site 28139 consisted of a complex of 18 agricultural features spanning the inland two-thirds of the parcel. The features of this site included eight mounds, six pits, two modified outcrops, and two retaining walls. The mounds and modified outcrops were interpreted as clearing features, while the pits were interpreted as planting features, and the retaining walls were interpreted as agricultural plot boundary walls that helped retain soil.

Clark and Rechtman (2011) conducted an archaeological assessment survey of a 0.415-acre parcel (TMK: (3) 1-4-028:007) located adjacent to the southeastern boundary of the current project area (see Figure 27). Their 2011 study reexamined the findings of an earlier archaeological assessment conducted by O'Shaughnessy (2008). Clark and Rechtman (2011) identified seven discrete cobble features on that parcel, all of which were interpreted as modern constructions. The identified features include a retaining wall, five cement and rock features that were part of a “hippy camp,” and the base of a memorial erected in honor of Dana Ireland.

Most Recently, in 2018, ASM Affiliates (Clark 2018) conducted an archaeological field inspection of a 1.460-acre parcel (TMK: (3) 1-4-028:012) located to the southeast of the current project area (see Figure 27). No archaeological sites or features were reported as a result of that study.

3. PROJECT AREA EXPECTATIONS

Based on the specific location, terrain, and small size of the project area, the archaeological expectations for the current study are limited. The results of the background research and the review of prior archaeological work presented above indicates that the primary areas of Precontact habitation along this section of the Puna coast were located to the east and west of the project area, and that nearby Historic habitation may have occurred *mauka* of the parcel on the opposite side of the Government Beach Road (at Grant No. 997 to Haole). Feature types previously recorded at coastal parcels within Waʻawaʻa Ahupuaʻa to the east of the current study parcel include modified depressions, excavated pits, modified outcrops, mounds, terraces, retaining walls, enclosures, platforms, a trail, and a possible cairn that were used for Precontact and early Historic habitation, agriculture, and burial purposes, as well as walls that were created for Historic ranching activities. The locations of most of these previously recorded features relative to the coast, however, places them further inland than the *mauka* boundary of the current study parcel. Nearest the project area, on the neighboring parcel to the southeast, Corbin (2008) recorded potential Precontact Period temporary habitation and agricultural features and, on the neighboring parcel to the northwest ,Clark and Rechtman (2011) reported features related to a modern residential “camp.” It is possible that similar features to those recorded by either Corbin (2008) or Clark and Rechtman (2011) could be present within the current project area. Also, if any entrances to lava tubes are present, they may contain human skeletal remains (Rechtman 2009).

4. FIELDWORK, CONCLUSION, AND RECOMMENDATIONS

Fieldwork for the current study was conducted on October 15, 2020 by Lauren Kepaʻa and Matthew R. Clark (Principle Investigator). Fieldwork consisted of an intensive (100%) coverage survey of the entire surface of the project area utilizing systematic east-west pedestrian transects with fieldworkers spaced at roughly three-meter intervals. The entire project area was accessible at the time of the survey, and the boundaries were clearly identifiable in the field; vegetation cover on slightly limited ground visibility.

No cultural resources of any kind were identified within the current project area as a result of the fieldwork. Thus, it is the conclusion of this study that the proposed development of a single-family dwelling on the subject parcel will have no effect on any historic properties. With respect to the historic preservation review process of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR–SHPD) and the County of Hawaiʻi Planning Department, our recommendation is that no further work needs to be conducted prior to or during project implementation. In the unlikely event that significant archaeological resources are discovered during the proposed development activities, work shall cease in the area of the discovery and DLNR-SHPD shall be contacted pursuant to HAR 13§13-280-3.

REFERENCES CITED

Abbott, I. A.
1992 *Lāʻau Hawaiʻi, Traditional Hawaiian Uses of Plants*. Bishop Museum Press, Honolulu.

Advertiser, D. P. C.
1892 Wonders of Puna. *The Honolulu Advertiser* [Honolulu]. March 15, 1892: 5. Electronic document, https://www.newspapers.com/image/259366164/?terms=puna%2Btrail, , accessed 01/24/2019.

Alexander, W. D.
1891 *A Brief History of the Hawaiian People*. American Book Company, Chicago.

Athens, J. S., T. Rieth, and T. S. Dye
2014 A Paleoenvironmental and Archaeological Model-Based Age Estimate for the Colonization of Hawaiʻi. *American Antiquity* 79(1):144-155.

Barrère, D.
1959 Political History of Puna. In *Natural and Cultural History Report on the Kalapana Extension of the Hawaii National Park*, vol. I, pp. 15-65. Department of Anthropology, B. P. Bishop Museum, Honolulu.

Beckwith, M. W.
1917 Hawaiian Shark Aumakua. *American Anthropologist* N.S. 19:503-517.

Barrère, D.
1951 *The Kumulipo A Hawaiian Creation Chant*. University of Hawaii Press, Honolulu.

Beckwith, M. W.
1970 *Hawaiian Mythology*. University of Hawai'i Press, Honolulu.

Bird, I.
1875 *The Hawaiian Archipelago: Six Months among the Palm Groves, Coral Reefs, & Volcanoes of the Sandwich Islands*. John Murray, London.

Brigham, W.
1899 *Hawaiian Feather Work*. Memoirs of the Bernice Pauahi Bishop Museum Volume 1, Number 1. Bishop Museum Press, Honolulu.

1903 *Additional Notes on Hawaiian Feather Work*. Memoirs of the Bernice Pauahi Bishop Museum Volume 1, Number 3. Bishop Museum Press, Honolulu.

1911 *Ka Hana Kapa: The Making of Bark-cloth in Hawaiʻi*. Bishop Museum Press, Honolulu.

1918 *Additional Notes on Hawaiian Feather Work: Second Supplement*. Memoirs of the Bernice Pauahi Bishop Museum, vol. 7. Bishop Museum Press, Honolulu.

Brigham, W. and J. F. G. Stokes
1906 *Mat and Basket Weaving of the Ancient Hawaiians, Described and Compared With the Basketry of the Other Pacific Islanders With An Account of Hawaiian Nets and Nettings*. Memoirs of the Bernice Pauahi Bishop Museum, vol. II, Number 1. Bishop Museum Press, Honolulu.

Buck, P. H.
1944 The Local Evolution of Hawaiian Feather Capes and Cloaks. *The Journal of the Polynesian Society* 53(1):1-16.

1957 *Arts and Crafts of Hawaii*. B. P. Bishop Museum Special Publication 45. Bishop Museum Press, Honolulu.

Burtchard, G. and P. Moblo
1994 Archaeology in the Kīlauea East Rift Zone, Part 1: Land-Use Model and Research Design, Kapoho, Kamāʻili and Kīlauea Geothermal Subzones, Puna District, Hawaiʻi. Prepared for U.S. Department of Energy, Oak Ridge Operations Office, Tennessee.

Cannelora, L.
1974 *The origin of Hawaii land titles and of the rights of native tenants*. Security Title Corp.

Chinen, J. J.
1958 *The Great Mahele: Hawaii's Land Division of 1848*. University of Hawaii Press, Honolulu.

1961 *Original Land Titles in Hawaii*. Privately published.

Clark, M. R.
2018 Letter Report FINAL: Archaeological Field Inspection of TMK: (3) 1-4-028:012, Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi. ASM Affiliates Project Number 30050. Prepared for David Lippe (landowner).

Clark, M. R. and R. B. Rechtman
2006 An Archaeological Inventory Survey of TMK: 3-1-4-028:041, Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi. Rechtman Consulting Report RC-0384. Prepared for James and Van Donald, Emu Park, AU.

2008 An Archaeological Assessment Survey of TMK: 3-1-4-028:002, Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi. Rechtman Consulting,LLC Report RC-0565. Prepared for Jan and Marty Weekley, Palos Verdes Estates, CA.

2011 An Archaeological Assessment Survey of TMK: 3-1-4-028:007, Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi. Rechtman Consulting, LLC RC-0710. Prepared for Shon Magsalin, Ninole, HI.

Coan, T.
1882 *Life in Hawaii: An Autobiographic Sketch of Mission Life and Labors 1835-1881*. Randolph, New York.

Corbin, A.
2008 Archaeological Inventory Survey Waawaa Coastal Parcel, Land of Waawaa, Puna District, Island of Hawaiʻi (TMK:3-1-4-28:9). Paul H. Rosendahl, Ph.D. Inc. Report 2735-040308. Prepared for Pahoa Properties, LLC.

Cordy, R.
1994 The Ala Kahakai Trail – Or the Ala Loa: An Archaeological & Historic Preservation Perspective. Revised w/notes and references added, January 1995. Prepared for State Historic Preservation Division, Department of Land and Natural Resources, State of Hawaii.

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

Donn, J. M.
1901 *Hawaii, Hawaiian Islands*. Hawaii Territorial Survey Map. Registered Map 2060. Electronic document, http://hdl.handle.net/10524/49272, accessed Aug 9, 2017.

Ellis, W.
1827 *Narrative of a Tour of Hawaii, or Owhyee; with Observations on the Natural History of the Sandwich Islands, and Remarks on the Manners, Customs, Traditions, History, and Language of their Inhabitants*. Second ed. H. Fisher, Son, and P. Jackson, London.

Emerson, J. S.
1892 The Lesser Hawaiian Gods. *Second Annual Report of the Hawaiian Historical Society for the Year 1892* 1:1-24.

Emerson, N. B.
1894 The Bird Hunters of Ancient Hawaii. In *Thrum's Hawaiian Annual for 1895*, pp. 101-111. edited by T. A. Thrum. Thos. A Thrum, Honolulu.

1915 *Pele and Hiiaka; a myth from Hawaii*. Honolulu Star Bulletin Limited, Honolulu.

Fornander, A.

1918-1919 *Fornander Collection of Hawaiian Antiquities and Folk-lore. The Hawaiians' Account of the Formation of their Islands and Origin of their Race, with the Traditions of their Migrations, etc., as Gathered from Original Sources.* Memoirs of the Bernice Pauahi Bishop Museum Volume V. Bishop Museum Press, Honolulu.

1969 *An Account of the Polynesian Race: Its Origins and Migrations, and the Ancient History of the Hawaiian People to the Times of Kamehameha I*. Edited by J. F. G. Stokes. Charles Tuttle & Co., Inc., Tokyo.

Giambelluca, T. W., X. Shuai, M. L. Barnes, R. J. Alliss, R. J. Longman, et al.

2014 Evapotranspiration of Hawai‘i. Prepared for Water Resource Management, State of Hawai‘i.

Green, L. and M. Beckwith

1926 Hawaiian Customs and Beliefs Relating to Sickness and Death. *American Anthropologist* 28:176-208.

Gutmanis, J.

1986 *Pohaku: Hawaiian Stones.* Brigham Young University - Hawaii Campus, Laie.

2015 *The Secrets and Practice of Hawaiian Herbal Medicine*. Island Heritage Publishing, Honolulu.

Handy, E. S. C.

1940 *The Hawaiian Planter*. Bernice P. Bishop Museum Bulletin No. 126. Published by the Museum, Honolulu.

Handy, E. S. C., E. G. Handy, and M. K. Pukui

1991 *Native Planters in Old Hawaii: Their Life, Lore, and Environment*. Bernice P. Bishop Museum Bulletin 233. Bishop Museum Press, Honolulu.

Handy, E. S. C. and M. K. Pukui

1998a *The Polynesian Family System in Ka‘u, Hawai‘i*. Mutual Publishing, Honolulu.

1998b *The Polynesian Family System in Ka‘u, Hawai‘i*. Mutual Publishing, Honolulu.

Haun, A. E. and D. Henry

2002 Archaeological Inventory Survey of TMK: (3) 1-4-28:38, Land of Waawaa, Puna District, Island of Hawaii. Haun and Associates Report 189-042602. Prepared for Scot and Mary Goodwin, Kaaawa, HI.

2004 Archaeological Inventory Survey of TMK: (3) 1-4-28:33 and 34, Land of Waawaa, Puna District, Island of Hawai‘i (Revised). Haun and Associates Report 277-042004. Prepared for Mr. Dennis Davis, Guerneville, CA.

2010 FINAL, Archaeological Inventory Survey TMK: (3) 1-4-28:023, Land of Wa‘awa‘a, Puna District, Island of Hawai‘i. Haun and Associates 708-031611. Prepared for Dean Cail, Pahoa, HI.

Hilo Daily Tribune

1904 The Desolate Trail From Volcano House. *Hilo Daily Tribune* [Hilo]. December 20, 1904: 7. Electronic document, https://www.newspapers.com/image/555580207/?terms=puna%2Btrail.

1958 Subdivisions Approved. *Hilo Tribune-Herald* [Hilo, Hawaii]. May 13, 1958: 4. Electronic document,https://www.newspapers.com/image/556163769/?terms=waawaa%2Bpuna%2Binvestment, accessed October 19, 2020.

Hitchcock, C.

1909 *Hawaii and Its Volcanoes*. The Hawaiian Gazette Company, LTD., Honolulu.

Hommon, R.

1976 The Formation of Primitive States in Pre-Contact Hawaii. Ph.D. Dissertation, University of Arizona, Department of Anthropology, Tucson, AZ.

1986 Social Evolution in Ancient Hawaiʻi. In *Island Societies: Archaeological Approaches to Evolution and Transformation*, pp. 55-88. edited by P. Kirch. Cambridge University Press, Cambridge, Massachusetts.

2013 *The Ancient Hawaiian State: Origins of a Political Society*. Oxford University Press, New York.

Hoʻoulumāhiehie
2006 *The Epic tale of Hiʻiakaikapoliopele*. Translated by M. P. Nogelmeier. Awaiaulu, Honolulu.

Jarves, J.
1843 *Scenes and Scenery in the Sandwich Islands, and a Trip Through Central America: Being Observations from My Note-book During the Years 1837-1842*. James Munroe and Company, Boston.

Jokiel, P., K. Rodgers, W. Walsh, D. Polhemus, and T. Wilhelm
2011 Marine Resource Management in the Hawaiian Archipelago: The Traditional Hawaiian System in Relation to the Western Approach. *Journal of Marine Biology* 2011:1-16.

Kaaiakamanu, D. M. and J. K. Akina
1922 *Hawaiian Herbs of Medicinal Value: Found Among the Mountains and Elsewhere in the Hawaiian Islands, and Known to the Hawaiians to Possess Curative and Palliative Properties Most Effective in Removing Physical Ailments*. Board of Health of the Territory of Hawaii.

Kalākaua, D.
1972 *The Legends and Myths of Hawaii. The Fables and Folk-Lore of a Strange People*. Charles E. Tuttle Co., Inc., Rutland, Vermont and Tokyo, Japan.

Kaleohano and Nuuanu
1840 View of a stream of lava as it entered the sea at Nanawale, East part of Hawaii: June 1840. *The Polynesian* [Honolulu].

Kamakau, S. M.
1976 *The Works of the People of Old, Na Hana a ka Poʻe Kahiko*. B.P. Bishop Museum Special Publication 61. Bishop Museum Press, Honolulu.

1992 *Ruling Chiefs of Hawaii*. Revised ed. Kamehameha Schools Press, Honolulu.

Kelly, M.
1956 Changes in Land Tenure in Hawaii, 1778-1850. Manuscript. Hawaiian-Pacific Collection, Master's thesis. University of Hawaii at Manoa. 1956.

Kelly, M.
1969 *Historical Background of the South Point Area, Kaʻu, Hawaii*. Pacific Anthropological Records No. 6. Anthropology Department, B.P. Bishop Museum, Honolulu.

Kent, H. W.
1986 *Treasury of Hawaiian Words in One Hundred and One Categories*. Masonic Public Library of Hawaii, Honolulu.

Kenui, M., Tiona, Nawaakoa, Kilipina, Paele, et al.
1845 Concerning Foreigners Taking the Oath of Allegiance. *The Friend* 3(15):119.

Kikiloi, S. K.
2010 Rebirth of an Archipelago: Sustaining a Hawaiian Cultural Identity for People and Homeland. *Hūlili: Multidisciplinary Research on Hawaiian Well-Being* 6:73-115.

n.d. Hawaiian Land Titles. n.d. Electronic document, https://ags.hawaii.gov/wp-content/uploads, accessed May 15, 2020.

Kinney, H.
1913 *The Island of Hawaii*. Hilo Board of Trade, Hilo.

Kirch, P. V.
1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawaii Press, Honolulu.

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

Kirkendall, M. and T. Hunt
1990 Archaeological Inventory Survey for Two Parcels. Waʻa Waʻa Ahupuaʻa, District of Puna, Island of Hawaii.

Krauss, B. H.
1993 *Plants in Hawaiian Culture*. A Kolowalu Book. University of Hawaii Press, Honolulu.

Kuykendall, R.
1938 *The Hawaiian Kingdom 1778–1854. Foundation and Transformation*, vol. 1. 3 vols. University Press of Hawaii, Honolulu.

Kuykendall, R. and A. G. Day
1976 *Hawaii: A History; From Polynesian Kingdom to American Statehood*. Prentice-Hall, Englewood Lam, M.

Cliffs, New Jersey.
1985 The Imposition of Anglo-American Land Tenure Law On Hawaiians. *Journal of Legal Pluralism and Unofficial Law* 23:104-128.

Liliuokalani
1978 *An Account of the Creation of the World According to Hawaiian Tradition, Translated from Original Manuscript Preserved Exclusively in Her Majesty's Family*. Pueo Press, Kentfield.

Louis, R.
2008 Hawaiian Place Names: Storied Symbols in Hawaiian Performance Cartographies. Ph.D. Dissertation, University of Hawaiʻi, Mānoa, Geography Department, Honolulu.

Lucas, P.
1995 *A Dictionary of Hawaiian Legal Land-Terms*. Native Hawaiian Legal Corporation. University of Hawaiʻi Committee for the Preservation and Study of Hawaiian Language, Art and Culture, Honolulu.

Lyman, C.
1925 *Around the Horn to the Sandwich Islands and California, 1845-1850*. Yale University Press, New Haven.

MacKenzie, M. K.
2015 *Native Hawaiian Law, A Treatise*. Kamehameha Publishing, Honolulu.

Malo, D.
1951 *Hawaiian Antiquities*. Second ed. Translated by N. B. Emerson. B. P. Bishop Museum Special Publication 2. B. P. Bishop Museum Press, Honolulu.

Maly, K.
1998 "Puna, Ka ʻĀina I Ka Hikina A Ka Lā", A Cultural Assessment Study – Archival and Historical Documentary Research and Oral History Interviews For the Ahupuaʻa of ʻAhalanui, Laepāoʻo, and Oneloa (with Pohoiki), District of Puna, Island of Hawaiʻi. Kumu Pono Associates, LLC Report HiPu-15b (073198/060203). Prepared for A & O International Corporation, Oneloa Development. Hilo, HI.

1999a The Historic Puna Trail—Old Government Road (Keaʻau Section): Archival-Historical Documentary Research, Oral History and Consultation Study, and Limited Site Preservation Plan, Ahupuaʻa of Keaʻau, Puna District, Island of Hawaiʻi (TMK:1-6-01 various parcels). Kumu Pono Associates HiAla-17 (011199). Prepared for Na Ala Hele Program, State Division of Forestry and Wildlife, Hilo, Hawaii.

1999b Nā Ala Hele Ma Kai O Kohala Hema (The Coastal Trails of South Kohala): Archival-Historical Documentary Research, Oral History—Consultation Study and Limited Site Preservation Plan Kawaihae-ʻAnaehoʻomalu Trail Section: Lands of Kawaihae 2nd, ʻŌuli, Lālāmilo, Waikōloa, Puakō, Waimā, Kalāhuipuaʻa, and ʻAnaehoʻomalu; District of Kohala, Island of Hawaiʻi (TMK Overview Sheets: 6-2, 6-8 & 6-9). Kumu Pono Associates Report HiAla-17K (043099). Prepared for Na Ala Hele, Hilo, Hawaii.

2000 Nā Kūkiʻo Ma Ka ʻĀina Kaha: A Collection of Traditional and Historical Accounts of Kūkiʻo at Kekaha, North Kona. Kumu Pono Associates Hiku38b(030300). Prepared for Steven S. C. Lim, Hilo, HI.

McEldowney, H.
1979 Archaeological and Historical Literature Search and Research Design: Lava Flow Control Study, Hilo, Hawaiʻi. Department of Anthropology, B.P. Bishop Museum. Prepared for the U.S. Army Engineer Division, Pacific Ocean.

Menzies, A.
1920 *Hawaii Nei, 128 Years Ago*. Honolulu, T.H., Honolulu.

Mills, P.
2002 Social Integration and the Ala Loa: Reconsidering the Significance of Trails in Hawaiian Exchange. *Asian Perspectives* 41(1):148-166.

Mills, P. and M. Irani
2000 A Walk Through History: Pedestrian Survey Along the Old Government Beach Road, Honalo to Honuaʻino, North Kona, Hawaiʻi, Volume I. Prepared for Department of Anthropology, University of Hawaiʻi, Hilo, HI.

Musick, J. R.
1898 *Hawaii...Our New Possessions. An Account of Travels and Adventure, With Sketches of the Scenery, Customs and Manners, Mythology and History of Hawaii to the Present, and an Appendix Containing the Treaty of Annexation to the United States*. Funk & Wagnalls Company, New York.

Nakuina, M.
2005 *The Wind Gourd of Laʻamaomao (translated by Esther T. Mookini & Sarah Nākoa)*. University of Hawai'i Press, Honolulu.

National Park Service, Ala Kahakai National Historic Trail
2009 Ala Kahakai National Historic Trail Comprehensive Management Plan.

Neal, M. C.
1965 *In Gardens of Hawaii*, vol. 50. Bishop Museum Press, Honolulu.

Nimmo, H. A.
1990 The Cult of Pele in Traditional Hawaiʻi. *B.P. Bishop Museum Occasional Papers* 30:41-87.

Nogelmeier, M. P.
2010 *Mai Paʻa I Ka Leo: Historical Voices in Hawaiian Primary Materials, Looking Forward and Listening Back*. Bishop Museum Press, Honolulu.

Nordhoff, C.
1873a Hawaii-Nei. In *Harper's Magazine*. vol. XLVII.

1873b Hawaii-Nei II. In *Harper's Magazine*. vol. XLVII.

O'Shaughnessy, M.
2008 An Archaeological Assessment Survey of TMK: 3-1-4-028:007. Prepared for Maria S. Magsalin.

Oliver, D.
1961 *The Pacific Islands*. University of Hawaii Press, Honolulu.

Olivera, K.
2009 Wahi a Kahiki: Place Names as Vehicles of Ancestral Memory. *AlterNative* 5(2):101-115.

Pogue, J. F.
1978 *Moolelo of Ancient Hawaii*. Translated by C. W. Kenn. Topgallant Press, Honolulu.

Pukui, M. K. (editor)
1983 *ʻŌlelo Noʻeau: Hawaiian proverbs & poetical sayings*. Bishop Museum Press, Honolulu.

Pukui, M. K. and S. H. Elbert
1986 *Hawaiian Dictionary: Hawaiian-English, English-Hawaiian*. Revised and english ed. University of Hawaii Press, Honolulu.

Rechtman, R. B.
2008 Request for determination of "no historic properties affected" associated with the Conservation District Use Application (CDUA) on a 0.392-acre parcel (TMK:3-1-4-028:001). Rechtman Consulting, LLC Report RC-0566. Prepared for Joan Shafer, Maggie Valley, NC.

2009 Letter Report a Single Set of Human Skeletal Remains Inadvertently Discovered in a Lava Tube, the entrance to which is located on TMK:3-1-4-028:001 in Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi. Rechtman Consulting, LLC Letter Report RC-0654. Prepared for Joan Shafer, Maggie Valley, NC.

Rosendahl, P. H.
1972 Archaeological Salvage of the Hapuna-Anaehoomalu Section of the Kailua-Kawaihae Road (Queen Kahumanu Highway), Island of Hawaii. Department of Anthropology *Departmental Report Series* 72-5. B. P. Bishop Museum.

Sherrod, D., J. Sinton, S. Watkins, and K. Brunt
2007 *Geologic Map of the State of Hawaiʻi*. U.S. Department of the Interior, U.S. Geological Survey. Open-File Report 2007-1089. Electronic document, http://pubs.usgs.gov/of/2007/1089, accessed Apr 27, 2018.

Soehren, L.
2005 A Catalog of Hawaiʻi Place Names Compiled from the Records of the Boundary Commission and the Board of Commissioners to Quiet Land Title of the Kingdom of Hawaii. Part 2: Hāmākua and Kohala. 2005. Electronic document, http://ulukau.org/cgi-bin/hpn?, accessed September 14, 2016.

Soil Survey Staff (United State Deparment of Agriculture, Natural Resources Conservation Service)
2017 Web Soil Survey. Electronic document, http://websoilsurvey.nrcs.usda.gov/.

Summers, C.
1999 *Material Culture: The J. S. Emerson Collection of Hawaiian Artifacts*. B. P. Bishop Museum Press, Honolulu.

Tatar, E.
1982 Nineteenth Century Hawaiian Chant. *Pacific Anthropological Records*. Prepared for Department of Anthropology, B.P. Bishop Museum.

The Hawaiian Star
1906 By Authority. Sale of the Remnant of the Government Land of Waawaa, Puna, Hawaii. *The Hawaiian Star* [Honolulu]. January 23, 1894: 3. Electronic document, https://www.newspapers.com/image/79741892/?terms=waawaa%2Bpuna, accessed October 19, 2020.

The Honolulu Advertiser
1908 Puna Rent By the Earthquake. *The Honolulu Advertiser* [Honolulu]. October 4, 1908: 1. Electronic document, https://www.newspapers.com/image/259033244/?terms=puna%2Btrail.

The Polynesian
1840 The Appearance of Three Hills formed by the late eruption, on the coast at Nanawale bearing East by north one mile distant July 9, 1840. *The Polynesian* [Honolulu]. August 29, 1840.

Westervelt, W. D.
1916 *Hawaiian Legends of Volcanoes*. G.H. Ellis Press, Boston.

Whitney, H. M.
1875 *The Hawaiian Guide Book, Containing a Brief Description of the Hawaiian Islands, Their Harbors, Agricultural Resources, Plantations, Scenery, Volcanoes, Cimate, Population, and Commerce*. Henry M. Whitney, Honolulu.

Wilkes, C.
1845 *Narrative of the United States Exploring Expedition During the Years 1838, 1839, 1849, 1842*, vol. IV. Lea and Blanchard, Philadelphia.

Wilkes, C.
Wilmshurst, J., T. Hunt, C. Lipo, and A. Anderson
2011 High-Precision Radiocarbon Dating Shows Recent and Rapid Colonization of East Polynesia. *Proceedings of the National Academy of Sciences* 108:1815-1820.

Yent, M. and J. Ota
1982 Archaeological Reconnaissance Survey, Nanawale Forest Reserve, Halepuaʻa Section, Puna, Hawaii Island. Division of State Parks and Historic Sites, Department of Land and Natural Resources. Prepared for Division of Forestry, Department of Land and Natural Resources.

[This page intentionally left blank]

Environmental Assessment

Roehrig Single-Family Residence in the Conservation District in Wa‘awa‘a

APPENDIX 3
Coastal Erosion Study

[This page intentionally left blank]

tes ARCH services

Timothy E. Scheffler, Ph.D.
Sole Proprietor - Principal Archaeologist
P.O. Box 388 Volcano, HI 96785
(808) 345 - 2282
tesarchservices@gmail.com

DRAFT

Coastal Erosion Study for the Roehrig Property

Wa'awa'a Subdivision, Lot 43

Puna, Hawai`i

TMK: (3) 01-04-028:08

By:

T.E. Scheffler, Ph. D.

and

J.P. Lockwood, Ph.D.

For:

Christopher and Wendi Roehrig

64-629 Kolohala Place Kamuela, HI 96743

c/o Ron Terry, Geometrician Assoc., LLC.

P.O. Box 396 Hilo, HI 96721-0396

(808) 969-7090

April 2, 2021

- This page left intentionally blank –

Executive Summary

This Coastal Erosion Survey (CES) has been prepared in accordance with HRS-343 (Hawaii Environmental Policy Act) and HAR Ch. 200-16 (Environmental Impact Statement Rules) for inclusion in an Environmental Assessment for the "Roehrig Property" (TMK: (3) 1-4-028:008) in the Wa`awa`a Subdivision of Puna District, Hawaii Island.

The Average Annual Erosion Rate (AAER) of the shoreline at the property over the past 67 years is estimated to be a maximum of 0.15 feet per year (4.6 cm/yr). This estimate is based on geological field observations and the quantitative evaluation of historic aerial photos as prescribed in the Hawaii Coastal Zone Mitigation Handbook (Hwang *et al.* 2005).

Contents

Introduction 1
Study Requirement 1
Property Location and Physical Setting 1
Geological Background 3
Marine Conditions 4
Wave Climate 4
Tides 5
Findings of the Field Inspection 6
Lithology and Internal Structures of the Lava Substrate 6
Unconsolidated Cobble and Boulder deposits on the “Beach Bench” 8
Beach Profile and Granulometry 9
Calculation of Average Annual Erosion Rate (AAER) 12
Analysis of Historic Aerial Photos 12
Effects of Subsidence and Sea Level Rise on Shoreline 13
General Coastal Zone Hazards 14
Volcanic/Seismic Hazards 14
Stream Flooding Hazards 14
Tsunami 15
Hurricane and Storm Surge 15
Summary and Conclusion 16
References Cited 17

List of Figures

Figure 1 Roehrig Property on Tax Map Key. 1
Figure 2 Roehrig Property on Google Earth image (5/11/2019). 2
Figure 3 Wave Direction and Magnitude (Vitousek and Fletcher 2008) 4
Figure 4 Tidal levels at Hilo Bay, Hawaii. 5
Figure 5 Property line, shoreline (from dlb and Associates 2021) and flow contact line (red-dashed). 8
Figure 6 Project area geology and location of beach profile (A – A'). 10
Figure 7 Beach profile at the Roehrig property. 10
Figure 8 Portions of 1954, 1977 and 2019 aerial photos with Roehrig property indicated. 13

List of Tables

Table 1 Aerial photography reviewed for the project. 12
Table 2 Natural hazards along the Roehrig Property coastline (Fletcher *et al.*, 2002:150). 14

List of Photos

Photo 1 Overview of Beach Reserve with Roehrig property in background, view to west. 2
Photo 2 Pāhoehoe shelf, view south. 6
Photo 3 Close-up of lava flow contact (pāhoehoe above, red (oxidized) `a`ā, below). 7
Photo 4 `a`ā beach fronting the Roehrig property, view to east-northeast. 11

Introduction

Study Requirement

The Hawaii Administrative Rules concerning Conservation Districts (Title 13, Subtitle 1, Chapter 5, adopted August 12, 2011) state that applicants for Single Family Residential construction in coastal Conservation Districts must consider rates of coastal erosion affecting their properties in order to determine minimum shoreline setbacks for permitting. DLNR established a requirement that Annual Coastal Erosion Rates must be determined, based on formal "Coastal Erosion Studies". This report documents the nature of erosion and shoreline migration at the Roehrig property, based on quantitative measurements and observations obtained through field inspection, aerial photography, satellite imagery, and review of the geologic literature.

Property Location and Physical Setting

The Roehrig property is located in lower Puna District, along the Old Government Beach Road. The property is lot 43 in Wa`awa`a Subdivision, named for the traditional Hawaiian land division, the Ahupua`a of Wa`awa`a, in which it lies.

In the Hawaiian language, a "wa`a" is a canoe. However, the reduplicative version "wa`awa`a" has different connotations, referring to something "… full of gulches, gullies, grooves; gullied, furrowed, grooved. (Pukui and Elbert 1986). Note the contours of the coastline shown on the TMK map (Figure 1) just east of the subject property. This ahupua`a is named for the unique contours of her coast.

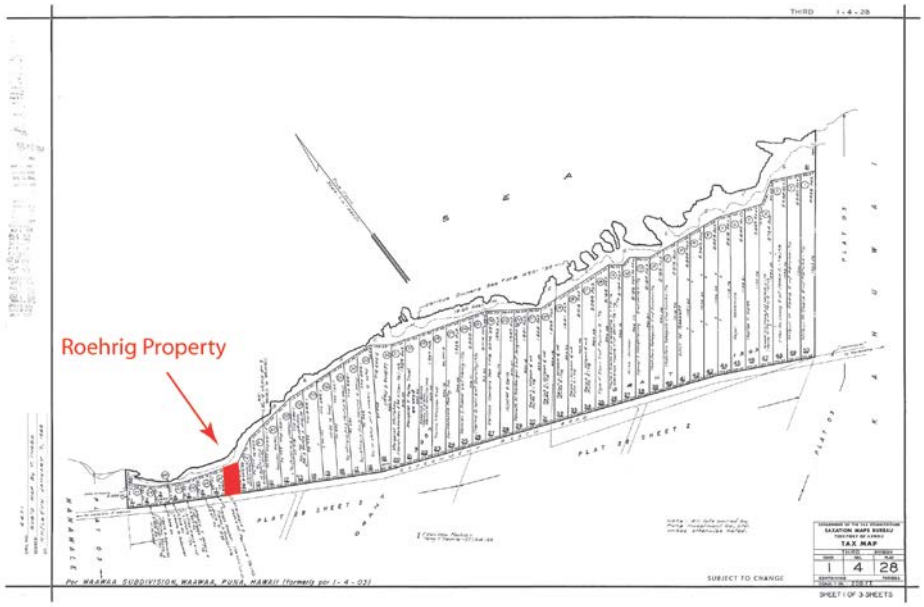


Figure 1 Roehrig Property on Tax Map Key.

The Govt. Road runs at an elevation between 30 and 40 feet above sea level. The Roehrig property slopes seaward from the road. The mauka two-thirds of the property are a mix of pāhoehoe and a`ā lavas, the uneven ground is heavily covered with hala (screw pine, *Pandanus sp.*). The makai third, however is covered with naupaka (*Scaevola taccada*). This change can be seen on the google image (Figure 2). This vegetative front extends to the edge of an abrupt cliff of 1 – 2 meters in height and represents the current shoreline.

Between the property and the ocean is a broad "Beach Reserve" (see TMK, Figure 1). This shelf extends from below this small cliff to the water's edge. The objective of this Coastal Erosion Survey (CES) is to evaluate any historic changes in the breadth of this shelf, as well as any changes in relative positions of the pali-line (the cliff) or coastline (seaward edge of rocks).

Figure 2 Roehrig Property on Google Earth image (5/11/2019).

Photo 1 Overview of Beach Reserve with Roehrig property in background, view to west.

A view westward of the coastline fronting the Roehrig property is shown in Photo 1 (above). Normal surf does not reach above the coastal cliff in the background. However, rounded and sub-angular boulder rubble as well as very well-rounded cobbles shown in the foreground attest to the impact of storm waves over this zone. The vegetation is another indication of these impacts, defining the official "shoreline" at the property and the 40 – 60 foot zone of "beach".

Geological Background

The lava flows underlying the property, a geological unit known as "Qp3," have estimated ages of 750-1,500 years before present (Trusdell *et al.* 2007 and Moore and Trusdell 1991). This unit is described as mostly consisting of dense pāhoehoe lava, but it is underlain by 'a'a at this site. The basalt rock is typical tholeiitic basalt, of the Holocene Puna Basalts (Sherrod *et al.* 2007).

Kilauea volcano is extremely active, perhaps one of the most active volcanos in the world (Sigurdsson *et al.* 2015). Directly to the west, less than a quarter of a kilometer away, Pele sent a lava flow ("Qp5") to the sea in 1840. This eruption built the large littoral cone at Honolulu. A little more than a kilometer to the east is a lava flow ("Qp4y") that is merely 200 – 400 years old.

This dynamic volcanic environment and the fluid basalt lava flows create a unique topography and landscape in Wa`awa`a. The hard rock coastline is dramatic in this respect. The grooved or, serrated appearance of the coast is a result of this volcanism. The fingers are remnants of lava tubes and channels in which denser rock ponded and solidified, leaving weaker less dense portions of the flow to be worn away.

The relatively old (for Puna) age of the coastline along the Roehrig property may be used to argue that erosive forces have reached a more or less stable equilibrium, independent of allochthonous changes such as sea level rise, or island subsidence. These factors are discussed below.

Marine Conditions

Wave Climate

The coast of this part of the Puna District faces the open ocean with no submerged barriers such as offshore reefs or sand bars to buffer it. The submarine slope is approximately 1,300 feet/mile for a distance of roughly 6 miles, descending into the deep water Puna Canyon. The extremely long fetch of waves crossing the Pacific creates a situation where big, long period swells rising to significant heights slam into the island's flank. Large waves reaching the coast are predominantly related to trade wind conditions, though the coastline is also exposed directly to large North Pacific swells. The direction and magnitude of waves approaching the Big Island is shown in Figure 3, below.

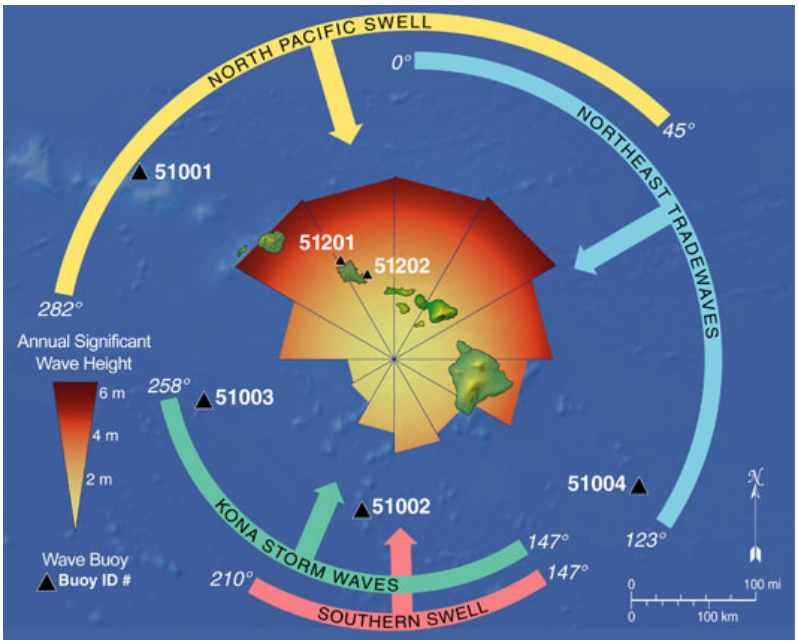


Figure 3 Wave Direction and Magnitude (Vitousek and Fletcher 2008)

The Wa`awa`a coastline faces approximately north. This is significant relative to typical incoming waves. Note on Figure 3 that the largest waves of all come from the north-north-east, north or north-north-west direction. These North Pacific swells can reach significant heights of 20+ ft. and are a major contributor to coastal erosion and storm damage.

Tides

Tidal conditions for this part of the island are summarized in Figure 4. These are based upon data collected in nearby Hilo Bay, the closest continuously monitored tidal station to the property. The magnitudes of these relative elevations are an important reference for assessing the importance of any measured changes or, in particular their impacts outside the normal range.

The mean range of tidal change (MN) is 1.67 ft. with a Great Diurnal Range (GT) of 2.4 ft. Understanding the tidal variation throughout the year is important as any instantaneous "snapshot" of the coastline at a given tide can be misleading on the whole. The effects of tides are dependent on beach slope. For example, 2.4 ft. of tide will move the tideline 24 ft. horizontally on a 10% slope. This can have dramatic effects, changing the location and breadth of active weathering.

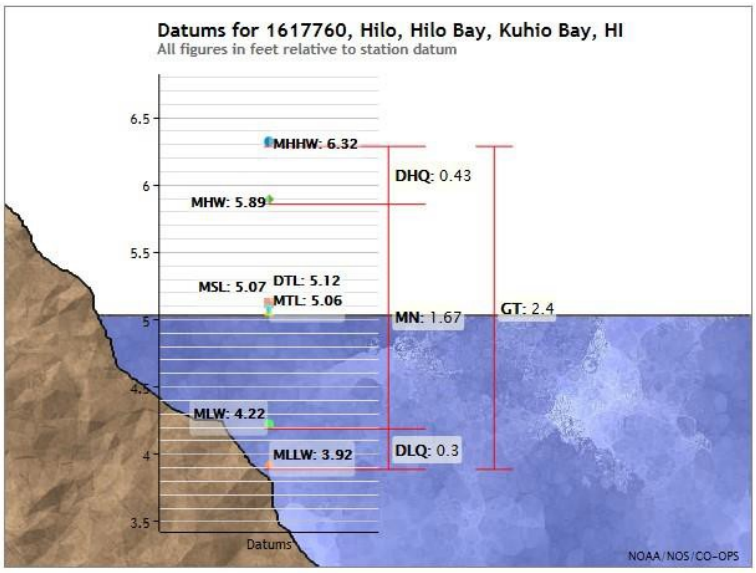


Figure 4 Tidal levels at Hilo Bay, Hawaii.

Findings of the Field Inspection

Tim Scheffler visited the subject property on March 22, 2021; 3 hours were spent making field observations, surveying with Brunton pocket transit and measuring tape, and obtaining site photography.

The field observations of observed water line were taken as the tide reached a high of 0.9 feet. The ocean was characterized by moderate to large swells (6 - 8 feet), which generating surf necessitating a high surf advisory for the County of Hawaii's east facing shores and prevented detailed observation of coastal lavas along the sea cliff.

Lithology and Internal Structures of the Lava Substrate

The lava flow underlying most of the Property is pāhoehoe, but coastal erosion reveals that this pāhoehoe overlies 'a'a, along a sharp contact (Photo 2, 3 and Figure 5). The coastal sea cliff is composed of the dense, "blue lava" core of this 'a'a unit. The flow morphology grades upward into densely welded and moderately oxidized 'a'a breccia. These welded breccias are in turn overlain by discontinuous loose rubble zones up to 10 feet thick. The (slightly) older 'a'a lavas were formed during the same eruption that produced the overlying pāhoehoe, during earlier phases of the eruption sequence, during which discontinuous high fountaining favored 'a'a production. The pāhoehoe was formed during later phases of this eruption when major lava fountaining ceased and copious pāhoehoe was erupted at steady rates and mostly buried the earlier 'a'a flows. The fact that both the pāhoehoe and 'a'a were produced by the same eruption is demonstrated by their identical mineralogic and textural characteristics (next section).

Photo 2 Pāhoehoe shelf, view south.

Photo 3 Close-up of lava flow contact (pāhoehoe above, red (oxidized) `a`ā, below).

The ‘a’a and pāhoehoe lavas underlying the Property have similar mineralogy and textural characteristics, indicating that they were emplaced as separate phases of the same eruption. Both lava types are olivine-rich, with olivine typically varying between 20-25% in the pāhoehoe, and between 8-20% in the ‘a’a. The olivine phenocrysts in the pāhoehoe are light apple-green in color, sub-rounded to sub-hedral (crystalline) in form, and mostly 2-4 mm in size. Some distinctive olivine crystals are lath-shaped (<0.5 mm thick), appearing as “needles” in cross-section. Olivine crystals in the ‘a’a are typically more oxidized than in the pāhoehoe, with brownish-green colors and some oxidation to red-brown colors – especially in the upper portions of the flow. Vesicles (gas bubbles) are sub-rounded in the pāhoehoe, but angular and contorted in the ‘a’a. Some orthopyroxene may be present in both flow types, but no microscopic confirmation of this was attempted.

This Pāhoehoe lava overlies looser 'a'a breccia. The overlying pāhoehoe flow consists of a single 2 – 3 meter thick flow unit where exposed along the shoreline cliff. However, the pāhoehoe flow is too thin to contain pyroducts (“lava tubes”) beneath the Property. The interface of these two flow-types largely defines the geomorphology of the area. The weak joint between the `a`ā and pāhoehoe allowed the 2 – 3 meter thick pāhoehoe “skin” to be peeled back, thus creating the beach bench (see Figure 6).

Unconsolidated Cobble and Boulder deposits on the "Beach Bench"

The ‘a’a beneath the Property consists of a single thick flow, and is highly variable in internal structure where exposed makai of the Property, becoming denser and more homogenous with depth. The flow is of unknown thickness, but middle sections as exposed at the sea cliff consist of very dense, erosion resistant "blue rock" in the normal wave impact zone. This "blue rock" core of the flow is gradationally overlain by dense, internally brecciated ‘a’a with tightly welded fragments. This forms an erosion-resistant surface despite the scouring of this storm wave impact zone.

Note the sub-rounded storm-tossed boulders overlying this ‘a’a closer to the vegetation-defined shoreline. These large blocks are remains of the upper pāhoehoe lip, slowly crumbling in the face of extreme wave run-up.

Figure 5 Property line, shoreline (from dlb and Associates 2021) and flow contact line (red-dashed).

In the uppermost sections of this ‘a’a flow pockets of unwelded, looser ‘a’a fragments directly underlie a cap of the younger pāhoehoe. These fragmental zones are more vulnerable to erosion by the highest reaches of storm waves. The relationship of this contact to the shoreline is shown in Photos 2 and 3). Notice in Figure 5 that some vegetation has established below this pali-line, indicating the rarity of such extreme events reaching this elevation, which is at least 20 feet above sea level.

Beach Profile and Granulometry

The shoreline is legally defined in Hawaii as "*the upper reaches of the wash of the waves, other than storm and seismic waves, at high tide during the season of the year in which the highest wash of the waves occurs, usually evidenced by the edge of vegetation growth, or the upper limit of debris left by the wash of the waves, ...*" (HAR §13-5-2). In this case the shoreline has been surveyed as the edge of vegetation growth, that also coincides with the 4-10' high erosional cliff that marks the landward-most impact of storm waves.

The vegetation inland from this cliff consists of dense *naupaka* growth. The pāhoehoe flow is overlain by a discontinuous soil zone, consisting mostly of organic debris intermixed with fine silt- and clay-size mineral material, likely derived from the accumulation of windblown volcanic ash. The fact that this loose soil is present inland of the shoreline indicates no erosion is taking place in this area. Furthermore, the zone inland of the shoreline was searched systematically for "ballistically" emplaced fragments that may have been thrown behind the beach during extreme events. None were found.

The beach, *per se*, is a slightly sloping (12-15 degrees) accumulation of well-worn cobbles and boulders overlying the basal substrate of `a`ā described above. The toe of this `a`ā shelf, or "beach bench", is mostly scoured clean of debris by storm waves. It ends abruptly at the water's edge, on low tide with perhaps 2 – 3 ft above sea level.

Debris accumulates against the rear of this bench, in the "crotch" created by the cliff. The majority of this rubble talus is materials eroded from the surface of the a`a bench heavily worn by the ocean and occurring as smaller very-well rounded clasts. The cliff is highly resistant to erosion, even by powerful marine wave action, as there is little jointing or fracturing of its' interior. Large sub-rounded to sub-angular detached boulders at its base and intermingled with the more heavily weathered storm tossed `a`ā debris does indicate that minor sea-cliff erosion is occurring. However, this occasional weathering and the stochastic block failures do not seem to contribute to any significant rate of retreat of the cliff. Several of these large blocks can be seen on the bench in Photo 4.

These relationships are illustrated in Figure 7, a scaled schematic profile of the beach bench, cliff face and property. In the infrequent, but likely, event of significant waves reaching this area, the talus material serves as a sort of revetment and protective shield to direct impacts on the cliff face. This is likely one factor in the relative lack of evidence for active erosion along this edge (see below).

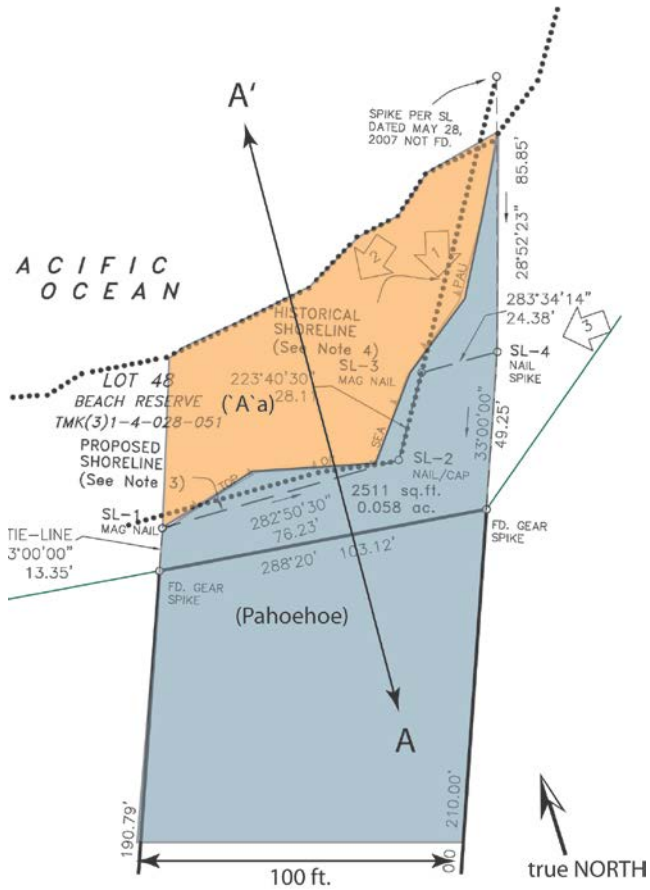


Figure 6 Project area geology and location of beach profile (A – A').

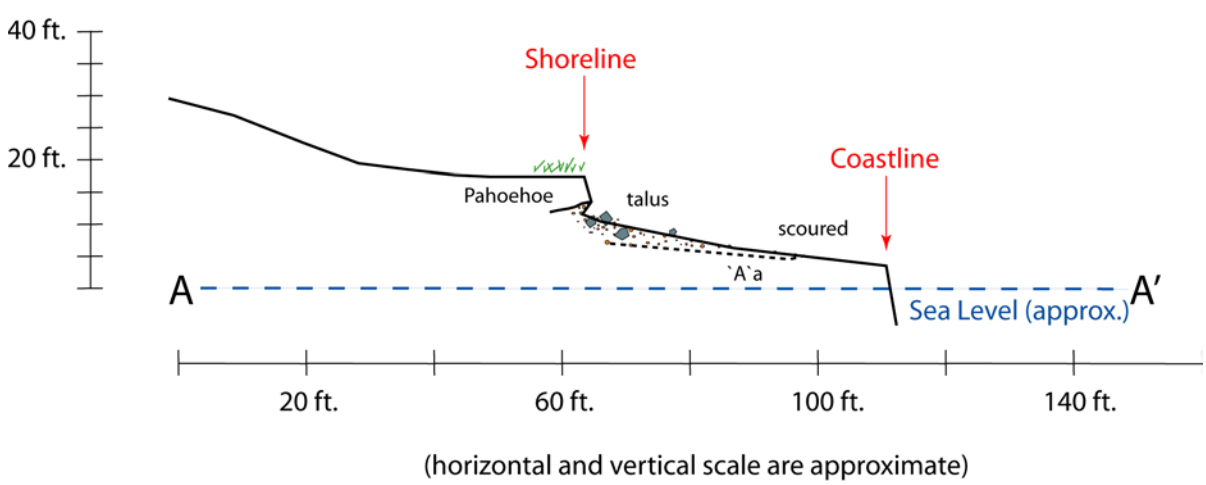


Figure 7 Beach profile at the Roehrig property.

Photo 4 `A`ā beach fronting the Roehrig property, view to east-northeast.

Calculation of Average Annual Erosion Rate (AAER)

As described above, the ‘a’a bench leading up to the water’s edge is overlain especially at the rear by a rubbly layer of ‘a’a breccia. Where it most often subject to storm or tsunami wave erosion, at its toe, however, the loose ‘a’a fragmental zone has been completely eroded away. The interior core of this ‘a’a flow that forms the low sea cliff *coastline* is extremely durable “blue rock” and does not seem to be subject to appreciable horizontal erosion. Similarly, the cliff 40 – 60 feet back from the water, the *shoreline*, is composed of a dense sheet of pāhoehoe also relatively impervious to erosion on a human time scale. Nevertheless, to independently substantiate these assertions requires a quantitative comparison of aerial views of the area over time. This was accomplished using standard practices and methods outlined in Hwang *et al.* (2005).

Analysis of Historic Aerial Photos

The inspection of available aerial photographs (Table 1) showed no measurable change in position of the overall coastal sea-cliff or of the vegetation line since the earliest 1954 photos. Figure 8 shows the Wa`awa`a coastline at three points in time over the last 67 years. The large scale (and thus limited resolution) of the aerial photographs inspected study makes quantifying fine-scale morphological changes of the shoreline or sea-cliff impossible. Given the maximum 600 dpi resolution of the images, a single pixel represents around 10 ft., so, changes of less than 10 feet cannot be detected.

Date	Agency	Flight Line	Frames
1954	USN-USGS	017	132, 133
1965	USDA	EKL-12CC	007, 008
1977	USGS	GS-VEEC 6	152, 153
2019	Google Earth		

Table 1 Aerial photography reviewed for the project.

Given these confounding variables, any shoreline determinations must rely more heavily upon primary indicators – as discussed above, primarily observations of active erosion indicators such as freshly cut cliff faces or presence of angular erosional debris. The authors also broadened the examination to include comparisons over this time of the prominent lava fingers to the east. These also seem to have not undergone any significant change in the last half century. There is no visible indication that the shoreline vegetation, or the width of the `a`ā bench has changed over the 67 year period since the first aerial photographic record began. Nor are there measureable changes in sea cliff’s (coastline) position. It appears that the maximum amount of coastal erosion fronting the Property is 10 feet or less – for a maximum AAER of 0.15 ft. / year (4.6 cm/yr).

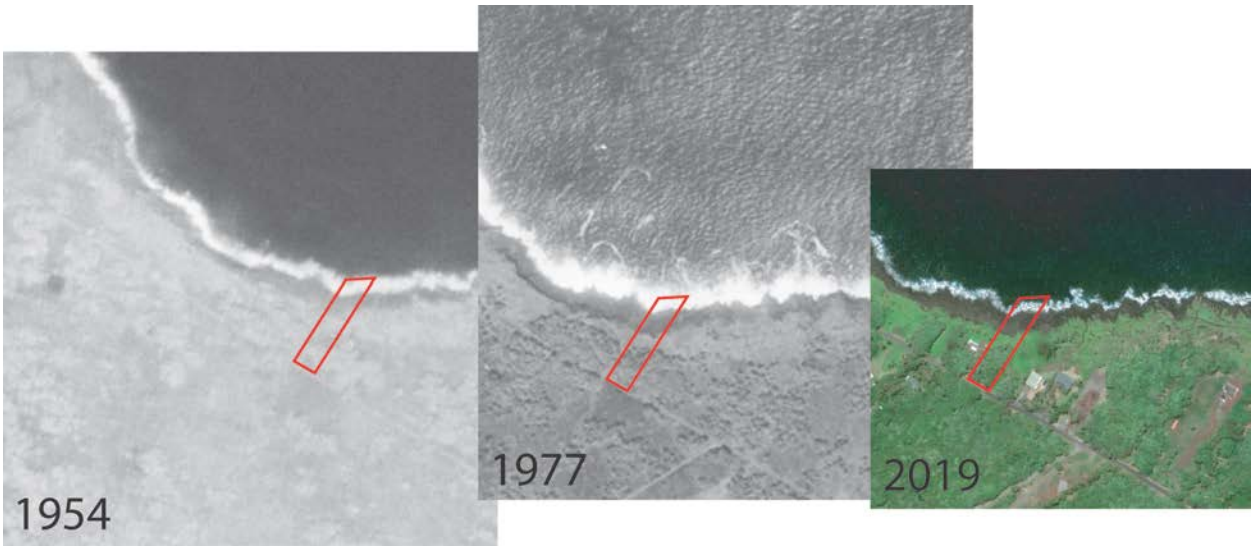


Figure 8 Portions of 1954, 1977 and 2019 aerial photos with Roehrig property indicated.

Effects of Subsidence and Sea Level Rise on Shoreline

An overall global rise in sea level of 3.3 feet by the end of the 21st century has been proposed by Fletcher (2010) and others. Hwang et al (2007) use a figure of .16 in/yr in their assessments. Relative sea-level rise, of course, is a result of the combined water rise and land subsidence. Changes in these variables may have a positive effect on future AAER.

The 1975 Kalapana earthquake on Kilauea's rift caused land in Kapoho to drop 0.8ft. (based on Hawaii Volcano Observatory (USGS) data in Hwang *et al.* 2007:6). This *episodic* seismic induced subsistence is difficult to anticipate or measure over long periods of time. On the basis of InSAR (Synthetic Aperture Radar Interferometry) remote sensing data, Hwang *et al.*(*ibid.*) state that the coastline at Kapoho may be subsiding at a *continuous* rate of between .31 – .67 in/yr. Rates of subsidence at the Property, however, are necessarily much lower as a result of their distance from Kilauea's active rift zone.

The combined effects of land subsidence and rising sea levels may cause an overall (relative) drop in the shoreline elevation of between 0.1 - 0.3 in/yr. The height of the coastal shelf and elevation of the shoreline cliff ensure that combined sea level change and land subsidence will not cause significant shoreline transgression in this area. The northern boundary of the Property lies at ~30 feet above sea level, as estimated by hand-leveling.

General Coastal Zone Hazards

Hwang (2005) recommends that all hazards facing coastal areas should be considered when planning for land-use zoning in Hawaii, and not just erosion. Fletcher *et al.* (2002) portray generalized hazards assessments for long areas of Hawaii's coastlines. They rate the specific hazards for the area of Puna fronting the Roehrig lot as shown in the following Table:

Hazard Type	Scale (1-4)
Tsunami	4
Stream Flooding	3
High Waves	3
Storms	3
Erosion	2
Sea Level Change	3
Volcanic/Seismic	4
Overall Hazard Assessment	4 (on scale of 1-7)

Table 2 Natural hazards along the Roehrig Property coastline (Fletcher *et al.*, 2002:150).

Volcanic/Seismic Hazards

Elevated risks associated with "Volcanic/Seismic" hazard types are due to the Wa`awa`a coast's susceptibility to lava flows and the periodic morphological changes caused by Kilauea's active East Rift Zone (ERZ). Kilauea's south flank has generated many historic earthquakes and despite a current pause in eruptive activity, it will feel them in the future as well. For example, three more recent earthquakes in 1954, 1975 and 1989 registered 6.5, 7.2 and 6.1 on the Richter scale of magnitude (not to mention the most recent M=5.4 and 6.9 pair of tremblors that hit May 4, 2018 - which was felt strongly in this area). A hazard intensity rank of 4 indicates "frequent" seismic activity and recommends for a UBC seismic zone factor of >/= 2 (Fletcher *et al.* 2002:3). Other volcanic hazards include the threat of inundation by lava flows. The Roehrig property lies in a USGS defined hazard Zone 3 (Wright *et al.* 1992). It is a fair distance from the active East Rift Zone or summit of Kilauea (Zone 1).

Stream Flooding Hazards

The 3 rating for stream flooding corresponds to the properties location in a watershed which can receive greater than 7.9 inches of rain per month and has few mitigation measure in place in the event of a flood (Fletcher *et al.* 2002:3). No evidence of past flooding was observed, although water can be expected to pond for short periods in low-lying areas.

Tsunami

There is a possibility of tsunami (seismically generated "tidal"-waves) threatening this coastline. A hazard rank of 4 reflects this fact. The high rating is a result of the historical occurrence of tsunami as well as the generally low slope of the coastline. Exceedingly large "tidal waves" generated by local or wide ranging Pacific-Rim volcanic movements can severely impact this region. Data are available for historic tsunami heights from Hilo as well as from Cape Kumukahi (the property is about half-way between the two). In 1946 a tsunami reached 26 ft. above normal sea level in Hilo and 19 ft. at Cape Kumukahi. In 1957, waves of 13 and 12 ft. (respectively) were recorded at these locations. One of the largest tsunami of modern times to hit the island came in 1960 when a 35 ft. high wall of water, focused by Hilo Bay, completely decimated the low-lying coastal areas of Hilo. The effects of a tsunami are highly variable, dependent on both local and extra-regional factors. For example, on the southeast shore this wave amounted to only 13 ft. in height (Fletcher *et al.* 2002:7).

Hurricane and Storm Surge

It is beyond the scope of this study to quantify changes in storminess or significantly higher wave heights due to climate change and a precise forecast of these positively contributing variables is impossible. However, rising sea surface temperatures in Hawaiian waters could, for example, influence hurricane storm tracks impacting the islands (Businger, 1998). The recurrence and intensity of wave energy focused on the coastline is obviously a critical factor in the discussion of erosion along any coast. Merrifield and Maltrud (2011) noted that trade winds have intensified across the Pacific gradually since the early 1990s, e.g. The intensification of trade winds and accompanying sea level rise is more pronounced 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. The probability and impact of sea level rise associated with climate change at the subject property is discussed in a separate section. 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 *et al.* 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).

Summary and Conclusion

The shoreline, beach and sea-cliff in front of the Property were surveyed in order to assess the erodibility of underlying rocks and the dynamic nature of geologic and marine processes that contribute to erosion. Where overlying loose ‘a’a rubble, a thin pāhoehoe flow defines the shoreline. It is susceptible to mechanical erosion by storm or tsunami waves, but no measurable lateral erosion could be documented in the past 67 years. Historical aerial photos dating back to 1954 were compared to 1965, 1977 and 2019 imagery in this calulation erosion rate for the area. No measureable change could be measured. Future migration of the shoreline will be affected predominantly by unpredictable and episodic events including subsistence due to seismicity or by accretion due to future eruptions of Kilauea and by the future impacts of sea level rise. The Roehrig Property shoreline is located 40-60 feet inland on a coastal shelf 30-35 feet above sea level, currently, and there is no indication of any immediate erosional threat to the Property.

References Cited

Businger, S., 1998, poster, Hurricanes in Hawaii; Hurricane and Extreme Weather Phenomena Symposium; Center for the Study of Active Volcanoes, Federal Emergency Management Agency, and National Oceanographic and Atmospheric Administration, hht://www.soest.hawaii/edu/MET/Faculty/businger/poster/hurricane.

Fletcher, C. H., Boyd, R., Neal, W. J., and Tice, V. (2010) Living on the Shores of Hawaii – Natural Hazards, the Environment, and our Communities: University of Hawaii Press, 371 pp.

Fletcher, C. H., Grossman, E. E, Richmond, B. M. and Gibbs, A. E. (2002). Atlas of Natural Hazards in the Hawaiian Coastal Zone: U.S. Geological Survey, Geologic Investigations Series Map I-2761, scale 1:50,000.

Grinsted, A., Moore, J.C., Jevrejeva, S., 2012, Projected Atlantic hurricane storm threat from rising temperatures, Proceedings of the National Academy of Sciences, vol. 110, no. 4, pp. 5369-5373.

Holland, G., and Bruyére, C.L., 2013, Recent intense hurricane response to global climate change, Journal of Climate Dynamics (on line): DOI: 10.1007/s00382-013-1713-0.

Hwang, D. J. (2005). Hawaii Coastal Zone Mitigation Handbook: Hawaii Coastal Zone Management Program. DBED; State of Hawaii, 216 pp.

Hwang, D. J. (2007). Coastal Subsidence at Kapoho, Puna, Island and State of Hawaii: Private report for Hawaii County Planning Department, 82 pp.

Merrifield, M.A., and Maltrud, M., 2011, Regional sea level trends due to a Pacific trade wind intensification, Geophysical Research Letters (on-line), DOI: 1029/2011GLO49576.

Moore, J. G. (1970). Relationship between subsidence and volcanic load, Hawaii: Bulletin of Volcanology, V. 34, pp. 562-576.

Moore, J. G. and Fornari, D. J. (1984). Drowned reefs as indicators of the rate of subsidence of the Island of Hawaii: Journal of Geology, v. 92, p. 752-759.

Moore, R. B. and Trusdell, F. A. (1991). Geologic Map of the Lower East Rift Zone of Kilauea Volcano, Hawaii: U. S. Geological Survey Misc. Investigations Series, Map I-2225, Scale:1:24,000.

Pukui, M. K., & Elbert, S. H. (1986). Hawaiian Dictionary: Hawaiian-English English-Hawaiian Revised and Enlarged Edition. University of Hawaii Press.

Ruggiero, P., Komar, P.D., Allan, J.C., 2010, Increasing wave heights and extreme wave projections; the wave climate of the Pacific Northwest, Journal of Coastal Engineering, vol. 57, pp. 539-552

Sherrod, D. R., Sinton, J. M., Watkins, S. E., & Brunt, K. M. (2007). Geologic map of the State of Hawaii. US geological survey open-file report, 1089(8).

Sigurdsson, H., Houghton, B., McNutt, S., Rymer, H., & Stix, J. (Eds.). (2015). The encyclopedia of volcanoes. Elsevier.

Trusdell, F. A., Wolfe, E. W., & Morris, J. (2006). Digital database of the geologic map of the island of Hawai'i [Hawaii] (No. 144). US Geological Survey.

Vitousek, S., & Fletcher, C. H. (2008). Maximum Annually Recurring Wave Heights in Hawai ‘i1. Pacific Science, 62(4), 541-553.

Wang, X.L., Feng, Y., and Swail, V.R., 2014, Changes in global ocean wave heights as projected usingf CMIP5 simulations, Geophysical Research Letters (on line), DOI:1002/2013GLO58650.

Wright,,T L., Chun, J.Y.F., Esposo, Joan, Heliker, C., Hodge, J., Lockwood, J. P., and Vogt, S. M. (1992). Map showing Lava-flow Hazard Zones, Island of Hawaii: U.S. Geological Survey, Misc. Field Studies Map MF-2193, 1:250,000.

[This page intentionally left blank]

Environmental Assessment

Roehrig Single-Family Residence in the Conservation District in Wa‘awa‘a

APPENDIX 4
Cultural Consultation Report

[This page intentionally left blank]

ASM Project 35970.01

April 1, 2021

Kit Roehrig
64-629 Kolohala Place
Kamuela, HI 96743
kitroehrig@hotmail.com

Subject: **Results of the Cultural Consultation in association with a Conservation District Use Application and Environmental Assessment for a Proposed Single Family Residence on Tax Map Key: (3) 1-4-028:008, Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi**

Dear Kit:

At your request, ASM Affiliates (ASM) has conducted consultation to assess the impacts of the proposed project on traditional and customary practices and valued cultural resources that may be associated with the subject parcel, Tax Map Key (TMK): (3) 1-4-028:008, Waʻawaʻa Ahupuaʻa, Puna District, Island of Hawaiʻi (Figures 1, 2, and 3). It is understood that conducting consultation is an important part of the planning process and completion of the Conservation District Use Application (CDUA) and Environmental Assessment. In 2020, ASM completed an archaeological assessment survey (Kepaʻa and Clark 2020) of the subject parcel in which no historic properties were identified. Extensive culture-historical background information specific to Waʻawaʻa and relevant to the subject parcel were prepared as part of that study. This letter report presents the results of ASM's outreach efforts along with the findings of the consultation process in conjunction with the culture-historical background information included in the Kepaʻa and Clark (2020) study.

Consultation Methodology

Gathering input from community members and cultural practitioners with genealogical ties and long-standing residency or relationships to the project area is vital to the process of assessing potential impacts to traditional and customary practices, and valued cultural resources. It is precisely these individuals that ascribe meaning and value to traditional resources and practices of an area. These community members often possess traditional knowledge and in-depth understanding that are unavailable elsewhere in the historical or cultural record of a place.

To identify individuals knowledgeable about past and ongoing customary and traditional cultural practices associated with the project area, a public notice was submitted to the Hawaii Tribune-Herald and Ka Wai Ola, a monthly newspaper published by the Office of Hawaiian Affairs. The Hawaii Tribune-Herald affidavit, which confirms publication, and a copy of the Ka Wai Ola public notice are attached to this letter report as Appendix A and B. To date, no response has been received from the public notices. Efforts were also made by ASM staff to contact cultural practitioners and community members via email or phone; the names of these individuals are listed in Table 1 below. These individuals were identified as persons who were believed to have genealogical ties, long-standing residency, or knowledge of cultural and or historical properties in Waʻawaʻa Ahupuaʻa. Of the six individuals contacted, responses were received from five individuals. If these five individuals, four provided cultural information.

Table 1. Persons contacted for consultation.

Name	*Initial Contact Date*	*Notes*
Ikaika Marzo	March 17, 2021	Responded to request but was not able to secure an interview.
Ryan McCormack	March 23, 2021	See comments below.
Hidi Botelho	March 23, 2021	See comments below.
Leila Kealoha	March 23, 2021	See comments below
Linda Saffery	March 23, 2021	Email request was sent however, email was returned as undeliverable.
Keone Kalawe	March 24, 2021	See comments below.

Findings from Consultation

As a result of the consultation efforts, Mr. Ryan McComack shared that there are *waʻa* (canoe) traditions associated with Waʻawaʻa, specifically in the area known as Honolulu Landing. He noted that along this portion of the Puna coastline, *hālau waʻa* (canoe sheds) can be found. Mr. McCormack recalled that students from Kua O Ka Lā public charter school used to visit the Waʻawaʻa area as part of their curriculum. Aside from traditions associated with the broader Waʻawaʻa Ahupuaʻa, no specific cultural practices associated with the subject parcel were noted. Mr. McCormack recommended ASM staff speak to Mrs. Leila Kealoha and Mr. Keone Kalawe.

In conversations with Mrs. Hidi Botelho, she shared that she recalled fishing along the Waʻawaʻa coastline once before as a child. However, she explained that for her *ʻohana* (family) this was not their preferred spot to gather marine resources. She noted that there may be other *ʻohana* that have and continue to gather marine resources from this area. She believes that if there is a reasonable setback from the coastline to allow for the perpetuation of traditional marine resource gathering, there would likely be minimal to no impact on traditional gathering practices. Mrs. Botelho recommended ASM staff speak to Mrs. Leila Kealoha.

Concerning the conversation with Mrs. Leila Kealoha, she requested a map of the project area. Maps showing the project area location were subsequently emailed to her. Generally speaking, Mrs. Kealoha noted that she was aware of *hala* (*Pandanus odoratissimus*) in the project area. Aside from noting the presence of *hala*, Mrs. Kealoha recommended that ASM staff contact Mr. Keone Kalawe and Mrs. Linda Saffery.

Mr. Keone Kalawe shared that he was aware of some *ʻohana* platform burials on the *mauka* (upland) side of the government road near the project area as well as burials located near the sand dunes by Kapoho. Aside from noting burials in the nearby area, Mr. Kalawe was not aware of any burial or other valued resources and traditional and customary practices occurring in the project area.

Recommendations

A review of the culture-historical background information from the Kepaʻa and Clark (2020) study and as noted by Mrs. Kealoha, *hala* is perhaps one of the most valued cultural resources found in Puna. Hawaiian cultural practitioners have and continue to gather *lauhala* (pandanus leaves) from the district. It is from the *hala* plant that various items of cultural importance (*hīnaʻi* [burial baskets]; *moena* [mats]; *uluna* [pillow]; cordage) and ornamental value were woven (Abbott 1992). Additionally, *hala* is a key bio-cultural feature that has and continues to be synonymous with Puna District. Efforts by the landowner to preserve, to the extent reasonable, any *hala* on the subject parcel would help to maintain this valued cultural resource.

As a coastal property, it can inferred that practitioner and community member likely access the coast to gather a variety of marine resources, including but not limited to, *ʻopihi* (limpets), *pūpūʻawa* (*Drupa sp.*), *iʻa* (fish), and *puhi* (eel). While no coastal access trail was identified on the property, it should be anticipated that fishers likely traverse the coastline in the area fronting the subject parcel. The *makai* boundary of the subject parcel does not extend to the sea, and there is a long, narrow lot (TMK: (3) 1-4-028:008) that lies between the residential lots and the sea. The subject parcel or the proposed project will not impede upon the shoreline area thus, adverse impacts to traditional marine resource gathering are not anticipated.

Based on the findings of ASM's consultation efforts in conjunction with the culture-historical background information that was prepared as part of the Kepaʻa and Clark (2020) study, it is concluded that if efforts to preserve, to the extent reasonable, the *hala* on the property there would be no foreseeable adverse impacts to any valued cultural resources, traditional and customary practices, beliefs, or historic properties.

Should you have any questions or concerns, please don't hesitate to contact me directly.

Sincerely,

Lokelani Brandt, M.A.
Senior Archaeologist

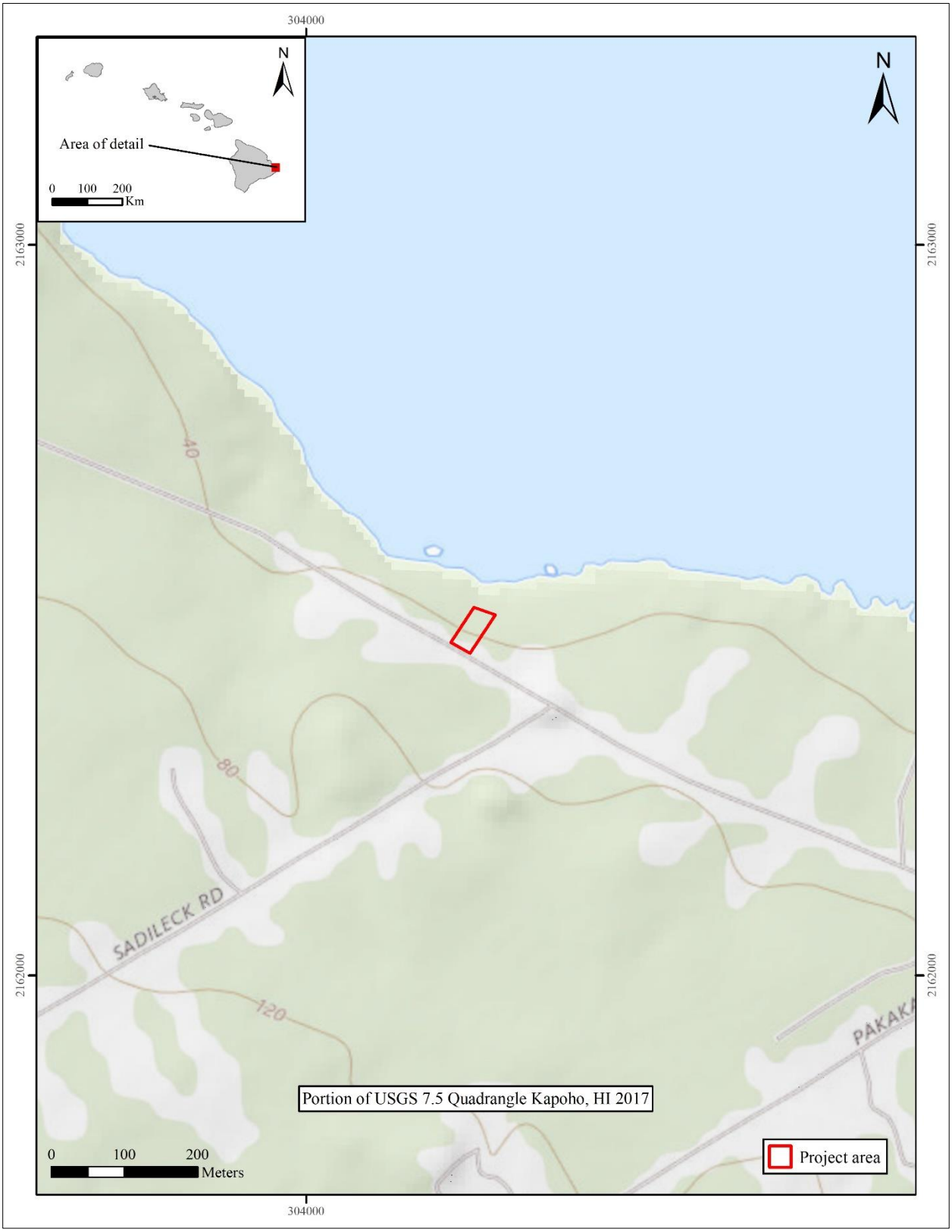


Figure 1. Project area.

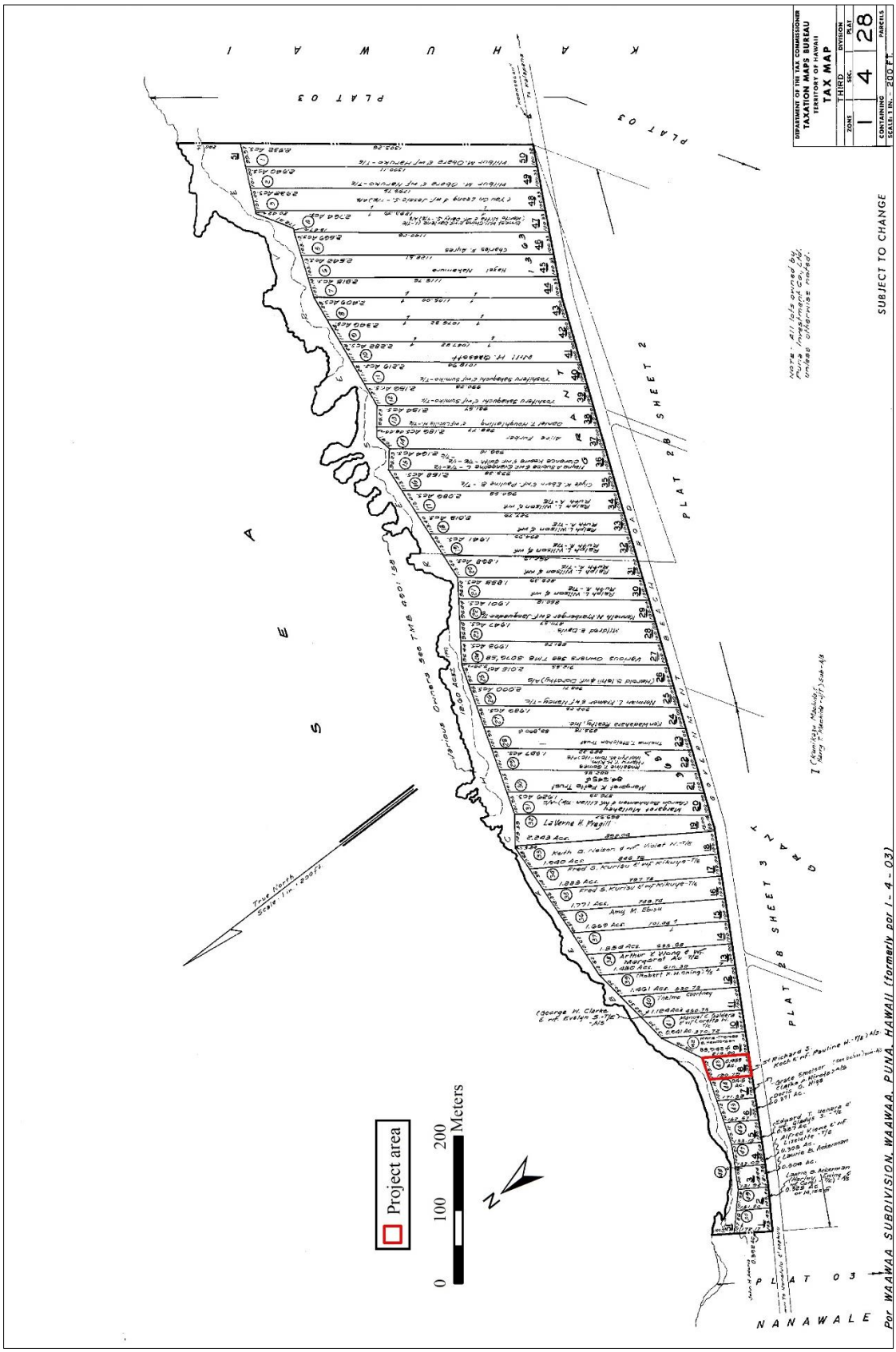


Figure 2. Tax Map Key plat (1) 4-028 showing location of current project area parcel (028).

Figure 3. Google Earth™ satellite image showing project area location.

References Cited

Abbott, I. A.
1992 *Lāʻau Hawaiʻi, Traditional Hawaiian Uses of Plants*. Bishop Museum Press, Honolulu.

Brandt, L.
2021 Public Notice. *Ka Wai Ola* [Honolulu]. April 1, 2021: 36. Electronic document, https://iskh447eqhe3kks2q2rvzg06-wpengine.netdna-ssl.com/wp-content/uploads/2021/03/KaWaiOla-April2021.pdf, accessed April 1, 2021.

Kepaʻa, L. M. U. and M. R. Clark
2020 An Archaeological Assessment of Lot 43 of the Wa'awa'a Subdivision, TMK: (3) 1-4-028:008, Wa'awa'a Ahupu'a, Puna District, Island of Hawai'i. ASM Affiliates Project Number 35970.00. Prepared for Kit Roehrig.

Appendix A

Hawaii Tribune-Herald Affidavit

AFFIDAVIT OF PUBLICATION

IN THE MATTER OF
PUBLIC NOTICE

STATE OF HAWAII }
} SS.
City and County of Honolulu }

Doc. Date: MAR 09 2021 **# Pages:** 1
Notary Name: COLLEEN E. SORANAKA First Judicial **Circuit**
Doc. Description: Affidavit of Publication
Notary Signature MAR 09 2021 Date

COLLEEN E. SORANAKA NOTARY PUBLIC No. 90-263 STATE OF HAWAII

PUBLIC NOTICE
ASM Affiliates is conducting consultation for a Conservation District Use Application (CDUA) being prepared for the proposed development of a single-family dwelling on a 0.459-acre parcel in Wa'awa'a Ahupua'a, Puna District, Island of Hawai'i. We are seeking consultation with any community members who may have knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices in the general vicinity of the subject property that may be impacted by the proposed project. If you have and can share any such information, please contact Lokelani Brandt lbrandt@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikaula Street, Hilo, HI 96720.
(HTH1317970 3/7/21)

Lisa Sakakida being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser, MidWeek, The Garden Island, West Hawaii Today, and Hawaii Tribune-Herald, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the

Honolulu Star-Advertiser 0 times on:

MidWeek 0 times on:

The Garden Island 0 times on:

Hawaii Tribune-Herald 1 times on:
03/07/2021

West Hawaii Today 0 times on:

Other Publications: 0 times on:

And that affiant is not a party to or in any way interested in the above entitled matter.

Lisa Sakakida

Subscribed to and sworn before me this 9th day of March A.D. 2021

Colleen E. Soranaka, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Jan 06 2024

Ad # 0001317970

COLLEEN E. SORANAKA NOTARY PUBLIC No. 90-263 STATE OF HAWAII

ICSP NO.:

Appendix B

Copy of Ka Wai Ola Public Notice

CONSERVATION DISTRICT USE APPLICATION: PUNA DISTRICT, ISLAND OF HAWAI'I

ASM Affiliates is conducting consultation for a Conservation District Use Application (CDUA) being prepared for the proposed development of a single-family dwelling on a 0.459-acre parcel in Wa'awa'a Ahupua'a, Puna District, Island of Hawai'i. We are seeking consultation with any community members who may have knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices in the general vicinity of the subject property that may be impacted by the proposed project. If you have and can share any such information, please contact Lokelani Brandt lbrandt@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikaula Street, Hilo, HI 96720.

(Brandt 2021:22)