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County of Hawai'i
DEPARTMENT OF PUBLIC WORKS

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OFC. OF ENVIRONMENTAL
QUALITY CONTROL

16 SEP 30 P 3:00

RECEIVED

September 29, 2016

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

FILE COPY
OCT 23 2016

Dear Director:

SUBJECT: Draft Environmental Assessment for Puna Subdivision Connector Roads to Volcano Highway In Vicinity of Mountain View, TMKs: (3rd) 1-1-038:207, 1-1-072:067, 1-1-100:042 & 051, 1-8-004:102, ROW of Lauko and Pszyk Roads, and Old Volcano Trail Alignment, Island of Hawai'i

With this letter, the Hawai'i County Department of Public Works (DPW) hereby transmits the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) for the subject project for publication in the next available edition of the Environmental Notice.

Enclosed is a completed OEQC Publication Form, one copy of the DEA-AFONSI, a CD with an Adobe Acrobat PDF file of the same and an electronic copy of the publication form in MS Word. Please contact Kason Pacheco of DPW at 961-8931 if you have any questions.

Sincerely,

Warren H. W. Lee

Warren H. W. Lee, P.E., Director

klp

Attachments: As noted above

Cc: Ron Terry, Ph.D., Project Environmental Consultant (w/o attachments)

17-144

AGENCY
PUBLICATION FORM

FILE COPY

OCT 23 2016

Project Name:	Puna Subdivision Connector Roads to Volcano Highway In Vicinity of Mountain View
Project Short Name:	Puna Subdivision Connector Roads
HRS §343-5 Trigger(s):	Use of County Land and Funds, Use of State Land and Funds
Island(s):	Hawai'i
Judicial District(s):	Puna
TMK(s):	(3) 1-1-038:207, 1-1-072:067, 1-1-100:042 & 051, 1-8-004:102 ROW of Lauko and Pszyk Roads, and Old Volcano Trail Alignment in Plat 1-8-004
Permit(s)/Approval(s):	County of Hawai'i, Department of Public Works: Grubbing and Grading Permit(s), Permit(s) for Work in County ROW Department of Health, Section 402 Clean Water Act National Pollutant Discharge Elimination System Permit(s) Department of Health, Community Noise Control Permit(s) (potential) U.S. Army Corps of Engineers Section 404 Clean Water Act Permit(s) for Fill in Waters of U.S. (potential) Department of Health Section 401 Clean Water Act Water Quality Certification(s) (potential) Department of Health Section Underground Injection Control Permit(s) (potential)
Proposing/Determining Agency:	County of Hawai'i Department of Public Works
<i>Contact Name, Email, Telephone, Address</i>	Kason Pacheco, Kason.Pacheco@hawaiicounty.gov 101 Pauahi St #7 (808) 961-8931 Hilo HI 96720
Accepting Authority:	(for EIS submittals only)
<i>Contact Name, Email, Telephone, Address</i>	
Consultant:	Geometrician Associates
<i>Contact Name, Email, Telephone, Address</i>	Ron Terry rterry@hawaii.rr.com (808) 969-7090 PO Box 396 Hilo HI 96721

Status (select one) X DEA-AFNSI**Submittal Requirements**

Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEA, and 4) a searchable PDF of the DEA; a 30-day comment period follows from the date of publication in the Notice.

 FEA-FONSI

Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; no comment period follows from publication in the Notice.

 FEA-EISPN

Submit 1) the proposing agency notice of determination/transmittal letter on agency letterhead, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEA, and 4) a searchable PDF of the FEA; a 30-day comment period follows from the date of publication in the Notice.

 Act 172-12 EISPN
("Direct to EIS")

Submit 1) the proposing agency notice of determination letter on agency letterhead and 2) this completed OEQC publication form as a Word file; no EA is required and a 30-day comment period follows from the date of publication in the Notice.

 DEIS

Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the DEIS, 4) a searchable PDF of the DEIS, and 5) a searchable PDF of the distribution list; a 45-day comment period follows from the date of publication in the Notice.

<input type="checkbox"/> FEIS	Submit 1) a transmittal letter to the OEQC and to the accepting authority, 2) this completed OEQC publication form as a Word file, 3) a hard copy of the FEIS, 4) a searchable PDF of the FEIS, and 5) a searchable PDF of the distribution list; no comment period follows from publication in the Notice.
<input type="checkbox"/> FEIS Acceptance Determination	The accepting authority simultaneously transmits to both the OEQC and the proposing agency a letter of its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS; no comment period ensues upon publication in the Notice.
<input type="checkbox"/> FEIS Statutory Acceptance	Timely statutory acceptance of the FEIS under Section 343-5(c), HRS, is not applicable to agency actions.
<input type="checkbox"/> Supplemental EIS Determination	The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is or is not required; no EA is required and no comment period ensues upon publication in the Notice.
<input type="checkbox"/> Withdrawal	Identify the specific document(s) to withdraw and explain in the project summary section.
<input type="checkbox"/> Other	Contact the OEQC if your action is not one of the above items.

Project Summary. The County of Hawai'i, Department of Public Works proposes to improve the connectivity of Puna subdivisions with Volcano Highway in the area centered on Fern Acres. The project would assist in response to floods, fires, automobile accidents, or other emergencies that block critical roads. It would also provide residents of Fern Acres and nearby subdivisions with permanent access alternatives to the South Kulani Road outlet. It is in response to and in conformance with Puna Community Development Plan Action Committee proposals. The three component sub-projects under study are 1) the improvement and extension from Volcano Highway to Puhala Road of South Lauko Road; 2), the improvement and extension from Volcano Highway to Puhala Road of South Pszyk Road; and 3) the extension of Puhala Road south to South Kopua Road. Depending on funding availability and other factors, the County may choose to construct one, two, all three, or none of the component projects under study, at various levels of road improvement ranging from compacted gravel to paved, with bridge or ford crossings at streams. The County would own and maintain the roads. Construction will minimally disrupt existing traffic. The project will permanently increase connectivity and emergency response in the area, but could also increase traffic at some Volcano Highway intersections. This would be balanced by an equal decrease in traffic at other intersections and a more efficient circulation pattern, particularly for school traffic. Best Management Practices that will be required as part of permits will minimize erosion and sedimentation. No significant biological, archaeological or cultural resources would be adversely affected.

DRAFT ENVIRONMENTAL ASSESSMENT

**Puna Subdivision Connector Roads to Volcano Highway
In Vicinity of Mountain View**

County Job No. E-4337

October 2016

**County of Hawai'i
Department of Public Works
101 Pauahi Street, Suite 7
Hilo, Hawai'i 96720**

DRAFT ENVIRONMENTAL ASSESSMENT

Puna Subdivision Connector Roads to Volcano Highway In Vicinity of Mountain View

**TMKs: (3rd) 1-1-038:207, 1-1-072:067, 1-1-100:042 & 051, 1-8-004:102
ROW of Lauko and Pszyk Roads, and Old Volcano Trail Alignment in Plat 1-8-004
County Job No. E-4337**

PROPOSING/APPROVING AGENCY:

County of Hawai'i
Department of Public Works
101 Pauahi Street, Suite 7
Hilo, Hawai'i 96720

CONSULTANT:

Geometrician Associates LLC
PO Box 396
Hilo, HI 96721

CLASS OF ACTION:

Use of County Lands and Funds

This document is prepared pursuant to:

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

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TABLE OF CONTENTS

SUMMARY	ii
PART 1: PROJECT DESCRIPTION, PURPOSE AND NEED AND EA PROCESS ...	1
1.1 Project Location and Purpose and Need	1
1.2 Project Description.....	3
1.3 Environmental Assessment Process.....	4
1.4 Public Involvement and Agency Coordination	5
PART 2: ALTERNATIVES.....	6
2.1 No Action	6
2.2 Alternative Routes and Strategies not Advanced for Study	6
PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION	7
3.1 Physical Environment	15
3.1.1 Geology, Soils and Geologic Hazard.....	12
3.1.2 Climate, Water Bodies, Drainage and Water Quality.....	17
3.1.3 Flora, Fauna and Ecosystems	25
3.1.4 Air Quality, Noise and Scenic Resources	27
3.1.5 Hazardous Substances, Toxic Waste and Hazardous Conditions.....	29
3.2 Socioeconomic and Cultural	29
3.2.1 Socioeconomic Characteristics	29
3.2.2 Cultural and Historic Resources	31
3.3 Infrastructure	44
3.3.1 Utilities	44
3.3.2 Roadways and Traffic.....	44
3.3.3 Public Facilities and Services	48
3.4 Secondary and Cumulative Impacts.....	49
3.5 Required Permits and Approvals	50
3.6 Consistency With Government Plans and Policies.....	50
3.6.1 Hawai‘i State Plan.....	50
3.6.2 Hawai‘i State Land Use Law	50
3.6.3 Hawai‘i County Zoning and General Plan.....	50
3.6.4 Puna Community Development Plan.....	56
PART 4: DETERMINATION	57
PART 5: FINDINGS AND REASONS	57
REFERENCES	59
LIST OF FIGURES	
FIGURE 1 Location Map	2
FIGURE 2 Project Corridor Photographs	8
FIGURE 3 Context of Old Volcano Trail Alignment and Puhala Street Extension	15
FIGURE 4 Map of Unnamed Stream System	18
FIGURE 5 Photos of Existing County of Hawai‘i Fords	23

LIST OF TABLES

TABLE 1	Properties and Property Ownership	1
TABLE 2	Design Options for Roadways and Stream Crossings	3
TABLE 3	Selected Socioeconomic Characteristics.....	30

LIST OF APPENDICES

APPENDIX 1a	Comments in Response to Early Consultation
APPENDIX 2	Plant Species Detected in Project Corridors
APPENDIX 3	Archaeological Inventory Survey
APPENDIX 4	Stream Reports and Waters of U.S. Correspondence

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

The County of Hawai‘i, Department of Public Works (DPW) is proposing to improve the connectivity of Puna subdivisions with Volcano Highway (State Highway 11), particularly in the area centered on Fern Acres. The purpose is to improve road accessibility during events such as floods, fires, automobile accidents, or other emergencies that block subdivision roads, connector roads, or Volcano Highway. There is also a need to provide permanent alternatives to the South Kulani Road outlet for residents of Fern Acres, upper Hawaiian Acres, and nearby subdivisions. The project addresses needs identified by the Connectivity and Emergency Response Subcommittee of the Puna Community Development Plan Action Committee.

The three component sub-projects under study include 1) the improvement and extension from Volcano Highway to Puhala Road of South Lauko Road; 2), the improvement and extension from Volcano Highway to Puhala Road of South Pszyk Road; and 3) the extension of Puhala Road south to South Kopua Road. Depending on funding availability and other factors, the County may choose to construct one, two, all three, or none of the component projects under study, at various levels of road improvement ranging from compacted gravel to paved, with bridge or ford crossings at streams. The roads would be owned and maintained by the County of Hawai‘i.

Construction will minimally disrupt existing traffic. The project will increase road connectivity in the Mt. View area, and will be especially useful for emergency situations. Conversely, the project could increase traffic at existing intersections on Volcano Highway. This would be balanced by an equal decrease in traffic at other intersections and a more efficient circulation pattern, particularly for school traffic. Depending on the alternative combinations and design options that are constructed, construction could take place over intervals of several months to a year, separated by periods of little or no construction. Best Management Practices that will be required as part of permits will minimize erosion and sedimentation. No significant biological, archaeological or cultural resources would be adversely affected.

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

1.1 Project Location and Purpose and Need

The County of Hawai‘i, Department of Public Works (DPW) is proposing a project to improve the connectivity of Upper Puna subdivisions with Volcano Highway (State Highway 11), particularly in the area centered on Fern Acres (Figure 1). The properties involved and their ownership are shown in Table 1.

The project addresses needs identified by the Connectivity and Emergency Response Subcommittee (CERS) of the Puna Community Development Plan (CDP) Action Committee. The Puna CDP has the goal of translating broad County General Plan Goals, Policies, and Standards related to land-use and delivery of government services into implementation actions for the Puna District. The Puna CDP Action Committee is a volunteer working group whose purpose is to serve as a proactive, community based steward of the CDP's implementation by way of providing guidance and making recommendations to the Planning Director as it pertains to budget priorities, CDP amendments, General Plan amendments, and program initiatives. The Action Committees are intended to broaden community awareness of the CDP and build partnerships with local communities and organizations to implement CDP goals, objectives, policies, and actions. One of their principal charges of the CERS has been to identify access routes in the Puna District that promote connectivity and facilitate construction of roadways on these routes. According to an Annual Report to the Action Committee dated May 2015 (Comm. No. 2015-24), the CERS identified an alternate route in Upper Puna from Volcano to Highway 130 as its number one priority, and also identified the need for two additional roads to connect the subdivisions of Upper Puna with Volcano Highway as a high priority.

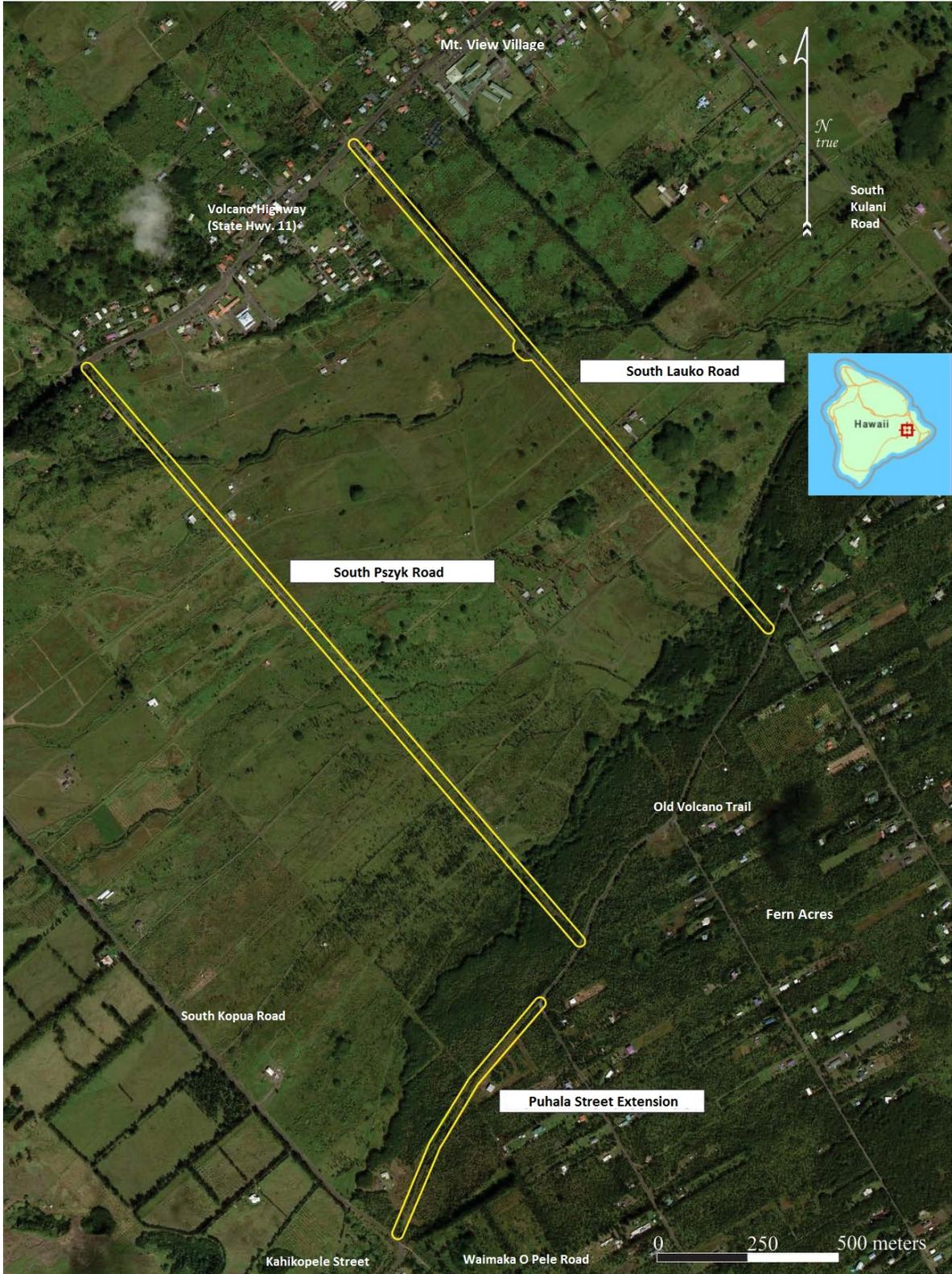
The overriding purpose of the project is to respond to the directives from the Puna CDP Action Committee and the CERS to improve road connectivity. There is a need to improve accessibility during events such as floods, fires, automobile accidents, or other emergencies that block subdivision roads, connector roads, or Volcano Highway. There is also a need for alternative permanent connection(s) to South Kulani Road for residents of Fern Acres, upper Hawaiian Acres, and potentially Kopua Farm Lots and Eden Roc Estates.

Table 1. Properties and Property Ownership

TMK	Location	Landowner
None*	Right of way of Lauko and Pszyk Roads (portions are unbuilt)	County of Hawai‘i
1-1-038:207	Puhala Street	Crescent Acres Ltd.
1-8-004:102	Lauko Road, where road veers south to avoid low waterfall	Roddy/Janice Nagata
1-1-100:042	Property for Puhala Street Extension	Harold Tanouye & Sons
1-1-100:051	Portion of Waimaka o Pele Street (potentially)	Kopua Farmlots Assoc.
1-1-072:067	Portion of Kahikopele Street (unbuilt portion)	Hawaii Mt. View Dev. Corp.
None*	Old Volcano Trail Alignment	State of Hawai‘i

*Within Plat 1-8-004

Figure 1 Location Map



1.2 Project Description

The three component sub-projects under study include 1) the improvement and extension from Volcano Highway to Puhala Road of South Lauko Road; 2), the improvement and extension from Volcano Highway to Puhala Road of South Pszyk Road; and 3) the extension of Puhala Road south to South Kopua Road (see Fig. 1).

The roads would be built, owned and maintained by the County of Hawai'i. As shown in Table 2, DPW is considering two levels of roadways that differ in cross-section width, pavement base, and surface paving type. DPW is also evaluating bridge and ford options for crossing streams.

Each of these design options would provide a road that would be functional for connectivity and emergency use purposes. Roads with higher levels of improvement, i.e., 24-foot wide roadways with AC paving and bridge crossings, would be the most functional, because they would allow higher traffic volumes and would not be as vulnerable to heavy rains that can make ford crossings unusable.

Table 2. Design Options for Roadways and Stream Crossings

TYPE	COST ESTIMATE¹
South Lauko Road – Road Type	
Option 1a: 24-ft wide roadway, 2" AC over 4" base course over 6" sub-base course	\$282,100
Option 1b: 24-ft wide roadway, 6" base course over 12" sub-base course	\$212,700
Option 2a: 12-ft wide roadway, 2" AC over 4" base course over 6" sub-base course	\$141,000
Option 2b: 12-ft wide roadway, 6" base course over 12" sub-base course	\$106,300
South Lauko Road – Two Stream Crossings	
Option 1: Bridge crossing ²	\$150,000-\$3,500,000
Option 2: Low volume culvert with ford crossing ²	\$50,000
South Pszyk Road – Road Type	
Option 1a: 24-ft wide roadway, 2" AC over 4" base course over 6" sub-base course	\$316,300
Option 1b: 24-ft wide roadway, 6" base course over 12" sub-base course	\$238,400
Option 2a: 12-ft wide roadway, 2" AC over 4" base course over 6" sub-base course	\$158,100
Option 2b: 12-ft wide roadway, 6" base course over 12" sub-base course	\$119,200
South Pszyk Road – Five Stream Crossings	
Option 1: Bridge crossing ²	\$150,000-\$1,500,000
Option 2: Low volume culvert with ford crossing ²	\$30,000
Puhala Street Extension	
Option 1A: 24-ft wide roadway, 5-foot gravel shoulders, 2" AC over 4" base course over 6" sub-base course	\$138,600
Option 1B: 24-ft wide roadway, 6" Base Course over 12" Subbase Course	\$107,100

¹ Preliminary only; soil conditions in some areas may require additional sub-base thickness, increasing costs.

² Price is per crossing, with highest end of range for the main S. Lauko stream, lowest for smaller S. Pszyk streams.

Depending on funding availability and other factors, the County may choose to construct one, two, all three, or none of the component projects under study. There are thus seven alternative combinations, as listed below:

- Lauko Road alone
- Pszyk Road alone
- Puhala Street alone
- Lauko Road and Pszyk Road
- Lauko Road and Puhala Street
- Pszyk Road and Puhala Street and
- Lauko Road, Pszyk Road and Puhala Street

DPW’s preliminary preferred action, taking into account a number of factors including cost, constructability and timeframes, is to construct the Puhala Street Extension Option 1a, and then utilize either Option 1B or Option 2b for South Lauko Road or South Pszyk Road, with a culverted ford for a crossing. DPW believes that this combination will provide most of the benefits sought in the purpose of the project at a cost that can be incrementally funded. The preferred action will be re-evaluated after consideration of comments by agencies, organizations and the public received in response to the Draft EA. After consideration of environmental impacts documented in this EA, public and agency comments, discussions with affected landowners, and the determination by the County Council and Mayor of the level of funding available for the project, DPW will select the alternative combination and road and bridge crossing design options for initial construction. DPW may phase this decision making process, as well as construction, according to the considerations listed above. The Final EA will present additional information on the decision-making process.

Depending on the alternative combinations and design options that are constructed, the improvements could cost as little as \$107,000 or as much as \$6.5 million (a very approximate figure that would require completion of bridge design before refinement). Project construction could take place over intervals of several months to a year, separated by periods of little or no construction.

In the discussion of environmental conditions and impacts in Chapter 3, most discussions will focus on the individual project components discussed above. Unless there is a noteworthy difference among the alternative combination on a particular environmental variable, the seven alternative combinations will not be distinguished.

1.3 Environmental Assessment Process

This Environmental Assessment (EA) process is being conducted in accordance with Chapter 343 of the Hawai‘i Revised Statutes (HRS). This law, along with its implementing regulations, Title 11, Chapter 200, of the Hawai‘i Administrative Rules (HAR), is the basis for the environmental impact process in the State of Hawai‘i. According to Chapter 343, an EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria.

Part 4 of this document states the finding (anticipated in the Draft EA) that no significant impacts are expected to occur; Part 5 lists each criterion and presents the findings by the Hawai‘i County Department of Public Works, the proposing/approving agency. In the EA process, if the approving agency determines after considering comments to the Draft EA that no significant impacts would

likely occur, then the agency issues a Finding of No Significant Impact (FONSI), and the action is permitted to proceed to other necessary permits and approvals. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, then an Environmental Impact Statement (EIS) is prepared.

1.4 Public Involvement and Agency Coordination

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

State:

Department of Land and Natural Resources, State Historic Preservation Division
Office of Hawaiian Affairs
Department of Health, Environmental Planning Office

County:

County Council
Civil Defense Agency
Fire Department
Department of Water Supply
Planning Department
Police Department
Puna CDP Action Committee, Connectivity and Emergency Response Subcommittee

Private:

Sierra Club
Fern Acres Community Association
Eden Roc Community Association
Kopua Farm Lots Association
34 Adjacent Landowners

Copies of communications received during early consultation are contained in Appendix 1a. In addition, DPW held a meeting at its office on July 25, 2016, with residents who had contacted the project manager (see sign-in sheet and comments in Appendix 1a). A member of the project team also attended a July 26, 2016 meeting of the Puna Community Development Plan Action Committee – Connectivity and Emergency Response Subcommittee, as well as an August 20, 2016 meeting of the Board of Directors of the Fern Acres Community Association.

PART 2: ALTERNATIVES

2.1 No Action

Under the No Action Alternative, no road improvements would be made, and South Kulani Road would remain the sole connection between Fern Acres and Volcano Highway. There would be no interconnection of Fern Acres and the subdivisions *mauka*. The connectivity and emergency evacuation capability goals of the Puna CDP would not be realized here, but there would also be no impacts on existing vegetation, scenery or waterways, no additional sources of traffic on Volcano Highway, and no disturbance to neighbors adjacent to the proposed routes. This EA considers the No Action Alternative as the baseline by which to compare environmental effects from the project.

2.2 Alternative Routes and Strategies Not Advanced for Study

The County recognizes that as the population of rural areas of the Island of Hawai‘i continues to grow, many areas throughout the island require better connectivity. In Puna, the County as well as private subdivisions are investigating connectivity routes such as improvements to Ola‘a Road connecting Kurtistown with Orchidland, the Puna Makai Alternate Route (an alternate to State Highway 130 between Pahoia and Kea‘au), and minor but critical connections utilizing lots or paper roads located in the interior of various subdivisions. The analysis of potential alternatives for this project cannot consider all competing road needs in the County, or even the Puna District. Instead, it focuses more narrowly on the purpose and need defined above related to a single concrete and solvable need. To summarize, this is to provide additional connectivity for emergency situations and everyday use for residents of the subdivisions south of Mt. View, centered on Fern Acres, but also extending to upper Hawaiian Acres, Kopua Farm Lots and Eden Roc Estates.

South Lauko Road and South Pszyk Road are the only County roads in this area. Any alternative route to Volcano Highway paralleling these two roads would require extensive land acquisition and complete new road construction, costing significantly more money and time, and potentially involving acquisition under eminent domain. Furthermore, there would be little or no environmental advantage to such routes. A different approach to the purpose and need would be to construct a roughly 5-mile road from Eden Roc through Kopua Farm Lots, Fern Acres and Hawaiian Acres that would exit Moho Road (Road 8) in Hawaiian Acres, which would then connect via existing paved roads both north to Volcano Highway and south to State Highway 130. Property would need to be acquired, with the consent of literally thousands of road owners, as well as reconstruction of existing subdivision roads or new construction for the entire 5-mile length. However, this same connectivity could be achieved through a combination of the Puhala Street Extension and either South Lauko Road or South Pszyk Road, with only five landowners and 1.5 miles of road reconstruction/new construction. The 5-mile *mauka-makai* route would be much more costly and uncertain.

For these reasons, there do not appear to be other reasonable alternatives to the proposed project that could meet the project’s purpose and need without greatly higher costs and equivalent or greater environmental impacts. Therefore, no other alternatives have been advanced for further study in this Environmental Assessment.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

Basic Geographic Setting

As used in this EA, the term *project corridor(s)* includes the areas proposed for road improvements (see Figure 1 for map, and Figure 2 for photos of the project corridors). The term *project area* is used generally and flexibly depending on the resource under discussion to denote this part of the island, and most specifically, Upper Puna.

South Lauko Road (Figures 2b-f) has a total length of 1.05 miles and a right-of-way (ROW) width of 30 feet. Approximately the first 0.4 miles in from Volcano Highway is paved and County-maintained. Approximately the next 0.41 miles is surfaced with gravel and considered by the County a road in limbo¹. A drainage ditch parallels the northeastern side of the maintained portions of the road. Fences enclose the road on both sides. Beyond the fencing are pastures. Private driveways branch off from the road along what appear to be former cane field roads. The last approximately 0.24-mile long section is a paper road², with the ROW heavily overgrown with weedy vegetation.

Including all three sections, the road extends from Volcano Highway almost to Puhala Street. The Old Volcano Trail alignment, a long, linear State of Hawai'i property that represents the approximate path of an old road that connected Hilo with Volcano, separates the South Lauko Road ROW from Puhala Street. There is no actual trail or any traces of it on the Old Volcano Trail alignment in this area, and it is possible that the former trail ran outside rather than within the current property boundaries, but it represents an area for future trail development.

Two streams cross the South Lauko Road ROW. The largest is about halfway along the ROW, and because there is a low waterfall on the ROW, the actual roadway veers to the south around this before crossing the stream (Figure 2f), into a private property for which the County will require an easement or purchase of the road. The smaller stream is located near the Puhala Street end (Figure 2g), where currently no roadway exists. These streams converge between South Lauko and South Kulani Road (see Section 3.1.2, below, for information about streams).

¹ A road-in-limbo is defined by DPW as a government road that meets all of the following criteria: (1) is a government or homestead road, (2) there is no legal documentation showing the County having fee ownership for the road, (3) is not a State Highway as determined by the State Department of Transportation, Hawai'i District Office, (4) is not a county road or highway as established on the DPW Highway Maintenance Division's inventory of County roads.

² A paper road means a government road that does not physically exist on the ground, including unauthorized or unpermitted improvements.

**Figure 2 Project Corridor Photographs
2a: Photo Index Map**

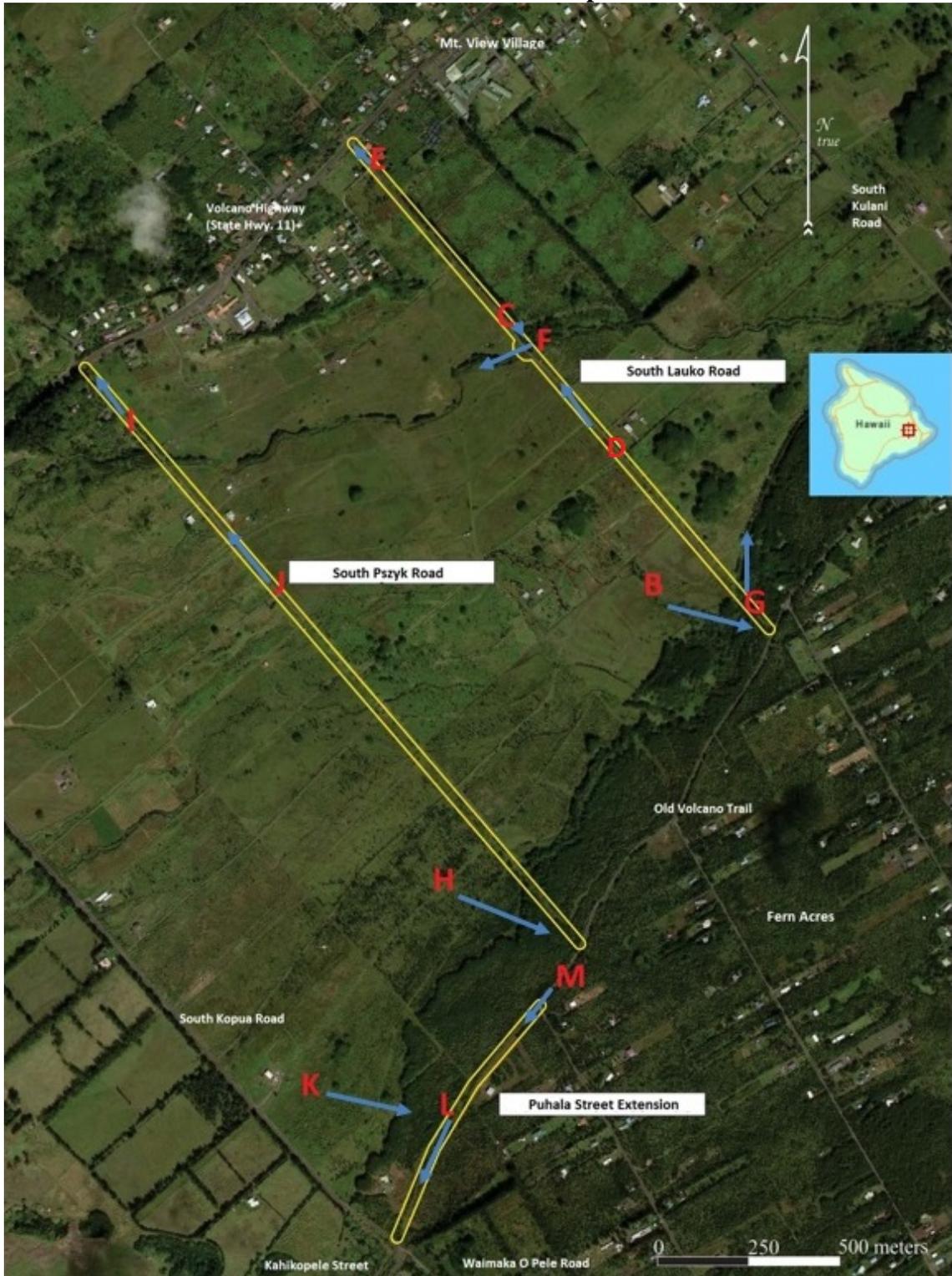


Figure 2 Project Corridor Photographs

2b: Top: Aerial View, Intersection of S. Lauko ROW/Puhala (Earthstar Geographics SIO © 2016 HERE)

2c: Bottom: End of paved road on S. Lauko;



Figure 2 Project Corridor Photographs
2d: Top: Unpaved section of S. Lauko;
2e: Bottom: S. Lauko Intersection with Volcano Highway



Figure 2 Project Site Photographs, continued
2f: Top: Major stream on S. Lauko; 2g: Bottom: Typical smaller stream (S. Lauko)



Current conditions within the South Pszyk Road are similar to the South Lauko Road (Figures 2h-j). It has a total length of 1.24 miles and a ROW width of 30 feet. Approximately the first 0.1 miles in from Volcano Highway is paved and County-maintained. Approximately the next 0.45 miles is surfaced with gravel and considered by the County a road in limbo. Fences enclose much of the road in these sections on both sides, with homes, pastures and open fields beyond the fencing.

The last approximately 0.69-mile long section is a paper road where the ROW is heavily overgrown with weedy vegetation. A gravel road continues along the paper road section but appears to be outside of the South Pszyk Road ROW. South of here, the road becomes obscured by vegetation and terminates at a gate near a minor stream, just short of Puhala Street. Just as with South Lauko Road, the Old Volcano Trail alignment property is between the end of the ROW and Old Volcano Trail.

Puhala Street is a two-lane, paved private road open to the public and owned by the Fern Acres subdivision, to which the four major north-south roads in Fern Acres all connect. The road also connects to South Kulani Road. Puhala Street is unpaved for a distance of 0.2 miles *mauka* of Pikake Street (Figure 2m), as it currently leads to only one residence. The extension of Puhala Street to South Kopua Road would be within the northern edge of 28-acre TMK: (3) 1-1-100-042, and would parallel the State-owned Old Volcano Trail alignment until intersecting an unconstructed, 275-foot long portion of the private road Kahikopele Street, before intersecting South Kopua Road (Figure 2k). This area is currently heavily vegetated with strawberry guava (*Psidium cattleianum*), *ōhi‘a* (*Metrosideros polymorpha*), uluhe (*Dicranopteris linearis*), and Himalayan raspberry (*Rubus ellipticus*) (Figure 2l).

The proposed extension area also contains a modern trail that appears to have been scraped by a bulldozer. Although gated, it is used informally by ATVs, pedestrians and bicyclists. It is useable but difficult for 4WD vehicles as well. Figure 3 is a map showing the relationship of the two properties and the trail as it exists, based on a survey for this EA conducted by Island Survey, Inc., with additional map work by ASM Affiliates, Inc., the archaeological contractor for the EA.

Figure 2 Project Corridor Photographs

2h: Top: Aerial View, Intersection of S. Pszyk ROW/Puhala (Earthstar Geographics SIO © 2016 HERE)

2i: Middle: Paved portion of S. Pszyk; 2j: Bottom: Unpaved portion of S. Pszyk



Figure 2 Project Corridor Photographs

2k: Top: Aerial View, Puhala Street Extension Corridor (Earthstar Geographics SIO © 2016 HERE);

2l: Middle: Vegetation in Puhala Street Extension Corridor;

2m: Bottom: Puhala Road, unfinished portion in Fern Acres;

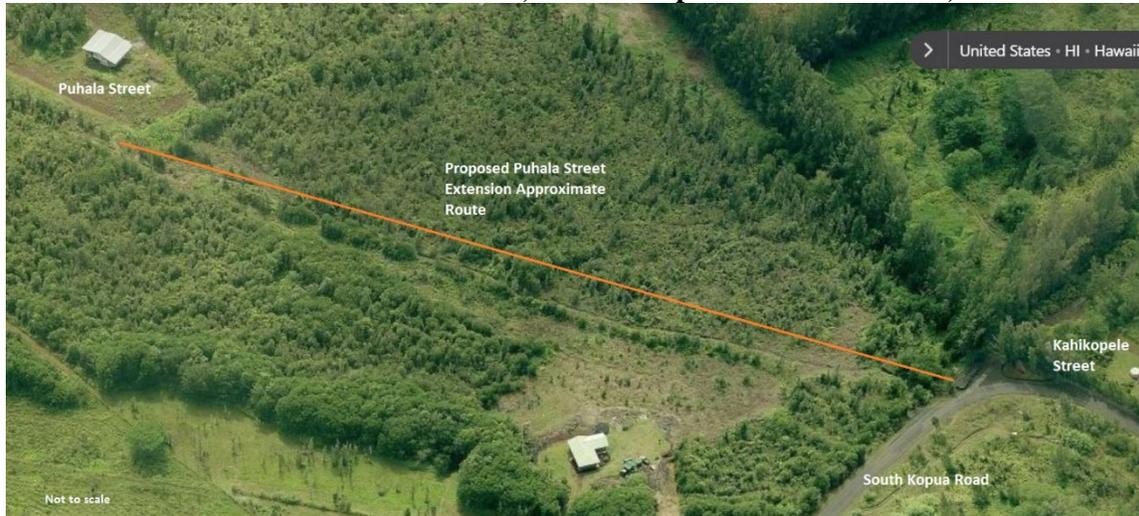


Figure 3. Context of Old Volcano Trail Alignment and Puhala Street Extension



3.1 Physical Environment

3.1.1 Geology, Soils and Geologic Hazards

Existing Environment

Geologically, the project corridors are located near the crease between Kīlauea and Mauna Loa Volcanoes. Most of the South Lauko Road and South Pszyk Road project corridors are located on Mauna Loa lava flows, where the surface consists of weathered basalt soils derived from Pleistocene epoch (more than 10,000 years old) lava flows (Wolfe and Morris 1996). The remainder of those project corridors and the entirety of the Puhala Street Extension project corridor are located on Kīlauea flows dating from 200 to 750 years ago.

Ubiquitous feature of pahoehoe lava landscapes, including the portions of the project corridors with pahoehoe lava, are lava tubes. Lava tubes potentially have valuable geological, biological,

recreational, and historic site resources. Construction over lava tubes may also expose humans to hazard during construction, or afterwards during use. Therefore, lava tubes are considered in the contexts of both geological resource and hazard in this section. Lava tubes are an integral and common element of extrusive volcanic landscapes in shield volcanoes such as Kīlauea and Mauna Loa. They are formed by the crusting over of active surface flows and provide an efficient means to transfer molten lava from the flow source to its terminus. After the molten lava drains away, an open segment of a roofed lava tube is often left behind. These caves vary in diameter from inches to tens of feet, and in length from several feet to over ten miles. They may contain multiple branches and layers braided together in a complex fashion. A lava tube system formed as one unit is often separated into multiple caves through collapse of intervening sections. Although their number cannot be ascertained precisely, it is certain that many thousands of lava tubes lie within the pahoehoe flows, which together with ‘a‘a flows and limited areas of ash compose the surface mosaic of the volcanoes. A number of well-known lava tube caves are present under Puna subdivisions, including several named caves with impressive diameters and lengths, such as Kazumura, Keala and Lower U‘ilani Caves. No lava tube cave openings were found in or near the project corridors during the fieldwork for the current project. Nevertheless, it is possible that undetected lava tubes lie beneath the surface, which may or may not have openings that would allow human entry and thus classify them as caves.

Soils in the project corridors are classified by the U.S. Natural Resources Conservation Service (formerly Soil Conservation Service) as primarily Ohia series, which occurs on the Mauna Loa substrate. The northern portions of the South Lauko Road and South Pszyk Road project corridors contain Ohia extremely silty clay loam (OSD), a well-drained silty clay loam formed in Mauna Loa volcanic ash over 5,000 to 10,000 years ago on fragmented ‘a‘ā lava; typical depths are from 20 to 36 inches deep. Permeability for this soil is rapid, runoff is slow to medium, and erosion hazard is slight to moderate. The middle portions of the South Lauko Road and South Pszyk Road project corridors contain Ohia silty clay loam (OHC) underlain by weathered pahoehoe lava; typical depths can reach 62 inches. This soil is similar to the former soil but more permeable, with slow runoff and slight erosion hazard. Soils in the southern ends of both South Lauko Road and South Pszyk Road, as well as the Puhala Street Extension corridor, are classified as Pahoehoe lava flow (rLW); field observations noted very thin decomposing leaf litter overlying the lava flow. Permeability for this land type is generally rapid, with slow runoff and slight erosion hazard, particularly when the pahoehoe is mechanically broken. The Ohia soils were used for sugarcane, while the lava soils have primarily wildlife and watershed uses (U.S. Soil Conservation Service 1973).

Slopes on the project corridors vary from about 1.1 percent on South Lauko Road and South Pszyk Road, which run more or less perpendicular to the regional slope, to 3.5 percent on the Puhala Street Extension, which runs basically parallel to the regional slope. No geomorphic features such as cinder cone hills, large rifts or other areas of high slopes are present. This area does not appear to be subject to subsidence, landslides or other forms of mass wasting.

The entire Big Island is subject to geologic hazards, especially lava flows and earthquakes. The Island of Hawai‘i experiences high seismic activity and is at risk from major earthquake damage (USGS 2000), especially to structures that are poorly designed or built, as the 6.7-magnitude quake of October 15, 2006 demonstrated.

Volcanic hazard as assessed by the U.S. Geological Survey in this area of Puna is Zone 3, on a scale of ascending risk from 9 to 1 (Heliker 1990:23). Zone 3 areas are gradationally less hazardous than Zone 2 because of greater distance from recently active vents and/or because the topography makes it less likely that flows will cover these areas. In Kīlauea's Zone 3 areas, 1 to 5 percent of land has been covered by lava since 1800, and between 15 and 75 percent has been covered in the last 750 years.

Although no lava flows have entered the subdivisions of Upper Puna since they were created, Kīlauea's ongoing eruption from January 1983 to the present has provided many scares. Early flows out of Pu'u O'o from 1983 to 1986 covered the Kahaualea area south of Fern Forest and Eden Roc. From 1986 to 1992 the eruption shifted down-rift to Kupaianaha, sending flow after flow to the coast, covering the village of Kalapana in the process. Almost 200 homes were lost along with parks, stores, beaches, a church and an entire community. Since then, the focus has shifted up and down the rift, and back and forth from the more frequently threatened southern side of the rift, to the occasionally affected northern side, most famously in the 2014 lava flow that entered Pahoa. This flow threatened to cut the Puna District in half, and three new emergency roads were rapidly constructed, costing tens of millions of dollars (<http://hvo.wr.usgs.gov/kilauea/history/main.html>). As recently as August 2016 lava flows from Pu'u O'o have coursed north within a few miles of Fern Acres.

Impacts and Mitigation Measures

In general, geologic conditions impose no constraints on any of the proposed road connections. Slopes and soils are appropriate for road construction, given appropriate drainage infrastructure. These roads will provide critical assistance in emergency hazard evacuations – especially lava flows – and will be designed in accordance with regulations related to its seismic setting.

More than 300 miles of private and public roads, ranging from multi-lane highways to dirt tracks, form a dense grid over the Puna lava flows, which are rife with lava tubes. During road construction previously unknown lava tubes are sometimes encountered (on rare occasions with damaging results). For the most part the lava tubes lie far enough beneath the surface to avoid substantial disturbance. Because most of the project corridors involve existing paved or unpaved roads with a history of over 30 years of travel by heavy equipment, it is unlikely that large lava tubes will be uncovered. If they are discovered, the U.S. Geological Survey and the State Historic Preservation Division will be informed, and their advice considering scientific investigation and access will be considered. Structural modifications will be assessed and design changes investigated as necessary.

3.1.2 Climate, Water Bodies, Drainage, and Water Quality

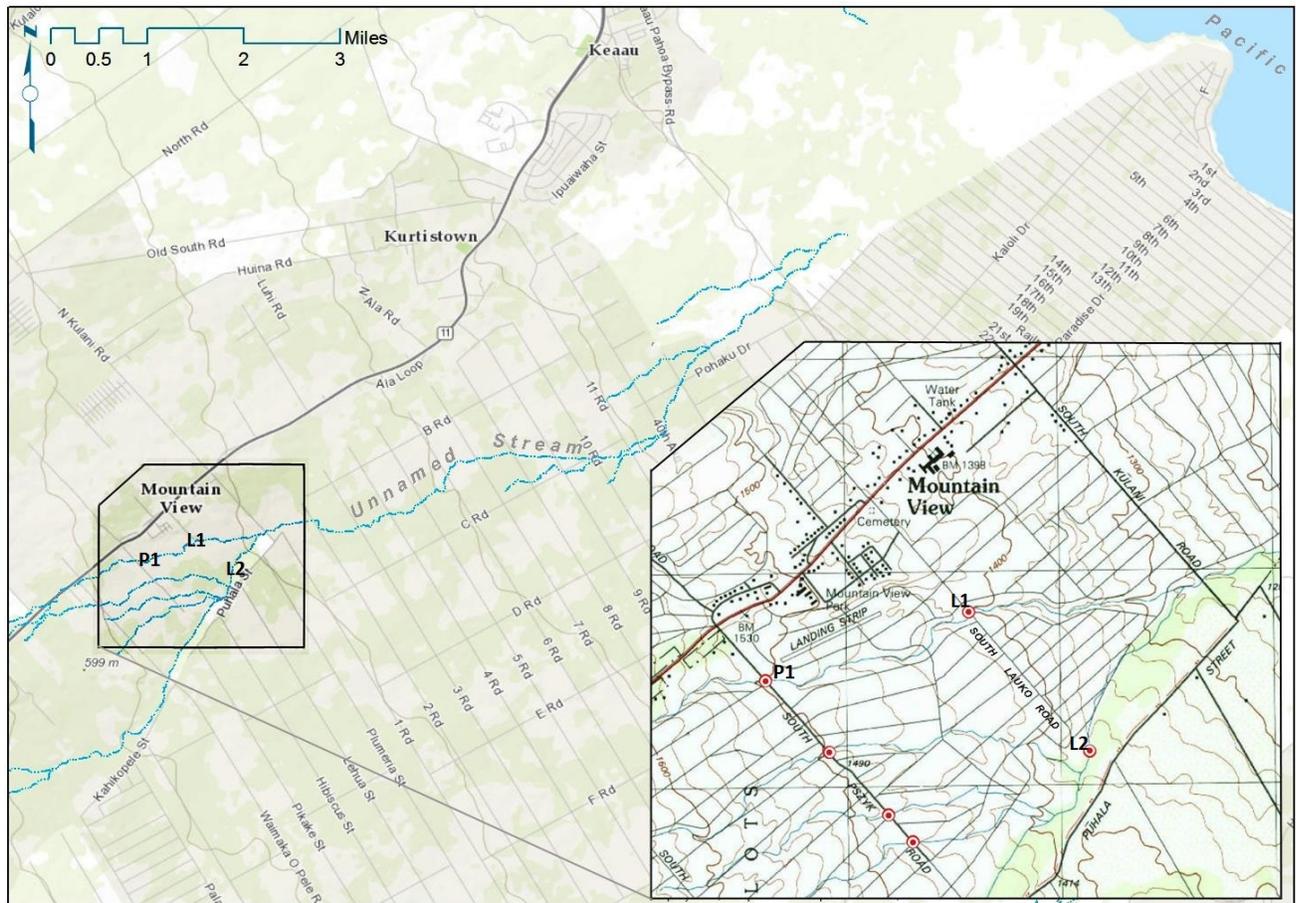
At between 1,370 and 1,580 feet above sea level on the windward slope of the Island of Hawai'i, the climate in the project area is mild, with a mean annual temperature of 72 degrees F, varying only 8 degrees from February's minimum to August's maximum (U.H. Hilo-Geography 1998:49). Average annual rainfall is approximately 180 inches, with a winter maximum (Giambelluca et al 2014).

Existing Environment: Water Bodies and Water Quality

As described above, the improvements in the South Pszyk Road ROW would involve five crossing of streams, which by the time they have moved downhill to South Lauko Road ROW have converged into two crossings, which themselves converge just before crossing South Kulani Road (see Figures 2f and 2g for photos of streams; Figure 4 is a map of entire stream system). The unnamed stream system is an intermittently-flowing, interrupted stream. As discussed in Section 3.1.3, the nature of these streams has precluded their use by native stream fauna, and they are dominated by invasive organisms.

The U.S. Geological Survey (USGS) maps for the area (Pu‘u Maka‘ala Quadrangle, 2013; Mountain View Quadrangle, 2013; and Pāhoā North Quadrangle, 2013) show the unnamed stream system originating on the east slope of Mauna Loa, 2,200 ft above sea level (ASL) in the Ola‘a Homesteads region. Just after the point that the stream system crosses Highway 130 between Kea‘au and Hawaiian Paradise Park, the stream system disappears – presumably where it flows out onto highly

Figure 4. Map of Unnamed Stream System



permeable Kīlauea lavas. The USGS map depicts the point at which the stream disappears underground to be approximately 7.0 miles downslope from South Lauko Road, and 3.5 miles upslope from the Pacific Ocean at Paki Bay. A previous study of this system was conducted for improvements to Highway 130 in order to determine if the U.S. Army Corps of Engineers (USACE) had jurisdiction of the stream under Section 404 of the Clean Water Act (AECOS 2009). If the stream is found to be jurisdictional, any activities that could involve fill or construction within the stream channel require coordination and potentially a permit with this agency. The study concluded that this stream system is isolated from the ocean and that its flow contributes only to the general groundwater aquifer of Puna. On October 26, 2009, the U.S. Army Corps of Engineers confirmed this assessment with an approved jurisdictional determination form (POH-2009-00270-JD1), which determined the unnamed stream system is not jurisdictional because it “is isolated with no connection to the Pacific Ocean. All water infiltrates via fractures in the lava surface approximately 3.5 miles before reaching the ocean. The waters are not navigable nor do they maintain a nexus to interstate commerce.” By letter of September 9, 2016, AECOS consulted the USACE on behalf of the County to determine if the stream system is still considered to be non-jurisdictional (see Appendix 4 for letter).

A water quality analysis was conducted as part of stream analysis for this EA (see Appendix 4 for report). During the field investigation in July 2016, water was present at three of the seven crossings on South Lauko Road and South Pszyk Road. Field measurements of temperature, pH, and dissolved oxygen (DO) were taken, and water samples were collected for analysis of conductivity, turbidity, total suspended solids (TSS), nitrate+nitrite (NO₃+NO₂), total nitrogen (TN), and total phosphorus (TP) at these three stations. Two sampling stations (*L1* and *L2*) were located along the route of the proposed extension of South Lauko Road and a third station (*PI*) was located at an existing crossing of South Pszyk Road (see Figure 4 for location of stations). *L1* had minimal water flow during sampling. At the time of the survey, water from a shallow pool upstream of the road was flowing over a ford and into a plunge pool where the flow terminated. Downstream from the plunge pool, water ponded in pockets of bedrock with no surface flow between pools. A single large pool extended the width of the channel at *L2*. The pool was 10 to 14 inches deep. A veneer of silt covered the bottom of the pool. The stream channel at *PI* had water in several pools, but no discernible flow between pools. Pools had bedrock bottoms with little sediment.

Temperature readings ranged from 22.3 to 24.6°C at the three stations. As the water present in the stream was limited to ephemeral pools, differences in temperature are related to both the depth and degree of shading of individual pools. Deeper pools and those well shaded were cooler and shallow, while unshaded pools were hotter. Dissolved oxygen (DO) levels were low, ranging from 1.99 to 4.92 mg/L, representing 24 to 58% saturation at observed temperatures. The pH at *L1* was near neutral (6.98), while *PI* and *L2* were slightly basic and slightly acidic, 7.26 and 6.20, respectively. Conductivity was consistently low at the three stations, ranging from 58 to 63 µmhos/cm. Sediment load, as measured by total suspended solids (TSS), and turbidity, a measurement of the cloudiness of the water, were highest at *L2* (3.2 mg/L and 5.73 ntu) and lowest at *L1* (0.9 mg/L and 1.30 ntu). Total nitrogen (TN) was elevated at Sta. Lauko 2 (364 µg N/L), but inorganic nitrogen (NO₃+NO₂) accounted for only 11% (40 µg N/l) of the TN at that station. NO₃+NO₂ and TN were low at the other two stations and TP was low at all three stations.

Water quality at *L1* and *PI*, as measured on July 12, 2016, was very good, perhaps reflecting a relatively constant turnover of the water in the isolated pools due to regular rainfall inputs. Turbidity and inorganic and total nitrogen were slightly elevated at *L2*. Water quality in this tributary may reflect watershed activities (e.g., pasture) more so than the other two stations.

The unnamed stream system is classified as a Class 2 “flowing waters” in the Hawai‘i water quality standards (HDOH 2014a). Beneficial uses of Class 2 waters are designated as follows:

The objective of class 2 waters is to protect their use for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping and navigation. The uses to be protected in this class of waters are all uses compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation on and in these waters. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible with the criteria established for this class.

Specific water quality criteria have been promulgated that, if met, are designed to allow the water bodies to achieve designated beneficial uses. The primary purpose of water quality measurements made for this EA was to characterize the existing aquatic environment, not to set baseline values or determine compliance with Hawai‘i’s water quality standards. In fact, the State stream criteria for all nutrient measurements, turbidity, and TSS are based upon calculating geometric mean values. A minimum of three separate samples per sampling location would be needed to compute a geometric mean (HDOH 2014a). Additionally, the water quality criteria for streams are applicable only to flowing waters, not the standing pools that were sampled in July of 2016 and in fact are almost always the condition for these streams. The unnamed stream system is not on the Department of Health list of impaired waters in Hawai‘i (HDOH 2014b) prepared under Clean Water Act, §303(d).

Existing Environment: Flood Zones and Drainage

The current Federal Emergency Management Agency’s Flood Insurance Rate Map (FIRM) for the area is labeled 1125C but has not been developed or printed, meaning that all areas are within Zone X, outside the area identified as within the 100-year flood zone. The Puna Flood Study Project, which is currently under review, is proposing a revised flood designation for the area that would recognize floodplains associated with the streams in the area. Due to the high rainfall, moderately permeable soils with a history of mechanical cultivation, and other factors, flooding or poor drainage exist in various portions of the South Lauko Road and South Pszyk Road corridors. Particularly persistent flooding occurs near the main stream crossing (especially to the south) on South Lauko Road (see Figure 2f). This existing unculverted ford crossing is a hazard to the several residents who live beyond it on South Lauko Road, as there are no alternative ways out of this area. These residents cannot cross the stream during very heavy rainfall, as occurred several times in August and September 2016 due to the passage of four tropical storms or upper level lows near the Island of Hawai‘i, which were accompanied by rainfall totaling 5 to 15 inches in the already saturated Mt. View-Glenwood area. A resident of South Lauko Road reported that some streams may be blocked by debris. A South Pszyk Road resident reported that during heavy rain, the main bridge on this road

can be overtopped. Another important factor to consider is that floods on this unnamed stream affect the private properties and roadways of subdivisions downstream, particularly in Hawaiian Acres.

Impacts and Mitigation Measures: Regulatory Context

A key goal of the project, regardless of which alternative combination or design options are ultimately selected, is to build it using methods that can minimize impacts to flooding and water quality during construction and operation. The principal differences among the alternative project components and their effects on flooding and water quality are that the Puhala Street Extension lacks any water bodies or areas of major flooding concern. Reconstructing parts of South Lauko Road and South Pszyk Road and building new portions will involve work in and around streams, which are both sources of flooding and areas to especially protect from pollution. Construction using culverted fords would involve work within stream channels and would expose drivers to more flood hazard than would the use of bridges, but it is far less expensive and more practical to implement. Single-span bridges that completely avoid the stream channel are the most expensive structures to construct, but they involve the least disturbance of existing channels and potential for sedimentation.

All construction will require DPW review for consistency with laws, regulations and policies related to Chapter 10 (Erosion and Sedimentation Control) and Chapter 27 (Drainage) of the Hawai‘i County Code. Grading and grubbing permits from the County of Hawai‘i will be required, as well as a National Pollutant Discharge Elimination System (NPDES) Permit from the State Department of Health. These reviews, permits and approvals are meant to minimize impacts from flooding and erosion and sedimentation. The determination by the USACE of whether the unnamed streams that cross South Lauko Road and South Pszyk Road are “jurisdictional” will dictate whether a Section 404 Department of the Army (DA) Permit will be required to work within the streams. For crossings of waters determined to be jurisdictional, a DA permit would be required unless there were a single-span bridge that avoided fill or construction in streams or adjacent wetlands that may be present. The permit would consider the area of each water of the U.S. that would experience fill or construction activity, and then determine conditions to minimize impacts to the integrity of that water body and the functions that the unnamed stream system performs in terms of flood control, water quality maintenance, aquatic habitat and wildlife. If the streams were determined jurisdictional, it might also be necessary to conduct wetlands delineations, undertake water quality monitoring, and acquire other permits and approvals such a Section 401 Water Quality Certification and a Stream Channel Alteration Permit. If wetlands are impacted, compensatory mitigation involving USACE-approved mitigation banks, in-lieu fee programs, or permittee-responsible mitigation might also be required.

Impacts and Mitigation Measures: Flooding and Drainage

Construction of a new road or reconstruction of an existing road can disrupt drainage patterns in existing gullies and swales, which can concentrate run-off in channels that create new drainage and flood issues. Roads can also create new impermeable surfaces that prevent water percolation. If a design option is chosen in which the roads were paved, this would permanently increase the extent of impermeable road surface (which is currently virtually non-existent in the area). An enlarged area of impermeable surfaces would increase surface water runoff during precipitation events. Design

options that involve base course only with no paving would reduce impermeability, as a large fraction of the precipitation that falls on or runs off to the road could be absorbed directly into the ground.

Flooding and drainage impacts would be prevented or minimized by structures that will be reviewed by permitting agencies and required by conditions of the permits. At streams, two different approaches are being evaluated for each crossing: bridges and fords. Bridges, whether single-span or consisting of one or more circular pipe or concrete box culverts, would be designed to prevent water from flowing over the roadway during major storm events. The 100-year design storm would serve as the basis of bridge design, in keeping with County standards. Bridge and culvert design will be determined by drainage studies that will be conducted after the alternative combination and design options are selected and the drainage structures designed accordingly to ensure that no significant impacts would occur.

Ford crossings are utilitarian and inexpensive alternatives to bridges. Figure 5 provides several views of existing County of Hawai'i fords. If an alternative combination involving South Lauko Road and/or South Pszyk Road is selected for construction, and a ford is selected as the stream crossing design option, the road will be designed to allow water to flow over the road in the culvert location during very heavy flows. Signs will be placed on both sides of the crossing to warn motorists of conditions, and a "ruler" will be placed on the side of the stream to indicate the height of the water.

Runoff generated from the roads or intercepted by the roads will be handled differently depending on the alternative combination selected. In keeping with agricultural standards for minor roads, roadside drainage will be allowed to flow off onto adjacent roadside pastures and forest, as with all current roads in the area. As long as runoff is not allowed to flow concentrate for long distances along the roadway, increasing in volume as it goes and exiting in concentrated flows, these areas are general capable of this level of runoff absorption. Drainage ditches will be used to intercept and channel existing drainage from areas upslope of the road into culverts that direct it to its natural path across the road. If paved roads are part of the alternative combination selected, a drainage study will evaluate the need for drywells and design and construct them accordingly.

Impacts and Mitigation Measures: Water Quality

Without appropriate mitigation, the construction of roadways can generate adverse short-term effects on the surface water quality of runoff, particularly an increase in suspended sediments in runoff during and shortly after precipitation events. Construction removes vegetation, disturbs soils, and changes overland flow characteristics, intensifying the effects of natural erosion until soils stabilize.

As discussed above, stormwater discharges are regulated through the Clean Water Act (CWA) and the National Pollutant Discharge Elimination System (NPDES) program by the State Department of Health, as well as County ordinances. The County grading and grubbing and NPDES permits, as well as potentially other permits, will specify a series of best management practices (BMPs) for the project. These BMPs may include, but would not be limited to, the following:

Figure 5. Photos of Existing County of Hawai'i Fords



- Minimization of sediment loss by emplacement of structural controls, such as sediment barriers silt fences, and sand bag barriers;
- Minimizing disturbance of soil during periods of heavy rain;
- Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
- Routine maintenance of BMPs by adequately trained personnel; and
- Cleanup and disposal at an approved site of significant leaks or spills, if they occur.
- Utilization of temporary dust control measures.

Potential sources of pollution from the operation of roads include solids, heavy metals, and organics from fuels and motor oils. Stormwater flowing over impermeable surfaces may pick up petroleum residues, and, if not controlled, transport them off the roadway. Contaminated stormwater from major highways can degrade the quality of surface waters if any are nearby or filter through soils and degrade groundwater resources. For smaller roads such as those proposed as part of this project, such impacts are generally minor, but the context of each road requires examination. After construction is complete, stormwater from the Puhala Street Extension project corridor (which would run *mauka-makai*) would runoff down the roadways into roadside swales, from which it would be periodically directed onto the adjacent forested terrain, just as it currently is on the existing Puhala Street and all other roads in the area. On the Kīlauea lava surface present here, runoff is rapidly absorbed into the highly permeable geology, providing natural filtration and avoiding sedimentation. On the well-developed Mauna Loa soils that are present on much of the project corridors for South Lauko Road and South Pszyk Road, which run across the slope, runoff would tend to sheet flow along the roads short distances and then accumulate on the downhill side of the roadways.

As discussed above in the context of flooding, design options that involve paving would develop more runoff and carry more sediment from the roadsides, although the pavement itself would generate no sediment. Minimization of water quality impacts to the adjacent waterways on rural roadways such as those proposed occurs through allowing roadside drainage to sheet flow off into areas of natural vegetation that have sufficient absorptive capacity under unsaturated conditions. Based on the proposed designs, which involve narrow roads in areas of pasture and forest, this objective is achievable, and no significant impacts to water quality would occur.

Impacts and Mitigation Measures: Climate Change Resiliency

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. In addition to sea level rise, which would not be an issue for this upland project, higher air temperatures will warm ocean waters, especially in Northern Hemisphere tropical and subtropical seas. Wet and dry season contrasts will increase, and wet tropical areas in particular are likely to experience more frequent and extreme precipitation.

Federal guidance (US CEQ 2016) and State of Hawai'i policy articulated in Hawai'i Revised Statutes §226-109 urges agencies to consider in the impact analysis for project alternatives 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.

Although a non-negligible amount of fossil fuels will be utilized in constructing/reconstructing roads in this area, the greenhouse gas emissions this generates will be compensated for over time by the reduction in trip lengths. This would happen sooner if South Lauko Road and/or South Pszyk Road were constructed, because either one (or both) allow Fern Acres parents a direct route to and from Mt. View School, saving several miles of roundtrip travel, much of the time spent in idling waiting for left turns in congested conditions.

Although it is difficult to speculate on the direction or degree of precipitation changes that would occur in this specific area of the Big Island as climate change progresses, it appears likely that the frequency of tropical storms will increase here. There is a clear need to have alternative accesses to subdivisions and routes to get residents between subdivisions when one or more alternative accesses are blocked. All alternative combinations of the project would thus increase the resiliency of the transportation system to the presumed effects of climate change.

3.1.3 Flora, Fauna and Ecosystems

Existing Environment, Impacts and Mitigation Measures

Walk-through biological surveys of the route were conducted by the author on several days in July 2016. Most of the lengths of the South Lauko Road and South Pszyk Road project corridors were influenced by the former cultivation of sugar cane. These areas were dominated by various grasses, especially guinea grass (*Megathyrsus maximus*), California grass (*Urochloa mutica*) and bush beardgrass (*Schizachyrium condensatum*), as well as guavas (*Psidium spp.*), gingers (*Hedychium spp.*) and bamboo orchid (*Arundina graminifolia*). In the Puhala Street Extension project corridor, the vegetation retained some of the natural character of Lowland Wet Forest, per Gagne and Cuddihy (1990). The base flora of 'ōhi'a (*Metrosideros polymorpha*) trees and uluhe fern (*Dicranopteris linearis*) is still present, although heavily invaded by strawberry guava (*Psidium cattleianum*), Koster's curse (*Clidemia hirta*) and other melastomes, as well as molasses grass (*Melinis minutiflora*) and bush beardgrass. Because an informal road or trail connecting two subdivisions winds in and out of the Puhala Street Extension project corridor on the site of a former farming operation, the area has long been disturbed by bulldozing, dumping and other activities. Several native forest understory plants that tolerate disturbance, including *naupaka kuahiwi* (*Scaevola gaudichaudii*) and 'uki'uki (*Machaerina mariscooides*), are fairly common. A full list of observed plants species is contained in Appendix 2.

Bird surveys were conducted on several occasions as part of field visits to inspect the botany and hydrology of the area. Only a few species of birds were identified visually or by their calls. The most abundant species were common mynas (*Acridotheres tristis*), northern cardinals (*Cardinalis cardinalis*), and Japanese white-eyes (*Zosterops japonicus*). No native birds were observed, with the exception of the endangered but widespread Hawaiian hawk (*Buteo solitarius*), which was observed

in the general area, though not within a mile of the project corridors. Due to the relatively low elevation and disturbed habitat of the site, a diversity or abundance of native forest birds was not expected. However, it is likely that Hawai'i 'amakihi (*Hemignathus virens*) can be observed here, as some populations of this native honeycreeper appear to have adapted to the mosquito borne diseases of the Hawaiian lowlands. It is also possible that 'apapane (*Himatione sanguinea*) is occasionally present, although they are generally restricted to elevations above 4,000 feet.

With the exception of the endangered Hawaiian hoary bat (*Lasiurus cinereus semotus*; 'ōpe 'ape 'a), all terrestrial mammals in Hawai'i are alien species. Mammals were not formally surveyed but were noted when present during the site visits. We saw, heard or detected sign of feral pigs (*Sus scrofa*), domestic cattle (*Bos taurus*), domestic dogs (*Canis f. familiaris*), feral cats (*Felis catus*) and small Indian mongooses (*Herpestes a. auropunctatus*). It is likely that various species of rat (*Rattus* spp.) and European house mice (*Mus domesticus*) are also present.

The endangered Hawaiian hoary bat was not detected during the course of any surveys. It is, however, probable that this species uses resources within the general project area, as they have been frequently seen in Upper Puna. The impact that the project potentially poses to bats is during the clearing and grubbing phases of construction as vegetation is removed. The removal of tall shrubs or trees can temporarily displace bats that may be roosting in the vegetation. As bats use multiple roosts within their home territories, this disturbance from the removal of vegetation is likely to be minimal. However, during the pupping season, female bats carrying pups may be less able to rapidly vacate a roost site when the vegetation is cleared. Additionally, adult female bats sometimes leave their pups in the roost tree while they forage and very small pups may be unable to flee a tree that is being felled.

There are no native terrestrial reptiles or amphibians in Hawai'i. The highly invasive coqui frog (*Eleutherodactylus coqui*) is known from this area of Puna. Careful observation over a period of time would undoubtedly reveal various other reptiles and amphibians, including various species of gecko and skink lizards. No terrestrial invertebrate survey was undertaken as part of the survey, but rare native invertebrates tend to be associated with intact native vegetation and are very unlikely to be present.

The aquatic biology survey documented in Appendix 4 detected various aquatic organisms, most of them non-native. Because of the lack of a connection to the sea, native fish and shellfish are not present. Adults of four species of dragonfly, including three fairly common natives (*Anax junius*, *A. strenuus* and *Pantala flavescens*), were seen cruising the stream channels or present as nymphs in the water. Non-native species included the American crayfish (*Procambarus clarkii*), which were common at one sampling site but were not seen elsewhere. Swordtails (*Xiphophorus helleri*) and rainbow guppies (*Poecilia reticulata*) inhabit several shallow pools. A few adult cane toads (*Rhinella marina*) and American bullfrogs (*Lithobates catesbeianus*) were present, and wrinkled Japanese frogs (*Rana rugosa*) were abundant at all stations.

Impacts and Mitigation Measures

Although a portion of the project corridors supports a somewhat degraded native ‘ōhi‘a-uluhe forest, the vegetation is generally extensively disturbed, dominated by nonnative species and not particularly sensitive. No threatened or endangered plant species are present. Cutting vegetation for the project should not generate any adverse impact upon vegetation or rare, threatened or endangered plant species.

A new issue for construction projects located in ‘ōhi‘a forests has recently surfaced. A fungus called *Ceratocystis fimbriata* has led to a disease that is new to science and new to Hawai‘i - Rapid ‘Ōhi‘a Death. It has killed hundreds of thousands of ‘ōhi‘a trees across more than 34,000 acres of the Big Island. It was first discovered in Lower Puna. Any construction project may exacerbate the spread of Rapid ‘Ōhi‘a Death. The ongoing realignment and reconstruction of the Saddle Road (Daniel K. Inouye Highway) construction project is dealing with the issue currently, closely coordinating on mitigation measures with the U.S. Forest Service. Knowledge and treatment protocols are evolving, but the current mitigation is to stack all wood from the project in one place for ultimate onsite disposal, which may consist of chipping and/or burying. To mitigate for potential impacts associated with Rapid ‘Ōhi‘a Death, DPW will closely coordinate with the U.S. Forest Service and the DLNR to properly dispose of any ‘ōhi‘a trees that require removal for areas of the project that work where these trees are present. Decontamination of heavy equipment and tools that work in areas with ‘ōhi‘a may also be conducted before and after entry to such areas.

Several mitigation measures will be implemented to avoid or minimize impacts to the endangered but regionally widespread terrestrial vertebrates listed above. DPW will not allow any construction from activities that disturb or remove shrubs or trees taller than 15 feet between June 1 and September 15, when Hawaiian hoary bats and their pups may be sensitive to disturbance. If landclearing occurs between the months of March and September, inclusive, a pre-construction hawk nest search by a qualified ornithologist using standard methods will be conducted. If Hawaiian hawk nests are present, no land clearing will be allowed until October, when hawk nestlings will have fledged.

The precautions for preventing effects to water quality during construction listed above in Sections 3.1.1 and 3.1.6 will reduce adverse impact on the aquatic biological resources – which are restricted to a few common native insects and primarily nonnative, even invasive species – to minimal levels.

3.1.4 Air Quality, Noise and Scenic Resources

Environmental Setting

Air pollution in Puna is mainly derived from volcanic emissions of sulfur dioxide, which convert into particulate sulfate and produce a volcanic haze (vog) that persistently blankets North and South Kona, and periodically affects the Puna District when kona (southerly) winds are present.

Noise on the project corridors varies from low to moderate. Where a roadway is already present, homes, farm machinery, livestock, dogs and motor vehicles contribute to moderate and occasionally

moderately high noise. In areas currently lacking any roads, noise is derived principally from natural sources including wind, birds and frogs as well as noise from the sources named above but in the distance. A few noise-sensitive receptors are present near the project corridors in the form of existing single-family homes. All of them are already on roadways, although each of the roadways is currently a dead-end and thus does not experience high levels of vehicular noise.

The District of Puna contains a number of sites designated significant for their scenic character in the Hawai‘i County General Plan (Hawaii County Planning Department 2005). Although none of these specific sites are located near the project corridors, the General Plan names the “View of Mauna Kea and Mauna Loa from Pahoa-Keaau, Volcano-Keaau Roads, and various Puna subdivisions” as an example of natural beauty. In addition, the forests, gullies and farms of the area are scenic.

Impacts and Mitigation Measures

The proposed action will not measurably affect air quality except during grading and construction. In order to minimize impacts from dust, DPW will prepare and implement, or require its contractor to prepare and implement, a dust control plan compliant with provisions of Hawai‘i Administrative Rules, Chapter 11-60.1, “Air Pollution Control,” and Section 11-60.1-33, “Fugitive Dust.”

Construction would entail limited grading, compressors, vehicle and equipment engine operation during the three-month construction period. These activities may generate noise exceeding 95 decibels at times, impacting nearby noise sensitive receptors, which are located on existing dead-end roadways. To mitigate for noise impacts, DPW will require that construction will be limited to reasonable hours, and no night construction will be allowed unless an emergency situation develops. In cases where construction noise is expected to exceed the Department of Health (DOH) “maximum permissible” property-line noise levels, road construction must obtain a permit per Title 11, Chapter 46, HAR (Community Noise Control) prior to construction. DOH reviews the proposed activity, location, equipment, project purpose, and timetable in order to decide upon conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, additional restricted hours, and portable noise barriers. DPW and/or its contractors will consult with DOH to determine if noise reduction measures are necessary.

No important viewplanes or scenic sites, including views of Mauna Kea and Mauna Loa recognized in the Hawai‘i County General Plan, would be affected. Construction will have a brief, local scenic impact that cannot be practically mitigated. On a permanent basis, the proposed roadways will be in keeping with the existing landscape of rural subdivisions and County roads.

3.1.5 Hazardous Substances, Toxic Waste and Hazardous Conditions

Environmental Setting, Impacts and Mitigation Measures

No systematic assessment of the project site corridor has been conducted to determine if hazardous materials, toxic waste or other hazardous conditions may have been present on the site. State DOH hazardous material databases indicate that an active Underground Storage Tanks and a former Leaking Underground Storage Tanks is present on Volcano Highway, but not in the vicinity of the project corridors; no generators of hazardous waste are noted (<http://eha-web.doh.hawaii.gov/ehw/>). Reconnaissance of the site during topographic, botanical and archaeological surveys did not reveal any evidence of land uses such as service stations or industrial operations that would lead to such conditions, nor have there been reports of such conditions. Based on this, the potential for the presence of toxic or hazardous materials appears to be fairly low. If evidence of suspicious materials or conditions appears during excavation or other construction, the County may undertake a systematic assessment of the area in question to determine if remediation is required.

3.2 Socioeconomic and Cultural

3.2.1 Socioeconomic Characteristics

Existing Environment

Because of the gradual occupation of lots developed during widespread land subdivision about fifty years ago, the Puna District has been the Big Island's fastest-growing district over the last thirty years. Population as measured in the 2010 U.S. Census was 45,326, a 66 percent increase over the 2000 count of 27,232. Despite a lack of basic infrastructure such as paved roads and water in most subdivisions, the relatively inexpensive lots typically range in size from one to three acres and have attracted residents from the U.S. mainland and other parts of the State of Hawai'i who seek affordable property. The basis of the economy of Puna has evolved from cattle ranching and sugar to diversified agriculture, various services for the growing populations, commuting to Hilo, and tourism, which has been stimulated by being home to Kīlauea, one of the world's most active volcanoes. Some towns and subdivisions in Puna such as Mt. View, Hawaiian Acres, Fern Acres, and Eden Roc, are now partially bedroom communities for Hilo's workforce. This is evidenced by the heavy flow of Hilo-bound traffic during the AM rush hour, which is also derived from school traffic.

The subdivision of Fern Acres, the community most directly involved with the proposed project, was developed in the 1950s, when developer Crescent Acres LLC bulldozed one-lane roads into the forest and began selling lots. Fern Acres consists of primarily 2-acre lots spread out over 2,000 acres. There are now 25 miles of roadways maintained by a road association.

Table 3 provides information on the socioeconomic characteristics of the State of Hawai'i, the County of Hawai'i and Fern Acres, from the U.S. Bureau of the Census's 2010 U.S. Census of Population and the American Community Survey. Fern Acres is in many ways similar to the State and County as a whole, with a diverse population. In comparison to the County and State as a whole,

Table 3. Selected Socioeconomic Characteristics

SUBJECT	State of Hawai'i	County of Hawai'i	Fern Acres
Total population 2010	1,360,301	185,079	1,504
Median age (years)	38.6	40.9	40.2
16 years and over	80.2%	79.9%	78.7%
65 years and over	14.3%	14.5%	9.5%
Percent female	49.9%	49.8%	48.6%
White	24.7%	34.4%	39.3%
Black or African American	1.6%	0.8%	0.6%
American Indian and Alaska Native	0.3%	0.6%	0.4%
Asian	38.6%	22.1%	6.6%
Chinese	4.0%	0.9%	0.7%
Filipino	14.5%	8.6%	1.7%
Japanese	13.6%	9.8%	2.3%
Korean	1.8%	0.5%	0.1%
Native Hawaiian	5.9%	8.5%	9.8%
Two or More Races	23.6%	29.5%	40.7%
Total households	455,338	67,096	594
Family households (families)	70.2%	66.2%	61.6%
With own children under 18 years	20.1%	25.8%	24.4%
Female householder, no husband present	12.6%	12.3%	12.6%
With own children under 18 years	5.2%	6.0%	6.9%
Nonfamily households	31.1%	33.8%	38.4%
Householder living alone	23.3%	25.1%	30.5%
Average household size	2.89	2.70	2.53
Average family size	3.42	3.22	3.17
Total housing units	519,508	82,324	704
Occupied housing units	87.6%	66.0%	84.4%
Rental housing percent of occupied units	42.3%	34.0%	23.7%
Rental vacancy rate (percent)	7.8%	11.6%	4.1%
Median Household Income 2012-2014	\$68,201	\$51,213	X
Poverty rate 2012-2014	11.4%	18.1%	X

Source: U.S. Census Bureau, 2010 Census. 2010 Census Data.

Community Survey <https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml>

Census Quick Facts: <https://www.census.gov/quickfacts/table/PST045215/00>

Notes: (X) data not available

the Fern Acres area has very slightly fewer females, children and elderly people, although the median age is similar. There is a substantially higher percentage of whites, Native Hawaiians and persons reporting two or more races, with fewer Asians. There are fewer family households, smaller household sizes and family household sizes in Fern Acres, and more householders living alone. For occupied houses, a larger proportion are owner occupied as opposed to rented, and rental vacancies are low. Although no income or poverty data are available for small communities such as Fern Acres,

the data for the County versus the State shows lower incomes and higher poverty rates. U.S. Census American Community Survey data indicates that the census tracts comprising the Puna District have among the highest poverty rates in the State, and the Upper Puna subdivisions are believed to be fairly typical of Puna in this respect.

In addition to the broader community that would basically benefit from additional road connectivity, there are residents of neighborhoods that would be affected in various ways by new road connections and increased traffic. This applies particularly to the residents of South Lauko Road and South Pszyk Road, who currently live on dead-end County roads. This also applies to some extent to residents on Puhala Street, South Kopua Road and the Kopua Farmlots area, which currently do not experience inter-subdivision traffic.

Impacts and Mitigation Measures

The primary impact on socioeconomic conditions that would be produced by the proposed project is an increase in road connectivity. This will assist in emergencies – fires, floods, lava flows, hurricanes, and emergency medical situations – and also everyday life, particularly driving children to and from school. Residents of Fern Acres would have one, two or three more connections to Highway 11, depending on the alternative combination selected by the County for construction. However, residents on South Lauko Road, South Pszyk Road, and South Kopua Road would experience a higher level of traffic. According to several residents (see Appendix 1a for comments), they are especially concerned about the ability of criminals to more easily travel between subdivisions. Although this is true, it also improves access for police, fire and emergency medical services as discussed in Section 3.3.3.

While the No Action Alternative would not require the expenditure of public funds and would not produce any neighborhood impacts, it would obviate the substantial socioeconomic benefits associated with increased community connectivity.

3.2.2 Cultural and Historic Resources

Cultural and Historical Background

The first inhabitants of Hawai‘i were believed to be settlers who had undertaken difficult voyages across the open ocean. For many years, researchers have proposed that early Polynesian settlement voyages between Kahiki (the ancestral homelands of the Hawaiian gods and people) and Hawai‘i were underway by A. D. 300, although recent work suggests that Polynesians may not have arrived in Hawai‘i until at least A. D. 1000 (Kirch 2012).

The initial inhabitants of Hawai‘i are believed to have come from the southern Marquesas Islands and settled initially on the windward side, eventually expanding to leeward areas. Early Hawaiian farmers developed new strategies and tools for their new environment (Kirch 2012; Pogue 1978). Societal order was maintained by their traditional philosophies and by the conical clan principle of genealogical seniority (Kirch 2012). Universal Polynesian customs brought from their homeland

included the observance of major gods *Kane*, *Ku*, and *Lono*; the *kapu* system of law and order; cities of refuge, various beliefs, and the concepts of *mana* and the *'aumakua* (Fornander 1969).

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

Ahupua'a were ruled by *ali'i 'ai ahupua'a* or lesser chiefs and managed by a *konohiki*. *Ali'i* and *maka'ainana*, or commoners, were not confined to the boundaries of *ahupua'a* as resources were shared when a need was identified. *Ahupua'a* were further divided into smaller sections such as *'ili*, *mo'o'aina*, *pauku'aina*, *kihapai*, *koele*, *hakuone* and *kuakua*. The chiefs of these land units have their allegiance to a territorial chief or *mo'i* (literally translated as king) (Hommon 1986). The project corridors are located on both sides of the boundary between Ola'a and Kea'au *Ahupua'a*, land units of the District of Puna, one of six major districts on the island of Hawai'i. 'Ola'a was traditionally administered as a *kalana*, a discrete land unit larger than an *ahupua'a* but smaller than a district (*moku o loko*) and comprised of several land divisions (Maly and Maly 2002).

'Ola'a and Kea'au are two of fifty traditional land divisions found in the District of Puna on the eastern shores of the Island of Hawai'i. In *Native Planters in Old Hawaii*, Handy and Handy (1991) described Puna as an agriculturally fertile land that has been repeatedly devastated by lava flows. Writing during the 1930s, they relate that:

The land division named Puna—one of the six major chiefdoms of the island of Hawai'i said to have been cut ('*oki*) by the son of the 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 the most easterly point at Cape Kumukahi. The uplands of Puna extend back toward the great central heights of Mauna Loa, and in the past its lands have been built, and devastated, and built again by that mountain's fires. In the long intervals, vegetation took hold, beginning with miniscule mosses and lichens, then ferns and hardier shrubs, until the uplands became green and forested and good earth and humus covered much of the lava-strewn terrain, making interior Puna a place of great beauty...

...One of the most interesting things about Puna is that Hawaiians believe, and their traditions imply, that this was once Hawaii's richest agricultural region and that it is only in relatively recent time that volcanic eruption has destroyed much of its best land. Unquestionably lava flows in historic times have covered more good gardening land here than in any other district. But the present desolation was largely brought about by the gradual abandonment of their country by Hawaiians after sugar and ranching came in... (Handy and Handy 1991:539-542).

The District of Puna is situated largely on the slopes of Kīlauea Volcano. Nearly the entire crest of the rift zone is covered by lava that is less than 200 years old, and most of the young lava flows that emanate from vents along the crest have spread southward towards the southeastern coast of the district, covering older lava flows in the process (Wolfe and Morris 1996). Puna also includes portions of the Mauna Loa's lower slopes, which feature older geology (5,000 to 11,000 years old) and relatively developed soils. These characteristics of the land no doubt shaped the Pre-Western Contact settlement patterns and greatly influenced the later, nearly century of Historic Period sugar cultivation within a portion of the project corridors.

Puna was a region famed in legendary history for its associations with the goddess Pele and god Kāne. Because of the relatively young geology and persistent volcanic activity, the region has a strong association with Pele. However, the connection to Kāne is perhaps more ancient. Kāne, ancestor to both chiefs and commoners, is the god of sunlight, fresh water, verdant growth, and forests. It is said that before Pele migrated to Hawai'i from Kahiki, Puna was esteemed the most beautiful place in the islands by many. Contributing to that beauty were the groves of fragrant hala and forests of 'ōhi'a lehua for which Puna was famous. The inhabitants of Puna were famous for their expertise and skill in *lauhala* weaving. People probably began utilizing the agricultural resources of upland Puna during the early Expansion Period. As coastal populations increased, the need for food led people to seek arable land at higher elevations. This trend of population increase along desirable coastal locations and the expansion into upland regions to support the coastal populations would have continued throughout prehistory, slowly populating more marginal areas of Puna District.

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

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

‘Ōla‘a falls within the Upland Agricultural Zone (Zone II) of McEldowney’s (1979:15-18) model of Pre-Western Contact settlement patterns. While her model is largely based on early historical accounts, it also considers environmental variables and human resource needs, and offers insights into the prehistoric past (Burchard and Moblo 1994). McEldowney stated that the unwooded grasslands or “plains” noted by earlier observers as extending behind Hilo in a band from Kea‘au to modern-day Mountain View correspond to the distribution of ash soils. Scattered huts with adjacent garden plots and groves of economically beneficial tree and plant species dotted the expanse of the upland agriculture zone (McEldowney 1979). Planting of wetland taro, banana, and ti occurred along the banks of the small tributaries in this area, and sweet potatoes were cultivated in many areas Handy (1972). Because the *kalana* of ‘Ōla‘a does not extend to the sea, marine resources were not procured by the residents of the region, who would have relied on trade or travel in order to obtain marine resources.

Folklore traditions of the ‘Ōla‘a region focus on the area’s abundance of water. Beckwith (1970) wrote of the brother and sister gods Kūka‘ōhi‘alaka and Kauakuahiwi, who took human form and came to Hawai‘i from Kahiki (the ancestral homeland) and settled in Kea‘au and ‘Ōla‘a respectively. Kūka‘ōhi‘alaka (Kū) lived at the shore of Kea‘au with his wife, and Kauakuahiwi lived in the uplands of ‘Ōla‘a with her husband and children. Kū’s wife was stingy, however, and denied Kauakuahiwi and her family fish from the ocean. Unable to eat, Kauakuahiwi turned her family into rats, and herself into a spring of water. When Kū heard of this he went to the spring and turned himself into an ‘ōhi‘a tree. The spring and tree are one of the storied places of ‘Ōla‘a, said to be along an ancient trail to the volcano, near the thirteen-mile marker of the Old Volcano Road (Maly and Maly 2004), roughly 2 miles northeast of the project corridors. In an interview conducted by Takamoto (1976), Jack Suwa described the story of two wells that are located in nearby Kurtistown. The wells contained drinking water but were once used for washing, a defilement of ancient Hawaiian sanitary practices and religious codes. As a result of this failure to abide by the proper protocol, the drinking water disappeared and only returned once a *kahuna* (priest) purified and blessed the wells. At the time of the interview the wells reportedly still contained fresh water.

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. Puna was involved in this, as cited in the traditional historical accounts of Samule Kamakau, who recounted that, “Hua-‘a was the chief of Puna, but Puna was seized by ‘Umi and his warrior adopted sons... Hua-‘a was killed by Pi‘i-mai-wa‘a on the battle field of Kuolo in Kea‘au, and Puna became ‘Umi-a-Liloa’s” (Kamakau 1992:17-18).

Sometime during the reign of Kalaniopu‘u (A. D. 1736-1758), Kamehameha I was born in North Kohala. 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. Kamehameha helped Cook navigate his way to Hawai‘i Island. Cook exchanged gifts with Kalaniopu‘u at Kealakekua Bay the following January, and Cook attempted to leave Kona in February. However, Cook’s ship then sustained

damage to a mast in a severe storm off Kohala and returned to Kealahou, setting the stage for Cook's death on the shores of the bay.

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

The rampant sandalwood trade led to 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 and later the cultivation of sugarcane, which was more lucrative but carried a heavy environmental price.

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

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

The population in this part of Puna, though somewhat numerous, did not appear to possess the means of subsistence in any great variety or abundance; and we have often been surprised to find desolate coasts more thickly inhabited than some of the fertile tracts in the interior; a circumstance we can only account for, by supposing that the facilities which the former afford for fishing, induce the natives to prefer them as places of abode; for they find that where the coast is low, the adjacent water is usually shallow.

We saw several fowls and a few hogs here, but a tolerable number of dogs, and quantities of dried salt fish, principally albacores and bonitos. This latter article, with their *poë* [*poi*] and sweet potatoes, constitutes nearly the entire support of the inhabitants, not only in this vicinity, but on the sea coasts of the north and south parts of the island.

Besides what is reserved for their own subsistence, they cure large quantities as an article of commerce, which they exchange for the vegetable productions of Hilo and Mamakua [Hāmākua], or the mamake and other tapas of Ora [‘Ōla‘a] and the more fertile districts of Hawaii.

After proceeding north along the coast, Ellis described the settlement pattern in Waiākea as residences 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)

Theodore Kelsey, a historian born in Hilo in the late 1800s, recorded that ‘Ōla‘a was a land of bird catchers (Maly and Maly 2004). In 1921, many of the traditional bird catching techniques specific to ‘Ōla‘a and the Hilo area were related to him by an elder Hawaiian man named Rev. Henry B. Nālimu, who was born in Hilo in 1835. The techniques described included snaring or trapping birds on branches or *lehua* blossoms using snares, nets, or bird lime made from breadfruit sap and *kukui* (*Aleurites moluccanus*) nut. In these accounts, the birds that were collected for their feathers were not killed and eaten, but the needed feathers were plucked, and the birds were released (Maly and Maly 2004). The feathers were used to make *lei*, cloaks, and other emblems of Hawaiian royalty. The ‘ō‘ō, ‘i‘iwi, ‘ō‘ū and ‘*apapane* were the specific birds mentioned in the accounts of Rev. Nālimu. The collection and cultivation of *olonā* and *māmaki* (*Pipturus* sp.) within the forested regions of ‘Ōla‘a was practiced in more traditional times. According to Ellis (1965) the people of ‘Ōla‘a were famed for their fine *māmaki*, which could be processed to make a durable bark cloth and highly valuable cordage.

A year after Ellis’ visit, in 1824, the ABCFM established a base church in Hilo. From that church (Haili), the missionaries traveled to the more remote areas of the Hilo and Puna Districts. David Lyman, who came to Hawai‘i in 1832, and Titus Coan, who arrived in 1835, were two of the most influential Congregational missionaries in Puna and Hilo. As part of their duties they 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 Hawai‘i. In 1841, Titus Coan recorded that most of the 4,371 recorded residents of Puna lived near the shore, though there were hundreds of individuals who lived inland, in areas such as Ola‘a.

Written accounts describing ‘Ōla‘a are contained in the journals, letters, and articles of many of the early European visitors to Hawai‘i Island (see Maly and Maly 2004). These accounts typically describe the trailside lands as the visitors passed through the area on their way between Hilo and Kīlauea or Mauna Loa. The most traveled route between Hilo and Kīlauea was the Volcano Trail, which we now refer to as the “Old Volcano Trail.” McEldowney (1979), citing a number of historical sources described this trail as it would have appeared during the first part of the nineteenth century. Near the project corridors, McEldowney describes the trail as follows:

...From here [Kurtistown vicinity] to Mountain View or just beyond the “halfway house,” the trail crossed on to an extensive Kīlauea pahoehoe flow and continued along its western margin, which abutted mostly ash-covered Mauna Loa flows. The route of this old trail basically corresponds to the ‘Ōla‘a-Kea‘au boundary line on the current U.S.G.S. maps.

Descriptions of scattered, stunted trees, mixed with ferns, grasses, *‘ōhelo* (*Vaccinium* sp.), and low shrubs, sound typical of pioneer or early successional plant communities. When compared to the previous portion of the trail, ferns became more dominant, *pia* disappeared, and scattered clumps of woods, probably small *kīpūkas*, replaced the groves.

...the woods started one or two miles SE and NW of the path, giving it the appearance of an unwooded corridor. Several villages, as well as scattered huts along the forest edge, were reported without much detail other than the presence of fertile soil and a burial cave marked with poles. Most describe leaving this open stretch somewhere beyond the “halfway house” by entering a thick forest, which Pickering [1840-41] placed at 1,500 ft elevation. (McEldowney 1979:20)

Hawaiian Government Survey Registered Map 42 (see Figure 19 of Appendix 3) includes several place names indicated along the Old Volcano Trail. Near the project corridors, the map depicts a cluster of houses and the name “Mahiki” situated on either side of the trail. The cluster of houses appears to be located between the South Lauko and South Pszyk Road project corridors. This location corresponds well with the location of the ‘Ōla‘a chief Kinai’s residence described by C. S. Stewart (1831:80):

We accomplished fourteen miles just after four o’clock; and finding excellent accommodations for the night, at that distance, determined to sleep before proceeding farther. The establishment—consisting of three houses, situated a short distance from the road, on the borders of a fine tract of land, having very much the appearance of a large plantation of intermingled arable and meadow grounds at home and just at the edge of a fine forest running from the sea to the interior—belongs to Kinai, the head man of the thinly inhabited district of Ora [‘Ōla‘a].

Stewart noted that Kinai had prospered since the advent of the sandalwood trade: “Kinai’s house had separate rooms covered with native cloth and mats probably from the trees and plants of the woods, books in the native tongue bound and wrapped in native cloth and slate, furniture, chintz, etc.” (Olson, 1974:76-77 in Takamoto 1976). A temporary economic prosperity derived from sandalwood drastically changed the lifestyle of the chief of ‘Ōla‘a, and in turn would have impacted the entire commerce of the *ahupua‘a* and its residents. The wealth of natural resources indicated above may explain Kamehameha’s III’s decision to keep ‘Ōla‘a as crown lands during the *Māhele*.

The *Mahele ‘Aina* took place in 1848, placing all land in Hawai‘i into three categories: Crown Lands, Government Lands and Konohiki Lands. Ownership rights were “subject to the rights of the native tenants,” or those individuals who lived on the land and worked it for their subsistence and for their chiefs. As a result of the *Māhele* of 1848, the *kalana* of ‘Ōla‘a was distributed to Kaunuohua, who relinquished the land to King Kamehameha III (Soehren 2005). The king then retained ‘Ōla‘a as Crown Land. Kea‘au was awarded to Lunalilo as *‘apana* 16 of Land Commission Award 8559-B. All lands awarded during the *Māhele* were subject to the rights of the native tenants therein. Native tenants of the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to, *kuleana* parcels that they actively lived on or farmed. The Board of

Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). In Puna, however, very few claims for *kuleana* were submitted. Maly (1998:37) notes that, with the exception of the islands of Kaho‘olawe and Ni‘ihau, no other land division of comparable size, had fewer claims for *kuleana* from native tenants than the district of Puna. One Land Commission claim was made for a *kuleana* within ‘Ōla‘a, but it was not awarded (Maly and Maly 2004).

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 the stated goal of the grant program, many of the Government Lands were eventually sold or leased to foreigners. The Enabling Act set a precedent for the legal framework within which ‘Ōla‘a would be divided into homestead lots and sold as grants after the overthrow of the monarchy.

In 1862, the Commission of Boundaries (Boundary Commission) was established to legally set the boundaries of all the *ahupua‘a* that had been awarded as a part of the *Māhele*. In 1873, the Boundary Commission began conducting hearings to determine the boundaries of lands awarded to *ali‘i*, *konohiki*, and foreigners during the *Māhele*. The primary informants for the boundary descriptions were old native residents of the lands, many of whom had also been claimants for *kuleana* during the *Māhele*; the information was primarily collected between 1873 and 1885. The testimonies were generally given in Hawaiian and transcribed in English as they occurred. The testimonies concerning ‘Ōla‘a and the neighboring lands of Kea‘au, Keauhou, and Waiākea contain numerous references to named places along the boundaries of ‘Ōla‘a, including groves of trees, ponds, trails, roads, old villages, and peoples’ houses (see Maly and Maly 2004:42-68). One of these major landmarks was the Old Volcano Trail (at the time called “the Volcano Road”), which formed the boundary between ‘Ōla‘a and Kea‘au and facilitated travel between Hilo, Kea‘au and ‘Ōla‘a as well as to the greater Puna district.

The alignment of the Old Volcano Trail was mapped as early as 1874 by John M. Lydgate who referred to the Old Volcano Trail as “Road to Hilo” (Figure 20 of Appendix 3). The trail appears as a meandering line that straddled the *ahupua‘a* of ‘Ōla‘a and Kea‘au and strays in and out of the boundaries between the two (Rowland 2003). A letter addressed to H.A.P. Carter, the Minister of Interior from J.F. Jordan, who in 1881 acted as the Road Supervisor for the Hilo and Puna districts, referenced the appearance and construction of the Old Volcano Trail as similar to the Puna Road:

Your excellency are aware of the fact that the Puna Road, *like the Volcano Road*, was built of coarse stone with a small sprinkle of gravel which had to be carried a long ways, put in the middle of the trail. (Jordan 1881 in Rowland 2003, emphasis added)

In the decades following the *Māhele*, economic interests in the region swiftly changed from traditional Hawaiian subsistence farming and regional trading networks to the gathering or growing

of export cash crops, including *pulu* (fiber) from the *hapu 'u* (tree fern), coffee, tobacco, sugar, timber, and pineapple, and also dairy farming and cattle ranching. During this period, lands near the project corridors were initially planted in coffee, a crop which ultimately failed to perform satisfactorily.

A critical step toward developing agriculture in 'Ōla'a was the creation of a new road between Hilo and Kīlauea located *mauka* of the Old Volcano Trail. Despite the network of Pre-Western contact trails that covered the island, Hawai'i lacked a comprehensive system of interior roads for overland travel before 1846. In that year, the Kingdom established the Department of the Interior and the office of Superintendent of Internal Improvements (the forerunner of Public Works) to oversee the construction of piers, harbors, government buildings, roads, and bridges (MKE and Fung 2013:6). The primary goal of early road-building in Hawai'i was to modernize infrastructure and create access to commercial agricultural lands, but other commercial endeavors spurred road development as well. Kīlauea had become a viable tourist destination in the 1860s, and despite increasingly comfortable accommodations near the crater, most visitors stayed only a day or two. Poor roads to the volcano were thought to deter visitors from staying longer. Tourists consistently derided the condition of the Old Volcano Trail, leaving numerous entries in the Volcano House register complaining about the rains, mud, and obstacles that stretched travel times to seven hours or more. Increasing tourism spurred the development of new routes from Hilo, Keauhou, and Pāhala in the 1880s. In 1888, the government appropriated \$30,000 for a new carriage road between Hilo and Volcano that became today's Volcano Highway (Duensing 2015). Work on the road began in 1890 using mainly prison labor, and in September of 1894 the entire road was completed.

As the new Volcano Road through 'Ōla'a was being built, the Crown made a large portion of potential agricultural lands in 'Ōla'a available for lease and homesteading. Three hundred eighty-five 'Ōla'a Reservation lease lots were created *mauka* and *makai* of the new Volcano Road, as well as an additional forty homesteads. The leasehold lots near the project corridors generally comprised fifty acres, although larger lots were created along the 'Ōla'a-Kea'au boundary. They were available for thirty-year leases for at just under \$1.30 per acre, with incentives for clearing and planting that included waiver of the rent fee for the first three years (Thrum 1894). The lot plan included thirty-foot wide roads that branched off of the Volcano Road to connect with the Old Volcano Trail, at least on paper. The rights-of-way for South Lauko Road and South Pszyk Road were among those created in 1892. The earliest of these leases in 'Ōla'a were made for coffee cultivation (McEldowney 1979; McGregor 2007).

By the turn of the century, the land in 'Ōla'a *makai* of the Volcano Road was a patchwork of large grant parcels planted in coffee. Along the South Lauko Road and South Pszyk Road project corridors, nine properties, comprising sixteen of the original lease lots, were purchased as grants between 1896 and 1899 (see Appendix 3: Figure 22 and Table 2). The coffee industry in 'Ōla'a, however, was short-lived, as the coffee varieties that were planted there failed to thrive. By the spring of 1900, major changes were underway that would lead to over a century of sugar cultivation.

The Olaa Sugar Company was incorporated on May 3, 1899. With a \$5,000,000 investment, the promoters purchased 16,000 acres in fee simple land and nearly 7,000 acres in long leasehold from

W.H. Shipman. The plantation fields extended for ten miles along both sides of Volcano Road as well as in the Pāhoa and Kapoho areas of the Puna District. They also purchased 90% of the stock in the adjacent Puna Plantation, adding another 11,000 acres to the holdings. OIaa Sugar Company began as one of Hawai'i's largest sugar plantations with much of its acreage covered in trees. Previous to cane, coffee was the primary agricultural crop grown in the region. After purchase of these lands, the company uprooted the coffee trees and cleared it for planting sugarcane. All the lands in and around South Lauko Road and South Pszyk Road were farmed for sugar whether by homesteaders or the plantation.

The town of Mountain View grew with the sugar trade, as immigrant laborers were imported from Japan, Puerto Rico, and the Philippines to work on the sugar plantation (McGregor 2007). Another lesser known group also came to 'Ōla'a. In 1897, the Hawaiian Minister of Foreign Affairs approved a request by H.F Hackfeld and Company (who acted as a recruiting agency for the "Planters Association") to bring in European laborers for a number of sugar plantations. Between 1897 and 1910, a number of Ukrainian families and single workers were recruited to work for 'Ōla'a Sugar Company. Most Ukrainian immigrants left 'Ōla'a for the United States mainland in 1905 and 1906 (Ewanchuck 1986:96), but a few remained. Among those who stayed in Mountain View were Michael and Anna Pszyk, the namesakes of South Pszyk Road.

The 'Ōla'a Sugar Company had many problems throughout its operation, ranging from challenging growing conditions to financial issues. The wet weather made sugarcane difficult to grow and the company continuously experimented with finding varieties suitable for the climate. Transporting cane to their mill in what is now the town of Kea'au was also problematic. The company initially used flumes and portable rail to bring cane from the fields to the Hilo Railroad. For the struggling company, the manpower and maintenance costs of these systems soon proved to be financially draining. Beginning around 1938, the plantation management experimented with other transportation options in the fields, including the use of Athey Wagons pulled by tractors (OIaa Sugar 1939). They also started a program to build gravel field roads and acquire trucks. Roads were built to service plantation-owned lands as well as fields owned by their contract planters (who were to pay the company back over time). The road-building program was curtailed during 1941 due to a shortage of labor, and then terminated at the onset of World War II when the U.S. Engineers commandeered the company's equipment (OIaa Sugar 1941). By that time, however, enough roads had been built to allow almost 39 percent of that year's crop – all the cane produced in Kapoho, Malama, and Kamaili and large parts of the cane produced in the plantation's Pāhoa, 'Ōla'a, and Mountain View Sections – to be hauled by truck. By the end of 1945, the plantation's conversion to truck hauling was completed when its final cane roads were built in the Mountain View Section. The development of OIaa Sugar's infrastructure created the South Lauko Road and South Pszyk road corridors. The Puhala Road Extension corridor was always located outside of OIaa Sugar's lands.

As discussed previously, during the Boundary Commission hearings, the Old Volcano Trail was recognized as marking the boundary between 'Ōla'a and Kea'au. In 1930, W. H. Shipman, Ltd., which owned the *ahupua'a* of Kea'au, submitted Land Court Application 1053 to fix the boundaries of Kea'au more precisely than had been done by the Boundary Commission. Surveyor P. E. Arioli and his assistant, Charles L. Murray, demonstrated that on-the-ground alignment of the Old Volcano

Trail, which had fallen into disuse, meandered in and out of Kea‘au and ‘Ōla‘a. Making this alignment official would have adversely affected some of the homestead lots that abutted the trail. Upon completion and review of the survey in 1930, R.D King, who was acting Government Surveyor at the time, made the following notes:

The boundary between the Olaa Homesteads and Kea‘au is the old Volcano Trail, a meandering line. Arioli informs R.D King that this trail has not been in use for 20 years. The boundary traverse of this trail is along the trail (which is two feet wide, one built up section for a mile in distance being about 4 feet wide) and which is about 14 miles long. It is suggested that the traverse be adopted as the boundary between Olaa and Kea‘au. This is satisfactory to the Survey Dept. on the understanding that there is sufficient land to the north to meet the needs of the ancient right-of-way, etc., that no homestead lot will obstruct the right-of-way. (King 1930 in the files of the State Survey Division).

The Land Court amended the alignment of the trail and the boundary between ‘Ōla‘a and Kea‘au to match the traverse surveyed by Murray. In doing so, it created the fee simple Old Volcano Trail property currently owned by the government. It bears emphasis that this property is a simplified approximation of the Old Volcano Trail’s former footprint. In some places it does not necessarily fully contain or even overlap with the location of the Old Volcano Trail as it existed in the 1800s.

During the second half of the twentieth century ‘Ōla‘a Sugar continued to accumulate debt despite attempts to cut operating costs that included the introduction of mechanized harvesting in 1947. The boom in real estate following statehood prompted the company to sell some of its fee simple lands and offer employees the opportunity to purchase their own houses.

On March 28, 1960, the company’s shareholders decided that the name “Olaa Sugar Company” was jinxed, and rechristened the company the Puna Sugar Company. Despite making what appeared to be a slight financial upturn after the name change, by the 1980s the company had again fallen on hard times. Tax breaks and government subsidies disappeared, and competition from cheap artificial sweeteners such as high fructose corn syrup made continued operations unsustainable. On January 7, 1982, Puna Sugar Company announced that it would close its doors (Dorrance and Morgan 2000). The company disposed of equipment, sold its lease lands and laid off employee with severance packages that included five acres of land for each employee. By December 1, 1984, the plant was officially closed. In 1988 the entire sugar mill was sold to Fiji Sugar Corporation, Ltd., and Hawaiian Electric Light Company took over the power plant.

Archaeological Resources

An archeological inventory survey (AIS) of the project corridors was conducted in compliance with the requirements of Chapter 6e, HRS to determine the nature of archaeological resources and identify possible constraints to the improvements that were then proposed. ASM Affiliates prepared the AIS, which is summarized below and contained in full in Appendix 3.

Fieldwork began with a visual inspection of the surface of a 100-foot wide strip of land centered on the project corridors. Fieldworkers walked transects parallel to the centerline of each project corridor. The centerlines of the project corridors were staked and marked with flagging tape at the time of the fieldwork and the entire study area was accessible, with good ground surface visibility. Observed features were cleared of vegetation and mapped in detail using a measuring tape and compass. Features were photographed and described using a standardized site record form. Based on several factors related to geology, soils, and land-use history, no subsurface testing was conducted. The extremely thin soils in the Puhala Road project corridor make subsurface deposits there highly unlikely. As has been previously reported for former sugarcane fields (e.g., Haun and Henry 2006), over a century of commercial agriculture conducted in the South Lauko and South Pszyk Road corridors, which included mechanized sugar cultivation, makes intact subsurface deposits there highly unlikely.

Within the Puhala Road corridor, no archaeological features or any other historic properties were found. In the South Pszyk Road and South Lauko Road corridors, one previously unrecorded site (SIHP Site 50-10-44-30575) comprising eight features were identified. The site consists of various pieces of sugar cane plantation infrastructure, including a drainage ditch, a former plantation road, a concrete post, and several culverts. The archaeological survey determined it to be historically significant under Criterion d for the information it has yielded about Olaa Sugar Company's transition from portable rail to truck hauling. While these roads and related infrastructure were important components of the sugar plantation, these are merely a small part of the hundreds of miles of roads built by the company between the late 1930s and middle 1940s. The information content of this site within the current study area has been exhausted by the recordation conducted for the current study, and as such no further work is the recommended treatment for the site. Drawings, photographs and detailed descriptions of the features are contained in Appendix 3.

It is noteworthy that no traces of the Old Volcano Trail were found. As discussed above, the Old Volcano Trail was a road that wove in and out of the boundary between 'Ōla'a and Kea'au Ahupua'a. Based on old survey maps, the original road alignment falls within the 100-foot wide Puhala Street archaeological study corridor, although the DLNR Old Volcano Trail alignment property per se is located to the north of the strip of currently private property proposed for construction of the Puhala Street Extension (see Figure 3). The Old Volcano Trail may have also crossed the undeveloped areas where both South Lauko Road and South Pszyk Road would connect to Puhala Street, although the actual road may have been in the same location as Puhala Street in these areas. In historic literature from 1881 the track was described as a path of coarse stone with a small sprinkle of gravel. Archaeologists were thus looking for trail features such as curbing, gravel fills, or worn pathways in the project corridors. Careful examination of the ground surface revealed no physical evidence of the road. It is likely that mechanical disturbance associated with improvements to Puhala Street and the rough bulldozed trail that connects this street to South Kopua Road may have disturbed or destroyed portions of the original trail. An absence of physical traces consistent with Haun and Henry's (2006) similar archaeological survey findings to the west of the current project corridors.

Archaeological Impacts and Mitigation Measures

The archaeologists propose that the inventory survey adequately documented the historic sites in the area, all of them remnants of sugar cane plantation infrastructure, and that no further work is required. The proposed action will involve minor disturbance of some of the features, although many will be left intact. However, in the event that human skeletal remains, undocumented archaeological resources, or cultural or traditional remains are encountered during any aspect of construction, DPW will require that work in the immediate area of the discovery shall be halted and SHPD contacted as outlined in Hawai'i Administrative Rules 13§13-275-12. The AIS, along with this Draft EA, was provided to the SHPD for review and comment concerning the proposed course of action.

Cultural Resources and Traditional and Customary Practices

As discussed above, aside from plantation infrastructure, no significant archaeological remains reflecting the rich cultural history or supporting cultural values of this region are present in the project corridors. This general area has cultural importance derived from the core traditional values and resources of Puna, including active lava and abundant water. More specific utilization of resources occurred at springs and through gathering of bird feathers and *olonā* fiber. The project corridors do not support the resources or practices associated with them. Although some *ōhi'a* are present, especially on the Puhala Street project corridor, the area is not a prime or known location for gathering material from this tree or other native resources associated with it. No traces of the Old Volcano Trail, a road built in the mid-19th century to get visitors back and forth to Kīlauea Volcano, probably on the track of a more ancient trail, were found during the archaeological survey. However, the proposed connection of both South Lauko Road and South Pszyk Road to Puhala Street would cross the property that was created in the 1930s to represent a right-of-way for this former government road. Many north-south roadways in Upper Puna cross the Old Volcano Trail, and no aspect of the proposed project would adversely affect future cultural or other use of the right-of-way for an actual trail, should one ever be constructed there (see Section 3.3.3 for a discussion of the potential recreational values of this trail). The project corridors do not appear to support any known traditional resource uses, nor are there any Hawaiian customary and traditional rights or practices known to be associated with the project corridors. To date, no information has been received that would indicate any cultural resources or practices taking place here. In summary, it would appear that no valuable natural, cultural or historical resources are present.

Cultural Impacts and Mitigation Measures

Although there are no indications so far from literature review or consultation with the SHPD, the Office of Hawaiian Affairs, community associations, or local residents knowledgeable about Hawaiian cultural practices that there are any traditional cultural properties or practices on the project corridors, various parties including the Office of Hawaiian Affairs, the Association of Hawaiian Civic Clubs, the community associations and SHPD were supplied a copy or notified of the availability of the Draft EA in order to help finalize this finding.

3.3 Infrastructure

3.3.1 Utilities

Existing Facilities and Services

Electrical power to the general project area (but not all parts of the project corridors) is supplied by Hawai‘i Electric Light via its island-wide distribution network. Electrical poles are present in the ROW of Lauko Road for a distance of less than 0.1 miles, on Pszyk Road for a distance of 0.3 miles, and Puhala Street along its entire existing length. There are no poles or lines in the project corridor proposed for construction of the Puhala Street Extension. Telephone lines from Hawaiian Telcom are also housed on the electrical. There is no County water service on any of the project corridors, although it is present on Volcano Highway. There is no wastewater service or underground drainage facilities.

Impacts and Mitigation Measures

No utilities will be required for the proposed improvements in the project corridors under any of the alternative combinations. The extent of road improvements planned can be accommodated without relocating any electrical poles, which are expected to remain out of the clear zone of the completed roadways, which will be posted for 20-30 MPH, depending upon the design option selected. No effects to utilities would be expected, but the County of Hawai‘i Department of Public Works and/or its contractors will coordinate with Hawaii Electric Light, and the County Department of Water Supply, as necessary, before and during construction.

3.3.2 Roadways and Traffic

Existing Facilities

The following roadway facilities are of concern for the proposed action (see Figure 1 for locations, and Figure 2 for photos):

South Lauko Road has a total length of 1.05 miles and a 30-foot wide ROW. Approximately the first 0.4 miles in from Volcano Highway is paved and County-maintained, with one 10 to 12-foot lane and minimal grass shoulders, along with some drainage ditches. Approximately the next 0.41 miles is surfaced with gravel and considered by the County a road in limbo. The last approximately 0.24-mile long section is a paper road, heavily overgrown with weedy vegetation. At the intersection with Volcano Highway, a two-lane, striped apron is present (see Figure 2f). Two streams cross the ROW (see Figures 2k-1). The actual roadway veers to the south of the ROW into a private property before crossing the largest stream with an unculverted ford. The smaller stream is near the end of the ROW, in the paper road section. This currently dead-end road accesses only a handful of farming properties, and traffic is very light, with no observed bicycle or pedestrian use.

South Pszyk Road has a total length of 1.24 miles and a ROW width of 30 feet. The first approximately 0.1 miles in from Volcano Highway is paved and County-maintained, with one 10-foot lane. Approximately the next 0.45-mile long section is surfaced with gravel and considered by the County a road in limbo. The last approximately 0.69-mile long section is a paper road with the ROW heavily overgrown with weedy vegetation. A gravel road continues along the paper road section but appears to be outside of the South Pszyk Road ROW. Like South Lauko Road, it is dead-end and accesses several farming properties, with very light traffic and almost no bicycle or pedestrian use.

The ROWs of both South Lauko Road and South Pszyk Road terminate at the **Old Volcano Trail**, a long, linear State of Hawai‘i property that represents the approximate path of an old road that connected Hilo with Volcano. This property separates the aforementioned ROWs from Puhala Street. As discussed in Section 3.2.2, there is no actual trail or any traces of it on the Old Volcano Trail alignment in this area. The discussion in Section 3.3.3, below, discusses recreational values of this trail alignment.

Puhala Street is a two-lane, paved private road open to the public and owned by the Fern Acres subdivision, to which the four major north-south roads in Fern Acres all connect. The road also connects to South Kulani Road. Puhala Street is unpaved for a distance of 0.2 miles *mauka* of Pikake Street. The level of traffic varies on Puhala Street from light to moderately light, with greater traffic in the *makai* end approaching South Kulani Road, where traffic from the entire subdivision is funneled in. Bicycle and pedestrian use is currently minimal.

Also of interest are the following nearby highway and roadways:

Volcano Highway (State Highway 11), is the major transportation artery in Upper Puna, connecting Hilo and Kea‘au with Mt. View, Volcano, and beyond to Ka‘ū. In the vicinity of Mt. View, the speed limit is 45 MPH, with warning signs for school traffic at Mt. View School. In the approximately two-mile distance between Enos Road and Pszyk Road, there are ten cross-streets, six commercial/institutional driveways (including three at Mt. View School and Library), and 63 private residential driveways. The only intersection with either traffic signals or turn lanes is South Kulani Road, with shared through/right-turn lanes and left-turn lanes at all four approaches. The highway becomes congested at school and work rush hours, and there are frequent backups at the many minor roads and driveways that lack turn lanes. According to the State Department of Transportation’s *Federal-Aid Highways 2035 Transportation Plan for the District of Hawaii* (HDOT 2014: 3-9), Volcano Highway in the vicinity of Mt. View 11 has a Level of Service of “C” or better, on a scale of A to F, in which levels of D or above are considered generally acceptable. With no improvements such as widening or alternate routes, the plan forecasts that by 2035, LOS will have declined to E.

South Kulani Road is the primary entrance to the Fern Acres subdivision, as well as the southern portion of Hawaiian Acres. This two-lane roadway has a ROW varying from 35 to 60 feet, with 10-foot lane widths and grassed, mown shoulders. There is very modest use by bicycles or

pedestrians. It experiences a moderate level of motor vehicle traffic that is accommodated by a signalized intersection at Volcano Highway.

South Kopua Road is a two-lane road with 10-foot lanes and some grass shoulders within a 30-foot wide ROW. It serves residents on the street as well as connecting Volcano Highway to the Eden Roc Estates and Kopua Farm Lots subdivisions. The proposed extension of Puhala Street to South Kopua Road would connect to the southern terminus of South Kopua Road, where the latter road intersects with the Kahikopele Street. The level of traffic is moderately light, and bicycle and pedestrian use is currently minimal.

Impacts: Connectivity

The project is meant to address primarily the deficiencies in connectivity in the sprawling Upper Puna subdivisions, particularly the area south of the village of Mt. View, centered on the growing Fern Acres subdivision but extending to Hawaiian Acres below and Kopua Farm Lots and Eden Roc Estates above. Each one of the component subject projects would have the beneficial impact of improving connectivity, whether alone or in combination with the other components. South Lauko Road and South Pszyk Road are fairly redundant in terms of connectivity in that both would connect Puhala Street directly with Volcano Highway, with no other connections. As South Kulani Road serves as the primary access, it is unlikely that both alternative routes would be required in the case of an emergency that closed South Kulani Road. The extension of South Lauko Road would provide an alternative way out for several residents on the southern end of the road when the stream that is currently forded by the road overflows onto the road. The Puhala Street Extension would create critical inter-subdivision connectivity, providing an alternate route for Eden Roc/Kopua Farmlots residents if South Kopua Road were blocked, and for Fern Acres/Hawaiian Acres residents if South Kulani Road were blocked.

Impacts: Receiving Facilities

The different traffic patterns that new connections would allow would generate different traffic impacts on receiving roads and highways. These are not expected to be large changes, as the total volume of traffic generated by the several thousand residents of Fern Acres is itself not large, but they would likely be noticeable.

- **South Kulani Road** would experience a slight decline in traffic, as alternate routes to access Volcano Highway would move traffic off this road. This would be particularly true for alternative combinations that included either or both South Lauko Road or South Pszyk Road improvements, and would be especially noticeable for northbound AM traffic headed for Mt. View School.
- **South Kopua Road** would experience slightly less traffic for alternative combinations that included either or both South Lauko Road or South Pszyk Road improvements. If only the Puhala Street Extension is constructed, traffic differences would likely be fairly neutral, with some losses and some gains, depending on the origins and destinations of individual drivers.

- **South Lauko Road and South Pszyk Road** have almost no traffic today, as they are dead-end streets serving a few dozen farm lots. The increase in traffic would be noticeable, but it would not be expected to create poor level of service along these streets. At the intersections of both of these roads with Volcano Highway, however, there would be delays for motorists, especially for left turns (and for the very few motorists who would be expected to go straight through the intersections). Unless stacking lanes for right-turns are created, these left-turn delays would likely be experienced by those turning right as well.
- **Puhala Street** would experience traffic differences, with increases in some areas and decreases in others, patterns which would differ by the alternative combination selected for construction. In general, the impact would not be substantial or significant, but motorists would have to adapt to north bound turns from Puhala Street, which currently do not occur.
- **Volcano Highway** (State Highway 11) is ultimate recipient of all traffic that would be expected to utilize the roadways. To reiterate the discussions above related to other roads, but focusing on Volcano Highway, the only existing convenient outlet to Volcano Highway for Fern Acres (as well as the upper area of Hawaiian Acres) is South Kulani Road, and the only existing outlet for Kopua Farmlots and Eden Roc Estates is South Kopua Road. Under any alternative combination, traffic that currently utilizes the intersections of South Kulani Road and South Kopua Road would be redistributed on Volcano Highway. This would induce delays for traffic on Volcano Highway, especially for *mauka*-bound (towards Volcano) motorists who were behind vehicles turning left in South Lauko Road or South Pszyk Road. It should be noted, however, that while all such motorists are already turning left at either South Kulani Road or South Kopua Road, South Kulani Road has left-turn lanes that help reduce delays. Although the impact would be noticeable, it would not be expected to be significant, as there are currently ten streets, six commercial and 63 private residential driveways where left-turn delays on Volcano Highway are already occurring.

To summarize impacts by alternative combination:

- **Any alternative combination involving South Lauko Road and/or South Pszyk Road** would improve Fern Acres direct access to Volcano Highway and Mt. View School, and also create more heavily utilized intersections at this highway. As there are no intersection improvements such as left-turn lanes or acceleration/deceleration/shelter lanes on Volcano Highway at either South Lauko Road or South Pszyk Road, these alternative combinations would produce traffic impacts for drivers on Volcano Highway by redistributing some of the traffic that is currently obliged to use South Kulani Road to alternate routes. For alternative combinations that include construction of both of these connectors, and thus better connectivity, there would be a balance of impacts in the sense that the increase in traffic at any one intersection would be lessened, but more intersections would be impacted.
- For the **alternative combination that would construct Puhala Street alone**, the impacts on Volcano Highway would likely be very modest. South Kulani Road would likely gain more traffic than it lost, but since it is the only signalized intersection in the area, it would be better equipped to handle a small level of additional traffic. The major difference would concern traffic headed to Mt. View School, which is more convenient to access from Volcano Highway heading *makai* towards Hilo rather than *mauka* towards Volcano, because only

right-turns are required when going *makai*. A typical parent (and possibly school buses as well) headed for Mt. View School from Fern Acres would utilize the extension of Puhala Street, South Kopua Road and Volcano Highway to access the school. On the way home, a right-turn out of the school would take one back to Fern Acres via South Kulani Road, creating a loop. As there are currently no left-turn lanes into Mt. View School, it is expected that this new circulation pattern would benefit traffic.

Construction of any alternative combination of the project would have a minor adverse effect on traffic on the existing roads, during the roughly six-month construction period that each portion would take.

Mitigation Measures

DPW would limit any construction with the potential to congest traffic to non-rush hours to minimize impacts to school traffic and commuting.

3.3.3 Public Facilities and Services

Police, fire and emergency medical services for the area are centered in Kea'au, about seven miles north on Volcano Highway. Both these agencies and the public they serve would benefit from greater connectivity to the Fern Acres area, especially during emergency situations.

Mt. View Elementary School, which services communities from Mt. View through Volcano, is located directly on Volcano Highway. Its students, parents, faculty and staff stand to benefit from better accessibility. No adverse impacts would be expected.

Mt. View Park, Mt. View Gymnasium and Mt. View Public/School Library are recreational facilities in Mt. View village. As with other facilities, increased road connectivity would improve access.

Another potential future recreational facility is the Old Volcano Trail alignment, which has been discussed in various sections above. A government property surveyed out in the 1930s approximately represents the former course of this road that was built in the mid-19th century to get visitors back and forth to Kīlauea Volcano. It is apparent that the former trail/road ran partially outside rather than fully within the current property boundaries; nevertheless, the Old Volcano Trail represents an area for future trail development. About ten years ago, citizen groups led by then-Councilman Bob Jacobson helped rebuild portions of the trail and sought to have the trail incorporated into Hawai'i Volcanoes National Park or the Ala Kahakai National Historic Trail (*Pacific Business News*, Jul 21, 2004). Although supported by then-U.S. Representative Ed Case and other officials, this has not occurred. Coordination for this project with the Land Division and Na Ala Hele (trails) program of the State Department of Land and Natural Resource indicates that at this point, the property is unencumbered government land that has not yet been entered into the trail inventory for the State, although this could occur in the future. Only a few sections of trail have apparently been cleared for pedestrian use. In most of the area near Fern Acres, there is no actual walkable trail, as the route is densely covered with 'ōhi'a/uluhe/strawberry guava forest. As discussed in Section 3.2.2, above, the

archaeological survey found no physical traces of the trail in the two 30-foot by 30-foot locations where this property would be crossed by the extensions of South Lauko Road and South Pszyk Road to Puhala Street, nor where the Old Volcano Trail property is adjacent to the proposed Puhala Street Extension.

No aspect of the proposed project would have a physical impact upon trail features in the Old Volcano Trail alignment. However, the proposed connection of South Lauko Road and South Pszyk Road to Puhala Street would both cross the property, requiring an easement from the State of Hawai‘i. Many north-south roadways in Upper Puna cross the Old Volcano Trail. If an actual trail is ever constructed in this alignment, and an alternative combination involving either or both South Lauko Road or Pszyk Road is selected, these crossings would be just two of the numerous spots where roads would cross the trail. No alternative combination would be expected to adversely affect future use of the Old Volcano Trail alignment property as a trail.

3.4 Secondary and Cumulative Impacts

The relatively small scale of the proposed project is not expected to generate any secondary impacts, such as population changes or effects on public facilities other than roadways, as analyzed above. The marketability of subdivision lots in the Fern Acres might marginally rise as a result of better connectivity and improved quality of life, but this would not realistically be expected to have any substantial effect on population.

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. Most of the adverse effects of the project – minor and temporary disturbance to traffic, air quality, noise and visual quality during construction, as well as permanent impacts to forest cover and traffic patterns – are very limited in severity, nature and geographic scale. In order to determine if any of these impacts could accumulate with those from other nearby projects and become significant, it is necessary to review the context of the proposed project and adjacent construction projects that would occur within the next year, the time-frame for the proposed roadway improvements.

Review of subdivision proposals on file with the Planning Department, Chapter 343 documents in the *OEQC Environmental Notice*, and press coverage for Upper Puna indicates that there are no major planned or ongoing projects in this area in the 2017-2018 timeframe. The large number of lots available at low prices, coupled with the difficulty and expense of subdivision, severely limits the possibility for creating new lots for sale. No new commercial, institutional or other large projects are known to be in planning. The only consideration is the slow, steady build-out of single-family residences on subdivision lots. The increase in the “official” Fern Acres population from the U.S. Census of Population of 756 in 2000 to 1,504 in 2010 (the actual population at these dates may have been greater, due to census undercounting) is a trend that appears to be continuing. This trend is of course a major reason for the proposed project. There are no other past, present or future foreseeable projects that would appear likely to produce traffic, forest cover loss, or other impacts that would accumulate with those of the current project in an adverse way.

3.5 Required Permits and Approvals

The following permits and approvals would be required:

- County of Hawai‘i, Department of Public Works: Grubbing and Grading Permit(s), Permit(s) for Work in County ROW
- Department of Health, Section 402 Clean Water Act National Pollutant Discharge Elimination System Permit(s)
- Department of Health, Community Noise Control Permit(s) (potential)
- U.S. Army Corps of Engineers Section 404 Clean Water Act Permit(s) for Fill in Waters of U.S. (potential)
- Department of Health Section 401 Clean Water Act Water Quality Certification(s) (potential)
- Department of Health Section Underground Injection Control Permit(s) (potential)

3.6 Consistency With Government Plans and Policies

3.6.1 Hawai‘i State Plan

Adopted in 1978 and last revised in 1991 (Hawai‘i Revised Statutes, Chapter 226, as amended), the Plan establishes a set of themes, goals, objectives and policies that are meant to guide the State’s long-run growth and development activities. The three themes that express the basic purpose of the *Hawai‘i State Plan* are individual and family self-sufficiency, social and economic mobility and community or social well-being. The proposed project would promote these goals by enhancing road connectivity, emergency preparedness and public safety on the Island of Hawai‘i, thereby enhancing quality-of-life and community and social well-being.

3.6.2 Hawai‘i State Land Use Law

All land in the State of Hawai‘i is classified into one of four land use categories – Urban, Rural, Agricultural, or Conservation – by the State Land Use Commission, pursuant to Chapter 205, HRS. All project corridors are within the State Land Use Agricultural District. The proposed use is consistent with intended uses for this Land Use District.

3.6.3 Hawai‘i County Zoning and General Plan

Hawai‘i County General Plan Land Use Pattern Allocation Guide (LUPAG) and Facilities Map. The LUPAG map component of the *General Plan* is a graphic representation of the Plan’s goals, policies, and standards as well as of the physical relationship between land uses. It also establishes the basic urban and non-urban form for areas within the planned public and cultural facilities, public utilities and safety features, and transportation corridors. The General Plan LUPAG maps indicate that the project corridors have varying designations, from the Rural category around the proposed Puhala Street Extension, to mainly the Orchard category surrounding South Pszyk Road and South Lauko Road, although the portions near Volcano Highway are designated in the Medium Density Urban

category. County roads are appropriate facilities in these LUPAG categories, and no General Plan amendment is necessary. The Transportation Facilities Map of the *Hawai‘i County General Plan* does not show any proposed new collector roadways in Upper Puna. However, this map is almost 12 years old; the Puna community has expressed a need for additional roadways in the Puna Community Development Plan (discussed in Section 3.6.4) and the County DPW is responding to this need. The proposed project is thus not inconsistent with the Facilities component of the General Plan.

Hawai‘i County Zoning and SMA. County zoning on the project corridors varies from A-3a (Agricultural, minimum lot size 3 acres) on the proposed Puhala Street Extension, to A-20a (Agricultural, minimum lot size 20 acres) on South Pszyk Road to A-20a plus A-5a (Agricultural, minimum lot size 5 acres) and RS-20 (Residential, minimum lot size 20,00 square feet) on South Lauko Road. Public roads and streets are permitted uses in any district. Therefore, the proposed road connections would be allowed under existing zoning. The project corridors are located outside the County’s Special Management Area (SMA), and no SMA permit is required.

The *General Plan* for the County of Hawai‘i is a policy document expressing the broad goals and policies for the long-range development of the Island of Hawai‘i. The plan was adopted by ordinance in 1989 and revised in 2005 (Hawai‘i County Department of Planning). The *General Plan* itself is organized into thirteen elements, with policies, objectives, standards, and principles for each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai‘i. Most relevant to the proposed project are the following Policies, Standards, Goals, and Courses of Action:

TRANSPORTATION – GOALS

- Provide a system of roadways for the safe, efficient and comfortable movement of people and goods.
- Provide an integrated State and County transportation system so that new major routes will complement and encourage proposed land policies.

TRANSPORTATION – POLICIES

- The improvement of transportation service shall be encouraged.
- Consider the provision of adequate transportation systems to enhance the economic viability of a given area.
- Work with various non-profit agencies to coordinate transportation opportunities.

TRANSPORTATION – STANDARDS

- Transportation systems shall meet the requirements of the U.S. Department of Transportation, State Department of Transportation and the County of Hawai‘i.
- Transportation systems shall conform with design guidelines established by the American Association of State Highway and Transportation Officials (AASHTO).

ROADWAYS – GOALS

- Provide a system of roadways for the safe, efficient and comfortable movement of people and goods.
- Provide an integrated State and County transportation system so that new major routes will complement and encourage proposed land policies.

ROADWAYS – POLICIES

- Encourage the programmed improvement of existing roadways by both public and private sectors.
- Transportation and drainage systems shall be integrated where feasible.

ROADWAYS – STANDARDS

- Minor Collector and Local Streets: Minor collectors are used at times as through streets and for access to abutting properties. The principal purpose of a local street is to provide access to property abutting the public right-of-way.

COURSES OF ACTION, ROADWAYS, PUNA

- Consider, in conjunction with community associations and the property owners, the use of a variety of mechanisms to provide infrastructure in non-conforming subdivisions, beginning with the major roads providing access into the more densely populated subdivisions.

Discussion: The establishment of improved road connectivity in the Upper Puna is consistent with goals and policies of the General Plan related to transportation in that it reflects coordination with local organizations to identify solutions to community-identified transportation connectivity problems for the underserved subdivisions of Puna. The roadways will meet American Association of State Highway and Transportation Officials (AASHTO) standards and County agricultural road standards.

ECONOMIC GOALS

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

Economic development and improvement shall be in balance with the physical, social, and cultural environments of the island of Hawaii.

Strive for diversity and stability in the economic system.

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 action is in balance with the natural, cultural and social environment of the County, and it will create temporary construction jobs for local residents and indirectly affect 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. More importantly, it supports economic development through improving the quality of life and commuting conditions for working families.

ENVIRONMENTAL QUALITY GOALS

Define the most desirable use of land within the County that achieves an ecological balance providing residents and visitors the quality of life and an environment in which the natural resources of the island are viable and sustainable.

Maintain and, if feasible, improve the existing environmental quality of the island.

ENVIRONMENTAL QUALITY POLICIES

Take positive action to further maintain the quality of the environment.

ENVIRONMENTAL QUALITY STANDARDS

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

Incorporate environmental quality controls either as standards in appropriate ordinances or as conditions of approval.

Discussion: The proposed action would not have a substantial adverse effect on the environment and would not diminish the valuable natural resources of the region. The project has been designed to avoid environmental degradation and will obtain permits and follow the conditions designed to reduce or eliminate pollution and environmental degradation.

HISTORIC SITES GOALS

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

Appropriate access to significant historic sites, buildings, and objects of public interest should be made available.

HISTORIC SITES POLICIES

Agencies and organizations, either public or private, pursuing knowledge about historic sites should keep the public apprised of projects.

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.

Public access to significant historic sites and objects shall be acquired, where appropriate.

Discussion: Archaeological resources have been properly documented through an inventory survey that is being reviewed by the State Historic Preservation Division. No adverse effect to significant historic sites should occur.

FLOOD CONTROL AND DRAINAGE GOALS

Conserve scenic and natural resources.

Protect human life.

Prevent damage to man-made improvements.

Control pollution.

Prevent damage from inundation.

Reduce surface water and sediment runoff

FLOOD CONTROL AND DRAINAGE POLICIES

Development-generated runoff shall be disposed of in a manner acceptable to the Department of Public Works in compliance with all State and Federal laws.

FLOOD CONTROL AND DRAINAGE STANDARDS

Applicable standards and regulations of Chapter 27, "Flood Control," of the Hawaii County Code.

Applicable standards and regulations of the Federal Emergency Management Agency (FEMA).

Applicable standards and regulations of Chapter 10, "Erosion and Sedimentation Control" of the Hawaii County Code.

Applicable standards and regulations of the Natural Resources Conservation Service and the Soil and Water Conservation Districts.

Discussion: Although some stream crossings within the project corridor are subject to flooding that has not yet been made part of official Flood Zone Rate Information maps, the project is an appropriate use of these areas and would not be expected to raise the base flood elevation. Stream crossings will utilize either bridges or culverted fords, and drainage studies will be undertaken prior to final design and construction of all project components advanced for construction. Appropriate drainage improvements per the applicable standards of Chapter 10 and Chapter 27 will be implemented.

NATURAL BEAUTY GOALS

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

Protect scenic vistas and view planes from becoming obstructed.

NATURAL BEAUTY POLICIES

Protect the views of areas endowed with natural beauty by carefully considering the effects of proposed construction during all land use reviews.

Do not allow incompatible construction in areas of natural beauty.

Discussion: No important viewplanes or scenic sites, including the views of Mauna Kea and Mauna Loa recognized in the Hawai'i County General Plan, would be affected. Construction will have a brief, local scenic impact that cannot be practically mitigated. On a permanent basis, the proposed roadways will be in keeping with the existing landscape of rural subdivisions and County roads.

NATURAL RESOURCES AND SHORELINES GOALS

Protect and conserve the natural resources of the County of Hawaii from undue exploitation, encroachment and damage.

Provide opportunities for the public to fulfill recreational, economic, and educational needs without despoiling or endangering natural resources.

Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.

Ensure that alterations to existing landforms and vegetation, except crops, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational

amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of earthquake.

NATURAL RESOURCES AND SHORELINES POLICIES

The County of Hawaii should require users of natural resources to conduct their activities in a manner that avoids or minimizes adverse effects on the environment.

Discussion: The proposed action would protect the environment and natural resources from degradation. Impacts to existing natural landforms and vegetation will be mitigated through permit-regulated Best Management Practices to avoid any impacts related to flooding, landslides, sedimentation or other similar impacts.

3.6.4 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 Action Committee is a volunteer working group whose purpose is to serve as a proactive, community based steward of the CDP’s implementation by way of providing guidance and making recommendations to the Planning Director as it pertains to budget priorities, CDP amendments, General Plan amendments, and program initiatives. The Action Committees are intended to broaden community awareness of the CDP and build partnerships with local communities and organizations to implement CDP goals, objectives, policies, and actions. The Connectivity and Emergency Response Subcommittee (CERS) is a subcommittee of the Puna CDP Action Committee.

As discussed in Section 1.1, the proposed action is highly consistent with aspects of the Puna CDP and follow-up proposals of the Puna CDP Action Committee and CERS related to the roadway network. The Puna CDP states includes in its goals for the roadway network:

- a. There are adequate emergency and evacuation routes and connectivity throughout Puna’s roadway network.
- b. Improvements are phased so that short-term actions support and lead toward projects that will take a longer time to implement.

The overriding purpose of the project is to respond to the directives from the Puna CDP Action Committee and the CERS to improve road connectivity of the Puna Community Development Plan Action Committee per these goals. One of their principal charges is to identify access routes in the Puna District that promote connectivity and facilitate construction of roadways on these routes. According to the Annual Report to the Action Committee dated May 2015 (Comm. No. 2015-24), the

CERS identified an alternate route in Upper Puna from Volcano to Highway 130 as its number one priority, and also identified the need for two additional roads to connect the subdivisions of Upper Puna with Volcano Highway as a high priority.

The project is being implemented in such a way that it is also consistent with other aspects of the CDP related to caring for the land and the environment, minimizing impacts to sensitive biological, scenic, historic and cultural resources, as well as nurturing Puna's communities.

PART 4: DETERMINATION

The Hawai'i County Department of Public Works has preliminarily determined that none of the alternative combinations for the proposed project would significantly alter the environment, as impacts will be minimal, and the agency intends to issue a Finding of No Significant Impact (FONSI). This determination will be reviewed based on comments to the Draft EA, and the Final EA will present the final determination and the alternative combination that is expected to be advanced for implementation.

PART 5: FINDINGS AND REASONS

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

1. *The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.* No valuable natural or cultural resources would be committed or lost. No water resources, geological features, native species or cultural resources will be degraded.
2. *The proposed project will not curtail the range of beneficial uses of the environment.* The proposed project expands and in no way curtails beneficial uses of the environment.
3. *The proposed project will not conflict with the State's long-term environmental policies.* The State's long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The project fulfills aspects of these policies calling for an improved social and economic environment. It would not degrade the environment and is consistent with all elements of the State's long-term environmental policies.
4. *The proposed project will not substantially affect the economic or social welfare of the community or State.* The project will benefit economic and social welfare by enhancing connectivity in an underserved area in conformance with community-based plans.
5. *The proposed project does not substantially affect public health in any detrimental way.* The proposed project will benefit public health by improving public safety, and no aspect of the project would degrade public health.
6. *The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities.* No adverse secondary effects are expected to result from the proposed action. The project will not enable development, but will instead improve road connectivity and public safety.

7. *The proposed project will not involve a substantial degradation of environmental quality.* The implementation of best management practices for construction will ensure that the project will not degrade the environment in any substantial way.
8. *The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.* No rare, threatened or endangered species of flora is present in the project corridors or would be affected in any way by the project. Other than Hawaiian hoary bats and Hawaiian hawks, island wide-ranging species that will experience no adverse impacts due to mitigation in the form of timing of vegetation removal and/or hawk nest survey, no rare, threatened or endangered species of fauna are known to exist on or near the project corridors, and none would be affected by any project activities. DPW will closely coordinate with the U.S. Forest Service and the DLNR on measures to prevent the spread of Rapid 'Ōhi'a Death.
9. *The proposed project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions.* The project is not related to additional activities in the region in such a way as to produce adverse cumulative effects or involve a commitment for larger actions.
10. *The proposed project will not detrimentally affect air or water quality or ambient noise levels.* No adverse effects on these resources would occur. Mitigation of construction-phase impacts will preserve water quality. Ambient noise impacts due to construction will be temporary and restricted to reasonable daytime hours.
11. *The project does not affect nor would it likely to be damaged as a result of being located in environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal area.* Although the project is located in an area with volcanic and seismic risk, the entire Island of Hawai'i shares this risk, and the project is not imprudent to construct, and employs design and construction standards appropriate to the seismic zone. Although some stream crossings within the project corridor are subject to flooding that has not yet been made part of official Flood Zone Rate Information maps, the project is an appropriate use of these areas and would not be expected to raise the base flood elevation. Stream crossings will utilize either bridges or culverted fords, and drainage studies will be undertaken prior to final design and construction of all project components advanced for construction. Appropriate drainage improvements per the applicable standards of Chapter 10 and Chapter 27 will be implemented.
12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* No scenic vistas and viewplanes identified in the Hawai'i County General Plan will be adversely affected by the project, and the project will preserve the scenic character of the area.
13. *The project will not require substantial energy consumption.* The project involves only minimal energy use during construction and no adverse effects are expected. Energy use for construction will be compensated for by fuel savings from more direct transportation routes, particularly for parents at Mt. View School.

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ENVIRONMENTAL ASSESSMENT

Puna Subdivision Connector Roads to Volcano Highway In Vicinity of Mountain View

APPENDIX 1a Comments in Response to Early Consultation

[THIS PAGE INTENTIONALLY LEFT BLANK]

From: GARY ETLING [mailto:garyetling@msn.com]
Sent: Thursday, July 7, 2016 12:36 PM
To: rterry@hawaii.rr.com
Subject: Re: Proposed Extension from Puhala Road...

Ron Terry: My name is Gary Etling and I live at 18-3720 South Kopua Road. Since the proposed extension from Puhala road to South Kopua Road will impact the entire length of our property, I would like to receive a copy of the Environmental Assessment.

The only comment I will make at this time has to do with traffic impact. This extension will create a super highway for drug users, growers, and thieves from Hawaiian Acres to Fern Acres to Kopua Farm Lots to Eden Rock and beyond.

I have other major issues, but will take them up with the Department of Public Works. Please keep me in the loop.

Thanks,
Gary Etling

From: Linnette Sawyer [mailto:lsawyer29@hotmail.com]

Sent: Sunday, July 10, 2016 4:41 PM

To: rterry@hawaii.rr.com

Subject: county connectivity

Dear mr. Terry. thank you for giving me a chance for community input. I would just like to say that i am in favor of the Lauko road extension into mt. view. This will not only give Fern Acres residents an additional route out of their subdivision, but also might possibly give those on the south end of Hawaiian acres another route also. When we had the terrible flood on S. Kulani, we were still able to access old volcano trail for awhile out of One road in the acres. (uhini ana) Additionally, this provides a route that the school bus could take if Kulani road would be shut down. I wish the county would consider also repairing that tiny stretch (maybe 500 to 700 feet is all) of the old volcano trail that separates the 2 subdivisions, but i understand that is not what you are looking at right now.

thank you for allowing public comment.

Linnette sawyer Quade

-----Original Message-----

From: P Macs [mailto:pmacs306@gmail.com]

Sent: Tuesday, July 19, 2016 10:41 AM

To: rterry@hawaii.rr.com

Subject: Ea eis

We wondered who approved paying for ea and eis at lauko not approved by county council or connectivity connection before any of the chosen routes and connections are made and the correct mapped routes were are ?

You did the ea and eis on Moho road now 29 years non compliance by Dpw and privately pay for the most dangerous 150,000 traffic that has never passed code ?

Can you please explain how Fern acres the smallest and newer subdivision with least population got approved before Ola'a which is all emergency response to Orchidland and HPP the cause of traffic problem ? Thank you Pmax

Sent from my iPhone

-----Original Message-----

From: P Macs [mailto:pmacs306@gmail.com]

Sent: Wednesday, July 20, 2016 7:56 AM

To: Ron Terry <rterry@hawaii.rr.com>

Subject: Re: Ea eis (can you forward this to Maile Davis ?)

Yes Patrice chairperson Hawaiian acres landowner Committee on emergency response

We in Hawaiian acres committee with knowledge and experience In Emergency response were refused any presentation for emergency response that Moho road . Dpw still in violation of our charter and bylaws and and mr Lee never one response or inspection of said failure to comply code . Had failed to comply with the original ea and eis mr terry did correctly . After informing the county , Bruce ncClure , mayor Kim , it was declared public , commercial use of "Moho road non viable and unusable for public commercial heavy truck hauling and 150,000 traffic . . flooding ,ISD s and removing our private stop signs , planting Albizia on an Emergency road ,only mowing garbage and spreading cane grass coqui LFA against our covenants increased the loss of emergency response and caused loss of 83 miles of roads. we were forced to pay privately for public use is not being repeated after 65 new subdivisions can be used equally and more roads preexisting have been closed and changed to illegal highways only through Hawaiian acres is insane .

Altho never consulted or reading all data the fifth AC , Rene Siracusa put 16 more maps of Hawaiian acres in district 3&4 against community input for eminent domain.

This is 8 years after all agreed the two problems and tiny lots of traffic 18000 are HPP and Orchidland . landlocked with preexisting roads closed after mapping was complete 2008 by Committee .

This appears disingenuous and mr warren lee has no permission to fail maintenance and code on the Moho road causing accidents and eminent danger is not emergency response . Moho road Never complied with once . All of a sudden without notification dpw enlarged and no ea or eis used for Kuauli and not OLAA is against emergency response .

Who Said can pay Fern acres and HPP while using only Hawaiian acres private money ignoring the 29 years of compliance and buyout .

The tiniest cheapest lots can open every preexisting road without any eminent domain or bankrupting HA is eminent danger .

Not one easement compliance since 1998 forces us to Lose 83 miles of roads .

It's HPP Makuu to Ilima through orchidland to Ola'a is the route

Not paying and doing Ola'a immediate and substituting lauko is not needed . Fern acres had two roads driving through HA already .

Ola'a to 35-37 Ainaloa and off

Ainaloa across Orchidland (the newest subdivisions) don't get to withdraw their connectors from plan. Hawaiian acres pays Moho out of private homeowners and auto insurance since apparently county refused to pay their easement and insurance is non compliant .

Since Ola'a is preexisting and voted by all 16000 .
who said Lauko less than (1000) people or Fern acres get paid a bridge while zero compliance on Moho or Ola'a has been done ?

Now paid no FTR Moho road has new 529 new houses violating the easement .)8' wide illegal with boulders and fences in road .

There are no legal deeds signed over easement by Devra reeves violating our charter .

Once again no notification to private landowners and 16000 surveys said Ola'a intersection had to be done FIRST as emergency .

16 years and 4 new AC later what must follow criteria written and approved in 2008 .

Thank you for your attention

For Larry brown to continue forging documents and mapping done is geocentric and causes landlocked HPP burden on our roads . Who can refuse emergency response or community presentation and input 16 years ?

When asked to provide our legal documents planning dept said : "all were removed and disappeared thousands of dollars legal documents and attorneys findings " . and all
Legal documents . Now planning dept says corporate binder disappeared . What ?

Fern acres three tiny lots and streets is using Hawaiian acres charter in the corporate binder is erroneous.

.Mayor Kenoi was informed of the irregularities of the facts and that the ad hoc is not using one single road connector voted by 16000 for Puna makai
501(4c) doesn't allow Illagan to politicking in HPP.

No AC presentation allowed to map HPP and orchidland and lower Puna is not correct .

mahalo

Patrice macs

From: P Macs [<mailto:pmacs306@gmail.com>]

Sent: Friday, July 29, 2016 3:01 PM

To: Pacheco, Kason

Subject: Re: Puna Subdivision Connector Roads to Volcano Highway

That was quite enlightening meeting of what voted and bill passed saying teeeeny Fern acres could pay themselves a private road and bridge ?

The same two threatening and violating the CDP pdcp and code for Moho ?

No we don't approve of any funding and Fern acres would have to pay that project themselves

Who the heck is Frank commandor ?

Is he employed by Dpw ?

I own in Fern acres and there is no board of elections .his connector allowed that services nobody but 700 people is absurd to pay for them

They completely violated -6 years of committees and community data to pay himself a new road? while Fern acres has three preexisting connectors in their deeds?

The same Frank who published hawaiian acres deeds erroneous as Fern acres is t a landowner? Or he would know he's violating the voted CDP data .

Those two who have been threatening and attacking us for years now get paid a new road going nowhere but FA violated emergency response

There is no public agreement or meetings noted any such rad or connector ever to pay Fern acres three tiny streets all the money .

They sure violated criteria . who exactly approved in council and what ordinance said "Fern acres can have a new road paid for them that only benefits themselves at upper Puna?"

Don't forget you are millions Dpw failure to comply with Moho road I would think should be paid for first .

No other roads in Hawaiian acres can be used so

Ola'a is the only route available and voted emergency route

Ola'a is voted 16000 . Ola'a is the only route Orchidland and HPP will be allowed to drive .

Sent from my iPhone

From: P Macs [<mailto:pmacs306@gmail.com>]

Sent: Monday, August 22, 2016 9:36 AM

To: Pacheco, Kason

Subject: Re: Puna Subdivision Connector Roads to Volcano Highway

You have violated all connectivity and routes voted surveyed and mapped and why was no one on committees been notified notified ? If this new routes ? if state and federal monies for a private non connector road ?

As you know pinto and commandor charged negligent homicide and data forgery got approved ? What?

The only voted route is Makuu to Ilima to Ola'a as you know signs by 160000 . Now Moho road is deliberate negligent homicide . Really 29 years you forgot to code and payments ? Mandatory Ans signed by county ?

Failure to comply with Moho is charged .

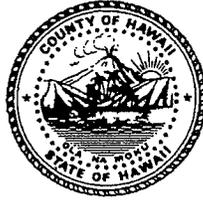
Moho road has failed 29 years can not be used by Dpw or public use as charged to Hawaiian acres

Why would I pay 700 people to lose 83 miles of E enemy by response ?

16099 votes being violated will be Fern acres paying their own road of course . We not paying for them using our roads . Are they vetted engineers ? Pinto and commandor ?

Sent from my iPhone

William P. Kenoi
Mayor



Harry S. Kubojiri
Police Chief

Paul K. Ferreira
Deputy Police Chief

County of Hawai`i

POLICE DEPARTMENT

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

July 11, 2016

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

Dear Mr. Terry:

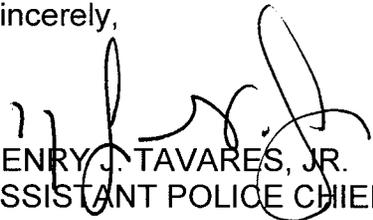
**SUBJECT: EARLY CONSULTATION FOR ENVIRONMENTAL ASSESSMENT FOR
PUNA SUBDIVISION CONNECTOR ROADS TO VOLCANO HIGHWAY
IN VICINITY OF MOUNTAIN VIEW, COUNTY JOB NO. E-4377, PUNA
DISTRICT, ISLAND OF HAWAII**

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

Thank you for allowing us the opportunity to comment.

If you have any questions, please contact Captain Samuel Jelsma, Puna District Commander, at 966-2716.

Sincerely,


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

SJ:lli
160451

William P. Kenoi
Mayor



Darren J. Rosario
Fire Chief

Renwick J. Victorino
Deputy Fire Chief

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

July 18, 2016

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

Dear Mr. Ron Terry:

SUBJECT: Early Consultation on Environmental Assessment for Puna Subdivision
Connector Roads to Volcano Highway in Vicinity of Mountain View, County
Job No. E-4377, Puna Distric, Island of Hawai'i

We are in receipt of your letter dated June 30, 2016 in regards to an early consultation on Environmental Assessment and Anticipated finding of no significant Impact for the above listed subject.

The Hawai'i Fire Department has no issues or comments with regards to the request for an early consultation on Environmental Assessment and Anticipated finding of no significant Impact as noted above.

If you should have any questions, please feel free to contact my office at (808)932-2911.

Mahalo,

A handwritten signature in black ink, appearing to read "Darren J. Rosario".

DARREN J. ROSARIO
Fire Chief

KV/ds





DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII

345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAII 96720
TELEPHONE (808) 961-8050 • FAX (808) 961-8657

July 20, 2016

Mr. Ron Terry
Geometrician Associates
P.O. Box 396
Hilo, HI 96720

Dear Mr. Terry:

**Subject: Pre-Environmental Assessment Consultation
Puna Subdivision Connector Roads to Volcano Highway
County Job No. E-4377
Mountain View, Puna, Island of Hawai'i**

This is in response to your letter dated June 30, 2016.

We have no comments to offer regarding environmental issues within the proposed project areas. The Department does not maintain any waterlines along the existing roadways. The nearest waterline is an existing 12-inch waterline along Volcano Highway.

Should there be any questions, please contact Mr. Ryan Quitariano of our Water Resources and Planning Branch at 961-8070, extension 256.

Sincerely yours,


for Keith K. Okamoto, P.E.
Manager-Chief Engineer

RQ:dfg

... Water, Our Most Precious Resource ... Ka Wai A Kāne ...

The Department of Water Supply is an Equal Opportunity provider and employer.

From: neena roumell [mailto:edenearthwork@gmail.com]

Sent: Wednesday, July 27, 2016 9:38 AM

To: Ron Terry <rterry@hawaii.rr.com>

Subject: Re: S.Lauko Rd.

Hi Ron,

Thank you for your thorough report on the E&A progress presented Monday June 25th.

I thoroughly approve of the DPW's proposed solution to the reconstruction of S.Lauko Rd. A concrete ford at the low end and a concrete ford at the Puhala end will meet safety concerns. A hard gravel road is definitely acceptable to me.

At present the road is unsafe for vehicle and driver.

Thank you for your thoughtful consideration. I look forward to the meeting in September.

Neena Roumell

From: J. B. Friday [mailto:jbfriday@hawaii.edu]
Sent: Wednesday, July 27, 2016 10:33 AM
To: Ron Terry <rterry@hawaii.rr.com>
Subject: Fwd: Rapid Ohia Death EA for County of Hawaii Puna roads

Ron,

Corie wanted me to respond to your email. I'll be in today except for a meeting 2:00 pm. Let me know when is a good time to talk.

The short answer is it would be best to leave all cut ohia right where it is cut and not bring it to the county greenwaste. Best also to decontaminate machinery after cutting ohia. Certainly the ohia forests along the routes are likely to be infected with Rapid Ohia Death / Ceratocystis wilt of ohia.

Yours,
JB

-
--

Corie Yanger
Rapid 'Ōhi'a Death (ROD) Educational/Outreach Specialist
College of Tropical Agriculture and Human Resources
University of Hawai'i

Komohana Research & Extension Center
875 Komohana Street
Hilo, HI 96720 USA
Phone: (808) 969-8268
Email: cmyanger@hawaii.edu
www.rapidohiadeath.org
www.facebook.com/rapidohiadeath

DAVID Y. IGE
GOVERNOR OF HAWAII



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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 29, 2016

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

via email: rterry@hawaii.rr.com

Dear Mr. Terry:

SUBJECT: Early Consultation for Environmental Assessment for Puna Subdivision
Connector Roads to Volcano Highway in the Vicinity of Mountain View;
County Job No. E-4377

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

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

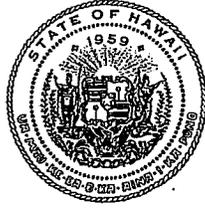
Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji
Land Administrator

Enclosure(s)
cc: Central Files

DAVID Y. IGE
GOVERNOR OF HAWAII



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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 8, 2016

MEMORANDUM

TO:
FR:

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

DEPT. OF LAND &
NATURAL RESOURCES
STATE OF HAWAII

2016 JUL 15 AM 10:44

16 JUL 8 9 41 AM ENGINEERING
LAND DIVISION

TO:
FROM:
SUBJECT:

Russell Y. Tsuji, Land Administrator
Early Consultation for Environmental Assessment for Puna Subdivision
Connector Roads to Volcano Highway in the Vicinity of Mountain View;
County Job No. E-4377

LOCATION: Puna District, Island of Hawaii; TMK: (3) various
APPLICANT: County of Hawaii, Department of Public Works

Transmitted for your review and comment is information on the above-referenced project. We would appreciate your comments on this project. Please submit any comments by **July 28, 2016**.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Lydia Morikawa at 587-0410. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed: _____

Print Name: Carty S. Chang, Chief Engineer

Date: 7/13/16

cc: Central Files

**DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION**

To: Land Division

**Ref: Early Consultation for Environmental Assessment for Puna Subdivision Connector
Roads to Volcano Highway in the Vicinity of Mountain View, Puna, Hawaii**

COMMENTS

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

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

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

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

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

Signed: 
CARTY S. CHANG, CHIEF ENGINEER

Date: 7/13/16

DAVID Y. IGE
GOVERNOR OF HAWAII



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

2016 JUL 11 10:22

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

July 8, 2016

MEMORANDUM

TO:

DLNR Agencies:

- Div. of Aquatic Resources
- Div. of Boating & Ocean Recreation
- Engineering Division
- Div. of Forestry & Wildlife
- Div. of State Parks
- Commission on Water Resource Management
- Office of Conservation & Coastal Lands
- Land Division – Hawaii District
- Historic Preservation

RECEIVED
 LAND DIVISION
 2016 JUL 18 AM 11:20
 DEPT. OF LAND &
 NATURAL RESOURCES
 STATE OF HAWAII

FROM:

Russell Y. Tsuji, Land Administrator

SUBJECT:

Early Consultation for Environmental Assessment for Puna Subdivision Connector Roads to Volcano Highway in the Vicinity of Mountain View; County Job No. E-4377

LOCATION:

Puna District, Island of Hawaii; TMK: (3) various

APPLICANT:

County of Hawaii, Department of Public Works

Transmitted for your review and comment is information on the above-referenced project. We would appreciate your comments on this project. Please submit any comments by **July 28, 2016**.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Lydia Morikawa at 587-0410. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed:

Print Name:

GORDON C. HEIT

Date:

7/15/16

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

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

July 15, 2016

TO: Russell Y. Tsuji, Land Administrator

FROM: Gordon C. Heit, District Land Agent 
DLNR-Hawaii District Land Office

SUBJECT: Early Consultation for Environmental Assessment for Puna Subdivision
Connector Roads to Volcano Highway in the Vicinity of Mountain View; County
Job No. E-4377.

The Old Volcano Trail, under the jurisdiction of the Department of Land and Natural Resources, runs adjacent and parallel to Puhala Street, which may affect the proposed project site. The crossing of the Old Volcano Trail will be required to connect South Lauko Road and South Pszyk Road to Puhala Street. We request additional opportunities to provide comments upon review of the completed "draft" environmental assessment.

From: Sue Pickert [mailto:sue.pickert@gmail.com]

Sent: Tuesday, August 2, 2016 11:57 AM

To: rterry@hawaii.rr.com

Subject: access via pszyk road

dear mr. terry

my partners and I are in the process of subdividing our 79 acres, bordering on pszyk road, and we are very much in favor of you choosing this route.

having decent access to our land would make development much easier for us in the future. I am hoping to make a viable farm from my 40 acres, and good access would allow me to put in orchards and a house instead of just using the land for cattle, hence increasing your tax base, and bringing more moneys into Hawaii.

runoff is not as bad at our higher elevation on pszyk road, compared to lauko road, which should make it easier to deal with water issues.

we just surveyed our land, so that part would be less expensive for you, as psyk road is now well marked on our lands border.

also, pszyk road was cleared aproximately 10 years ago by the previous owner, and roughly bulldozed, so that no huge trees would have to be dealt with at the first forested section where pszyk enters puhala.

respectfully yours, sue pickert

From: gay knutson [mailto:gay.knutson2014@gmail.com]

Sent: Thursday, August 4, 2016 6:40 AM

To: rterry@hawaii.rr.com

Subject: Pszyk Road Idea

Dear Mr. Terry,

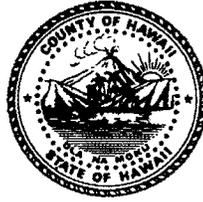
Greetings. My name is (Carola)Gay Knutson and, along with Sue Pickert and my husband, we are the owners of approximately 80 acres located very near Fern Acres, off of Pszyk Road. Sue has told us of the possibility of this road becoming a second entrance to your development.

As I babbled on the phone message, we live in a very rural are of western Washington state-sandwiched between mountains of the Strait of Juan de Fuca, not unlike much of the Hawaiian Islands. We have only ONE road by which to enter and leave, even in the most dire of emergencies, so we are VERY sensitive to the issue of this dilemma. Sue used to live on the same Olympic Peninsula, so she, too, understands the issues.

That being said, I'd like to once again express my willingness, even eagerness, to provide the residents of Fern Acres with another possible means of entering and leaving their properties. The road will likely only be used by your residents for some time to come as I don't believe Sue has any imminent plans and we certainly do not. We would be very pleased if you choose to use Pszyk Road and encourage you to do so!

Thanks for your time, Sincerely, Gay Knutson, looped in on the Olympic Peninsula

William P. Kenoi
Mayor



Duane Kanuha
Director

Joaquin Gamiao-Kunkel
Deputy Director

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

County of Hawai'i
PLANNING DEPARTMENT

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

July 25, 2016

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

Dear Mr. Terry:

SUBJECT: Pre-Consultation for Draft Environmental Assessment
Project: Puna Subdivision Connector Roads to Volcano Highway in
Vacinity of Mountain View, County Job No. E-4377
Parcels: S. Lauko Road, S. Pszyk Road, & Puhala Street Puna, Hawai'i

Thank you for your letter dated June 30, 2016, requesting comments from this office regarding the preparation of a Draft Environmental Assessment (EA) for the subject project.

The County of Hawai'i, Department of Public Works (DPW) is proposing a project to improve the connectivity of Puna subdivisions with Volcano Highway (State Highway 11), particularly in the area centered on Fern Acres. The purpose is to improve road accessibility during events such as floods, fires, automobile accidents, or other emergencies that block subdivision roads, connector roads, or Volcano Highway.

The Puna Community Development Plan (PCDP) is generally in favor of connectivity between subdivisions that provide alternative routes for emergency access and evacuation. Section 4.3.2c. of the PCDP states "Designate new connectivity points for local traffic and emergency and evacuation routes within the existing roadway network."

S. Lauko Road, S. Pszyk Road, & Puhala Street

The proposed project sites are situated within the State Land Use Agricultural District. Additionally, the proposed project sites are within or adjacent to the following zoning designations: A-3a, A-5a, and A-20a. According to the County of Hawai'i General Plan 2005 (amended December 2006), the proposed project sites are within or adjacent to areas designated as Important Ag Lands, Extensive Ag, and Rural by the Land Use Pattern Allocation Guide. The subject area is not within the Special Management Area (SMA).

Mr. Ron Terry, Principal
Geometrician Associates
July 25, 2016
Page 2

Although the projects sites are located in areas currently defined as flood zone X, the Puna Flood Study is proposing a revised flood designation with a mix of AE and X in the project site area. As appropriate, please contact the Department of Public Works for additional information pertaining to flood zones.

Please provide us with a copy of the Draft EA for our review.

If you have any questions or if you need further assistance, please feel free to contact Hans Santiago of this office at 961-8165.

Sincerely,



 DUANE KANUHA
Planning Director

HKS:

P:\wpwin60\Hans\EA-EIS Review\preconsultdraftea Puna Connector Roads.doc

cc: Mr. Warren Lee, Director, Department of Public Works

PHONE (808) 594-1888

FAX (808) 594-1938



STATE OF HAWAII
OFFICE OF HAWAIIAN AFFAIRS
560 N. NIMITZ HWY., SUITE 200
HONOLULU, HAWAII 96817

HRD16-7907

August 1, 2016

Ron Terry
Geometrician Associates, LLC
PO Box 396
Hilo, HI 96721

Re: Request for Early Consultation for Environmental Assessment for Puna Subdivision
Connector Roads to Volcano Highway in Vicinity of Mountain View
County Job No. E-4377
Puna Moku, Hawai'i Moku-puni

Aloha Mr. Terry:

The Office of Hawaiian Affairs (OHA) is in receipt of your June 30, 2016 letter requesting early consultation on the draft environmental assessment for the Puna Subdivision connector roads to Volcano Highway in the vicinity of Mountain View.

Geometrician Associates, LLC (Geometrician) is acting on behalf the County of Hawai'i, Department of Public Works (DPW). The DPW intends to improve the connectivity of the Puna Subdivisions during natural disasters and emergencies by 1) improving and extending Volcano Highway to Puahala Road of South Lauko Road; 2) improving and extending Volcano Highway to Puahala road of South Psyzk Road; and 3) extending Puahala Road south to South Kopua Road.

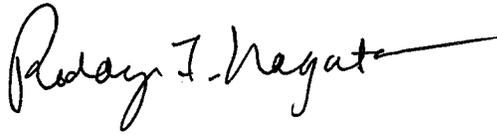
OHA appreciates the outreach efforts that Geometrician has undertaken by consulting with us. In the future, we would appreciate a list of all other consulted parties in order to determine whether additional ones, particularly Native Hawaiian Organizations (NHO), should be suggested. If you have not already done so, please consult with the 'Aha Moku Council, the appropriate Hawai'i based Hawaiian Civic Clubs, and the Hawai'i Island Burial Council. We

August 2, 2016

To: Ron Terry
Peter Sur

From: Roddy Nagata

Re: Connectivity Road



I own property on South Lauko Road and raise cattle on the land. This road makes a jog into my property where the drainage crosses the road. During periods of more than three inches rainfall this drainage becomes impassable to vehicular traffic. During September year 2000, I witness this drainage overflowing its banks and floodwaters extending back to the Owen's property. Over 2,000 feet of my fencing was destroyed, but luckily, I suffered no cattle losses. I am against having the S. Lauko connectivity road built because of the flooding issues and the cost of having a road built out to Highway 11 into Mountain View. A bridge would have to be built, culverts put in and the roadway elevated to make the roadway passable during high rainfall. With an elevated roadway, this would create a damming affect that would flood my pastures. If the culverts are not periodically cleared of debris, the flooding of my pasture becomes more severe and the loss of grazing land affects me financially. I also lease the Stan Sato property that borders Puhala street in Fern Acres and also use it for ranching. There is another drainage that flows across S Lauko Road. Again, during periods of high rainfall, this portion of the road floods. Culverts may work in this area, but must be maintained to prevent flooding. However, this increases the cost of S. Lauko connectivity. The fill for roadway would have to be trucked in, as much of S.Lauko Rd. is low roadway elevation. This increases the cost.

Dated September 1, 2015, the Department of Public works issued a letter to me stating the S.Lauko Road drainage as a floodplain area. Why would they even consider the S. Lauko connectivity in a designated flood zone? Cattle ranching is the best land use for this area.

The issue that all those in attendance at the connectivity hearings is that of having emergency access out of the back subdivision. Personal emergencies require quick responses out of the subdivisions to Highway 11. Connectivity roads may get you out to Highway 11 quicker, but the real gridlock is the traffic on Hwy.11, Panaewa, up Kawaiiani to Komohana, then to Waianuenuue to get to Hilo Medical Center. The near future will increase traffic congestion and response time. Connectivity roads to Hwy 11 is only a bandaid solution at best. My proposal is to bring a full trauma facility to the Keaau area/Mountain View Area. Puna is growing and will be generating the most tax revenue and the people of Puna deserve such a facility. Puna is the only County that has no regional hospital with full trauma capabilities on Hawaii Island. Hilo Medical Center cannot expand anymore because Wailuku River is to the north. Keaau is the hub of Puna and land to develop a regional hospital is available/affordable. It will create new jobs for residence and the "rest" would follow. Our elected officials should be seeking legislation support to fund a facility.

At the public Works meeting dated, July 25, 2016, a planner stated that the meeting was not of facilities, but of the connectivity issues. I disagree because if we plan for a facility to be built in the Keaau area, the connectivity roads should be built to this facility. No use spending a lot of money on S. Lauko when in the future, it may not be needed. I favor the extension of Puhala Street to South Kopua Road as this would be the cheapest of the three connectivity roads to Hwy. 11 in Mountain View. The S. Lauko Road would be the most expensive due to road construction costs, property owners buyout and infrastructures expenses such as streetlights, signal lights, road stripping, etc.

At present, the access into and out Fern Acres Subdivision is South Kulani Road. To have S. Lauko as another access route only 1/2 mile away does not make much sense as both roads crosses the same drainage system. The Puhala Street Extension would serve the greater Fern Acre Subdivision as an emergency access. No sense we spend 2 million or more for S. Lauko Road connectivity. We should use this expense of tax payers money for "start up" costs for a Puna Regional Hospital. All the people of Puna will benefit, and not individual benefits I am hearing. This would be a win-win solution for all

We need to plan now and I hope I have planted some seeds for thought. Support Ag!

Also at issue is the Hilo/Volcano Trail which bisects S. Hauko Rd. How is it being addressed? Additional costs? Cultural, historical impacts? etc.



STATE OF HAWAII
DEPARTMENT OF HEALTH

P. O. BOX 3378
HONOLULU, HI 96801-3378

In reply, please refer to:
File:

EPO 16-233

July 14, 2016

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

Dear Mr. Terry:

**SUBJECT: Early Consultation for Environmental Assessment (EC for EA)
Puna Subdivision Connector Roads to Volcano Highway, Puna, Hawaii**

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your EC for EA to our office via email on June 30, 2016.

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

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

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

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

A phase I Environmental Site Assessment (ESA) and site investigation should be conducted for residential development or redevelopment projects on formerly and currently zoned agricultural land used for growing sugar, pineapple or other agricultural products. If the investigation shows that a release of petroleum, hazardous substance, pollutants or contaminants may have occurred at the site, the site should be properly characterized through an approved Hawaii State Department of Health (DOH)/Hazard Evaluation and Emergency Response Office (HEER)

Mr. Ron Terry
Page 2
July 14, 2016

soil and/or groundwater sampling plan. Please refer to Sections 3 and 4 of the HEER Office Technical Guidance Manual <http://www.hawaiiidoh.org/>. If the site is found to be contaminated, then all removal and remedial actions to clean up hazardous substance or oil releases by past and present owners/tenants must comply with Chapter 128D, Environmental Response Law, HRS, and Title 11, Chapter 451, HAR, State Contingency Plan. To identify HEER records related to the property, visit <http://eha-web.doh.hawaii.gov/eha-cma/Leaders/HEER/public-records>

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

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

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

Mahalo nui loa,



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

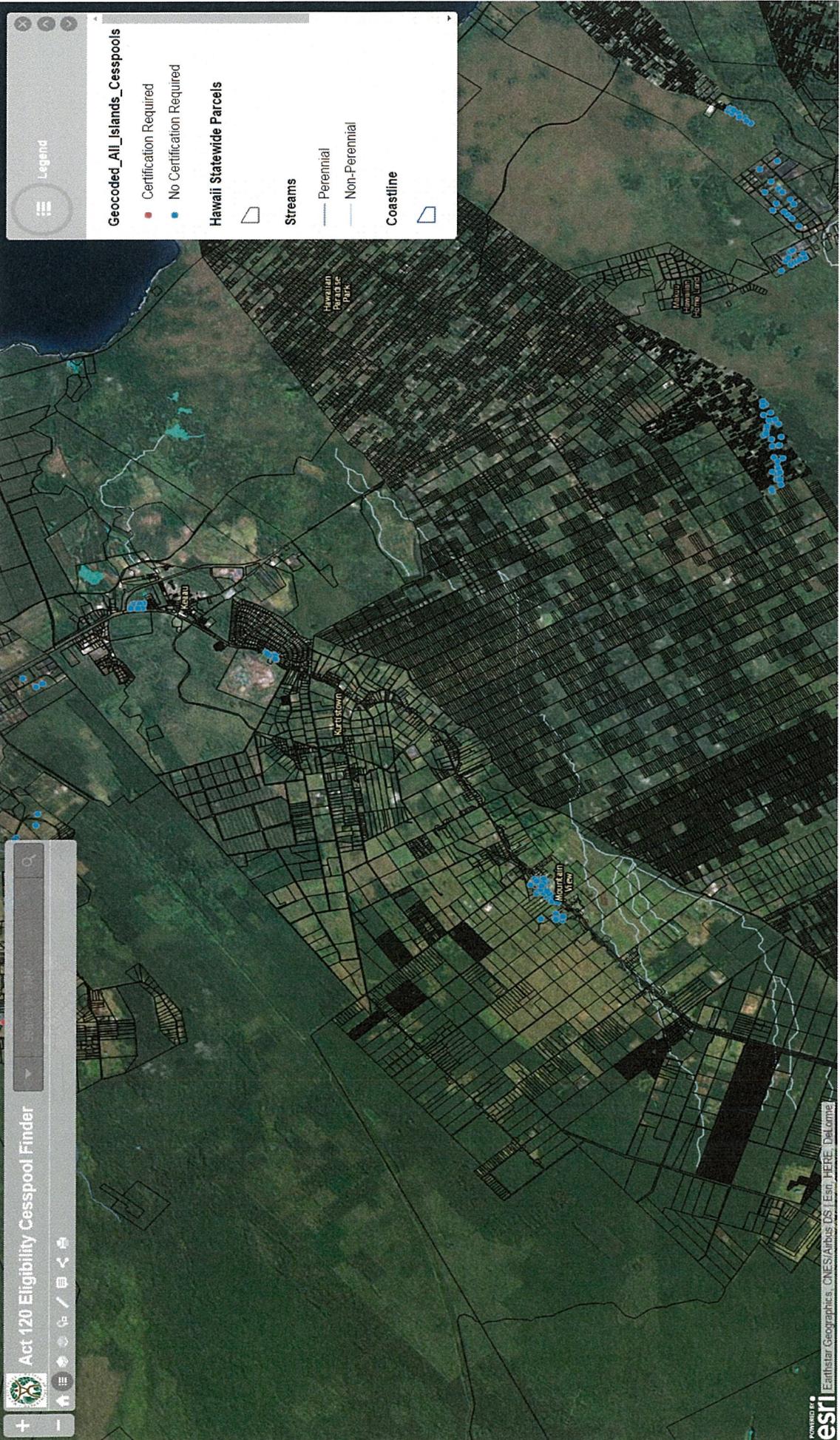
LM:nn

Attachment 1: Environmental Health Management Web App Snipit of Project Area: <http://health.hawaii.gov/epo/egis>
Attachment 2: Clean Water Branch: Water Quality Standards Map - Hawaii
Attachment 3: Wastewater Branch: Act 120 Cesspool Tax Credit Web App Snipit of Project Area
Attachment 4: Wastewater Branch: Recycled Water Use Map of Project Area
Attachment 5: Historic Sugarcane Map of Project Area
Attachment 6: OEQC Viewer Map of Project Area
Attachment 7: U.S. EPA EJSCREEN Report for Project Area

c: DOH: DHO HI, CWB, WWB {via email only}


Act 120 Eligibility Cesspool Finder

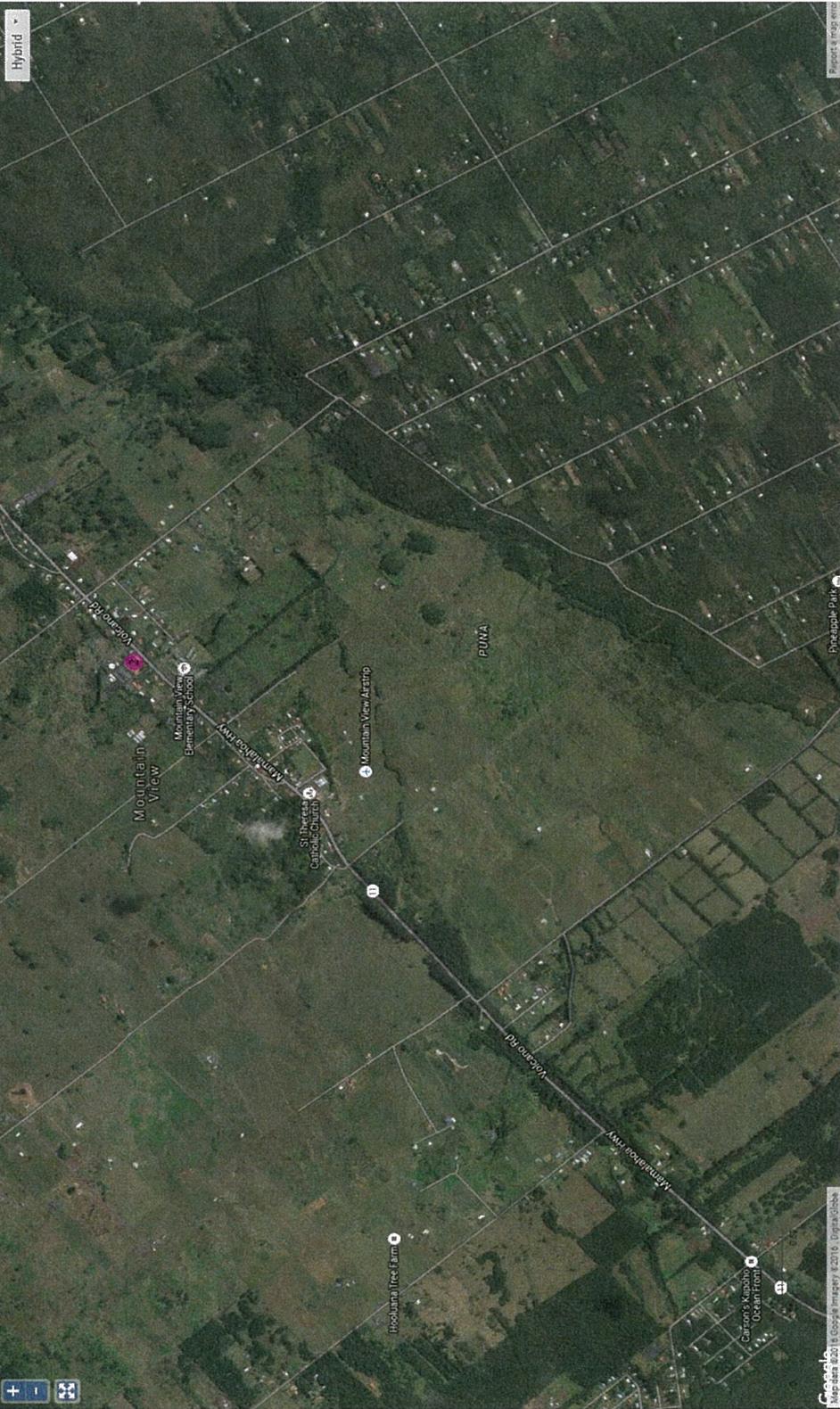






+ Recycled Water Use Maps
 Search by TMK
🏠 📏 📍 🗺️ 🔍

Hawaii Statewide Parcels
▭
Water Reuse Management Zones
■ No Restrictions
■ Conditional
■ Restricted



2 sites found

Results Filter

Show sites with no location

Ohae Wells (FEA-FONSI)
Environmental Assessment (Agency)

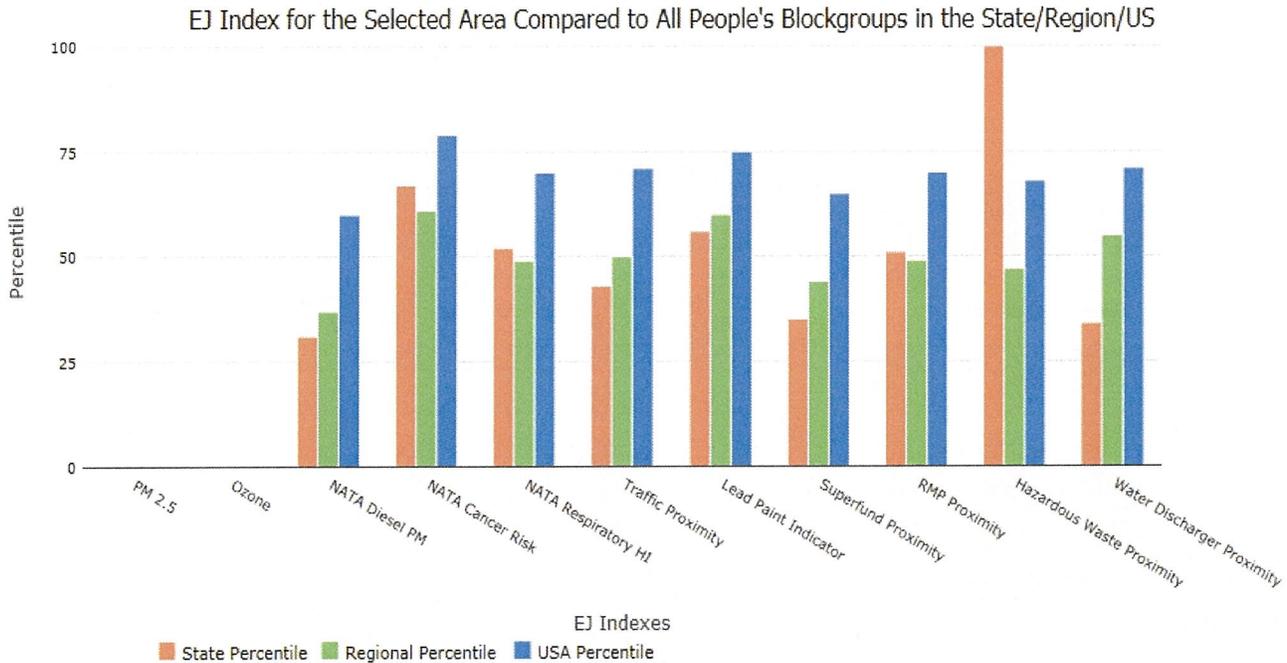
Ohae Wells Reservoir (DEA-AFNSI)
Environmental Assessment (Agency)



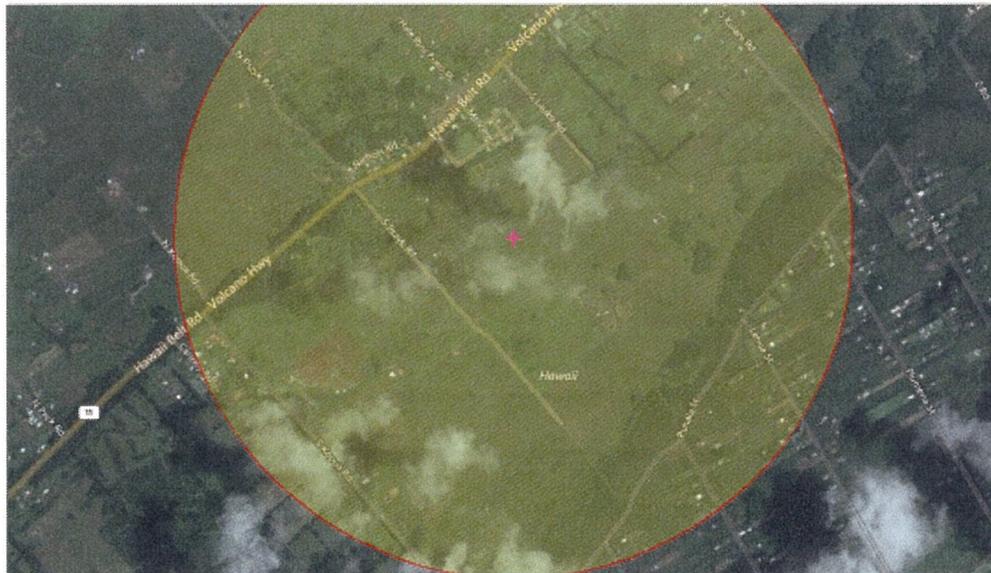
EJSCREEN Report (Version 2016)
 1 mile Ring Centered at 19.545262,-155.104782
 HAWAII, EPA Region 9
 Approximate Population: 361
 Input Area (sq. miles): 3.14



Selected Variables	Percentile in State	Percentile in EPA Region	Percentile in USA
EJ Indexes			
EJ Index for Particulate Matter (PM 2.5)	N/A	N/A	N/A
EJ Index for Ozone	N/A	N/A	N/A
EJ Index for NATA* Diesel PM	31	37	60
EJ Index for NATA* Air Toxics Cancer Risk	67	61	79
EJ Index for NATA* Respiratory Hazard Index	52	49	70
EJ Index for Traffic Proximity and Volume	43	50	71
EJ Index for Lead Paint Indicator	56	60	75
EJ Index for Superfund Proximity	35	44	65
EJ Index for RMP Proximity	51	49	70
EJ Index for Hazardous Waster Proximity	100	47	68
EJ Index for Water Discharger Proximity	34	55	71



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



July 14, 2016
 Buffer Area
 Digitized Point

1:18,000
 0 0.15 0.3 0.6 mi
 0 0.25 0.5 1 km
 © 2016 DigitalGlobe © 2015 Garmin, Earthstar Geographics, SWG, IGN, AeroVironment, CNES, Airbus, GeoEye
 Microsoft Corporation © 2013 Mapbox © 2012

Sites reporting to EPA

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

Selected Variables	Value	State Average	Percentile in State	EPA Region Average	Percentile in EPA Region	USA Average	Percentile in USA
Environmental Indicators							
Particulate Matter (PM 2.5 in $\mu\text{g}/\text{m}^3$)	N/A	N/A	N/A	9.37	N/A	9.32	N/A
Ozone (ppb)	N/A	N/A	N/A	51	N/A	47.4	N/A
NATA* Diesel PM ($\mu\text{g}/\text{m}^3$)	0.0144	0.149	9	0.978	<50th	0.937	<50th
NATA* Air Toxics Cancer Risk (risk per MM)	25	34	9	43	<50th	40	<50th
NATA* Respiratory Hazard Index	0.51	1	9	2	<50th	1.8	<50th
Traffic Proximity and Volume (daily traffic count/distance to road)	28	990	31	1100	21	590	30
Lead Paint Indicator (% pre-1960s housing)	0.076	0.16	44	0.24	41	0.3	32
Superfund Proximity (site count/km distance)	0	0.098	29	0.15	13	0.13	16
RMP Proximity (facility count/km distance)	0.051	0.19	16	0.57	6	0.43	9
Hazardous Waste Proximity (facility count/km distance)	0	0	100	0.11	19	0.072	26
Water Discharger Proximity (count/km)	0.045	0.34	11	0.2	10	0.31	7
Demographic Indicators							
Demographic Index	61%	52%	77	47%	70	36%	82
Minority Population	68%	77%	26	58%	58	37%	78
Low Income Population	54%	26%	92	36%	75	35%	80
Linguistically Isolated Population	1%	6%	25	9%	20	5%	46
Population with Less Than High School Education	10%	9%	64	17%	41	14%	48
Population under Age 5	6%	6%	55	7%	49	6%	53
Population over Age 64	7%	15%	15	13%	30	14%	22

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

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

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

Puna Subdivision Connector Roads to Volcano Highway
County Job No. E-4377

July 25, 2016 1:00PM
Engineering Division

Aupuni Center, 101 Pauahi Street, Suite 7, Hilo, Hawaii 96720

Attendance Sheet

Name	Organization	Address	Telephone No.	Email
Ron Terry	Geotechnical	10 Iwa St	969-7090	
Roddy Kikawa		348 Waleka Pl. Hilo	954-8203	
John & Acira Owen		18-3835 S LAUKO RD	1443 4479	
Lynn Lee		902 Pohakalani St, Hilo	959-6940	lyronlee@yahoo.com
Neena Roumel		18 3840 S. LAUKO	333-7444	ocleneowen@yahoo.com
Patricia Macdonald	Forest Hawaii Acres	Po Box 15 Kuniakom	557-4445	pmcs306@gmail.com
Randy Paleka	County Council	#25 Aupuni	961 8263	daniel.paleka@hawaii.gov
Frank Commeda	Hawaii Acres Comm. Assn		217-2245	fcommeda@yahoo.com

Puna Subdivision Connector Roads to Volcano Highway

July 25, 2016 1:00 PM

Name: Patrice Macdonald

Question/Comment/Concern:
Why pay lawko now when NO ONE mapped ROAD is being used.
Olia

Puna Subdivision Connector Roads to Volcano Highway

July 25, 2016 1:00 PM

Name: Lyron Lee

Question/Comment/Concern:
Please consider Puyuk for an immediate access road.

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ENVIRONMENTAL ASSESSMENT

Puna Subdivision Connector Roads to Volcano Highway In Vicinity of Mountain View

APPENDIX 2 Plant Species Detected in Project Corridors

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Scientific Name	Family	Common Name	Life Form	Status*
<i>Clerodendrum philippinum</i>	Acanthaceae	Pikake Honohono	Shrub	A
<i>Agave sp.</i>	Agavaceae	Agave	Shrub	A
<i>Dracena sp.</i>	Agavaceae	Money Tree	Shrub	A
<i>Washingtonia sp.</i>	Arecaceae	Chinese Fan Palm	Tree	A
<i>Ageratina riparia</i>	Asteraceae	Hamakua Pamakani	Herb	A
<i>Ageratum conyzoides</i>	Asteraceae	Ageratum	Herb	A
<i>Ageratum houstonianum</i>	Asteraceae	Ageratum	Herb	A
<i>Bidens pilosa</i>	Asteraceae	Bidens	Herb	A
<i>Conyza bonariensis</i>	Asteraceae	Conyza	Herb	A
<i>Erechtites hieracifolia</i>	Asteraceae	Erechtites	Herb	A
<i>Erechtites valerianifolia</i>	Asteraceae	Erechtites	Herb	A
<i>Pluchea symphytifolia</i>	Asteraceae	Sourbush	Shrub	A
<i>Senecio madagascariensis</i>	Asteraceae	Fireweed	Herb	A
<i>Wedelia trilobata</i>	Asteraceae	Wedelia	Herb	A
<i>Buddleia asiatica</i>	Buddleiaceae	Buddleia	Shrub	A
<i>Casuarina equisetifolia</i>	Casuarinaceae	Ironwood	Tree	A
<i>Casuarina glauca</i>	Casuarinaceae	Ironwood	Tree	A
<i>Commelina diffusa</i>	Commelinaceae	Honohono	Herb	A
<i>Sphaeropteris cooperi</i>	Cyatheaceae	Australian Tree Fern	Fern	A
<i>Cyperus halpan</i>	Cyperaceae	Cyperus	Herb	A
<i>Cyperus polystachyos</i>	Cyperaceae	Pycrus	Herb	A
<i>Machaerina mariscoides</i>	Cyperaceae	'Uki 'uki	Herb	I
<i>Rhynchospora caduca</i>	Cyperaceae	Rhynchospora	Herb	A
<i>Rhynchospora caduca</i>	Cyperaceae	Rhynchospora	Herb	A
<i>Cibotium chamissoi</i>	Dicksoniaceae	Hapu'u	Fern	E
<i>Aleurites moluccana</i>	Euphorbiaceae	Kukui	Tree	PI
<i>Chamaecrista nictitans</i>	Fabaceae	Partridge Pea	Herb	A
<i>Crotalaria micans</i>	Fabaceae	Rattlepod	Herb	A
<i>Desmodium sandwicense</i>	Fabaceae	Spanish Clover	Herb	A
<i>Desmodium triflorum</i>	Fabaceae	Desmodium	Herb	A
<i>Falcataria moluccana</i>	Fabaceae	Albizia	Tree	A
<i>Mimosa pudica</i>	Fabaceae	Sleeping Grass	Herb	A
<i>Dicranopteris linearis</i>	Gleicheniaceae	Uluhe	Fern	I
<i>Scaevola gaudichaudii</i>	Goodeniaceae	Naupaka kuahiwi	Shrub	E
<i>Adenophorus tamariscinus</i>	Grammitidaceae	Adenophorus	Fern	E
<i>Crocoshmia x crocosmiiflora</i>	Iridaceae	Tritonia	Herb	A
<i>Persea americana</i>	Lauraceae	Avocado	Tree	A
<i>Lycopodium venustulum</i>	Lycopodiaceae	Clubmoss	Herb	I
<i>Cuphea carthagenensis</i>	Lythraceae	Cuphea	Herb	A
<i>Hibiscus furcellatus</i>	Malvaceae	Rosemallow	Shrub	I
<i>Clidemia hirta</i>	Melastomataceae	Koster's Curse	Herb	A
<i>Dissotis rotundifolia</i>	Melastomataceae	Dissotis	Herb	A
<i>Melastoma sp.</i>	Melastomataceae	Melastoma	Shrub	A
<i>Pterolepis glomerata</i>	Melastomataceae	Pterolepis	Herb	A
<i>Melaleuca sp.</i>	Myrtaceae	Paperbark Tree	Tree	A
<i>Metrosideros polymorpha</i>	Myrtaceae	'Ōhi'a	Tree	E
<i>Psidium cattleianum</i>	Myrtaceae	Strawberry Guava	Tree	A

Scientific Name	Family	Common Name	Life Form	Status*
<i>Psidium guajava</i>	Myrtaceae	Common Guava	Tree	A
<i>Nephrolepis exaltata</i>	Nephrolepidaceae	Sword Fern	Fern	I
<i>Nephrolepis multiflora</i>	Nephrolepidaceae	Sword Fern	Fern	A
<i>Arundina graminifolia</i>	Orchidaceae	Bamboo Orchid	Herb	A
<i>Spathoglottis plicata</i>	Orchidaceae	Malayan Ground Orchid	Herb	A
<i>Pinus sp.</i>	Pinaceae	Pine	Tree	A
<i>Axonopus fissifolius</i>	Poaceae	Narrow-leaved Carpet Grass	Herb	A
<i>Coix lachryma-jobi</i>	Poaceae	Job's Tears	Herb	A
<i>Echinochloa colona</i>	Poaceae	Jungle Rice	Herb	A
<i>Eragrostis tenella</i>	Poaceae	Lovegrass	Herb	A
<i>Megathyrsus maximus</i>	Poaceae	Guinea Grass	Herb	
<i>Melinis minutiflora</i>	Poaceae	Molasses Grass	Herb	A
<i>Oplismenus sp.</i>	Poaceae	Basketgrass	Herb	A
<i>Panicum repens</i>	Poaceae	Torpedo Grass	Herb	A
<i>Paspalum conjugatum</i>	Poaceae	Hilo Grass	Herb	A
<i>Paspalum scrobiculatum</i>	Poaceae	Ditch Millet	Herb	A
<i>Paspalum urvillei</i>	Poaceae	Paspalum	Herb	A
<i>Pennisetum purpureum</i>	Poaceae	Elephant Grass	Herb	A
<i>Saccharum officinarum</i>	Poaceae	Sugar Cane	Herb	A
<i>Sacciolepis indica</i>	Poaceae	Glenwood Grass	Herb	A
<i>Schizachyrium condensatum</i>	Poaceae	Beardgrass	Herb	A
<i>Setaria palmifolia</i>	Poaceae	Palmgrass	Herb	A
<i>Sporobolus indicus</i>	Poaceae	Sporobolus	Herb	A
<i>Sporobolus sp.</i>	Poaceae	Sporobolus	Herb	A
<i>Urochloa mutica</i>	Poaceae	California Grass	Herb	A
<i>Podocarpus sp.</i>	Podocarpaceae	Podocarpus	Tree	A
<i>Polygala paniculata</i>	Polygalaceae	Milkwort	Herb	A
<i>Polygonum capitatum</i>	Polygonaceae	Polygonum	Herb	A
<i>Pityrogramma calomelanos</i>	Pteridaceae	Silver Fern	Fern	A
<i>Pteris cretica</i>	Pteridaceae	Pteris	Fern	I
<i>Rubus rosifolius</i>	Rosaceae	Thimbleberry	Herb	A
<i>Rubus sp.</i>	Rosaceae	Raspberry	Shrub	A
<i>Coffea arabica</i>	Rubiaceae	Coffee	Shrub	A
<i>Kadua corymbosa</i>	Rubiaceae	Hedyotis	Herb	A
<i>Paederia scandens</i>	Rubiaceae	Maile Pilau	Vine	A
<i>Spermacoce assurgens</i>	Rubiaceae	Spermacoce	Herb	A
<i>Castilleja arvensis</i>	Scrophulariaceae	Indian Paint Brush	Herb	A
<i>Torenia asiatica</i>	Scrophulariaceae	Ola'a Beauty	Herb	A
<i>Torenia sp.</i>	Scrophulariaceae	Torenia	Herb	A
<i>Melochia umbellata</i>	Sterculiaceae	Melochia	Tree	A
<i>Christella cyatheoides</i>	Thelypteridaceae	Cyclosorus	Fern	E
<i>Christella dentata</i>	Thelypteridaceae	Cyclosorus	Fern	N
<i>Trema orientalis</i>	Ulmaceae	Charcoal Tree	Tree	A
<i>Lantana sp.</i>	Verbenaceae	Lantana	Shrub	A
<i>Stachytarpheta jamaicensis</i>	Verbenaceae	Stachytarpheta	Herb	A
<i>Xyris sp</i>	Xyridaceae	Yelloweyed Grass	Herb	A
<i>Hedychium flavescens</i>	Zingiberaceae	Yellow Ginger	Herb	A

A=Alien E=Endemic I=Indigenous PI=Polynesian Introduction

ENVIRONMENTAL ASSESSMENT

Puna Subdivision Connector Roads to Volcano Highway In Vicinity of Mountain View

APPENDIX 3 Archaeological Inventory Survey

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An Archaeological Inventory Survey for Puna Subdivision Connector Roads to Volcano Highway in Vicinity of Mountain View

TMKs: (3) 1-1-100:042, (3) 1-8-001 (por.), (3) 1-8-004 (por.),
and (3) 1-8-086 (por.)

‘Ōla‘a and Kea‘au *ahupua‘a*
Puna District
Island of Hawai‘i

DRAFT VERSION



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ASM Project Number 26630.00

**An Archaeological Inventory Survey
for Puna Subdivision Connector Roads
to Volcano Highway in Vicinity
of Mountain View**

TMKs: (3) 1-1-100:042 (3), 1-8-001 (por.),
(3) 1-8-004 (por.), and (3) 1-8-086 (por.)

‘Ōla‘a and Kea‘au *ahupua‘a*
Puna District
Island of Hawai‘i

EXECUTIVE SUMMARY

At the request of Geometrician Associates, LLC, on behalf of the County of Hawai'i, ASM Affiliates (ASM) conducted an Archaeological Inventory Survey (AIS) of approximately 46 acres comprising three potential road corridors for the establishment of Puna subdivision connector roads to Volcano Highway in the vicinity of Mountain View, in 'Ōla'a and Kea'au *ahupua'a*, Puna District, Island of Hawai'i. The current study area consists of 100-foot-wide corridors centered on three existing road rights-of-way (South Lauko Road, South Pszyk Road, and Pūhala Road) that also extend on to twenty-six additional parcels. The current study was prepared as part of the environmental documentation prepared for the project and was conducted in accordance with Hawai'i Administrative Rules 13§13–275 and in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawai'i Administrative Rules 13§13–276.

Fieldwork for the current study was conducted between July 27 and August 8, 2016, and included a visual inspection of the surface of the entire study area (100 percent coverage) and detailed site recordation. As a result of the surface survey, eight features of one previously unrecorded site (Site 50-10-44-30575) were recorded. The features are associated with Field 4 of the Olaa Sugar Company plantation's Mountain View Section, and were constructed between 1939 and the 1960s. The features included a remnant drainage ditch (Feature A), four culverts (Features B, C, E, and F), a concrete post (Feature D), and the alignments and road surfaces of former plantations roads corresponding with South Pszyk Road (Feature G) and South Lauko Road (Feature H). Site 30575 was determined to be historically significant under Criterion d for the information it yielded during the current study. The site was fully documented during the current study, and the likelihood of encountering subsurface archaeological resources is remote, therefore no further historic preservation work is recommended. In the unlikely event that any unanticipated archaeological resources are unearthed within the study parcel during the proposed development activities, work in the immediate vicinity of those resources should be halted and DLNR-SHPD should be contacted in compliance with HAR 13§13-280.

CHAPTERS

	Page
1. INTRODUCTION	1
Study Area Description	5
2. BACKGROUND	15
CULTURE-HISTORICAL CONTEXT	15
A Generalized Model of Hawaiian Prehistory	16
History After Contact	19
Puna-‘Ōla‘a and the Current Study Area During the Precontact and Early Historic Periods	21
Land Use after the <i>Māhele</i>	24
The Olaa Sugar Company, 1899-1984	29
PREVIOUS ARCHAEOLOGICAL STUDIES	32
3. STUDY AREA EXPECTATIONS.....	33
4. FIELDWORK.....	34
METHODS.....	34
FINDINGS	34
Site 30575.....	34
Summary	46
5. SIGNIFICANCE EVALUATION AND Treatment RECOMMENDATIONS	47
REFERENCES CITED.....	48

FIGURES

	Page
1. Study area location.....	2
2. Tax Map Key (TMK) Plat (3) 1-8-004 with the current study corridors highlighted red.	3
3. Google Earth™ satellite image with current study corridors outlined in yellow.	4
4. Geology in the current study area (after Wolfe and Morris 1997).	5
5. Soils in the current study area (after Sato et. al 1973).	6
6. Paved portion of the South Lauko Road corridor, view to the southeast.	7
7. Unpaved portion of South Lauko Road, view to the southeast.....	7
8. Undeveloped portion of South Lauko Road, view to the southeast.....	8
9. Paved driveway extending from South Lauko Road, view to the southwest.....	8
10. South Lauko Road corridor near Pūhala Road, view to the northwest.	9
11. Paved section of South Pszyk Road, view to the northwest.	10
12. Modern (ca. 1970s) concrete bridge crossing the Kea‘au Tributary Stream, view to the northeast.....	10

13. Southern portion of South Pszyk Road crossing open pasture land, view to the southeast....	11
14. Corral and shed within South Pszyk Road corridor, view to the southeast.	11
15: Portion of study area currently being used as driveway, view to the southwest.	12
16. Location of the modern trail approximating the state-owned Old Volcano Trail.....	13
17: Portion of the Old Volcano Trail that has been mechanically cleared, view to the west.	13
18: Bulldozer tracks along a segment of the Old Volcano Trail.....	14
19. Registered Map 42 of the <i>kalana</i> of ‘Ōla‘a.	18
20. Portion of Registered Map 42 showing the “Road to Hilo” with the current study corridors added in red.	23
21. Registered Map No. 1665a, Map of Olaa Lots made available for lease in 1892.	27
22. Portion of Plat Map 854 depicting post-1895 Grants, study area corridors highlighted red. .	28
23. Detail of a 1917 Olaa Sugar Company field map, current study area corridors indicated in red.	29
24. Portions of Plat Map 818-C and 818-D showing the Old Volcano Trail and ‘Ōla‘a-Kea‘au Boundary surveyed in 1930, Pūhala Road Extension corridor outlined in red.	31
25. Previous archaeological studies, current study area in red.	33
26. SIHP Site 50-10-44-30575 site boundaries and feature locations.	35
27. Site 30575 Features A, B, C, and D plan view.	36
28. Site 30575 Feature A, view to the northwest.....	37
29. Site 30575 Feature A Feature A ditch wall masonry, view to the northeast.	37
30. Site 30575 Feature A, partial masonry ditch wall, view to the southwest.....	38
31. Site 30575 Feature B, view to the northwest.	39
32. Site 30575 Feature B, southeast elevation.	39
33. Site 30575 Feature B interior, view to the northwest.	Error! Bookmark not defined.
34. Site 30575 Feature A, view to the east.	40
35. Site 30575 Feature C, west elevation.....	41
36. Site 30575 Feature D, view to the west.	41
37. Site 30575 Feature E, view to the southwest.	43
38. Site 30575 Feature E northeast elevation.....	43
39. Site 30575 Feature F, view to the northeast.....	44
40. Site 30575 Feature F, southwest elevation.	44
41. Site 30575 Feature F, detail of broken rail segment in culvert roof.	45

TABLES

	Page
1. Parcels partially included in current study area.	1
2. Grant parcels adjacent to the current study area corridors.....	28
3. Previous archaeological studies.	32
4. Historic properties identified during the current study.	34
5. Significance and treatment recommendations.	47

1. INTRODUCTION

At the request of Geometrician Associates, LLC, on behalf of the County of Hawai‘i, ASM Affiliates (ASM) conducted an Archaeological Inventory Survey (AIS) of approximately 46 acres comprising three potential road corridors for the establishment of Puna subdivision connector roads to Volcano Highway in the vicinity of Mountain View, in ‘Ōla‘a and Kea‘au *ahupua‘a*, Puna District, Island of Hawai‘i (Figures 1 and 2). The current study area consists of 100-foot-wide corridors centered on three existing road rights-of-way (South Lauko Road, South Pszyk Road, and Pūhala Road) that also extend on to twenty-six additional parcels (Table 1). Within the road rights-of-way the roadway is partially paved and partially undeveloped. Both South Lauko Road and South Pszyk Road are paved beginning at Highway 11 and the pavement extends toward Pūhala Road, but in both cases ends before reaching Pūhala Road. The Pūhala Road corridor begins at the southeastern terminus of paved Pūhala Road and ends at the intersection with South Kopua Road (Figure 3).

The current study was prepared as part of the environmental documentation prepared for the project and was conducted in accordance with Hawai‘i Administrative Rules 13§13–275 and in compliance with the Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports as contained in Hawai‘i Administrative Rules 13§13–276. Compliance with the above standards is sufficient for meeting the initial historic preservation review process requirements of both the Department of Land and Natural Resources and the County of Hawai‘i Planning Department. This report contains background information outlining the project area’s physical and cultural contexts, a presentation of previous archaeological work in the vicinity of the project area, and current survey expectations based on that previous work. Also presented is an explanation of the project’s methods, a detailed description of the archaeological feature encountered, interpretation and evaluation of the resources, and treatment recommendations for the site.

Table 1. Parcels partially included in current study area.

<i>TMK</i>	<i>Owner</i>	<i>Study corridor</i>
(3) 1-1-100:042	Harold S. Tanouye and Sons, Inc.	Pūhala Extension
(3) 1-8-001:042	Howard Leslie, Sr., Howard K. Leslie, Jr	S. Lauko
(3) 1-8-001:043	Ronald T. Toyama, Ivan Toyama, Glenn Toyama	S. Lauko
(3) 1-8-004:006	Lee, Clifford Wayne/Lyron Jean L Trust	S. Pszyk
(3) 1-8-004:007	Priest (Monk) of Bang San Ho Temple	S. Pszyk
(3) 1-8-004:022	State of Hawaii	S. Pszyk
(3) 1-8-004:034	Chritine E Iha	S. Pszyk
(3) 1-8-004:035	Cynthia A Young, Eric Tyrell Young	S. Pszyk
(3) 1-8-004:037	Gary D Anderson, Joan C Gossett	S. Pszyk
(3) 1-8-004:038	Chad David Adrian, Julie Ann Luiz Adrian	S. Pszyk
(3) 1-8-004:039	Christopher R Bridges, Christine Albus	S. Pszyk
(3) 1-8-004:098	Glenn Y. Toyama, Ivan K Toyama	S. Lauko
(3) 1-8-004:100	Stanley Takashi Sato, Ann Mitsue Sato	S. Lauko
(3) 1-8-004:101	John Owen, Anthony Owen, Anita Gail	S. Lauko
(3) 1-8-004:102	Roddy F Nagata, Janice T Nagata	S. Lauko
(3) 1-8-004:105	Roy R Thompson, Phoebe P Thompson	S. Pszyk
(3) 1-8-004:106	Allan Alexander Paiva, Kauhane Sarah Kayumi Paiva	S. Pszyk
(3) 1-8-004:107	Courtney R Millburn, Mary Millburn	S. Pszyk
(3) 1-8-004:108	Susanne Maya Pickert, Carola-Gay Knutson, Michael Lowell Matheson	S. Pszyk
(3) 1-8-004:109	Frances D Silva	S. Pszyk
(3) 1-8-086:002	Jack W Kamohi, III, Jacky-Lynn Kamohi	S. Lauko
(3) 1-8-086:003	Boshard Family	S. Lauko
(3) 1-8-086:004	Neena Roumell	S. Lauko
(3) 1-8-086:005	Lai Stanley	S. Lauko
(3) 1-8-086:047	Sharon Ann Freitas	S. Lauko
(3) 1-8-086:048	Sharon Ann Freitas	S. Lauko

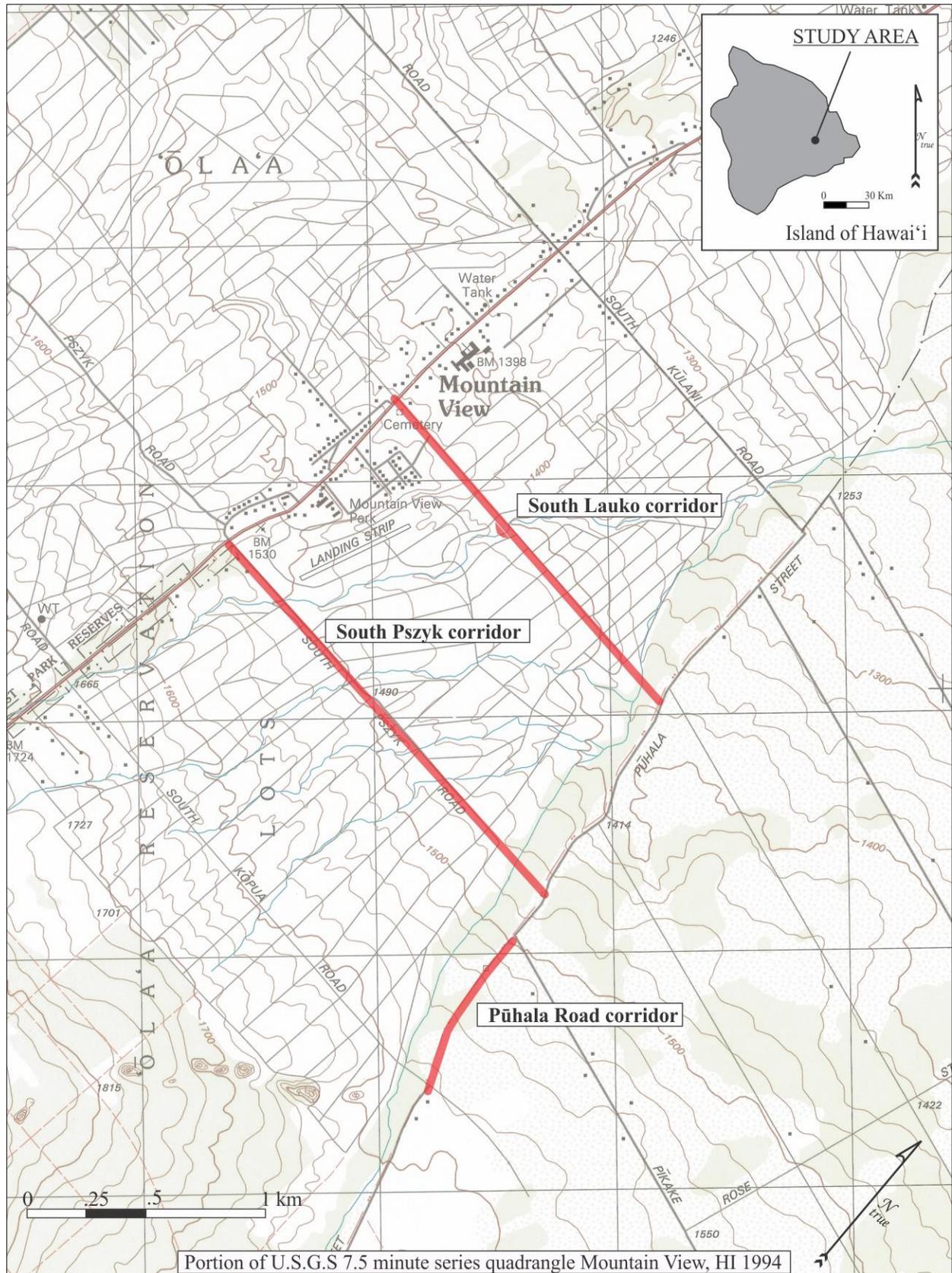


Figure 1. Study area location.



Figure 2. Tax Map Key (TMK) Plat (3) 1-8-004 with the current study corridors highlighted red.

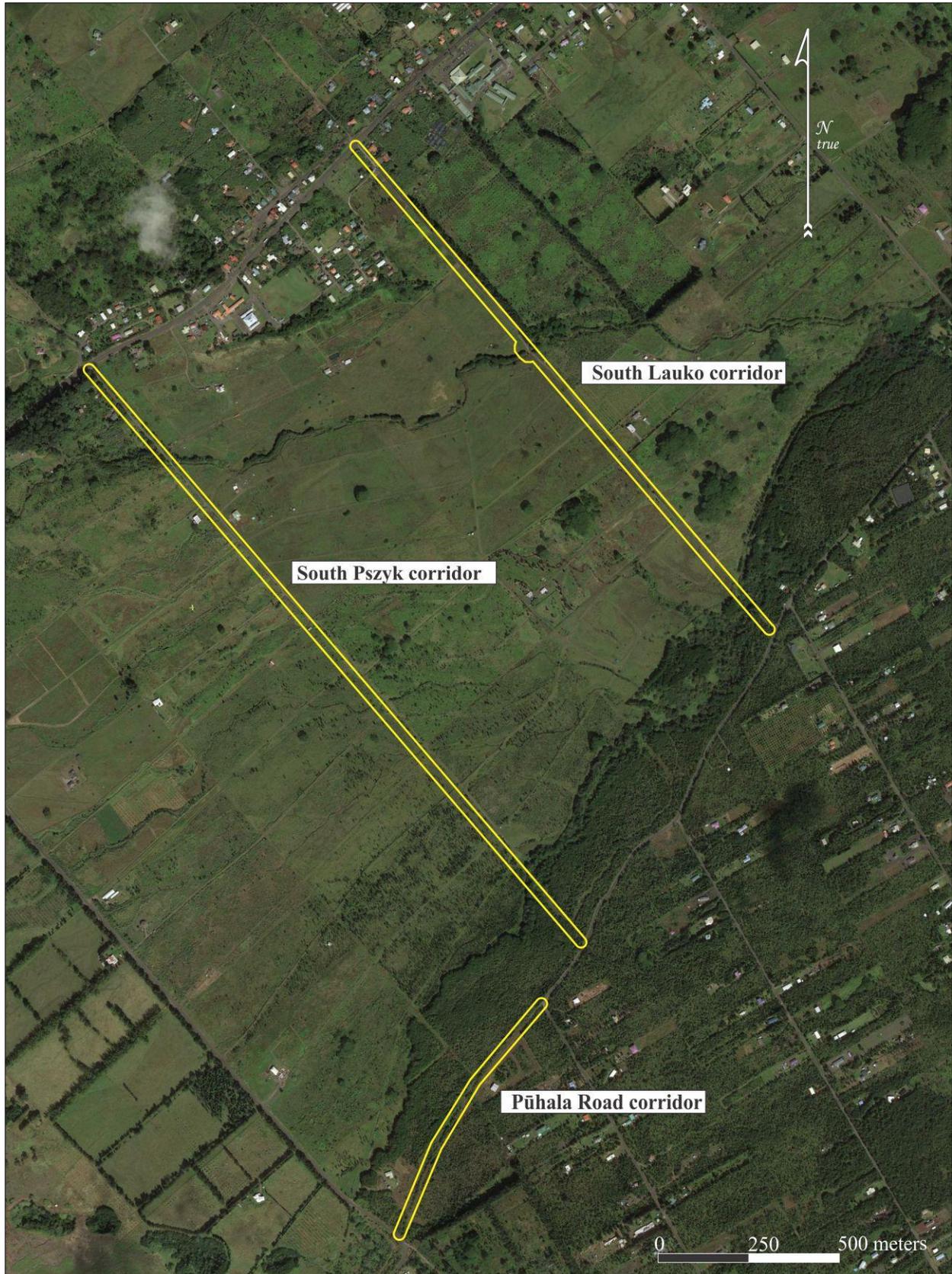


Figure 3. Google Earth™ satellite image with current study corridors outlined in yellow.

STUDY AREA DESCRIPTION

The three study corridors are situated in the town of Mountain View and the Fern Acres Subdivision at elevations ranging from 1,383 to 1,585 feet above sea level. This area receives a mean annual rainfall of 125 inches (Frazier et al. 2016). The study corridors cross former and current commercial agricultural fields (Figure 3) that slope gently (between one and four percent slope) toward the northeast. Multiple small and intermediate tributary streams of Kea‘au Stream cross the South Lauko Road and South Pszyk Road study corridors; one of these tributaries roughly parallels the Pūhala Road corridor.

Geologically, the current study area is located at the boundary between Mauna Loa and Kīlauea lava flows (Figure 4). The majority of the South Lauko Road and South Pszyk Road study corridors are located on Mauna Loa flows dating between 5,000 and 10,000 years B.P. (Qk1o) and greater than 10,000 years B.P. (Qk). The remainder of those corridors and the entirety of the Pūhala Road Extension corridor are located on Kīlauea flows dating between 200 and 750 years B.P. (Qp4). Soils in the current study area (Figure 5) are primarily Ohia series (Sato et al. 1973). The northern portions of the South Lauko Road and South Pszyk Road study corridors contain Ohia extremely silty clay loam (OSD), a well-drained silty clay loam formed in Mauna Loa volcanic ash over 5,000 to 10,000 years ago on fragmented ‘a‘ā lava; typical depths are from 20 to 36 inches deep. The middle portions of the South Lauko Road and South Pszyk Road study corridors contain Ohia silty clay loam (OHC) underlain by weathered *pāhoehoe* lava; typical depths can reach 62 inches. Soils in the Pūhala Road Extension corridor are classified as Pahoehoe lava flow (rLW); field observations noted very thin decomposing leaf litter overlying the lava flow.

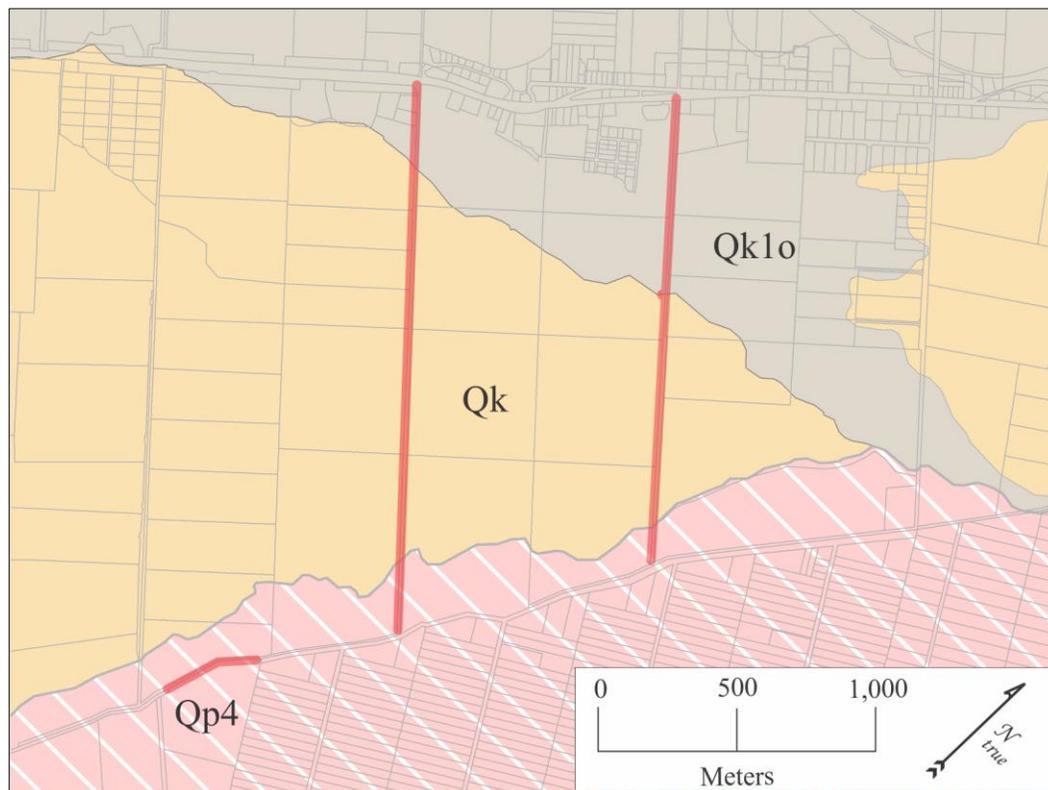


Figure 4. Geology in the current study area (after Wolfe and Morris 1997).

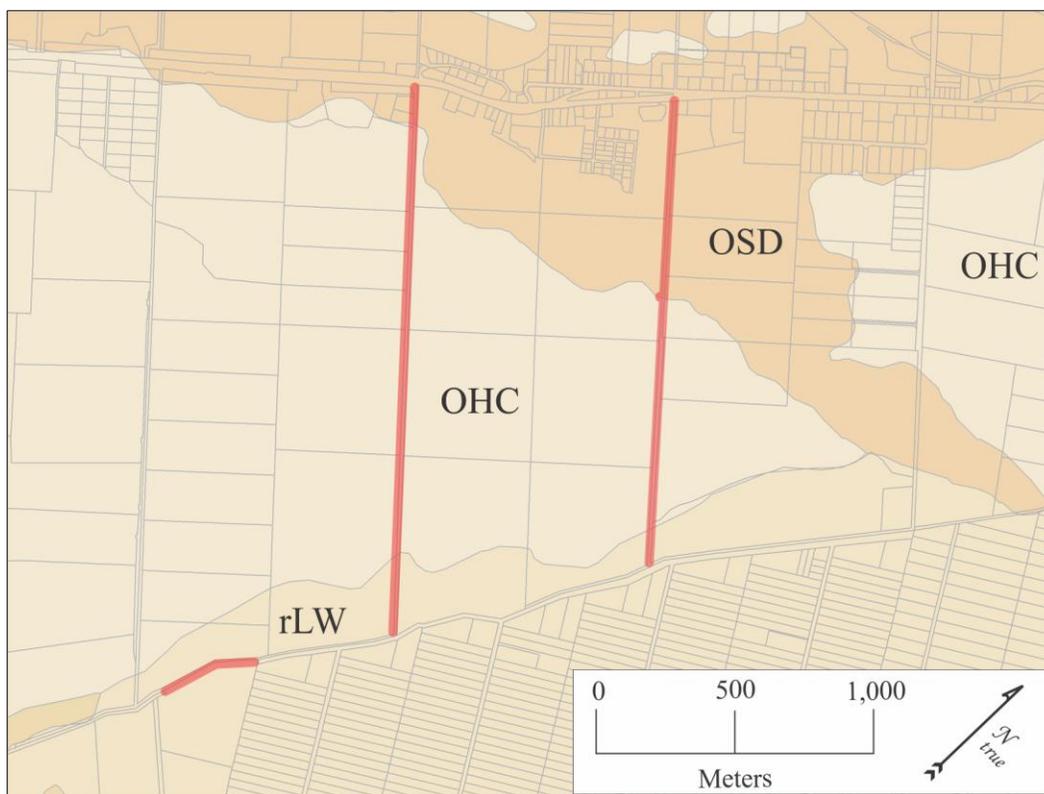


Figure 5. Soils in the current study area (after Sato et. al 1973).

The South Lauko Road corridor is located along the alignment of a county road (South Lauko Road) that has been maintained to varying degrees since the end of commercial sugar cultivation in 1984. Extending to the southeast from Highway 11 (see Figure 3), South Lauko Road is partially paved with asphalt (Figure 6), but the majority is a graded, gravel road (Figure 7). The last 385-meter long segment of the corridor (Figure 8) currently appears undeveloped and is overgrown with various grasses and weeds. A drainage parallels the northeastern side of the maintained portions of the road. The road is enclosed by fencing on both sides. Beyond the fencing are agricultural fields and pasture. Private driveways (Figure 9) branch off from the road along what appear to be former cane field roads. Vegetation at the southern end of the corridor is very thick (Figure 10) and dominated by ferns, grasses, and an overstory of *waiawī* (*Psidium cattleianum*) where the very thin soils overlying the Kīlauea lava flow precluded agricultural use.



Figure 6. Paved portion of the South Lauko Road corridor, view to the southeast.



Figure 7. Unpaved portion of South Lauko Road, view to the southeast.



Figure 8. Undeveloped portion of South Lauko Road, view to the southeast.



Figure 9. Paved driveway extending from South Lauko Road, view to the southwest.



Figure 10. South Lauko Road corridor near Pūhala Road, view to the northwest.

Current conditions within the South Pszyk Road corridor are similar to the South Lauko Road corridor. Within the corridor, South Pszyk Road is paved (Figure 11) for a distance of 325 meters from Highway 11; after this point the road is only roughly graded but drivable for an additional 1,265 meters at which point the road becomes obscured by vegetation and terminates at a gate near to the Kea‘au Stream tributary, just shy of Pūhala Road. The road crosses a tributary of Kea‘au Stream over a modern (1970s construction) concrete bridge at its northern end (Figure 12). After passing through a modern livestock control gate, the road deviates from the South Pszyk Road right of way by about 30 meters to the east. It continues through TMK: (3) 1-8-004:006 within road easements B-1 and B-2 (see Figure 2), and has open pasture (Figure 13) on either side. The road terminates within at a gate controlling access to a modern corral and shed structure (Figure 14). Beyond the corral, the study corridor enters the same heavily-vegetated environment near the ‘Ōla‘a-Kea‘au border as described above.



Figure 11. Paved section of South Pszyk Road, view to the northwest.



Figure 12. Modern (ca. 1970s) concrete bridge crossing the Kea'au Tributary Stream, view to the northeast.



Figure 13. Southern portion of South Pszyk Road crossing open pasture land, view to the southeast.



Figure 14. Corral and shed within South Pszyk Road corridor, view to the southeast.

The Pūhala Road corridor begins at the terminus of paved Pūhala Road adjacent to parcel TMK: (3) 1-1-038:187 (see Figure 2) and parallels (and includes) the state-owned Old Volcano Trail alignment until intersecting South Kopua Road. Vegetation in this corridor consists of *waiawī* (*Psidium cattleianum*), 'ōhi'a (*Metrosideros polymorpha*), *uluhe* (*Dicranopteris linearis*), and Himalayan raspberry (*Rubus ellipticus*). A portion of the study area is being used as a driveway, which is marked by a gate just off the paved section of Pūhala street (Figure 15) on parcel TMK: (3) 1-1-038:188. The terrain consists of a rolling *pāhoehoe* landscape with frequent outcrops and little soil. The study area corridor also contains a modern vehicular and pedestrian trail roughly approximating the state-owned Old Volcano Trail (Figure 16). In 2003 and 2004, the Old Volcano Trail was surveyed by R. M. Towill Company and cleared by members of the Sierra Club and *Nā Ala Hele*. The portion of the modern trail in the Pūhala Road corridor was surveyed as part of the current project by Island Surveyors, Inc. The modern trail consists of a mechanically-cleared, 2-3 meter wide corridor (Figure 17) that meanders between Pūhala Road and Kopua Road, generally following route that is slightly elevated compared to the surrounding terrain. Track scars (Figure 18) are visible on the surface of much of the cleared trail. Motor vehicle traffic in the corridor was observed during the current fieldwork, and the remains of at least two modern vehicles are located along the side of the Old Volcano Trail.



Figure 15: Portion of study area currently being used as driveway, view to the southwest.

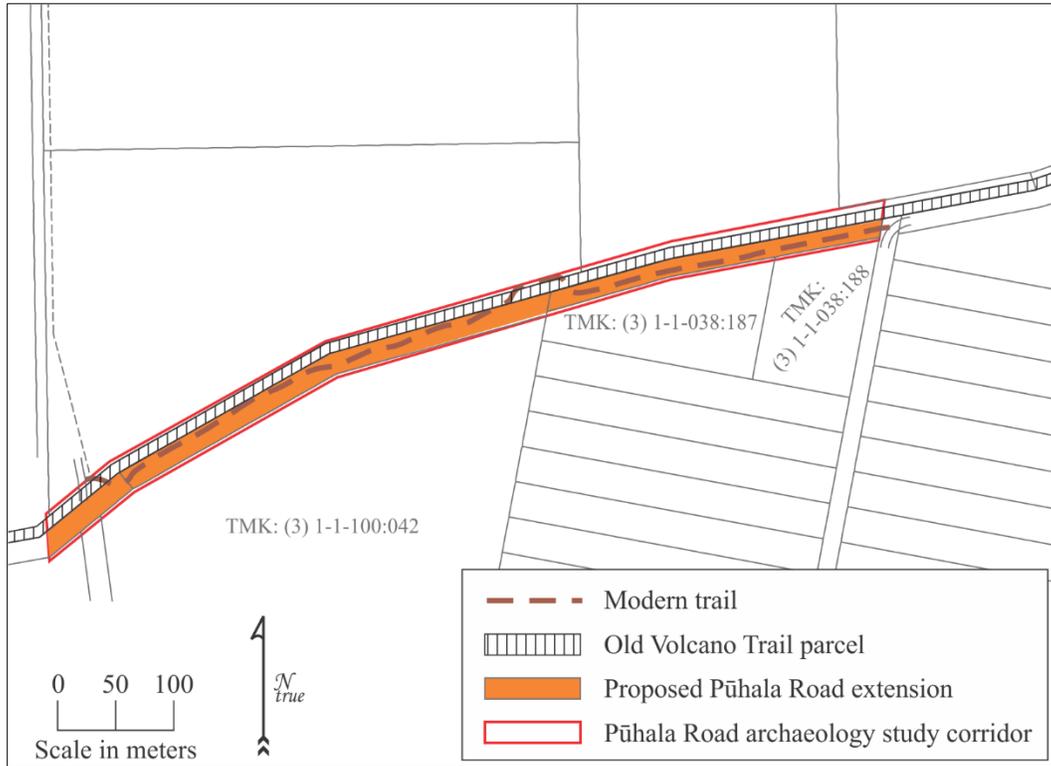


Figure 16. Location of the modern trail approximating the state-owned Old Volcano Trail.



Figure 17: Portion of the Old Volcano Trail that has been mechanically cleared, view to the west.



Figure 18: Bulldozer tracks along a segment of the Old Volcano Trail.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered in the current study area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the upper Puna District, the *ahupua'a* (*kalana*) of 'Ōla'a, and to a lesser extent Kea'au is presented as well as a summary of archaeological studies relevant to the current study area. For a more in-depth historical background the reader is referred to Maly and Maly (2004) and McGregor (2007).

CULTURE-HISTORICAL CONTEXT

'Ōla'a and Kea'au are two of fifty traditional land divisions found in the District of Puna on the eastern shores of the Island of Hawai'i. In *Native Planters in Old Hawaii*, Handy and Handy (1991) describe Puna as an agriculturally fertile land that has been repeatedly devastated by lava flows. Writing during the 1930s, they relate that:

The land division named Puna—one of the six major chiefdoms of the island of Hawai'i said to have been cut ('*oki*) by the son of the 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 the most easterly point at Cape Kumukahi. The uplands of Puna extend back toward the great central heights of Mauna Loa, and in the past its lands have been built, and devastated, and built again by that mountain's fires. In the long intervals, vegetation took hold, beginning with miniscule mosses and lichens, then ferns and hardier shrubs, until the uplands became green and forested and good earth and humus covered much of the lava-strewn terrain, making interior Puna a place of great beauty...

...One of the most interesting things about Puna is that Hawaiians believe, and their traditions imply, that this was once Hawaii's richest agricultural region and that it is only in relatively recent time that volcanic eruption has destroyed much of its best land. Unquestionably lava flows in historic times have covered more good gardening land here than in any other district. But the present desolation was largely brought about by the gradual abandonment of their country by Hawaiians after sugar and ranching came in... (Handy and Handy 1991:539-542)

The District of Puna is situated largely on the slopes of Kīlauea Volcano. The east rift zone of the volcano, a broad, low profile ridge (2-4 kilometers wide) formed by countless eruptions originating from numerous vents along its crest. The zone extends through the district from the Kīlauea Caldera to Cape Kumukahi at the eastern tip of the island, a distance of 55 kilometers. Nearly the entire crest of the rift zone is covered by lava that is less than 200 years old, and most of the young lava flows that emanate from vents along the crest have spread southward towards the southeastern coast of the district, covering the older lava flows in the process (Wolfe and Morris 1996). The north side of the rift zone, which extends to the slopes of Mauna Loa and to the northeastern Puna coast, is covered primarily by slightly older lavas that erupted from the summit of Kīlauea about 200-750 years ago. Puna also includes portions of the Mauna Loa's lower slopes, which feature older geology (5,000 to 11,000 years old) and relatively developed soils. The current study area is located at the boundary of 'Ōla'a and Kea'au, and includes portions of the relatively fertile Mauna Loa flows and the more recent, less fertile Kīlauea flows. These characteristics of the land no doubt shaped the Precontact settlement patterns and greatly influences the later, nearly century of Historic Period sugar cultivation within the current study area.

It is within this general context that the following discussion of the history and culture of the study area is framed. The chronological summary presented below begins with the peopling of the Hawaiian Islands and includes the presentation of a generalized model of Hawaiian Prehistory containing specific legendary references to the study area and a discussion of the general settlement patterns. The summary includes a discussion of the changing life ways and population decline of the early Historic Period, a review of land tenure in the study area during the *Māhele 'Āina* of 1848, and documentation of the transition to modern industries, agriculture, and residential development during the late nineteenth and twentieth centuries. A synthesis of the Precontact settlement patterns and the historically documented land use, combined with a review of the findings of previously conducted archeological studies, provides a means for predicting the types of archaeological features that may be encountered within the project area, and a basis for assessing the function, age, and significance of any encountered archaeological sites.

A Generalized Model of Hawaiian Prehistory

The generalized cultural sequence that follows is based on Kirch's (1985) model, but is amended to include recent revisions offered by Kirch (2011). The conventional wisdom has been that first inhabitants of Hawai'i Island arrived by at least A.D. 300 and focused habitation and subsistence activity on the windward side of the island (Burtchard 1995; Kirch 1985; Hommon 1986). However, there is no archaeological evidence for occupation of Hawai'i Island (or perhaps anywhere in Hawai'i) during this initial settlement, or colonization stage of island occupation (A.D. 300 to 600). More recently, Kirch (2011) and others (Athens et al. 2014; Duarte 2012; Wilmschurst et al. 2011) have convincingly argued that Polynesians may not have arrived in the Hawaiian Islands until at least A.D. 1000, but expanded rapidly thereafter. The implications of this on the currently accepted chronology would alter the timing of the Settlement, Developmental, and Expansion Periods, possibly shifting the Settlement Period to A.D. 1000 to 1100, the Developmental Period to A.D. 1100 to 1350, the Expansion Period to A.D. 1350 to 1650, and the Proto-Historic Period to A.D. 1650-1795.

The initial settlement in Hawai'i is believed to have occurred from the southern Marquesas Islands. The Settlement Period was a time of great exploitation and environmental modification, when early Hawaiian farmers developed new subsistence strategies by adapting their familiar patterns and traditional tools to their new environment (Kirch 1985; Pogue 1978). Their ancient and ingrained philosophy of life tied them to their environment and kept order. Order was further assured by the conical clan principle of genealogical seniority (Kirch 1984). According to Fornander (1969), the Hawaiians brought from their homeland certain universal Polynesian customs: the major gods Kāne, Kū, and Lono; the *kapu* system of law and order; cities of refuge; the *'aumakua* concept; various epiphenomenal beliefs; and the concept of *mana*. Over a period of several centuries areas with the richest natural resources became populated and perhaps even crowded, and the population began expanding to the *kona* (leeward side) and more remote regions of the island (Cordy 2000). In Puna, initial settlements were likely established at sheltered bays with access to fresh water and rich marine resources. These small communities would have shared extended familial relations, and there was likely an occupational focus on the collection of marine resources.

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

The Expansion Period is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. The greatest population growth occurred during the Expansion Period. It was during the Expansion Period that a second major migration settled in Hawai'i, this time from Tahiti in the Society Islands. According to Kamakau (1976), the *kahuna* Pā'ao settled in the islands during the 13th century. Pā'ao was the keeper of the god Kū'kā'ilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pā'ao was expelled from his homeland by Lonopele. He prepared for a long voyage, and set out across the ocean in search of a new land. On board Pā'ao's canoes were thirty-eight men (*kānaka*), two stewards (*kānaka 'ā'īpu'upu'u*), the chief Pilika'aiea (Pili) and his wife Hina'aukekele, Nāmau'u o Malaia, the sister of Pā'ao, and the prophet Makuaka'ūmana (Kamakau 1992). In 1866, Kamakau (1992:100-102) told the following story of their arrival in Hawai'i:

Puna on Hawai'i Island was the first land reached by Pā'ao, and here in Puna he built his first *heiau* for his god Aha'ula and named it Aha'ula [Waha'ula]. It was a *luakini*. From Puna, Pā'ao went on to land in Kohala, at Pu'uepa. He built a *heiau* there called Mo'okini, a *luakini*.

It is thought that Pā'ao came to Hawai'i in the time of the *ali'i* La'au because Pili ruled as *mo'i* after La'au. You will see Pili there in the line of succession, the *mo'o kū'auhau*, of Hanala'anui. It was said that Hawai'i Island was without a chief, and so a chief was brought from Kahiki; this is according to chiefly genealogies. Hawai'i Island had been without a chief for a long time, and the chiefs of Hawai'i were *ali'i maka'āinana* or just commoners, *maka'āinana*, during this time.

... There were seventeen generations during which Hawai‘i Island was without chiefs—some eight hundred years. ... The lack of a high chief was the reason for seeking a chief in Kahiki, and that is perhaps how Pili became the chief of Hawai‘i. He was a chief from Kahiki and became the ancestor of chiefs and people of Hawai‘i Island.

The Precontact population of the Puna District lived in small settlements along the coast where they subsisted on marine resources and agricultural products. The villages of Puna, McEldowney (1979:17) 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.

The concept of the *ahupua‘a* was established sometime during the A.D. 1400s, adding another component to a then well-stratified society (Kirch 1985). This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua‘a* were ruled by *ali‘i ai ahupua‘a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua‘a* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986). This form of district subdividing was integral to Hawaiian life and was the product of strictly adhered to resource management planning. In this system, the land provided fruits and vegetables and some meat for the diet, and the ocean provided a wealth of protein resources (Rechtman and Maly 2003). The *ali‘i* and the *maka‘āinana* (commoners) were not confined to the boundaries of the *ahupua‘a*; when there was a perceived need, they also shared with their neighbor *ahupua‘a ‘ohana* (Hono-ko-hau 1974). The *ahupua‘a* were further divided into smaller sections such as the *‘ili*, *mo‘o‘aina*, *pauku‘aina*, *kihapai*, *koele*, *hakuone*, and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mō‘ī* (king). ‘Ōla‘a, in which the current study area is located, was traditionally administered as a *kalana*, a discrete land unit (Figure 19) larger than an *ahupua‘a* but smaller than a district (*moku o loko*) and comprised of several other land divisions that contributed to its wealth (Maly and Maly 2002). As Maly and Maly explain, “the land of ‘Ōla‘a stood alone, almost independent of the other lands adjoining it in Puna, though it had no ocean frontage — being cut off by Kea‘au and Waiākea” (2004:6). ‘Ōla‘a was reserved for the reigning monarch, as the forest resources were exploited for the birds of the area, whose feathers made fabulous cloaks “reserved exclusively for the king of a whole island” as his battle or ceremonial cloak (Takamoto 1976). Sandalwood as well as cordage made from *mamaki* and *olonā* were also prized forest resources of the area.

People probably began utilizing the agricultural resources of upland Puna during the early Expansion Period (Burtchard and Moblo 1994). As coastal populations increased, the need for food led people to seek arable land at higher elevations. This trend of population increase along desirable coastal locations and the expansion into upland regions to support the coastal populations would have continued throughout prehistory, slowly populating more marginal areas of Puna District. ‘Ōla‘a falls within the Upland Agricultural Zone (Zone II) of McEldowney’s (1979:15-18) model of Precontact settlement patterns. While her 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). McEldowney notes that although estimates to the extent of this zone vary, she asserts that the unwooded grasslands or “plains” behind Hilo in a band from Kea‘au to modern-day Mountain View correspond to the distribution of ash soils. Scattered huts with adjacent garden plots and groves of economically beneficial tree and plant species dotted the expanse of the upland agriculture zone (McEldowney 1979). Planting of wetland taro, banana, and tī, occurred along the banks of the small tributaries in this area, and also the cultivation of yams as Handy (1972) noted. Because the *kalana* of ‘Ōla‘a does not extend to the sea, marine resources were not procured by the residents of the region, who would have relied on trade or travel in order to obtain marine resources.

As population density increased through A.D.1600-1700s, so would political competition. This competition, undoubtedly, produced conflict, which led to political exiles and the further expansion into upland areas as these refugees sought asylum in more remote places and hidden lava tubes (Burtchard and Moblo 1994).

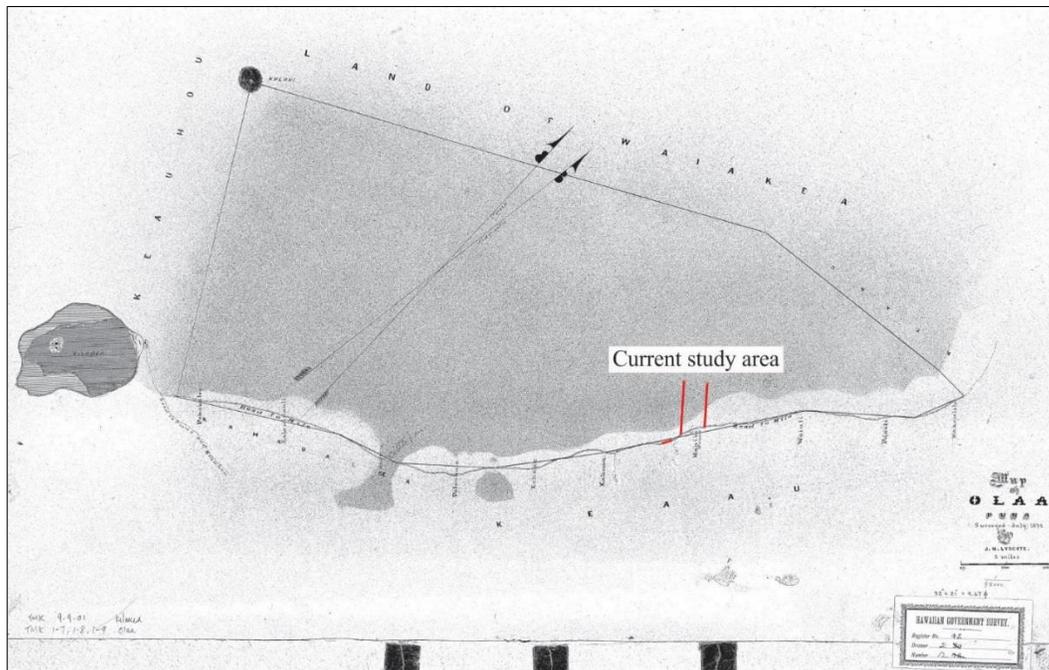


Figure 19. Registered Map 42 of the *kalana* of 'Ōla'a.

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

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

In A.D. 1754, after many bloody battles, Kalani'ōpu'u, the *ali'i 'ai moku* of Ka'ū, defeated his main rival Keaweopala in South Kona and declared himself ruler over all of the island of Hawai'i (Kamakau 1992:78). Kalani'ōpu'u was a clever and able chief, and a famous athlete in all games of strength, but according to Kamakau (1992) he possessed one great fault, he loved war and had no regard for others' land rights. According to Barrère (1959), the chiefs of the Puna District did not figure prominently into the Precontact political strife and turmoil on Hawai'i Island. Barrère writes:

Puna, as a political unit, played an insignificant part in shaping the course of history of Hawaii Island. Unlike the other districts of Hawaii, no great family arose upon whose support one or another of the chiefs seeking power had to depend for his success. Puna lands were desirable, and were

eagerly sought, but their control did not rest upon conquering Puna itself, but rather upon control of the adjacent districts, Kau and Hilo. (Barrère 1959:15)

History After Contact

The arrival of Western explorers in Hawai‘i signified the end of the Precontact Period, and the beginning of the Historic Period. With the arrival of foreigners, Hawai‘i’s culture and economy underwent drastic changes. Demographic trends during the late Proto-Historic Period/early Historic Period indicate population reduction in some areas, due to war and disease, yet increase in others, with relatively little change in material culture. At first there was a continued trend toward craft and status specialization, intensification of agriculture, *ali‘i* controlled aquaculture, the establishment of upland residential sites, and the enhancement of traditional oral history (Kirch 1985; Kent 1983). The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners very quickly introduced the concept of trade for profit, and by the time Kamehameha I had conquered O‘ahu, Maui and Moloka‘i, in 1795, Hawai‘i saw the beginnings of a market system economy (Kent 1983). Some of the work of the commoners shifted from subsistence agriculture to the production of foods and goods that they could trade with early visitors. Introduced foods often grown for trade with Westerners included yams, coffee, melons, Irish potatoes, Indian corn, beans, figs, oranges, guavas, and grapes (Wilkes 1845). Later, as the Historic Period progressed, Kamehameha I died, the *kapu* system was abolished, Christianity established a firm foothold in the islands, and introduced diseases and global economic forces began to have a devastating impact on traditional life-ways in the Hawaiian Islands. This marked the end of the Proto-Historic Period and the end of an era of uniquely Hawaiian culture.

The Arrival of Captain James Cook and the End of Kalani‘ōpu‘u’s Reign (1778-1782)

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

On February 4th, Cook set sail from Kealahou Bay, but a storm off the Kohala coast damaged the mast of the *H.M.S. Resolution*, and both ships were forced to return to Kealahou to make repairs. With Cook’s return many of the inhabitants of Kealahou began to doubt that he was actually the physical manifestation of Lono (Kamakau 1992). On February 13th, several natives were discovered stealing nails from the British ships. They were fired upon by the crew, and a chief close to Kalani‘ōpu‘u named Palea was knocked down, and his canoe taken. That night one of Cook’s boats was stolen, and the following morning Cook set ashore at Ka‘awaloa with six marines to ask Kalani‘ōpu‘u for its return. Kalani‘ōpu‘u, however, denied any knowledge of the theft; Cook decided to hold the chief captive until the boat was returned (Kamakau 1992). When Cook tried to seize Kalani‘ōpu‘u, however, a scuffle ensued and Cook was killed (along with four of his men and several natives) there on the shores of Ka‘awaloa, struck down by a metal dagger. When Captain Cook fell, the British ships fired cannons into the crowd at the shore and several more natives were killed. Kalani‘ōpu‘u and his retinue retreated inland, bringing the body of Cook with them.

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

...the SE sides of the districts of Opoona & Kaoo [Puna and Ka‘ū]. The East part of the former is flat, covered with Coco nut trees, & the land far back is of a Moderate height. As well as we could judge this is a very fine part of the Island, perhaps the best. Terreeoboo [Kalani‘ōpu‘u] has one of his residences here.

On the SW extremity of Opoona the hills rise abruptly from the Sea side, leaving but a narrow border, & although the sides of the hills have a fine Verdure, yet they do not seem Cultivated, & when we sailed pretty near & along this end of Opoona, we did not observe that it was equally

Populous with the Eastern parts; before we reachd the East point of the Island, & all along this SE side the snowy mountain calls Roa (or extensive) [Mauna Loa] is very conspicuous. It is flattish at the top or makes what we call Table land... (Beaglehole 1967:606)

After the departure of *H.M.S. Resolution* and *Discovery*, Kalani'ōpu'u moved to Kona, where he surfed and amused himself with the pleasures of dance (Kamakau 1992). While he was living in Kona, famine struck. Kalani'ōpu'u ordered that all the cultivated products of that district be seized, and he then set out on a circuit of the island. Kalani'ōpu'u first went to Hinakahua in Kapa'au, North Kohala where he amused himself with "sports and games such as hula dancing, *kilu* spinning, *maika* rolling, and sliding sticks" (Kamakau 1992:106). During his stay in Kohala, around 1780, Kalani'ōpu'u proclaimed that his son Kiwala'ō would be his successor, and he gave the guardianship of the war god Kūka'ilimoku to Kamehameha (Fornander 1996; Kamakau 1992). It was during his time in Kohala that an uprising, led by a highly esteemed chief of Puna named Imakakoloa, occurred. Upon hearing of the uprising, Kalani'ōpu'u immediately went to Hilo to quell the rebellion.

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

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

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

While the rebel Puna chief was sought, Kalani'ōpu'u "went to Ka-'u and stayed first at Punalu'u, then at Waiohinu, then at Kama'oa in the southern part of Ka-'u, and erected a heiau called Pakini, or Halauwailua, near Kama'oa" (Kamakau 1992:108). Imakakoloa was eventually captured and brought to the *heiau*, where Kiwala'ō was to sacrifice him. "The routine of the sacrifice required that the presiding chief should first offer up the pigs prepared for the occasion, then bananas, fruit, and lastly the captive chief" (Fornander 1996:202). However, before Kiwala'ō could finish the first offerings, Kamehameha, "grasped the body of Imakakoloa and offered it up to the god, and the freeing of the tabu for the heiau was completed" (Kamakau 1992:109). Upon observing this single act of insubordination, many of the chiefs believed that Kamehameha would eventually rule over all of Hawai'i. After usurping Kiwala'ō's authority with a sacrificial ritual in Ka'ū, Kamehameha retreated to his home district of Kohala.

The Rule of Kamehameha I (1782-1819)

After Kalani'ōpu'u's death in April of 1782, several chiefs were unhappy with Kiwala'ō's division of the island's lands, and civil war broke out. Kiwala'ō, Kalani'ōpu'u's son and appointed heir, was killed at the battle of Moku'ōhai, South Kona in July of 1782. Supporters of Kiwala'ō, including his half-brother Keōua and his uncle Keawemauhili, escaped the battle of Moku'ōhai with their lives and laid claim to the Hilo, Puna, and Ka'ū Districts. According to I'i (1963) nearly ten years of almost continuous warfare followed the death of Kiwala'ō, as Kamehameha endeavored to unite the Island of Hawai'i under one rule and conquer the islands of Maui and O'ahu. Keōua became Kamehameha's main rival on the Island of Hawai'i, and he proved difficult to defeat (Kamakau 1992). Keawemauhili would eventually give his support to Kamehameha, but Keōua never stopped resisting. Around 1790, in an effort to secure his rule, Kamehameha began building the *heiau* of Pu'ukoholā in Kawaihae, which was to be dedicated to the war god Kūka'ilimoku (Fornander 1996).

Unable to defeat Keōua in battle, Kamehameha resorted to trickery. When Pu'ukoholā Heiau was completed in the summer of 1791, Kamehameha sent his two counselors, Keaweheulu and Kamanawa, to Keōua to offer peace. Keōua was enticed to the dedication of the Pu'ukoholā Heiau by this ruse, and when he arrived at Kawaihae, he and his party were sacrificed to complete the dedication (Kamakau 1992). The assassination of Keōua gave Kamehameha undisputed control of Hawai'i Island by 1792 (Greene 1993). It is widely thought that Keōua knew the likely outcome

of his visit to Pu‘ukoholā Heiau, but sacrificed himself anyway to spare the people of Ka‘ū further bloodshed.

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

Puna-‘Ōla‘a and the Current Study Area During the Precontact and Early Historic Periods

The name ‘Ōla‘a connotes sacredness (its root being “*la‘a*” meaning sacred, holy, set apart or reserved as for sacred purposes; Pukui and Elbert 1986), and in native tradition it is a land famed for its sacred spaces, forests, birds, and *olonā* (*Touchardia latifolia*) resources (Maly and Maly 2004). Maly and Maly (2004:6) translate an ancient chant in the collection of Ho‘ohila Kawelo (Kepā Maly, curator) that tells of the relationship between men and birds in the uplands of ‘Ōla‘a:

Ka Uka holo kia ahi manu ‘Ōla‘a	The birds fly like flaming darts to the uplands of ‘Ōla‘a,
I pa e noe ka uahi noe i ka nahele,	Where the mist and smoke darken the forest,
Nōhenohea ka makani ‘ūhau pua,	Spread out by the breeze which lays out the blossoms,
He pua ‘oni ke kanaka, he mea laha ‘ole...	Man is like a flower, roving about, something that is irreplaceable...

Theodore Kelsey, a historian born in Hilo in the late 1800s, recorded that ‘Ōla‘a was a land of bird catchers (Maly and Maly 2004). In 1921, many of the traditional bird catching techniques specific to ‘Ōla‘a and the Hilo area were related to him by an elder Hawaiian man named Rev. Henry B. Nālimu, who was born in Hilo in 1835. The techniques described included snaring or trapping birds on branches or *lehua* blossoms using snares, nets, or bird lime made from breadfruit sap and *kukui* (*Aleurites moluccanus*) nut. In these accounts, the birds that were collected for their feathers were not killed and eaten, but the needed feathers were plucked, and the birds were released (Maly and Maly 2004). The feathers were used to make *lei*, cloaks, and other emblems of Hawaiian royalty. The ‘ō‘ō, ‘i‘iwi, ‘ō‘ū and ‘akakane were the specific birds mentioned in the accounts of Rev. Nālimu.

Bird catching also figures in the tradition of Pikoiaka‘alalā, written by S. M. Kauai and printed in the Hawaiian language newspaper *Ku Okoa* between December 16, 1865 and March 10, 1866 (translated by Kepā Maly), provides detailed narratives describing customary practices in the upland forests of ‘Ōla‘a (in Maly and Maly 2004:8-19). Pikoiaka‘alalā was a *kūpua* (a being with supernatural powers and the ability to change body forms) who was skilled at the Hawaiian art of *pana pua* (shooting with a bow and arrow). He was born to ‘Alalā and Koukou on the Island of Kaua‘i. In this tradition, set in the 1500s, Pikoiaka‘alalā travels the islands competing against other archers, shooting rats and birds from great distances. He arrives on the island of Hawai‘i at a time when Keawenui a ‘Urni, the chief of Hawai‘i Island, is in need of help getting rid of two supernatural ‘*elepaio* birds that are continually interrupting the work of canoe makers at a clearing in the uplands of ‘Ōla‘a called Kalehaupueo. The birds perched on a large *koa* tree and when they heard the striking of the adzes shaping the canoes they would fly down and call out: “Say Keawenui a ‘Ulu! Leave it behind, it is a bad canoe, a canoe that will shatter, a rotted hull” (Maly and Maly 2004:10). Keawenui a ‘Umi had already enlisted the help of Mainele, a champion archer from the island of O‘ahu, and promised him the hand of his beautiful daughter Keakalaulani if he could get rid of the birds. Mainele was boastful of his skill, but was unable to kill the two birds. Pikoiaka‘alalā, in the meantime, befriended Waiākea, a steward of the chief, and unbeknownst to Keawenui a ‘Umi took up residence with him in Hilo. While staying in Hilo, Pikoiaka‘alalā shoots many birds in the uplands of ‘Ōla‘a that feed on the *lehua* blossoms (including the ‘Ō‘ō (*Moho nobilis*), ‘I‘iwi (*Drepanis coccinea*), ‘Ō‘ū (*Psittirostra psittacea*), ‘Akakane (*Coccyzus coccineus*), ‘Amakihi (*Chlorodrepanis virens*), and the *Mamo* (*Drepanis pacifica*)), and gives them to the chief for food. When Mainele fails to kill the supernatural ‘*elepaio* birds, Pikoiaka‘alalā sets out for Kalehaupueo, and on the way he stops at a trailside resting place called Mahina‘akaaka along the trail that ascends to ‘Ōla‘a. There he shoots a large rat (*iole*) named ‘Aki‘akia ‘iole, and according to S. M. Kauai ‘Aki‘akia‘iole is now one of the storied places of ‘Ōla‘a (Maly and Maly 2004). Further along the trail he stops at a place called Makaulele where he sees the perfect fullness of the red *lehua* and white *lehua* blossoms, and he gathers the fragrant *palai* (*Microlepia setosa*) and made *luali‘i* (*F. angusta*). Upon reaching Kalehaupueo, Pikoiaka‘alalā kills the two birds with a single arrow while Waiākea strikes down Mainele and

his four companions. Keawenui a 'Umi then tells Pikoiaika'alalā that he can wed his daughter, and that he will inherit his kingdom.

Other folklore traditions of the 'Ōla'a region focus on the area's abundance of water. Beckwith (1970) writes of the brother and sister gods Kūka 'ōhi'alaka and Kauakuahiwi, who took human form and came to Hawai'i from Kahiki (the ancestral homeland) and settled in Kea'au and 'Ōla'a respectively. Kūka 'ōhi'alaka (Kū) lived at the shore of Kea'au with his wife, and Kauakuahiwi lived in the uplands of 'Ōla'a with her husband and children. Kū's wife was stingy, however, and denied Kauakuahiwi and her family fish from the ocean. Unable to eat, Kauakuahiwi turned her family into rats, and herself into a spring of water. When Kū heard of this he went to the spring and turned himself into an 'ōhi'a tree. The spring and tree are one of the storied places of 'Ōla'a, said to be along an ancient trail to the volcano, near the thirteen-mile marker of the Old Volcano Road (Maly and Maly 2004), roughly 2 mile northeast of the current study area. In an interview conducted by Takamoto (1976), Jack Suwa describes the story of two wells that are located in nearby Kurtistown. The wells contained drinking water but were once used for washing, a defilement of ancient Hawaiian sanitary practices and religious codes. As a result of this failure to abide by the proper protocol, the drinking water disappeared and only returned once a *kahuna* (priest) purified and blessed the wells. At the time of the interview the wells reportedly still contained fresh water.

The collection and cultivation of *olonā* and *māmaki* (*Pipturus* sp.) within the forested regions of 'Ōla'a was practiced in more traditional times. According to Ellis (1965) the people of 'Ōla'a were famed for their fine *māmaki*, which could be processed to make a durable barkcloth and highly valuable cordage. The forests of 'Ōla'a were also exploited for sandalwood (*Santalum paniculatum*) during the early decades of the nineteenth century. On visiting 'Ōla'a in 1829, Chaplain Charles Stewart of the U.S Vincennes described Kinai, the chief of the *kalana*, as "absent, some thirty or forty miles, superintending the cutting of sandal wood" (Stewart 1831:80). Handy (1972) also describes the practice planting banana, ti and taro as well as yams along streams and trails in the forest to provide a supplemental food source in times of drought or crop failure.

Written accounts describing lands in the vicinity of 'Ōla'a are contained in the journals, letters, and articles of many of the early European visitors to Hawai'i Island (see Maly and Maly 2004). These accounts typically describe the trailside lands as the visitors passed through the area on their way between Hilo and Kīlauea or Mauna Loa. The most traveled route between Hilo and Kīlauea was the Volcano Trail. McEldowney (1979), citing several historical sources (Pickering 1840-41; Bloxam 1925; Macrae 1922; Douglas 1914; Stewart 1970; Ellis 1963), describes this trail as it would have appeared during the first part of the nineteenth century. In the vicinity of the current project area, McEldowney describes the trail as follows:

...From here [Kurtistown vicinity] to Mountain View or just beyond the "halfway house," the trail crossed on to an extensive Kīlauea pahoehoe flow and continued along its western margin, which abutted mostly ash-covered Mauna Loa flows. The route of this old trail basically corresponds to the 'Ōla'a-Kea'au boundary line on the current U.S.G.S. maps. Descriptions of scattered, stunted trees, mixed with ferns, grasses, 'ōhelo (*Vaccinium* sp.), and low shrubs, sound typical of pioneer or early successional plant communities. When compared to the previous portion of the trail, ferns became more dominant, *pia* disappeared, and scattered clumps of woods, probably small *kīpūkas*, replaced the groves.

...the woods started one or two miles SE and NW of the path, giving it the appearance of an unwooded corridor. Several villages, as well as scattered huts along the forest edge, were reported without much detail other than the presence of fertile soil and a burial cave marked with poles. Most describe leaving this open stretch somewhere beyond the "halfway house" by entering a thick forest, which Pickering [1840-41] placed at 1,500 ft elevation. (McEldowney 1979:20)

Registered Map 42 (see Figure 19) includes several placenames indicated along the Old Volcano Trail. Near the current study area, the map depicts a cluster of houses and the name "Mahiki" situated on either side of the trail (Figure 20). The cluster of houses is located between the South Lauko and South Pszyk Road study corridors. This location corresponds well with the location of the 'Ōla'a chief Kinai's residence described by C. S. Stewart (1831:80):

We accomplished fourteen miles just after four o'clock; and finding excellent accommodations for the night, at that distance, determined to sleep before proceeding farther. The establishment—consisting of three houses, situated a short distance from the road, on the borders of a fine tract of land, having very much the appearance of a large plantation of intermingled arable and meadow grounds at home and just at the edge of a fine forest running from the sea to the interior—belongs to Kinai, the head man of the thinly inhabited district of Ora ['Ōla'a].

Stewart noted that Kinai had prospered since the advent of the sandalwood trade: “Kinai’s house had separate rooms covered with native cloth and mats probably from the trees and plants of the woods, books in the native tongue bound and wrapped in native cloth and slate, furniture, chintz, etc.” (Olson, 1974:76-77 in Takamoto 1976). Economic prosperity derived from sandalwood drastically changed the lifestyle of the chief of ‘Ōla‘a, and in turn would have impacted the entire commerce of the *ahupua‘a* and its residents. The wealth of natural resources indicated above may explain Kamehameha III’s decision to keep ‘Ōla‘a as crown lands during the Great *Māhele*.



Figure 20. Portion of Registered Map 42 showing the “Road to Hilo” with the current study corridors added in red.

Legacy of the Great Māhele (1848-1873)

By the middle of the nineteenth century the ever-growing population of Westerners in the Hawaiian Islands forced socioeconomic and demographic changes that promoted the establishment of a Euro-American style of land ownership. Beginning in 1848, the *Māhele*, traditionally a process by which lands were divided and redistributed, became the vehicle for determining ownership of native lands. During the *Māhele* of 1848, land interests of the King (Kamehameha III), the high-ranking chiefs, and the low-ranking chiefs, the *konohiki*, were defined, and all lands were placed in one of three categories: Crown Lands (for the occupant of the throne), Government Lands, and *Konohiki* Lands. The chiefs and *konohiki* were required to present their claims to the Land Commission to receive awards for lands provided to them by Kamehameha III. They were also required to provide commutations to the government in order to receive royal patents on their awards. To expedite the work of the Land Commission, these lands were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be surveyed (Chinen 1961:13). As a result of the *Māhele* of 1848, the *kalana* of ‘Ōla‘a was distributed to Kaunuohua, who relinquished the land to King Kamehameha III (Soehren 2005). The king then retained ‘Ōla‘a as Crown Land. Kea‘au was awarded to Lunalilo as *‘apana* 16 of Land Commission Award 8559-B.

All lands awarded during the *Māhele* were subject to the rights of the native tenants therein. Native tenants of the lands that were divided up among the Crown, *Konohiki*, and Government could claim, and acquire title to, *kuleana* parcels that they actively lived on or farmed. The Board of Commissioners oversaw the program and administered the *kuleana* as Land Commission Awards (LCAw.). In Puna, however, very few claims for *kuleana* were submitted. Maly (1998:37) notes that, with the exception of the islands of Kaho‘olawe and Ni‘ihau, no other land division of comparable size, had fewer claims for *kuleana* from native tenants than the district of Puna. One Land Commission

claim was made for a *kuleana* within ‘Ōla‘a, but it was not awarded (Maly and Maly 2004).

In conjunction with the *Māhele* of 1848, the King authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the “Enabling Act,” which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* should be set aside and sold as grants. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the *Māhele*, to purchase lands of their own. Despite the stated goal of the grant program, in reality, many of the Government Lands were eventually sold or leased to foreigners. The Enabling Act set a precedence for the legal framework within which ‘Ōla‘a would be divided into homestead lots and sold as grants after the overthrow of the monarchy.

In 1862, the Commission of Boundaries (Boundary Commission) was established to legally set the boundaries of all the *ahupua‘a* that had been awarded as a part of the *Māhele*. In 1873, the Boundary Commission began conducting hearings to determine the boundaries of lands awarded to *ali‘i*, *konohiki*, and foreigners during the *Māhele*. The primary informants for the boundary descriptions were old native residents of the lands, many of whom had also been claimants for *kuleana* during the *Māhele*; the information was primarily collected between 1873 and 1885. The testimonies were generally given in Hawaiian and transcribed in English as they occurred. The testimonies concerning ‘Ōla‘a and the neighboring lands of Kea‘au, Keauhou, and Waiākea contain numerous references to named places along the boundaries of ‘Ōla‘a, including groves of trees, ponds, trails, roads, old villages, and peoples’ houses (see Maly and Maly 2004:42-68). One of these major landmarks was the Old Volcano Trail (at the time called “the Volcano Road”), which formed the boundary between ‘Ōla‘a and Kea‘au and facilitated travel between Hilo, Kea‘au and ‘Ōla‘a as well as to the greater Puna district. One boundary commission testimony described the road:

Puaa^K. Sworn

I live on Ponahawai, was born in Kau at time of Keouamua [one of Kamehameha I’s battles]. I came to Keaau and lived there two years when I was a boy. Have lived on Waiakea a great many years, in 1860 I returned to Keaau and had charge of the land for five years. While in charge, I heard what some of the boundaries were, and went and saw them. . . . have always been told that the road from Hilo is between Keaau and Olaa, until you get to Makaualele, below Kahopuaku’s houses to a place called Kilohana where oranges are growing. Thence the boundary of Keaau and Olaa leaves the Volcano Road and runs *mauka* above these orange trees, thence to an *ohia* grove called Puaaeahu, thence to Waiaele, a place in the woods on the old road to Olaa. I have only been there once, Olaa is on the *mauka* side of this place and Keaau is on the *makai* side, and Waiakea on the Hilo side at Mawae. (Volume A No. 1:193-195)

Some of the earliest historical records of the ‘Ōla‘a region come from accounts of missionaries and other travelers who wrote of their stay in Mountain View as they made their way to volcano along the trail. Accounts differ greatly from source to source. In 1837, Laura Fish Judd stopped in Mountain View on her way to Volcano and described an uncomfortable night in a hut which had “neither window nor door, throughout the night natives whispered and talked, fleas bit, and at midnight a huge, black hog unsuccessfully tried to enter the house” (Judd 1928:50 in Takamoto 1976). In contrast, Frank Vincent commented favorably on Mountain view describing the drinking water, food, beds and the special *lomi-lomi* massage he received as a weary traveler. An anonymous writer in Takamoto’s essay also describes a *tī* leaf swamp in Mountain View: “to the manufactures of okolehao (Hawaiian moonshine), this might be the most attractive part of the journey, for there is ti-root enough here to manufacture liquor sufficient to kill off the whole population of the kingdom” (Our Trip to Kilauea, 1860 quoted in Takamoto 1976).

The alignment of the Old Volcano Trail was mapped as early as 1874 by John M. Lydgate who referred to the Old Volcano Trail as “Road to Hilo” (Figure 20). The trail appears as a meandering line that straddled the *ahupua‘a* of ‘Ōla‘a and Kea‘au and strays in and out of the boundaries between the two (Rowland 2003). A letter addressed to H.A.P Carter, the Minister of Interior from J.F. Jordan, who in 1881 acted as the Road Supervisor for the Hilo and Puna districts, references the appearance and construction of the Volcano trail as likened to the Puna Road:

Your excellency are aware of the fact that the Puna Road, *like the Volcano Road*, was built of coarse stone with a small sprinkle of gravel which had to be carried a long ways, put in the middle of the trail. (Jordan 1881 in Rowland 2003, emphasis added)

Land Use after the *Māhele*

Life for many in Hawai‘i changed rapidly during the early Historic Period. Writing in 1902, Dr. Nicholas Russel (who

owned several grant parcels in ‘Ōla‘a, including seven in the vicinity of the current study area) described these changes:

Some fifty years ago about 1,000 natives were living on the margin of the virgin forest and Pahoe-hoe rock along the trail connecting Hilo town with the crater Kilauea, island of Hawai‘i, in a spot corresponding to the present 22-mile mark of the Volcano road. Making of “kappa” out of “mamake” bark, of olona fiber for fishing nets out of *Touchardia latifolia*, and capturing “O-U” birds for the sake of the few precious yellow feathers under the wings, of which luxurious royal garments were manufactured—those were the industries on which they lived.

For the reasons common to all the native population of the islands, viz., the introduction of new germs of disease—syphilis, leprosy, tuberculosis, smallpox etc.—this settlement gradually dwindled away, and in 1862 the few surviving members migrated to other localities. At present only patches of wild bananas, taro, and heaps of stones scattered in the forest indicate the places of former habitation and industry. I have heard, however, that as late as the seventies Kalakaua still levied a tax on olona fiber he sold at high prices to Swiss Alpine clubs, who valued it for its light weight and great strength. (quoted in Smith 1902:310)

In the decades following the *Māhele*, economic interests in the region swiftly changed from traditional Hawaiian subsistence farming and regional trading networks to the gathering or growing of export cash crops. For example, in 1866, two requests were made of J. O. Dominis, agent of Crown Lands, for the lease of ‘Ōla‘a lands in order to gather *pulu* (fiber) from the *hapu‘u* (tree fern). The first request came from Thomas Spencer (April 23, 1866), who also wished to run cattle on the land, and the second from two native applicants, Kaaukai and Kaaua (September 18, 1866), who wished only the “*pulu* privileges...Birds & *awa*, to be reserved” (Maly and Maly 2004:42). It is not clear if either request was granted. More successful ventures included coffee, tobacco, sugar, timber, and pineapple, and also dairy farming and cattle ranching. During this period, lands surrounding the current study area were initially planted in coffee, a crop which ultimately failed to perform satisfactorily

A critical step toward developing agriculture in ‘Ōla‘a was the creation of a new road between Hilo and Kilauea located *mauka* of the Old Volcano Trail. Despite the network of Precontact trails that covered the island, Hawai‘i lacked a comprehensive system of interior roads for overland travel before 1846. In that year, the Kingdom established the Department of the Interior and the office of Superintendent of Internal Improvements (the forerunner of Public Works) to oversee the construction of piers, harbors, government buildings, roads, and bridges (MKE and Fung 2013:6). The primary goal of early road-building in Hawai‘i was to modernize infrastructure and create access to commercial agricultural lands, but other commercial endeavors spurred road development as well (Duensing 2015). Kilauea had become a viable tourist destination in the 1860s, and despite increasingly comfortable accommodations near the crater, most visitors stayed only a day or two. Poor roads to the volcano were thought to deter visitors from staying longer. Tourists consistently derided the condition of the Old Volcano Trail, leaving numerous entries in the Volcano House register that complain about the rains, mud, and obstacles that stretched travel times to seven hours or more. The increased tourism, however, spurred the development of new routes from Hilo, Keauhou, and Pāhala in the 1880s. In 1888, the government appropriated \$30,000 for a new carriage road between Hilo and Volcano that became today’s Volcano Highway (Duensing 2015). Work on the road began in 1890 using mainly prison labor, and in September of 1894 the entire road was completed.

As the Volcano Road through ‘Ōla‘a was being built, the Crown made a large portion of potential agricultural lands in ‘Ōla‘a available for lease and homesteading. Three hundred eighty-five ‘Ōla‘a Reservation lease lots (Figure 21) were created *mauka* and *makai* of the Volcano Road, as well as an additional forty homestead. The leasehold lots near the current study area generally comprised fifty acres, although larger lots were created along the ‘Ōla‘a-Kea‘au boundary. They were available for thirty-year leases for at just under \$1.30 per acre, with incentives for clearing and planting that included waiver of the rent fee for the first three years (Thrum 1894). The lot plan included thirty-foot wide roads that branched off of the then new Volcano Road to connect with the Old Volcano Trail, at least on paper. The rights-of-way for South Lauko Road and South Pszyk Road were among those created in 1892. The earliest of these leases in ‘Ōla‘a were made for coffee cultivation (McEldowney 1979; McGregor 2007).

Commercial agriculture was enabled by land tenure changes that were implemented after the overthrow of the Monarchy in 1893. Article 95 of the Republic’s constitution expropriated the Crown lands from the deposed Queen, and the 1895 Land Act reclassified Crown lands and Government lands into a single category of “Public Lands.” This act repealed much of the previous land-related laws, and made some Public Lands available to citizens of the Republic through homestead leases, right of purchase leases, and cash freehold agreements. Between the overthrow and

Annexation, 46,594 acres of former Crown Lands were sold by the government (Van Dyke 2008). As Kamana Beamer (2008) notes, the new land laws were intended to encourage immigration of Euro-American settlers and the expansion of commercial agriculture. For example, an article in the Hawaiian Gazette from April 26, 1898:

The keen inquiry for coffee and other lands since carrying into the operation the Land Act of 1895—the great increase in numbers of those who have flocked into this country since that time, men of means and industry seeking to avail themselves of the liberal terms of our Land Laws has greatly reduced the available acreage of the Public Lands. (quoted in Beamer 2008:279)

Sections 80 through 85 of the new land law were written specifically for the disposition of coffee lands in ‘Ōla‘a. Provisions were made for individuals and corporations holding a thirty-year Crown lease to convert their leases to a Right of Purchase Lease or Freehold Agreement, also for three corporations already holding leases to patent their land holdings. By the turn of the century, the land in ‘Ōla‘a *makai* of the Volcano Road was a patchwork of large grant parcels planted in coffee. Along the South Lauko Road and South Pszyk Road study area corridors, nine properties, comprising sixteen of the original lease lots, were purchased as grants between 1896 and 1899 (Figure 22, Table 2). The coffee industry in ‘Ōla‘a, however, was short-lived, as the coffee varieties that were planted there failed to thrive. By the spring of 1900, major changes were underway that would lead to over a century of sugar cultivation.

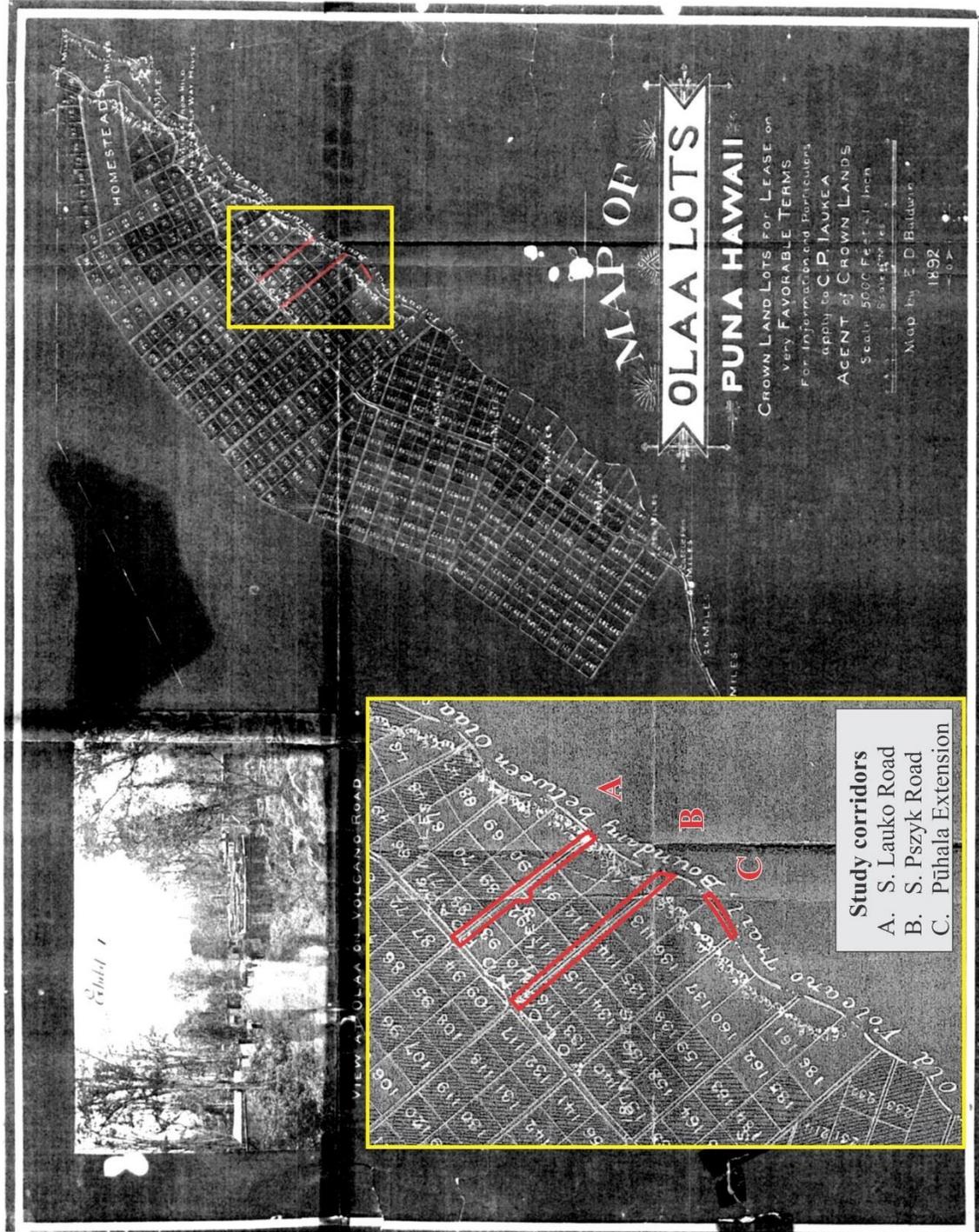


Figure 21. Registered Map No. 1665a, Map of Olaa Lots made available for lease in 1892.

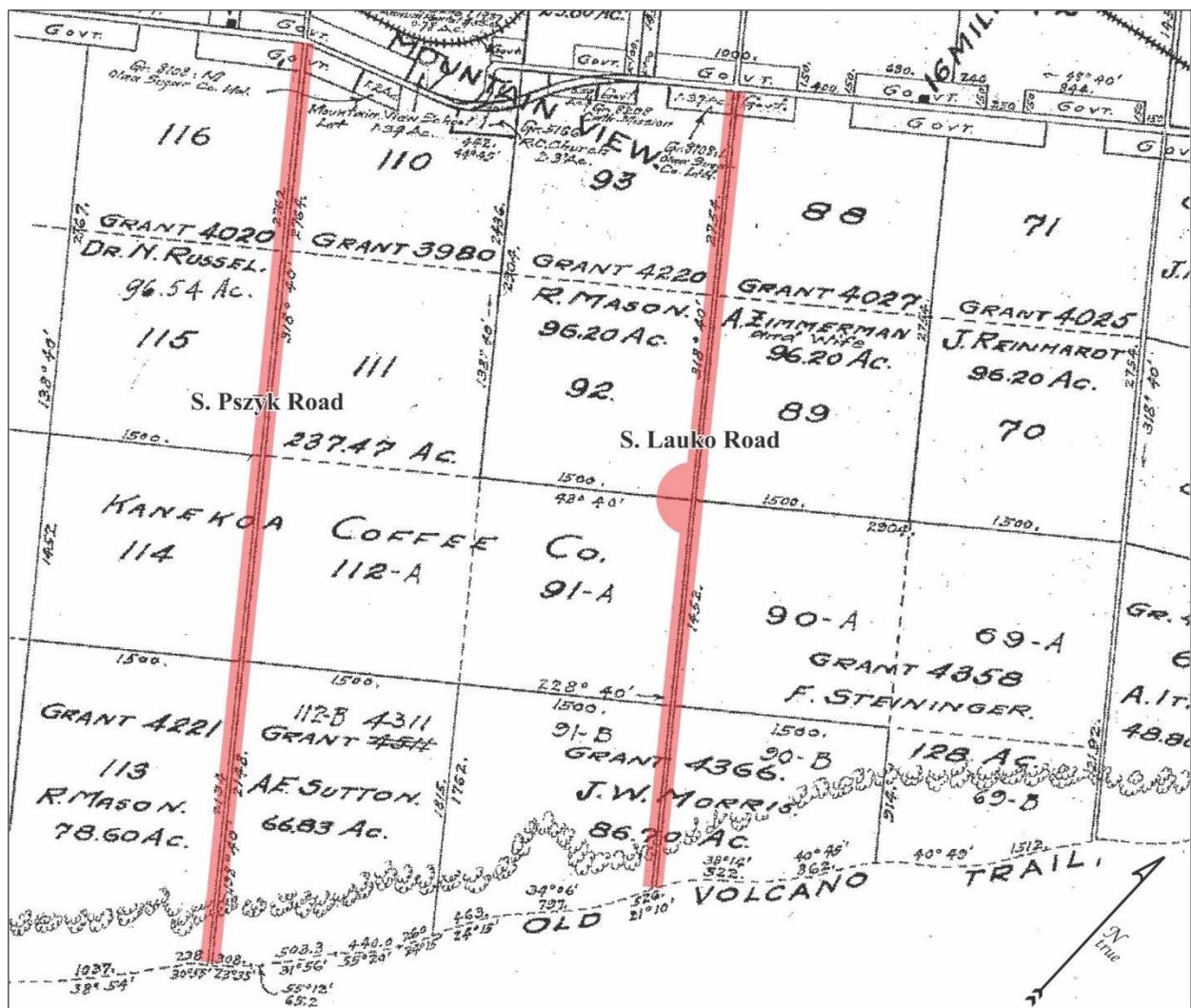


Figure 22. Portion of Plat Map 854 depicting post-1895 Grants, study area corridors highlighted red.

Table 2. Grant parcels adjacent to the current study area corridors.

Grant No.	Purchaser	Year Purchased	Current TMK Parcel(s)*	Study Corridor
3980	The, Kanekoa Coffee Co., LTD	1896	109,107,101	S. Pszyk, S. Lauko
4020	Dr Nicholas Russel	1897	001, 034, 035, 036, 037, 038, 039	S. Pszyk
4027	A. and A. Zimmerman	1897	003	S. Lauko
4220	R. Mason	1898	098,102	S. Lauko
4221	R. Mason	1898	108	S. Pszyk
4258	J. R. Hall	1898	008	Pūhala Road
4311	Albert. E Sutton	1899	006	S. Pszyk
4358	F. Steininger	1899	004	S. Lauko
4366	J. W. Morris	1899	005,100	S. Lauko

*TMK parcels preceded by Island, Zone, Section, and Plat prefix (3) 1-8-004:

The Oloo Sugar Company, 1899-1984

Charles Baldwin (1908:78-79) optimistically described ‘Oloo’a’s agricultural potential:

The Oloo section of Puna is a fine agricultural region, but owing to the want of a market, small truck farming does not pay. However, vanilla, tobacco, pineapples, and bananas grow well; and the rubber industry is destined to be an important one, as the climate is particularly well adapted to the growth of rubber trees. The cultivation of coffee in Oloo has been abandoned, as the trees did not thrive.

All the lower lands of Oloo are planted with the cane of the Oloo Sugar Company. This is one of the largest plantations on Hawaii, and occupies nearly all of the available cane land of the Puna district.

The Oloo Sugar Company was incorporated on May 3, 1899. With a \$5,000,000 investment, the promoters purchased 16,000 acres in fee simple land and nearly 7,000 acres in long leasehold from W.H. Shipman. The plantation fields extended for ten miles along both sides of Volcano Road as well as in the Pāhoa and Kapoho areas of the Puna District. They also purchased 90% of the stock in the adjacent Puna Plantation, adding another 11,000 acres to the holdings. Oloo Sugar Company began as one of Hawai‘i’s largest sugar plantations with much of its acreage covered in trees. Previous to cane, coffee was the primary agricultural crop that was grown in the region, with the purchase of these lands, the coffee was uprooted and cleared for the planting of sugarcane.

On July 1, 1899, active operations began under the management of Frank B. McStocker. In his first report, he stated, “As soon as the planting of the main crop begins, which will be about the month of March [1900], arrangements will be made by which a large portion of the crop will be cared for by laborers on shares.” From this early start of “share planting,” the company branched out into the leasing of land to individuals to raise cane and to making contracts to purchase cane from persons who owned or leased their own land. In most cases, the company carried the financial burden for the planter until he was paid for his cane and then recovered the advances made. Other independent cane farmers lived in their own homes, used their own work animals and tools, and supplied their own fertilizers. In 1935 the plantation housed 5,648 workers and dependents in 1,086 company-supplied houses distributed among 15 camps or villages (Dorrance and Morgan 2001). In addition, some 230 homesteaders lived and grew cane on family plots. In a system of leases and the above mentioned “share-planting” the majority the lands surrounding the project area road corridors was cultivated with sugarcane that was grown for ‘Oloo’a Sugar Company. On Figure 23, the fields owned by the Oloo Sugar Company in 1917 near the current study area corridors can be seen. The company’s field map (oriented in Figure 23 with north pointing to the lower left) shows Field 4 west (to the right on the map) of what became South Lauko Road. The South Pszyk Road corridor is located between Fields 4 and 5; a privately-held parcel (Grant 4020) borders a portion of the corridor.

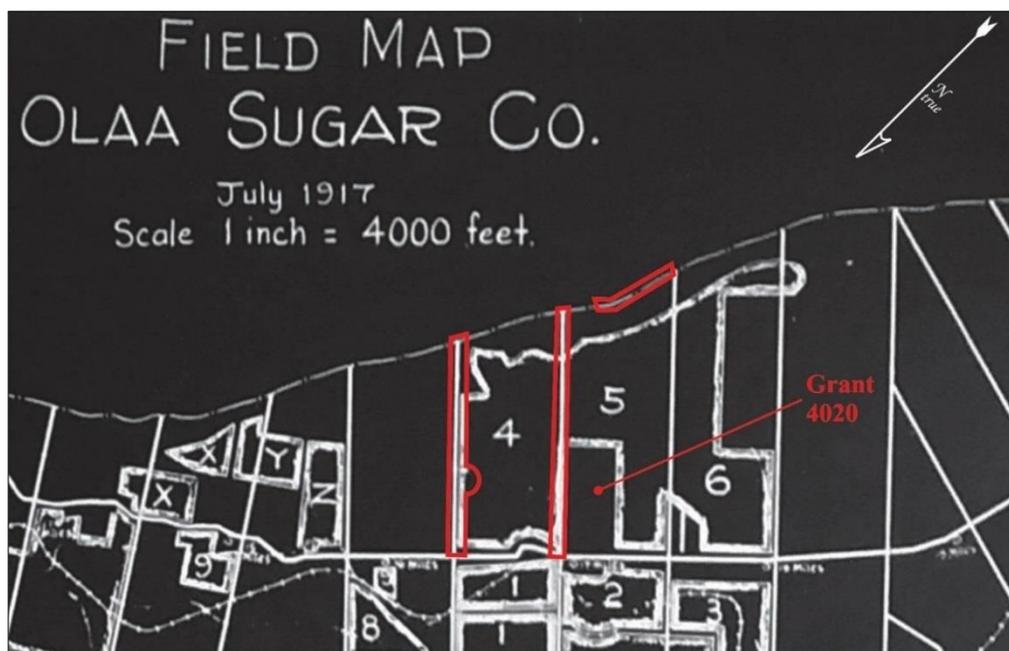


Figure 23. Detail of a 1917 Oloo Sugar Company field map, current study area corridors indicated in red. The town of Mountain View grew with the sugar trade, as immigrant laborers were

imported from Japan, Puerto Rico, and the Philippines to work on the sugar plantation (McGregor 2007). One other immigrant group to come to the ‘Ōla‘a region were Ukrainians. In 1897, the Hawaiian Minister of Foreign Affairs approved a request by H.F Hackfeld and Company (who acted as a recruiting agency for the “Planters Association”) to bring in European laborers for a number of sugar plantations. Between 1897 and 1910, families and individuals from Western Ukraine were brought to Hawai‘i—some of these people were recruited to work for ‘Ōla‘a Sugar Company. Most Ukrainian immigrants in ‘Ōla‘a left for the United States mainland in 1905 and 1906 (Ewanchuk 1986:96), but a few remained. Among those who stayed in Mountain View were Michael and Anna Pszyk. The Pszyks joined Anna’s grandfather, who was employed as a blacksmith. Helen Richardson-Pszyk, a daughter of Michael and Anna Pszyk, described life on their farm in Mountain View, including the construction of what became North Pszyk Road (located outside the current study area):

when the settlers were acquiring homesteads, my parents bought a fifty-acre farm beside that of my Grandfather [Peter Markewicz] and in addition to work on the plantation he began to clear some land and go into developing a small herds of cows... Father built a house of the type built on the plantations for the workers. It had to be raised of the ground for better ventilation. We are still living in it.

As I was told by my parents and as I remember, on the start we were rather isolated—we lived 1 ½ mi. from the highway. To start with my father blazed a path so that they were able to walk out to Volcano road. He then widened it into a trail, but it wasn’t very satisfactory to haul wood to the village for which there was good demand, and take milk and other products. There was a limit what one could haul in a cart. Finally my father approached the council to have them make the trail into a road, but there was little interest in such a project. He, eventually, widened the trail himself and made it into a passable road. Then the council took it over and named it Pszyk Road, and rightly so... (Ewanchuk 1986: 157-158).

The ‘Ōla‘a Sugar Company had many problems throughout its operation, ranging from difficult growing conditions to financial issues. The area was in the wet belt of Hawai‘i amid forests of fern trees and ‘*ōhi‘a* with an average monthly rainfall of 18-30 inches. The wet conditions of ‘Ōla‘a made it difficult to grow sugarcane and the company continuously experimented with finding varieties suitable for the climate. Transporting cane to their mill in what is now the town of Kea‘au was also difficult. The company initially used flumes and portable rail to bring cane from the fields to the Hilo Railroad. For the struggling company, however, the manpower and maintenance costs of these systems proved to be financially draining. Beginning around 1938, the plantation management experimented with other transportation options in the fields, including the use of Athey Wagons pulled by tractors (Olaa Sugar 1939). This year also marked the beginning of a program to build gravel field roads and acquire trucks. Roads were built to service plantation-owned lands as well as fields owned by their contract planters (who were to pay the company back over time). The road-building program was curtailed during 1941 due to a shortage of labor, and then terminated upon the onset of World War II when the United States Engineers commandeered the company’s equipment (Olaa Sugar 1941). By that time, however, sufficient roads had been built to allow almost thirty-nine percent of that year’s crop—all the cane produced in Kapoho, Malama, and Kamaili and large parts of the cane produced in the plantation’s Pāhoa, ‘Ōla‘a, and Mountain View Sections—to be hauled by truck. The manpower and equipment shortages caused by the war paradoxically interrupted the plantation’s conversion to truck hauling while simultaneously stimulating management’s desire to rid itself of portable tracks and flumes. In 1943, the company reported that it was able to resume its road building efforts, and that it planned to add 37.94 miles of road to its existing 512.58 miles across the entire plantation (Olaa Sugar 1944). By the end of 1945, the plantation’s conversion to truck hauling was completed when its final cane roads were built in the Mountain View Section.

The development of Olaa Sugar’s infrastructure created the roads presently located in two of the current study area corridors, but the third, the Pūhala Road Extension corridor, was always located outside of Olaa Sugar’s lands. During the Boundary Commission hearings, the Old Volcano Trail was recognized as marking the boundary between ‘Ōla‘a and Kea‘au. In 1930, W. H. Shipman, Ltd. owned the *ahupua‘a* of Kea‘au, and the company submitted Land Court Application 1053 to fix the boundaries of Kea‘au more precisely than had been done by the Boundary Commission. Surveyor P. E. Arioli and his assistant, Charles L. Murray, that demonstrated that the Old Volcano Trail strayed into Kea‘au, that it had fallen into disuse, and that its alignment would affect some homestead lots that abutted the trail. Plat Map 818 (Figure 24), created during this survey, includes a depiction of the Old Volcano Trail as it existed at the time. It should be noted that as depicted on this map, the Old Volcano Trail meanders in and out of the thirty-foot wide roadway, but mainly stays close to the parcel’s boundary with Kea‘au.

PREVIOUS ARCHAEOLOGICAL STUDIES

Reports on file at the DLNR-SHPD office indicate that seven archaeological studies (Table 3, Figure 25) have been conducted previously within ‘Ōla‘a, and none in Kea‘au near the current study area. No archaeological resources were identified as a result of any of these previous studies, which generally found their study areas to have been previously impacted by extensive sugarcane cultivation or development.

Table 3. Previous archaeological studies.

<i>Author</i>	<i>Year</i>	<i>Location</i>	<i>Study Type</i>
Dye	1976	Mountain View	Reconnaissance
Rosendahl and Walker	1992	Kurtistown	Field Inspection
Haun and Henry	2006	(3) 1-8-08:007	Archaeological Assessment
Haun and Henry	2008	Mountain View	Monitoring
Escott	2008	Mountain View	Field Inspection
Rechtman and Clark	2009	Mountain View	Archaeological Assessment
Rechtman	2008	Mountain View	Archaeological Assessment

In 1976, the Bernice P. Bishop Museum conducted an archaeological reconnaissance study (Dye 1976) in support of flood control improvements in the Mountain View area. Dye’s reconnaissance primarily occurred along North Pszyk Road and Kūlani Road, but included a small portion of the current study’s South Pszyk Road corridor near its intersection with Volcano Highway. Dye noted that much of the land was in sugarcane cultivation at the time of his study, and concluded that no Precontact archaeological features were likely to have survived the intensive planting and harvesting of sugarcane.

In 1992, Paul H. Rosendahl, Ph. D., Inc. conducted a field inspection (Rosendahl and Walker 1992) of a 46.0 acre parcel located in Kurtistown, approximately 7.3 kilometers northeast of the current study area. No historic properties were observed.

In 2006, Haun and Associates conducted an archaeological assessment (Haun and Henry 2006) of a 52.2 acre parcel (TMK: (3) 1-8-08:007) located approximately 4.5 kilometers to the southwest of the current project area. Haun and Henry (2006) noted that the Old Volcano Trail was once the seaward boundary of their parcel, but that no physical remains of that roadway were still extant at the time of the study.

In 2008, Haun and Associates conducted archaeological monitoring (Haun and Henry 2008) for improvements to the Mountain View Elementary School lot (TMK: (3) 1-8-01:007) located on Highway 11 to the east of the current project area. No archaeological resources were observed.

In 2008, Scientific Consulting Services conducted a field inspection (Escott 2008) of a 64.48 acre parcel (TMK: (3) 1-7-17:170) located approximately 3.5 kilometers to the northwest of the South Lauko Road study area corridor. No archaeological resources were observed.

In 2008, Cultural Surveys Hawai‘i conducted archaeological monitoring (Runyon et al. 2008) for cesspool improvements at Mountain View Elementary School. No archaeological resources were observed.

In 2008, Rechtman Consulting, LLC conducted a field inspection (Rechtman 2008) of a roughly 2.3 acre project area located approximately 3.5 kilometers southwest of the South Pszyk Road study area corridor. The study, which was in support of the expansion of the already existing Glenwood Transfer Station, found no historic properties.

In 2009, Rechtman Consulting, LLC conducted an archaeological and limited cultural assessment (Rechtman and Clark 2009) of a 1.287 acre project area in Mountain View approximately 600 meters northeast of the South Lauko Road study area corridor. No archaeological resources of any kind were observed.

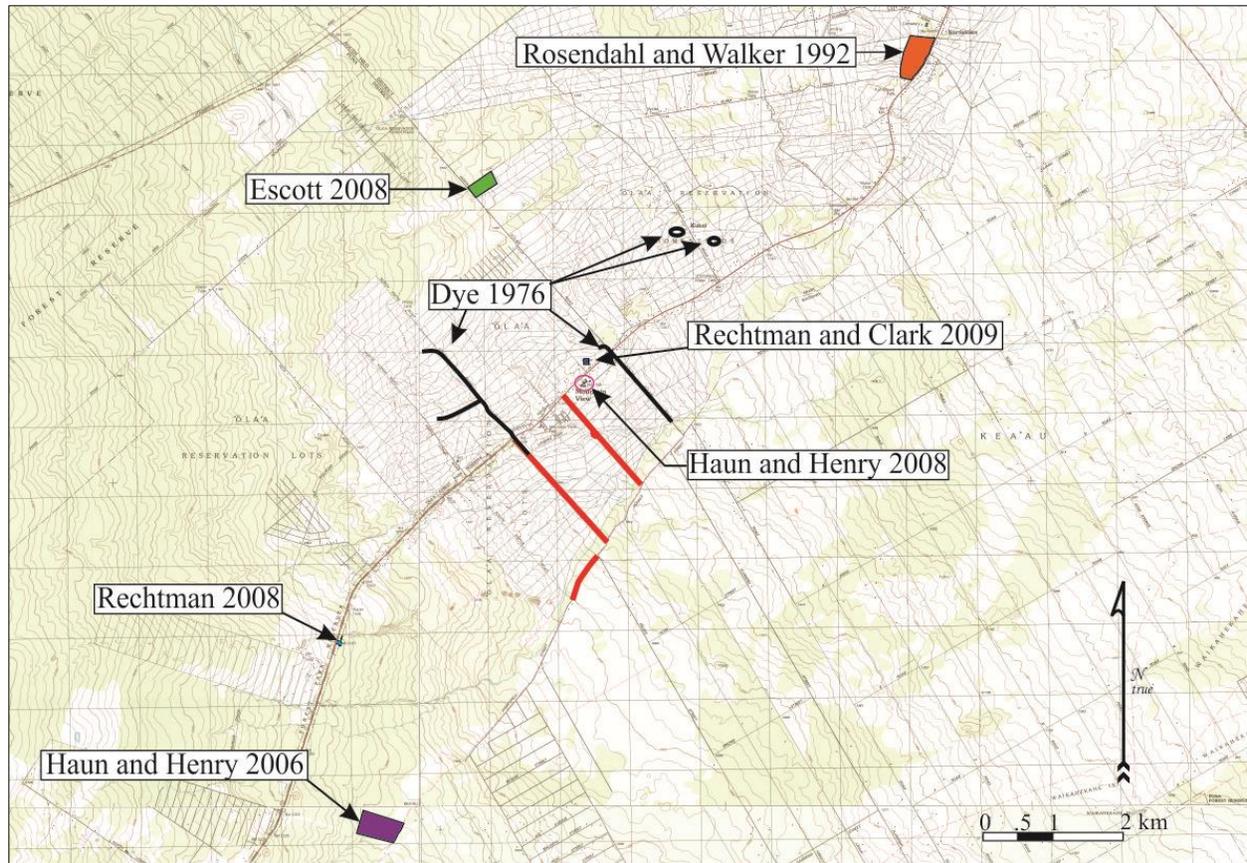


Figure 25. Previous archaeological studies, current study area in red.

3. STUDY AREA EXPECTATIONS

Historic accounts mention several native villages along the Old Volcano Trail, and suggest that these sparsely inhabited villages persisted into the 1870s. Registered Map 42 (see Figure 20) indicates the presence of a small village situated near the trail between the South Pszyk and South Lauko Road study corridors. Archaeological resources associated with this or other village sites may be indicated by the presence of stone features or remnant populations of traditional agricultural crops such as wild bananas and taro. If present, these are most likely to be located adjacent to Pūhala Road. However, extensive sugarcane cultivation (and before that coffee) on the arable lands adjacent to South Pszyk and South Lauko Roads have very likely destroyed archaeological sites and features pre-dating those activities. Sugar-related archaeological features that might be encountered are limited to roadways, irrigation and flood control features, and, possibly, field clearance stone piles. The South Pszyk Road and South Lauko Road study area corridors pass through former sugarcane fields that once belonged to Olaa Sugar Company. These roads were originally constructed to allow access into the company's fields. It is likely that the road surface, culverts, bridges, and other related infrastructure associated with Olaa Sugar Company will be encountered in these two study area corridors.

The Old Volcano Trail approximates the current boundary between 'Ōla'a and Kea'au. Based on survey maps created in 1930 (see Figure 24) and recently for the current project (see Figure 16), the original trail alignment falls within the Pūhala Road study corridor. The trail was described, generally, in 1881 as a path of coarse stone with a small sprinkle of gravel; however, no specific descriptions of the trail near the study corridor could be found in the historic literature. Although it is likely that mechanical disturbance associated with improvements to the modern trail have disturbed or destroyed portions of the original trail, it is still possible that trail features such as curbing, gravel fills, or worn pathways might be encountered in the Pūhala Road study corridor.

4. FIELDWORK

Fieldwork for the current study was conducted between July 27 and August 8, 2016 by Ashton Dircks Ah Sam, B. A., Genevieve Glennon, B.A., Ivana Hall, B.A., and Benjamin Barna, Ph. D.

METHODS

Fieldwork included a visual inspection of the surface of the entire study area (100 percent coverage) and detailed site recordation. Within the study parcel fieldworkers walked pedestrian transects parallel to the centerline of each study area corridor. The entire study area was accessible and the centerline of the study area corridors were staked and marked with flagging tape at the time of the fieldwork. Ground surface visibility was excellent throughout much of the study area. Portions of the study area that were not actively used as roadways or for agriculture pasture were covered with weedy vegetation. Observed features were cleared of vegetation and mapped in detail using a measuring tape and compass. Additionally, for Historic culverts, a measured drawing of one representative elevation for each culvert made. Features were photographed (both with and without a meter stick for scale), and described using a standardized site record form. Based on several factors related to geology, soils, and land-use history, no subsurface testing was conducted. The extremely thin soils in the Pūhala Road study area corridor make subsurface deposits there highly unlikely. As has been previously reported for former sugarcane fields (e.g., Haun and Henry 2006), over a century of commercial agriculture that was conducted in the South Lauko and South Pszyk Road corridors, which included mechanized sugar cultivation, makes subsurface deposits there highly unlikely.

FINDINGS

Within the Pūhala Road corridor no archaeological features associated with the Old Volcano Trail were identified, nor were any other historic properties recorded. In the South Pszyk Road and South Lauko Road corridors, one previously unrecorded site (SIHP Site 50-10-44-30575) comprising eight features were identified (Table 4). Site 30575 has been assigned to Historic Period infrastructure improvements associated with the Olaa Sugar Plantation's Field 4. The site and its constituent features that are located in the current study area are described in detail below.

Table 4. Historic properties identified during the current study.

<i>SIHP Site*</i>	<i>Formal Type</i>	<i>Function</i>	<i>Age</i>
30575	Plantation infrastructure	Transportation, drainage	ca.1938-1960s

*SIHP Site number includes State, Island, Quad prefix 50-10-44-

Site 30575

Site 30575 (Figure 26) comprises Historic Period infrastructure elements built by the Olaa Sugar Company for Field 4 within its Mountain View Section between the mid-1930s and the 1960s. The site includes six features (Features A, B, C, D, E, and F). Company records indicate that the haul roads that are currently known as South Pszyk Road and South Lauko Road were built between 1939 and 1940 (Olaa Sugar 1935-1941). It was during that period that most of the features described below were constructed. Universal Transvers Mercator (UTM) coordinates given below were recorded using Zone 5N of the North American Datum of 1983.

Feature A (Figure 27) is a remnant drainage ditch paralleling the southwestern side of South Pszyk Road between 278493 mE 2162673 mN and 278493 mE 2162673 mN, located partially within the county-owned road property and partially within TMK: (3) 1-8-004:034. The ditch (Figure 28) is roughly trapezoidal in cross-section (see Figure 27). The ditch measures 62 meters long by a maximum of 4.7 meters across. Ditch bank heights above the ditch bottom varies between 1.3 and 1.8 meters adjacent to the road shoulder (northeastern side of the ditch), and 0.9 and 1.6 meters on the opposite side. The ditch banks on the northeastern side (adjacent to South Pszyk Road) are lined with masonry (large cobbles and small boulders) mortared with cement (Figure 29). The majority of the southwestern side of the ditch (within Parcel 034) is bedrock (Figure 30) that gradually slopes down from the former sugar fields. Two portions of the southwestern side of the ditch walls have masonry lining similar to the northeastern side. These two portions are both about 11 meters long. The ditch bottom is unlined bedrock. The ditch appears to have originated near the existing Volcano Highway, but has been filled in between its former origin and a culvert (Feature B, see description below) located on TMK: (3) 1-8-004:035. The ditch is diverted under South Pszyk Road near the boundary between Parcels 034 and 035 via a precast concrete culvert (Feature C, see description below). The surviving portion of the ditch is in good condition where it has not been filled in. A modern telecommunications cable runs inside the ditch.

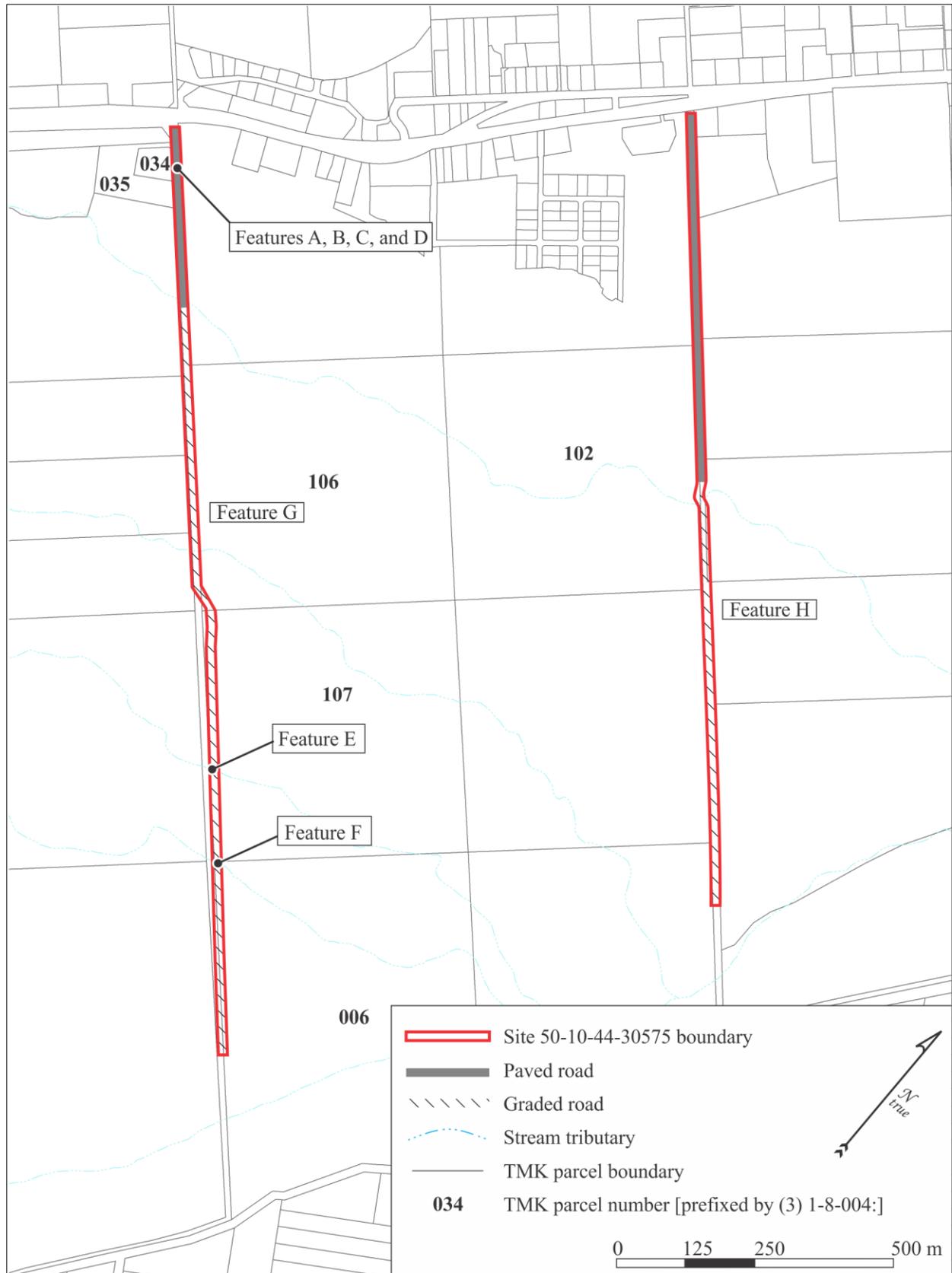


Figure 26. SIHP Site 50-10-44-30575 site boundaries and feature locations.

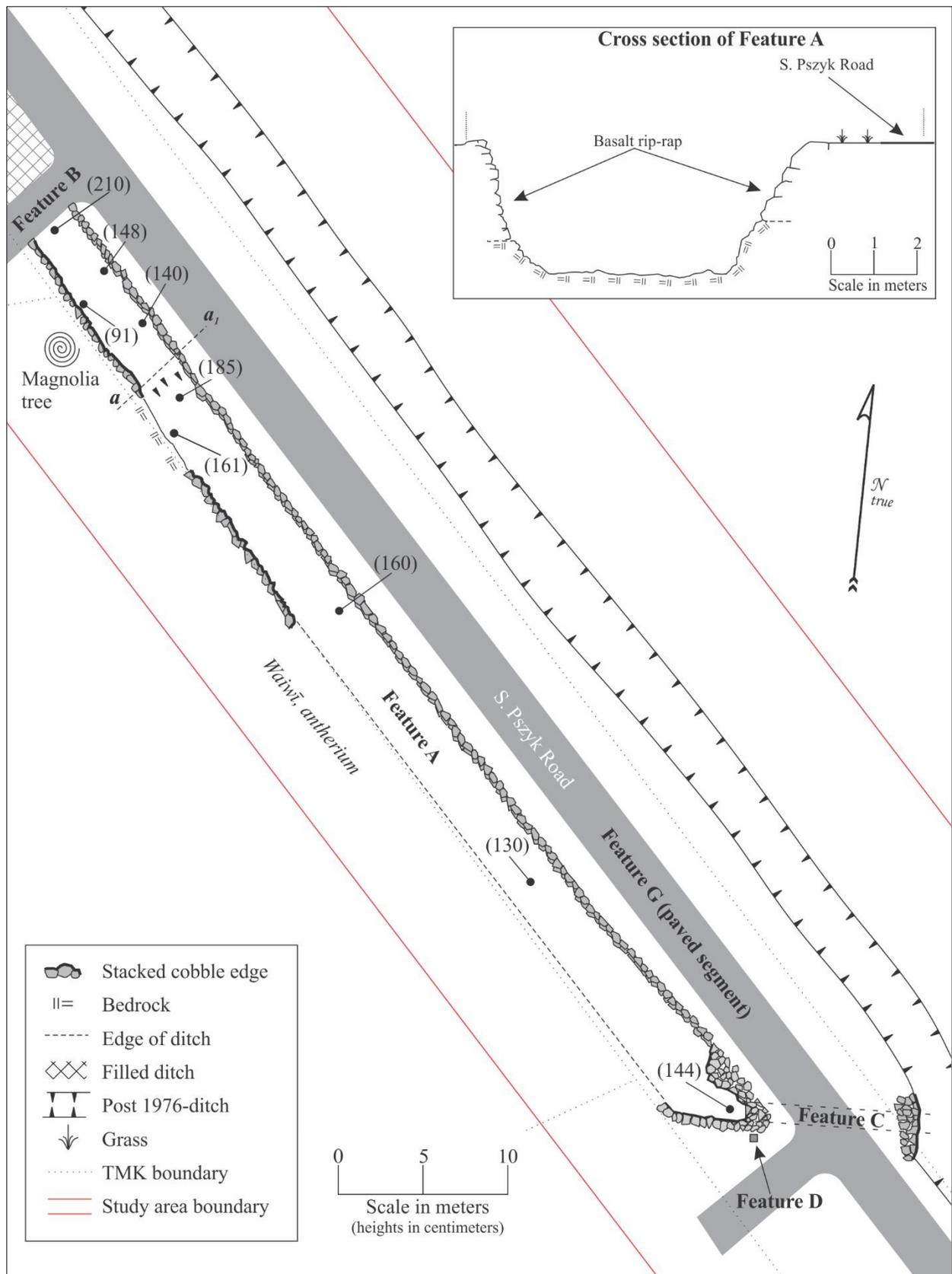


Figure 27. Site 30575 Features A, B, C, and D plan view.



Figure 28. Site 30575 Feature A, view to the northwest



Figure 29. Site 30575 Feature A Feature A ditch wall masonry, view to the northeast.



Figure 30. Site 30575 Feature A, partial masonry ditch wall, view to the southwest.

Feature B (Figure 31) is a culvert built over Feature A to provide access over the ditch for a driveway located at 278458 mE 2162719 mN on TMK: (3) 1-8-004:034. The driveway above the culvert measures 216 centimeters wide. The culvert is square in cross-section (Figure 32), measuring 150 centimeters wide and tall. The interior walls of the culvert are concrete, and impressions from the wooden forms are vaguely discernable in the walls (Figure 33). The roof of the culvert is constructed of segments of steel rail apparently repurposed from the plantation's railways. More than sixty segments are visible in the roof, but additional segments are obscured by corrugated sheet metal that appears to have been added to both ends of the culvert to widen it (the sheet metal extends beyond the concrete walls of the culvert). The visible rail segments are laid on their sides, and are well-corroded but intact. A 45-centimeter thick base course of cobbles has been laid on top of the rails. The upstream end of the culvert has been sealed off with large cobbles and cement. The modern telecommunications cable visible in Feature A enters the culvert through the sealed-off side. There is a lumber framework located inside the culvert that was perhaps a former support member (see Figure 33). The culvert is in fair to good condition despite the corrosion of the rails supporting the driveway and being sealed on its upstream end. Based on the construction materials, location, and stonework, Feature B appears to have been constructed during the road-building program undertaken by Olaa Sugar Plantation between 1939 and 1940.

Feature C (Figure 34) is a circular precast concrete culvert passing beneath South Pszyk Road near the Parcel 034/035 boundary at 278493 mE 2162673 mN. This culvert was designed to divert water from Feature A into the drainage ditch located on the opposite side of South Pszyk Road. The culvert has a 36-inch internal diameter (Figure 35) and is 11 meters long. Its headwalls are built of large cobbles mortared with cement, as are wing walls that extend from the southwestern headwall (there are no wing walls on the northeastern portal of the culvert). The culvert, headwalls, and wing walls are in very good condition. This culvert pre-dates the drainage improvements developed in the early 1980s that sealed off Feature A. Based on its construction materials it appears to have been installed between the late 1940s and the 1960s.

Feature D (Figure 36) is a concrete post located at 278500 mE 2162663 mN near the driveway on Parcel 035. The post is 20 centimeters (8 inches) square and measures 45 centimeters (18 inches) tall from the ground surface. According to county tax assessor's records, one building located on Parcel 035 was built in 1928, and a second building was constructed in 1944 (both of these buildings are outside the current study area). This post appears to have once marked the address of a house, and is probably contemporary with the 1944 building.



Figure 31. Site 30575 Feature B, view to the northwest.

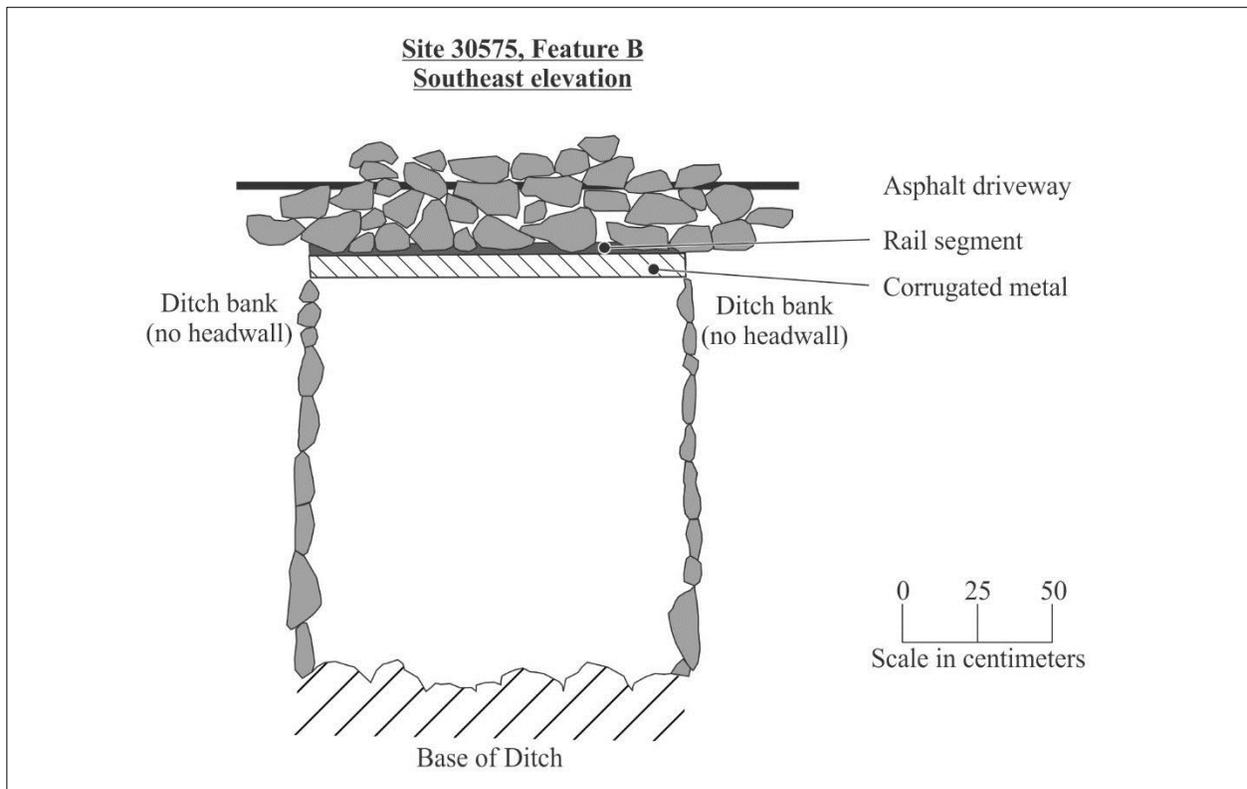


Figure 32. Site 30575 Feature B, southeast elevation.



Figure 33. Site 30575 Feature B interior, view to the northwest.



Figure 34. Site 30575 Feature A, view to the east.

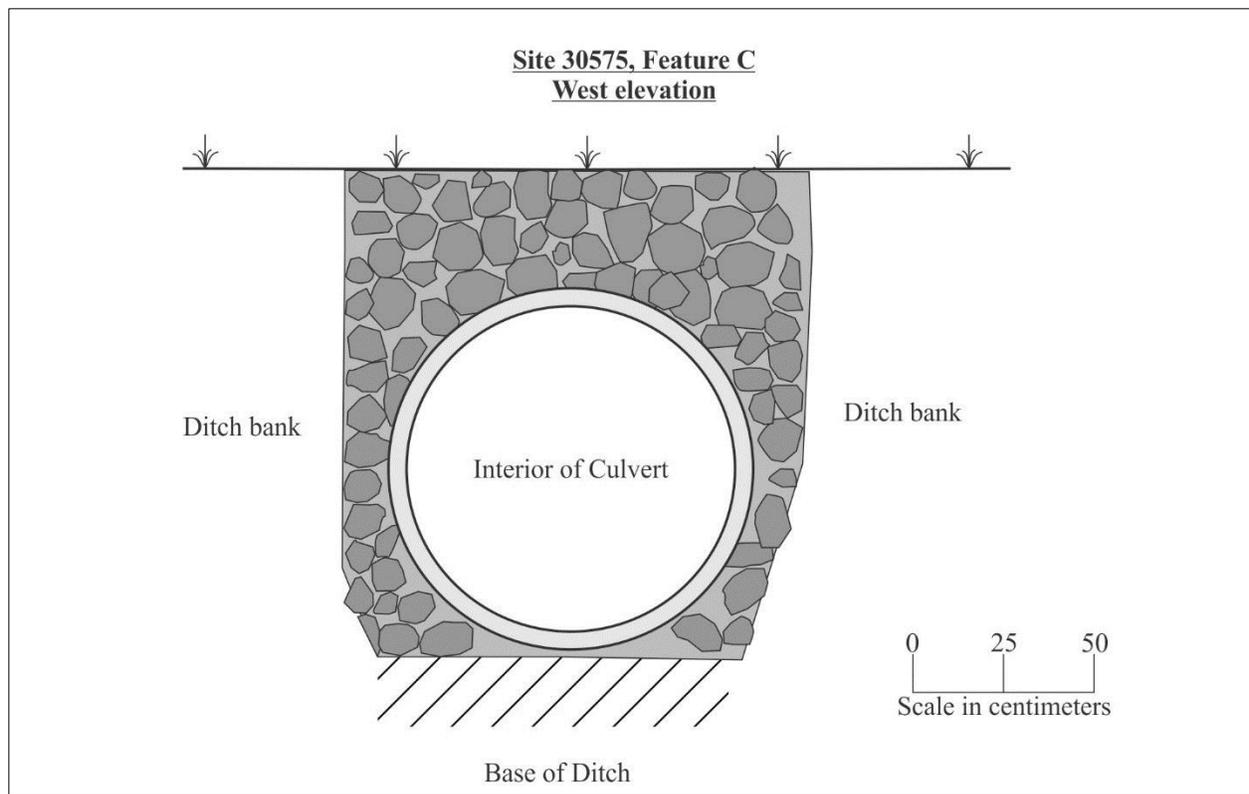


Figure 35. Site 30575 Feature C, west elevation.



Figure 36. Site 30575 Feature D, view to the west.

Feature E (Figure 37) is a culvert passing beneath South Pszyk Road located at 279198 mE 2161880 mN on Parcel 107. In this location, the road is gravel and appears to be privately maintained, as is located outside the county's right of way. The culvert measures 9 meters (29 feet 6 inches) wide across the road. The culvert is square in cross-section (Figure 38), measuring 1.4 meters (4 feet 7 inches) wide and tall. The roof of the culvert is constructed of segments of steel rail apparently repurposed from the plantation's railways. The rails are laid with their feet, which measure 11 centimeters (4 1/2 inches) wide, resting on the culvert's walls. The rail segments are spaced between 0 and 15 centimeters (6 inches) apart. The rails support a road base of medium cobbles, upon which the roadbed of small cobbles and coarse gravels has been built. The rails are quite corroded and are delaminating/flaking. The southwestern side of the culvert has been modified by the addition of two segments of precast concrete pipe with a 48 inch interior diameter. Based on the construction materials and location of this culvert, Feature E appears to have been originally constructed during the road-building program undertaken by Olaa Sugar Plantation between 1939 and 1940, with the precast concrete pipe added more recently.

Feature F (Figure 39) is a culvert passing beneath South Pszyk Road located at 279371 mE 2161657 mN on Parcel 006. The culvert measures 4.7 meters (16 feet 5 inches) wide across the road. The culvert is rectangular in cross-section (Figure 40), measuring 1.7 meters (5 feet 7 inches) wide by 1.3 meters (4 feet 3 inches) tall. The roof of the culvert is constructed of segments of steel rail apparently repurposed from the plantation's railways. The rails are laid with their feet, which measure 11 centimeters (4 1/2 inches) wide, resting on the culvert's walls. The rail segments are spaced between 0 and 15 centimeters (6 inches) apart. The rails support a road base of medium cobbles, upon which the roadbed of small cobbles and coarse gravels has been built. The rails are very corroded and are delaminating/flaking. One rail has broken near its midpoint (Figure 41). The walls of the culvert are constructed of rock and cement. Based on the construction materials and location of this culvert, Feature F appears to have been originally constructed during the road-building program undertaken by Olaa Sugar Plantation between 1939 and 1940.

Feature G (see Figure 26) is the former cane field road currently known as South Pszyk Road. Olaa Sugar Company records indicate that this road was originally built during 1939 and 1940 during the plantation's program to replace the portable rail infrastructure in its fields with gravel haul roads and trucks. Within the current study area, South Pszyk Road is paved for a distance of 325 meters from Highway 11. The road crosses a tributary of Kea'au Stream over a modern (1970s construction) concrete bridge at its northern end. Just after the bridge, the pavement ends and the road surface becomes graded (Figure 42). The graded road surface is 9 meters (30 feet) wide. This graded portion of the road continues to the southeast for about 1,265 meters. After passing through a gate, the road surface becomes less well-maintained and veers to the east before paralleling South Pszyk Road within a road easement on TMK: (3) 1-8-004:107 and 106. The road terminates within TMK: (3) 1-8-004:006 at a gate controlling access to a modern corral and shed structure. Of the portions of the road observed during the current fieldwork, only the graded portion resembles the Historic construction of the road; however, the alignment of the road has not changed since the late 1930s.

Feature H (see Figure 26) is the former cane field road currently known as South Lauko Road. Olaa Sugar Company records indicate that this road was originally built during 1939 and 1940 during the plantation's program to replace the portable rail infrastructure in its fields with gravel haul roads and trucks. Extending to the southeast from Highway 11, South Lauko Road is paved for approximately 660 meters. Upon reaching a stream tributary on parcel TMK: (3) 1-8-004:102, the pavement ends. South Lauko Road veers to the left and crosses the stream tributary over a modern culvert. After crossing the stream tributary, the road continues as a 9-meter (30-foot) wide graded road (Figure 43) for another 580 meters; this section of the road most closely resembles its Historic construction. The road continues, physically resembling a two-track, for 110 meters. At this point, the road becomes unmaintained and is overgrown with various grasses and other weedy plants. Of the portions of the road observed during the current fieldwork, only the graded middle portion resembles the Historic construction of the road; however, the alignment of the road has not changed since the late 1930s.



Figure 37. Site 30575 Feature E, view to the southwest.

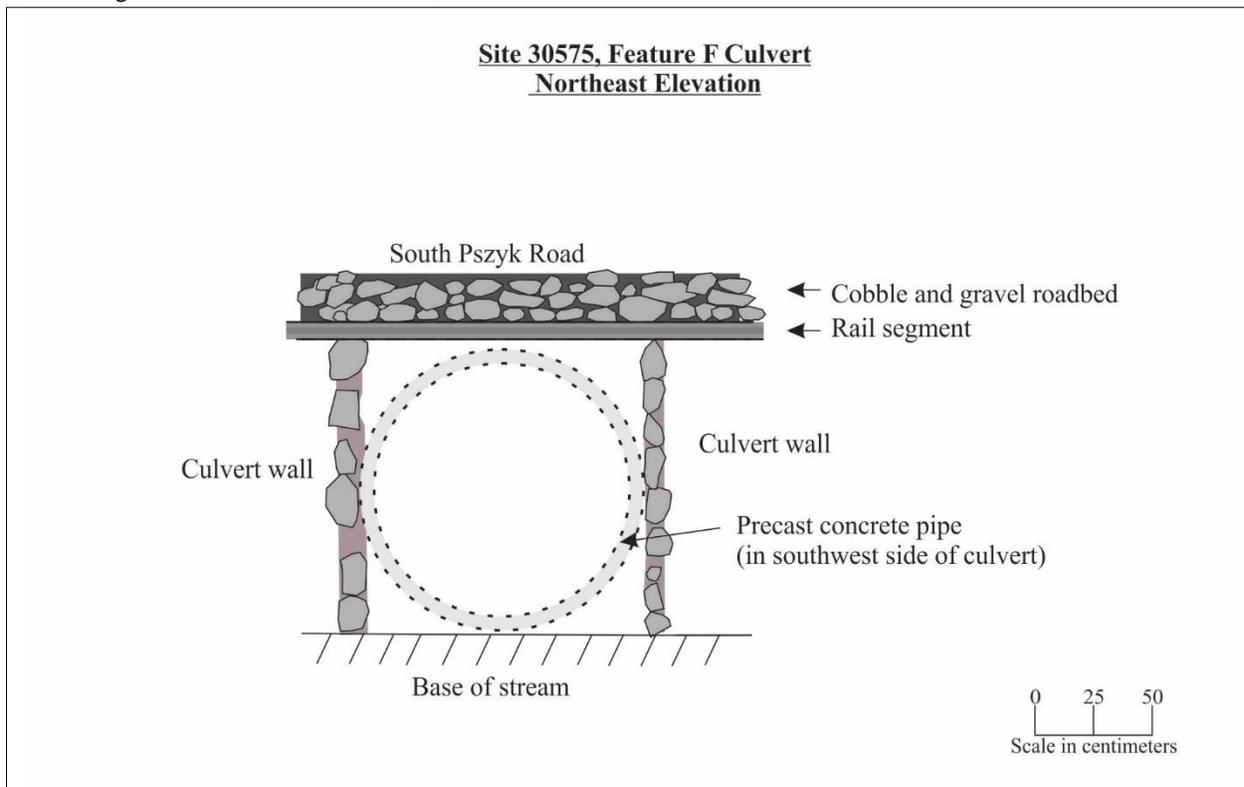


Figure 38. Site 30575 Feature E northeast elevation.



Figure 39. Site 30575 Feature F, view to the northeast.

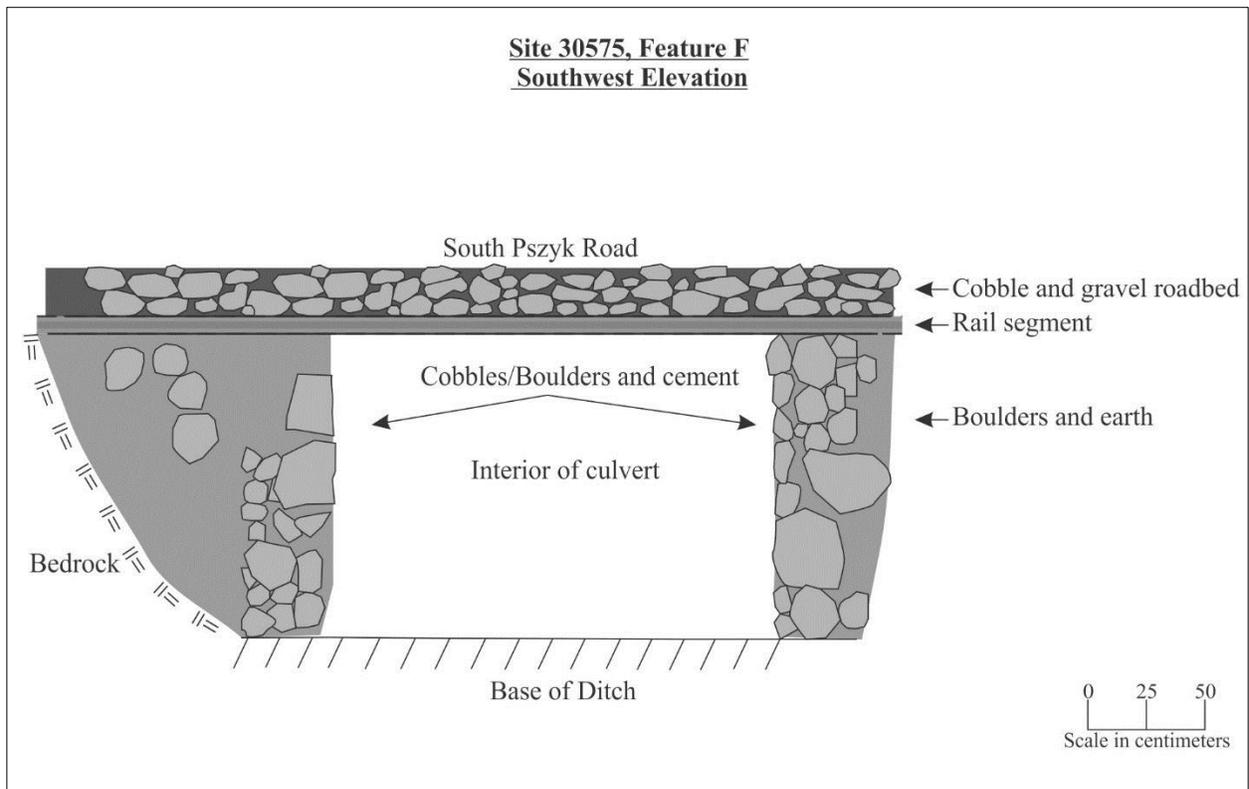


Figure 40. Site 30575 Feature F, southwest elevation.



Figure 41. Site 30575 Feature F, detail of broken rail segment in culvert roof.



Figure 42. Site 30575 Feature G (South Pszyk Road) crossing Feature F, view to the east-southeast.



Figure 43. Site 30575 Feature H (South Lauko Road) graded surface, view to the southeast.

Summary

As a result of the current investigation one archaeological site (Site 30575) was recorded, Site 30575 is associated with Field 4 of the Olaa Sugar Company plantation's Mountain View section, which matches with our pre-fieldwork study area expectations. The alignments of the two roads corresponding to South Pszyk and South Lauko Roads (Features G and H, respectively) have not been altered since their construction during 1939 and 1940. The fact that they do not currently connect with the Old Volcano Trail, as they were intended to in the 'Ōla'a Reserve Lots plan (see Figures 21 and 22), can be attributed to the needs of the Olaa Sugar Company, which built only enough road to service its cane fields. Three of the culverts (Features B, E, and F) recorded during the current study incorporate repurposed steel rails apparently salvaged during the decommissioning of the plantation's portable rail system. For the financially-troubled Olaa Sugar Company, repurposing the rails in this way was a logical and cost-effective solution to the twin problems of road building and the disposal of the surplus rails. The conditions of the drainage ditch (Feature A) and culvert (Feature C) crossing beneath South Pszyk Road reflect later developments related to the maintenance of flood control within the plantation. The truncation of Feature A occurred during a major overhaul of flood control infrastructure in the late 1970s, and Feature C appears to be of later construction than the other culverts identified on South Pszyk Road. Overall, the features of Site 30575 recorded during the current study reflect the gradual process of change implemented by Olaa Sugar Company during its eighty-five year experiment with growing sugarcane in Mountain View.

Despite map records indicating the presence of the Volcano Trail within the Pūhala Road study corridor, no physical evidence of the trail was observed during the current fieldwork. This finding is consistent with Haun and Henry's (2006) similar observations to the west of the current study area. In the Pūhala Road study corridor, our findings are most likely a result of the mechanical disturbance associated with the modern land use practices.

5. SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

The above described historic property is assessed for its significance based on criteria specified in the Hawai'i Administrative Rules 13§13-284-6. For a resource to be considered significant it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

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

The significance and recommended treatments for the single historic property (Site 50-10-44-30575) identified during the current study are discussed below and presented in Table 4.

Table 5. Significance and treatment recommendations.

<i>SIHP Site No.</i>	<i>Function</i>	<i>Temporal Association</i>	<i>Significance</i>	<i>Treatment</i>
50-10-44-30575	Plantation infrastructure	1939-1960s	d	No further work

As a result of the current study, Site 30575, is determined to be historically significant under Criterion d for the information it has yielded about Olaa Sugar Company's transition from portable rail to truck hauling. While these roads and related infrastructure were important components of the sugar plantation, these are merely a small part of the hundreds of miles of roads built by the company between the late 1930s and middle 1940s. The information content of this site within the current study area has been exhausted by the recordation conducted for the current study, and as such no further work is the recommended treatment for Features A through H of the site.

Our historic and archival research indicates that other plantation infrastructure associated with Olaa Sugar Company's Mountain View Section fields such as inter-field roads and other drainage features, may be extant on privately-owned properties located outside of the current study area. Additionally, the cluster of houses depicted on Registered Map 42 (see Figure 20) between what is now South Pszyk and South Lauko Roads (but outside the current study area) may correspond to the historically-described residence of Kinai, the chief of 'Ōlā'ā during the early 1830s, and archaeological remains of the residence may have survived to the present. It is recommended that future historic preservation review of proposed projects in the Mountain View area consider these possibilities.

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ENVIRONMENTAL ASSESSMENT

Puna Subdivision Connector Roads to Volcano Highway In Vicinity of Mountain View

APPENDIX 4 Stream Reports and Waters of U.S. Correspondence

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Water quality and biological surveys of an unnamed stream system in Mountain View, Puna, Hawai'i



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September 18, 2016

Water quality and biological surveys of an unnamed stream system in Mountain View, Puna, Hawai'i

September 18, 2016

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Introduction

The County of Hawai'i proposes to upgrade and extend one or both of two existing unimproved roads (South Lauko Road and South Pszyk Road) to connect Volcano Highway (State Route 11) and Pūhala Street ("Project") in Mountain View, Hawai'i Island. Extensions of the unimproved roads will cross tributaries of an unnamed, intermittent stream (Figure 1). AECOS, Inc. conducted environmental surveys at six existing stream crossings (Project area) on July 12, 2016. The surveys included measuring water quality, assessing aquatic fauna, and surveying terrestrial flora. This report details the findings of those surveys.¹

Stream Description

Tributaries of the unnamed stream originate in Ola'a Homesteads on the eastern slopes of Mauna Loa between 1900 and 2200 ft (580 and 670 m) above sea level (ASL), approximately 2 to 4 mi (3.2 to 6.4 km) upslope from the Project area. The streams run in a generally northeast direction between Mountain View and Glenwood before reaching the Project area. The tributaries merge approximately a half mile downslope of South Lauko Road and the

¹ Report prepared for Geometrician Associates for project permitting and intended to become part of the public record.



Figure 1. Unnamed stream system along the eastern slopes of Mauna Loa.

stream channel continues northeast toward the former Waipāhoehoe village. The stream channel disappears just downslope from Highway 130 at 180 ft (55 m) ASL, where it flows out onto highly permeable Kilauea lavas. The stream system is not included in either the Hawai'i Stream Assessment (HCPSU, 1990), which assesses perennial streams, or the Atlas of Hawaiian Watersheds (Parham et al, 2008).

In the Project vicinity, the most notable feature of the stream system is the northern most channel, which is well incised near S. Pszyk Road (Figure 2). This channel had the most water and aquatic life during the July 12, 2016 survey. The three other channels surveyed (herein tributaries) are much smaller, notably overgrown with vegetation and generally without aquatic biota. The southernmost tributary to the unnamed stream which parallels Pūhala Street has a defined channel in places but markedly undefined in others.



Figure 2. Incised stream channel at Sta. P1 with S. Pszyk Rd. bridge visible(top) and tributary channel through pasture at Sta. P2 (bottom).

Methods

Water Quality

Some water was present at five of the six crossings in the Project area during the July 12, 2016 survey. However, only three locations had adequate water depth for sampling. Field measurements of temperature, pH, and dissolved oxygen (DO) were taken and water samples for analysis of conductivity, turbidity, total suspended solids (TSS), nitrate+nitrite (NO_3+NO_2), total nitrogen (TN), and total phosphorus (TP) were collected at these three stations. Two sampling stations ("Lauko 1" and "Lauko 2") were located along the route of the proposed extension of South Lauko Road and a third station ("P1") was located at an existing crossing of South Pszyk Road (Figure 3).

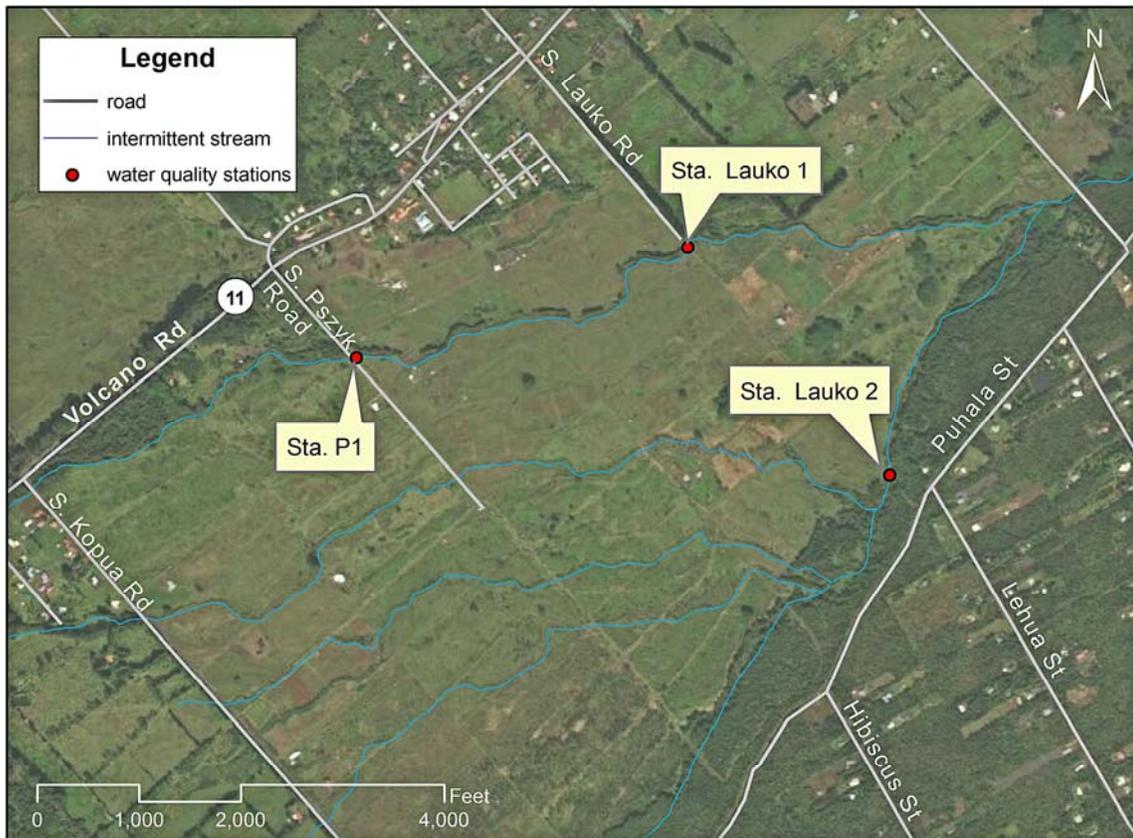


Figure 3. Water quality stations sampled on July 12, 2016.

Sta. "Lauko 1" had minimal water flow during sampling. At the time of our survey, water from a shallow pool upstream of the road was flowing over a ford and into a plunge pool where the flow terminated. Downstream from the plunge pool, water was present in pockets of bedrock with no surface flow between individual pools. A single large pool the several meters width of the channel at Sta. "Lauko 2" served as the water source. This pool was 10 to 14 in (25 to 36 cm) deep. A veneer of silt covered the bottom of the pool. The stream channel at Sta. "P1" had water in several pools, but no discernible flow between pools. Pools were bedrock bottom with little sediment present.

All field measurements were made and samples collected from just below the water surface between 9:50 am and 12:40 pm. Samples, collected in appropriate bottles, were stored on ice for transport to the *AECOS* laboratory (Log No. 32509). Analytical methods and instruments for all parameters are listed in Table 1.

Table 1. Analytical methods and instruments used for water quality analyses.

Analysis	Method	Reference	Instrument
Temperature	SM 2550 B	SM (1998)	YSI Model 550A DO meter thermistor
pH	SM 4500 H+	SM (1998)	pHep HANNA meter
Dissolved Oxygen	SM 4500-O G	SM (1998)	YSI Model 550A DO meter
Conductivity	SM 2520-B	SM (1998)	Hydac conductivity meter
Turbidity	USEPA 180.1 Rev 2.0	EPA (1993)	HACH 2100N Turbidimeter
Total Suspended Solids	Method 2540 D	SM (1998)	Mettler Toledo H31 analytical balance
Nitrate + Nitrite	Grasshoff	Grasshoff et al. (1983)	Seal AA3 Autoanalyzer, colorimetric
Total Nitrogen	Grasshoff 9.6.3	Grasshoff et al. (1983)	Seal AA3 Autoanalyzer, UV
Total Phosphorus	Grasshoff 9.1.5	Grasshoff et al. (1983)	Seal AA3 Autoanalyzer, UV

Botanical Survey

A botanist conducted a pedestrian survey of plants growing in the stream channels and within 50 ft (15 m) of the six crossing points (Figure 4). Two channels were surveyed at Sta. Lauko 2, designated Stas. Lauko 2a and Lauko 2b. Plants were identified in the field and those not immediately identifiable were photographed and/or a specimen collected for identification in the laboratory. As the survey progressed, notes were made on relative abundances (e.g., rare, common, abundant) of each species encountered. Plant names follow *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst, & Sohmer, 1990, 1999) for native and naturalized flowering plants, *A Tropical Garden Flora* (Staples & Herbst, 2005) for crop and ornamental plants, and *Hawai'i's Ferns and Fern Allies* (Palmer, 2003) for ferns. Some plant names have been updated as presented in various recent published papers and summarized by Imada (2012).

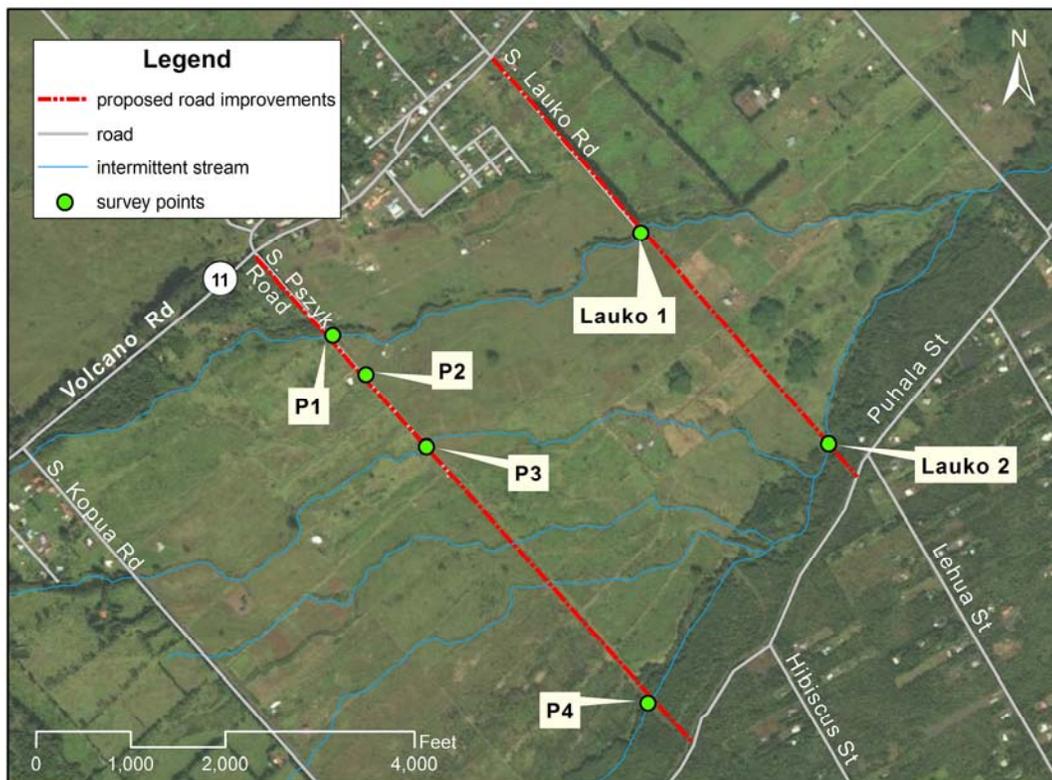


Figure 4. Locations of botanical and biological survey areas on July 12, 2016.

Aquatic Biota

A biologist observed aquatic organisms by walking in the channels and along the banks in the six crossing areas. Dip nets were utilized to confirm the identification of species observed and to reach into deeper pools. As the survey progressed, notes were made on relative abundances (e.g., rare, common, abundant) of each species encountered. Nomenclature and identifications follow *Hawai'i's Native and Exotic Freshwater Animals* (Yamamoto and Tagawa, 2000).

Survey Results

Water Quality

Water quality results are shown in Table 2. Temperature readings ranged from 22.3 to 24.6°C at the three water quality stations. As the water present in the stream was limited to apparently isolated pools, differences in temperature are related to both the depth and degree of shading of individual pools. Deeper pools and those well shaded were cooler. Dissolved oxygen (DO) levels were low, ranging from 1.99 to 4.92 mg/L representing 24 to 58% saturation at observed temperatures. The pH at Sta. Lauko 1 was near neutral (6.98), while Sta. P1 and Lauko 2 were slightly basic and slightly acidic (7.26 and 6.20), respectively.

Conductivity was consistently low at the three stations, ranging from 58 to 63 μ mhos/cm. Sediment load, as measured by total suspended solids (TSS), and water cloudiness, as measured by turbidity, were highest at Sta. Lauko 2 (3.2 mg/L and 5.73 ntu) and lowest at Sta. Lauko 1 (0.9 mg/L and 1.30 ntu).

Total nitrogen (TN) was elevated at Sta. Lauko 2 (364 μ g N/L), with nitrate-nitrite (NO_3+NO_2) accounting for only 11% (40 μ g N/l) of the total nitrogen at that station. Nitrate-nitrite and total nitrogen were low at Sta. Lauko 1 and P1. Total phosphorus was present in low concentrations at all sampled stations.

Botanical Survey

Vegetation - Surveys at each area included the stream channel's bed and banks and 50 ft (15 m) to either side of the stream banks. Riparian vegetation along the stream banks transitions into grassland pasture at Lauko 1, P2 and P3.

Table 2. Results of water quality field measurements and laboratory analyses.

Station	Time hhmm	Temp. (°C)	DO (mg/L)	DO	pH (su)	Cond. (µmhos/cm)
				% sat (%)		
Sta. Lauko 1	0950	24.1	4.92	58	6.98	63
Sta. P1	1100	22.3	3.66	42	7.26	58
Sta. Lauko 2	1240	24.6	1.99	24	6.20	61

Station	Turbidity	TSS	NO ₃ +NO ₂	TN	TP
	(ntu)	(mg/L)	(µg N/L)	(µg N/L)	(µg P/L)
Sta. Lauko 1	1.30	0.9	<1	114	4
Sta. P1	1.44	2.3	1	149	5
Sta. Lauko 2	5.73	3.2	40	364	4

Flora - A listing of all vascular plants observed in the survey areas is presented as Table 3. In total, 81 ferns and flowering plants were recorded. Of these 81 species, one species (1%) is an escaped cultivar, two species (2%) are indigenous, two (2%) are endemic to the Hawaiian Islands, and two (2%) are early Polynesian introductions (so-called “canoe plants”). The remaining plants (93%) are species introduced to the Hawaiian Islands.

A mix of grasses, including wainaku grass (*Panicum repens*), Hilo grass (*Paspalum conjugatum*), Indian dropseed (*Sporobolus diander*), molasses grass (*Melinis minutiflora*), carpetgrass (*Axonopus fissifolius*), and broomsedge (*Andropogon virginicus*) cover the stream banks and surrounding wet pasture near Sta. Lauko 1. *Christella dentata* and manyspike flatsedge (*Cyperus polystachyos*) are growing in parts of the stream channel. *Maile honohono* (*Ageratum conyzoides*), *Hypericum mutilum*, red clover (*Trifolium pretense*), yellow ginger (*Hedychium flavescens*), and false heather (*Cuphea hyssopifolia*) are common. A thicket of strawberry guava (*Psidium guajava*) is adjacent to the stream channel.

The channel is well incised at Sta. P1 where a single lane bridge crosses the stream. Paca fern (*Diplazium esculentum*), yellow ginger, and elephant grass

(*Cenchrus purpureum*) dominate the stream bank vegetation at this location. False heather (*Cuphea hyssopifolia*) occupies slightly higher patches in the stream channel. Several clumps of strawberry guava are present at Sta. P1.

The small tributary is directed under the road through a culvert at Sta. P2 and then the channel broadens in a pasture downstream from the road. Sword fern (*Nephrolepis multiflora*), red clover, and Koster's curse (*Clidemia hirta*) are common in the stream channel at the road. Vegetation in the channel is very similar to that of the pasture downstream and includes carpetgrass, molasses grass, Natal redtop (*Melinis repens*), wainaku grass (*Panicum repens*), California grass (*Urochloa mutica*), uluhe (*Dicranopteris linearis*) and manyspike sedge.

Wedelia (*Sphagneticola trilobata*), *Hypericum mutilum*, hilahila (*Mimosa pudica* var. *unijuga*), red clover, paca fern, sword fern and Koster's curse are common in the narrow, shallow channel at Sta. P3. Grasses on the tributary banks and surrounding pasture include: broomsedge, molasses grass, Natal redtop, Hilo grass (*Paspalum conjugatum*), Dallis grass (*Paspalum dilatatum*), palm grass (*Setaria palmifolia*), wainaku grass, and California grass.

At Sta. P4, the tributary channel is indistinct from the surrounding landscape. *Maile honohono*, false heather, yellow ginger, blechnum fern (*Blechnum appendiculatum*), and paca fern grow in the nearly indiscernible channel. Trees, including strawberry guava and 'ōhi'a (*Metrosideros polymorpha*), are present in what functions as a floodplain.

Paca fern dominates the small tributary channel at Sta. Lauko 2a. Broomsedge is common on the floodplain. *Maile honohono*, *Hypericum mutilum*, false heather, pearl flower (*Heterocentron subtriplinervium*), bubble gum plant (*Polygala paniculata*), buttonweed (*Spermacoce assurgens*), *honohono* (*Commelina diffusa*), Natal redtop, and Guinea grass (*Urochloa maxima*), yellow ginger, and manyspike flatsedge are common on the broad floodplain.

At Sta. Lauko 2b, the channel vegetation is not distinct from the surrounding floodplain. Sword fern are abundant in and adjacent to the stream channel. Silverback fern (*Pityrogramma calomelanos*), hilahila, Koster's curse, pearl flower, and lantana (*Lantana camara*) sprawl over the ground throughout the area. Strawberry guava and 'ōhi'a shrubs and trees are growing adjacent to the channel. Common grasses in the area include broomsedge, molasses grass, Natal redtop, and basket grass (*Osplismenus hirtellus*).

Table 3. List of plants observed in the survey area on July 12, 2016.

3a. Non-native (ornamentals and naturalized) plants

Family <i>Species</i>	Common name	Status	Abundance (by area)							
			Lauko 1	P1	P2	P3	P4	Lauko 2a	Lauko 2b	
<i>FERNS AND FERN ALLIES</i>										
ATHYRIACEAE										
<i>Diplazium esculentum</i> (Retz.) Sw.	paca fern	Nat	--	A	--	C	A	AA	--	
BLECHNACEAE										
<i>Blechnum appendiculatum</i> Willd.	blechnum fern	Nat	R	C	--	--	A	--	--	
NEPHROLEPIDACEAE										
<i>Nephrolepis multiflora</i> (Roxb.) F.M. Jarrett ex C.V. Morton	sword fern	Nat	--	C	C	C	C	--	A	
POLYPODIACEAE										
<i>Phlebodium aureum</i> (L.) J. Sm.	golden polypody	Nat	R	--	--	--	--	--	--	
PTERIDACEAE										
<i>Pityrogramma calomelanos</i> (L.) Link	silverback fern	Nat	R	--	U ₃	--	--	--	C	
SELAGINELLACEAE										
<i>Selaginella stellata</i> Spring	---	Nat	--	R	--	--	--	--	--	
THELYPTERIDACEAE										
<i>Christella dentata</i> (Forsk.) Brownsey & Jermy	---	Nat	C	R	O	--	--	--	--	
<i>Christella parasitica</i> (L.) Levi	wood fern	Nat	--	C	--	O	--	--	--	
<i>FLOWERING PLANTS</i>										
DICOTYLEDONS										
ACANTHACEAE										
<i>Aphelandra aurantiacta</i> (Scheidweiler) Lindley	tiger plant	Nat	--	--	--	--	--	R	--	
ASTERACEAE										
<i>Ageratum conyzoides</i> L.	ageratum	Nat	C	R	--	--	--	--	--	
<i>Ageratum houstonianum</i> Mill.	<i>maile honohono</i>	Nat	--	--	--	--	C	C	--	
<i>Conyza canadensis</i> (L.) Cronquist var. <i>canadensis</i>	horseweed	Nat	--	--	--	--	--	O	--	
<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	---	Nat	--	--	--	--	--	R	--	
<i>Erechtites valerianifolia</i> (Wolf) DC	---	Nat	--	--	R	--	--	R	--	

Family <i>Species</i>	Common name	Status	Abundance (by area)							
			Lauko 1	P1	P2	P3	P4	Lauko 2a	Lauko 2b	
ASTERACEAE (continued)										
<i>Sphagneticola trilobata</i> (L.) Pruski	wedelia	Nat	R	O	--	C	--	--	--	--
BEGONIACEAE										
<i>Begonia hirtella</i> Link	wild geranium	Nat	--	R	--	--	--	--	--	--
BUDDLEJACEAE										
<i>Buddleja asiatica</i> Lour.	dogtail	Nat	--	--	--	--	R	--	--	--
CAMPANULACEAE										
<i>Hippobroma longiflora</i> (L.) G. Don	star-of-Bethlehem	Nat	R	--	--	--	--	--	--	--
CARYOPHYLLACEAE										
<i>Drymaria cordata</i> (L.) Willd. ex Roem. & Schult. var. <i>pilipili</i>		Nat	--	R	--	--	--	--	--	--
<i>pacifica</i> M.Mizush.										
CASUARINACEAE										
<i>Casuarina equisetifolia</i> L.	ironwood	Nat	R	--	--	--	--	--	--	--
CLUSIACEAE										
<i>Hypericum mutilum</i> L. ssp. <i>mutilum</i>	---	Nat	C	--	--	C	C	C	--	--
FABACEAE										
<i>Chamaecrista nictitans</i> (L.) Moench ssp. <i>patellaria</i> (DC. ex Collad.) H.S.Irwin & Barneby var. <i>glabrata</i> (Vogel) H.S.Irwin & Barneby	patridge pea, <i>lauki</i>	Nat	--	--	--	U	--	--	--	--
<i>Desmodium incanum</i> DC	Spanish clover	Nat	O	--	U	--	--	--	--	--
<i>Mimosa pudica</i> L. var. <i>unijuga</i> (Duchass. & Walp.)Griseb	sleeping grass; <i>hilahila</i>	Nat	O	C	O	C	--	--	C	--
<i>Neonotonia wightii</i> (Wight & Arn.) Lackey	glycine	Nat	--	R	--	--	--	--	--	--
<i>Trifolium pratense</i> L. var. <i>sativum</i> Schreb	red clover	Nat	C	--	C	C	--	--	--	--
LAURACEAE										
<i>Persea americana</i> Mill.	avocado	Nat	R	--	--	--	--	--	--	--
LYTHRACEAE										
<i>Cuphea carthagenesis</i> (Jacq.) Macbr.	---	Nat	O	--	R	--	--	O	--	--
<i>Cuphea hyssopifolia</i> Kunth	false heather	Nat	C	A	--	--	A	C	--	--
MALVACEAE										
<i>Hibiscus furcellatus</i> Desr.	' <i>akiohala</i>	Nat	--	--	--	--	--	U	--	--
MELASTOMATAACEAE										
<i>Clidemia hirta</i> (L.) D. Don	Koster's curse	Nat	O	C	C	C	C	--	C	--
<i>Dissotis rotundifolia</i> (Sm.) Triana	--	Nat	O	--	--	--	--	--	--	--

Family <i>Species</i>	Common name	Status	Abundance (by area)							
			Lauko 1	P1	P2	P3	P4	Lauko 2a	Lauko 2b	
MELASTOMATACEAE (continued)										
<i>Heterocentron subtriplinervium</i> (Link & Otto.) A. Braun & C. Bouché	pearl flower	Nat	U	O	--	O	--	C	C	
MYRTACEAE										
<i>Melaleuca quinquenervia</i> (Cav.) S.T. Blake	paperbark	Nat	--	R	--	--	--	--	--	
<i>Psidium cattleianum</i> Sabine	strawberry guava	Nat	C	C	U	U	C	--	C	
<i>Psidium guajava</i> L.	common guava	Nat	O	O	O	--	--	--	--	
<i>Syzigium jambos</i> (L.) Alston	rose apple	Nat	R	--	--	--	--	--	--	
POLYGALACEAE										
<i>Polygala paniculata</i> L.	bubble gum plant	Nat	O	R	O	--	--	C	O	
POLYGONACEAE										
<i>Persicaria capitata</i> (Buch.-Ham. ex D.Don) Masam.	---	Nat	O	--	--	--	--	--	--	
ROSACEAE										
<i>Rubus ellipticus</i> var. <i>obcordatus</i> Focke	yellow Himalayan raspberry	Nat	--	--	--	R	--	--	U	
RUBIACEAE										
<i>Coffea arabica</i> L.	coffee	Nat	--	--	--	--	U ₃	--	--	
<i>Paederia foetida</i> (Lour.) Merr.	<i>maile pilau</i>	Nat	--	--	--	--	--	U	--	
<i>Spermacoce assurgens</i> Ruiz & Pav.	buttonweed	Nat	--	O	--	--	--	C	--	
SCROPHULARIACEAE										
<i>Castilleja arvensis</i> Cham. & Schlechtend	Indian paintbrush	Nat	--	--	--	--	R	R	--	
<i>Torenia asiatica</i> L.	<i>ola'a</i> beauty	Nat	O	U	--	R ₁	O	--	O	
ULMACEAE										
<i>Trema orientalis</i> (L.) Blume	gunpowder tree	Nat	R	U	--	--	--	--	R	
URTICACEAE										
<i>Pilea microphylla</i> (L.) Liebm.	artillery plant	Nat	O	--	--	--	--	--	--	
VERBENACEAE										
<i>Clerodendrum chinense</i> (Osbeck) Mabb.	<i>pikake honohono</i>	Nat	--	--	--	--	O	O	--	
<i>Lantana camara</i> L.	lantana	Nat	--	--	--	--	--	--	C	
<i>Stachytarpheta jamaicensis</i> (L.) Vahl	Jamaican vervain	Nat	R	--	--	--	--	R	--	
MONOCOTYLEDONES										
COMMELINACEAE										
<i>Commelina diffusa</i> N.L. Burm.	<i>honohono</i>	Pol?	R	O	--	--	--	C	--	
CYPERACEAE										
<i>Rhynchospora caduca</i> Elliot	anglestem beakrush	Nat	O	R	O	C	--	--	--	

Family <i>Species</i>	Common name	Status	Abundance (by area)							
			Lauko 1	P1	P2	P3	P4	Lauko 2a	Lauko 2b	
IRIDACEAE										
<i>Crocosmia x crocosmiiflora</i> (Lemoine ex E. Morr.) N.E.	montbretia	Nat	--	--	R	--	--	--	--	--
Brown										
ORCHIDACEAE										
<i>Arundina graminifolia</i> (D. Don) Hochr.	bamboo orchid	Nat	--	U	--	--	--	--	--	--
POACEAE (GRAMINEAE)										
<i>Andropogon virginicus</i> L. var. <i>virginicus</i>	broomsedge	Nat	C	--	C	C	--	R	C	
<i>Axonopus fissifolius</i> (Raddi) Kuhl	carpetgrass	Nat	C	O	O	--	--	--	R	
<i>Cenchrus purpureus</i> (Schumach.) Morrone	elephant grass	Nat	R ₃	A	--	--	--	--	--	
<i>Coix lachrymal-jobi</i> L.	Job's tears	Nat	--	--	--	--	R ₃	--	--	
<i>Digitaria eriantha</i> Steud	pangola grass	Nat	--	--	A	--	--	--	--	
<i>Melinis minutifloras</i> P. Beauv.	molasses grass	Nat	C	C	C	C	--	--	C	
<i>Melinis repens</i> (Willd.) Zizka	Natal redtop	Nat	C	C	C	C	C	C	C	
<i>Osplismenus hirtellus</i> (L.) P. Beauv.	basket grass	Nat	--	--	--	--	C	--	C	
<i>Paspalum conjugatum</i> Bergius	Hilo grass	Nat	C	C	--	C	--	--	--	
<i>Paspalum dilatatum</i> Poir.	Dallis grass	Nat	--	--	U	A	--	--	U	
<i>Paspalum urvillei</i> Steud.	vasey grass	Nat	U	--	--	--	--	--	--	
<i>Panicum repens</i> L.	wainaku grass	Nat	C	--	C	A	--	--	--	
<i>Saccharum spontaneum</i> L	sugar cane cultivar	Orn	--	--	R ₁	O	--	--	--	
<i>Sacciolepis indica</i> (L.) Chase	Glenwood grass	Nat	--	O	--	--	--	O	--	
<i>Setaria palmifolia</i> (J. Konig) Stapf	palmgrass	Nat	O	R	O	C	C	C	--	
<i>Setaria verticillata</i> (L.) P. Beauv	bristly foxtail	Nat	--	--	--	U	--	--	--	
<i>Sporobolus diander</i> (Retz.) P. Beauv	Indian dropseed	Nat	C	C	O	--	--	--	--	
<i>Urochloa maxima</i> (Jacq.) R.D.Webster	Guinea grass	Nat	--	--	--	--	C	C	--	
<i>Urochloa mutica</i> (Forssk.) Stap.	Californa grass	Nat	C	C	A	A	--	A	--	
ZINGIBERACEAE										
<i>Hedychium coronarium</i> J. Konig	white ginger	Nat	--	U	--	--	--	--	--	
<i>Hedychium flavescens</i> Carey ex Roscoe	yellow ginger	Nat	C	C	--	C	A	C	--	

Table 3b. Native (and early Polynesian introduced) Plants

Family <i>Species</i>	Common name	Status	Abundance (by site)						
			Lauko 1	P1	P2	P3	P4	Lauko o 2a	Lauko 2b
<i>FERNS AND FERN ALLIES</i>									
DICKSONIACEAE <i>Cibotium glaucum</i> (Sm.) Hook & Arn.	<i>hapu'u</i>	End	R	R	--	--	--	--	R
GLEICHENIACEAE <i>Dicranopteris linearis</i> (Burn. f.) Underw.	<i>uluhe</i>	Ind	R	R	C	--	--	--	R
FLOWERING PLANTS DICOTYLEDONS									
AGAVACEAE <i>Cordyline fruticosa</i> (L.) A. Chev.	<i>ki</i>	Pol	--	--	R	--	--	--	--
CYPERACEAE <i>Cyperus polystachyos</i> Rottb.	manyspike flatsedge	Ind	C	C	C	--	--	C	--
MYRTACEAE <i>Metrosideros polymorpha</i> var. <i>polymorpha</i>	<i>'ohi'a</i>	End	--	--	--	--	U ₂	--	C
ONAGRACEAE <i>Ludwigia octovalvis</i> (Jacq.) P.H.Raven	primrose willow	Pol?	--	--	--	--	R	R	--

Legend to Table 3

Status categories:

- End** – endemic; native to Hawai'i and found naturally nowhere else.
- Ind** – indigenous; native to Hawai'i, but not unique to the Hawaiian Islands.
- Pol** – Early Polynesian introduction; canoe plant.
- Pol?** – Likely an early Polynesian introduction; canoe plant.
- Nat** – Naturalized, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and -established outside of cultivation.
- Orn** – Ornamental; a cultivated plant; a species not thought to be naturalized (spreading on its own) in Hawai'i.

Abundance categories:

- R – Rare – observed in only one or perhaps two locations.
- U – Uncommon – observed at most in several locations.
- O – Occasional – observed with some regularity.
- C – Common – observed numerous times during the survey.
- A – Abundant – found in large numbers; may be locally dominant.
- AA – Very abundant – dominant; defining vegetation type.

Numbers (as in R₃) offset occurrence ratings (1 – several plants; 2 – many plants; 3 – abundant in a limited area) in cases where distribution across the survey area may be limited, but individuals seen are more than indicated by the occurrence rating alone.

Aquatic Biota

Table 4 is a listing of aquatic animals identified by AECOS biologists on July 12, 2016 in the unnamed stream system in the Project area. Also included in this table (without abundance categories given) are species previously reported from the stream system (AECOS, 1998, 2004). A cyanobacterium and a green alga are present in standing pools in the stream channel. Adults of four species of dragonfly, including two natives (*Anax junius* and *Pantala flavescens*), were seen cruising the stream and tributary channels. American crayfish (*Procambarus clarkii*) are common at Sta. P1, but not seen elsewhere. Swordtail (*Xiphophorus helleri*) and rainbow guppy (*Poecilia reticulata*) inhabit the shallow pools at Sta. Lauko 1 and Lauko 2. Adult cane toad (*Rhinella marina*) and wrinkled frog (*Glandirana rugosa*) are present, while tadpoles from both species are abundant throughout the survey area.

Table 4. List of aquatic species observed in unnamed stream.

PHYLUM, CLASS, ORDER, FAMILY <i>Genus species</i>	Common name	Abundance	Status	ID Code
CYANOBACTERIA				
CYANOPHYTA				
OSCILLATORIACEAE				
<i>Phormidium cf. retzii</i> (C.Agardh) Gomont		R	Ind	1
ALGAE				
CHLOROPHYTA				
SCHIZOMERIDACEAE				
<i>Spirogyra cf. elegantissima</i> Ling et Zheng		C	Ind	1
INVERTEBRATES				
MOLLUSCA, GASTROPODA				
BASOMMATOPHORA				
LYMNAEIDAE				
<i>Pseudosuccinea columella</i> Say	pond snail	--	Nat	3
PHYSIDAE				
<i>Physa cf. virgata</i> Gould	pond snail	--	Nat	3

Table 4 (continued).

PHYLUM, CLASS, ORDER, FAMILY <i>Genus species</i>	Common name	Abundance	Status	ID Code
ARTHROPODA,INSECTA				
ODONATA				
AESHNIDAE				
<i>Anax junius</i> Drury	<i>pinao</i> ; common green darner	R	Ind	2
<i>Anax strennus</i> Hagen	<i>pinao</i> ; giant Hawaiian darner (nymph)	--	End	3
LIBELLULIDAE				
<i>Crocothemis servilia</i> Drury	scarlet skimmer	O	Nat	2
<i>Orthemis ferruginea</i> Fabricius	roseate skimmer	R	Nat	2
<i>Pantala flavescens</i> Fabricius	globe skimmer, adult	O	Ind	2
<i>Pantala flavescens</i> Fabricius	globe skimmer, nymph	--	Ind	4
ARTHROPODA, MALACOSTRACA, DECOPODA				
<i>Procambarus clarkii</i> Girard	American crayfish	C	Nat	2
FISHES				
CHORDATA, ACTINOPTERYGII				
POECILIIDAE				
<i>Poecilia reticulata</i> Peters	rainbow guppy	R	Nat	2, 3
<i>Xiphophorus hellerii</i> Heckel	swordtail	C	Nat	2
AMPHIBIANS				
CHORDATA, AMPHIBIA				
ANURA				
BUFONIDAE				
<i>Rhinella marina</i> Linnaeus	cane toad	U	Nat	2
RANIDAE				
<i>Glandirana rugosa</i> Temminck and Schlegel	wrinkled frog	A	Nat	2
<i>Lithobates catesbeianus</i> Shaw	American bullfrog (tadpoles and adults)	--	Nat	3

LEGEND TO TABLE 4

Abundance categories:

- R - Rare - only one or two individuals observed.
- U - Uncommon - several to a dozen individuals observed.
- O - Occasional - seen irregularly in small numbers
- C - Common -observed everywhere, although generally not in large numbers.
- A - Abundant - observed in large numbers and widely distributed.

Status categories:

- End** - Endemic - species found only in Hawai'i
- Ind** - Indigenous - species found in Hawai'i and elsewhere
- Nat - Naturalized - species introduced to Hawaii intentionally or accidentally.

Table 4 (continued).

ID codes:

- 1 – field specimen collected for microscopic examination
 - 2 – species field identified
 - 3 – observed upstream from Project area (AECOS, 1989)
 - 4 – observed downstream from Project area (AECOS, 2004)
-

Assessments

Water Quality

Water quality at Stas. Lauko 1 and P1, as measured on July 12, 2016, is good, perhaps reflecting a relatively constant turnover of the water in the isolated pools due to regular rainfall inputs. Turbidity and inorganic and total nitrogen were slightly elevated at Sta. Lauko 2.

The unnamed stream system is classified as a Class 2 “flowing waters” in the Hawai’i water quality standards (HDOH, 2014a). Beneficial uses of Class 2 waters are designated as follows:

“The objective of class 2 waters is to protect their use for recreational purposes, the support and propagation of aquatic life, agricultural and industrial water supplies, shipping and navigation. The uses to be protected in this class of waters are all uses compatible with the protection and propagation of fish, shellfish, and wildlife, and with recreation on and in these waters. These waters shall not act as receiving waters for any discharge which has not received the best degree of treatment or control compatible with the criteria established for this class.”

Specific water quality criteria have been promulgated that, if met, are designed to allow the water bodies to achieve designated beneficial uses. Criteria for freshwater streams are presented in Table 5 (HDOH, 2014a).

The primary purpose of water quality measurements made on July 12, 2016 was to characterize the existing aquatic environment, not to set baseline values or determine compliance with state water quality standards. In fact, the state stream criteria for all nutrient measurements, turbidity, and TSS (Table 5, above) are based upon calculating geometric mean values and a minimum of three separate samples per sampling location would be needed to compute a geometric mean (HDOH, 2014a). Additionally, the water quality criteria for streams are applicable to flowing waters and not standing pools, such as those that were present in the Project area on July 12, 2016.

Table 5. State of Hawai'i water quality criteria for streams for wet (Nov. 1-Apr. 30) and dry (May 1-Oct. 31) seasons from HAR §11-54-5.2(b) (HDOH, 2014a).

Parameter	Total Nitrogen (µg N/l)	Nitrate + Nitrite (µg N/l)	Total Phosphorus (µg P/l)	Total Suspended Solids (mg/l)	Turbidity (NTU)
Geometric mean not to exceed given value					
(wet season)	250.0	70.0	50.0	20.0	5.0
(dry season)	180.0	30.0	30.0	10.0	2.0
Not to exceed more than 10% of the time					
(wet season)	520.0	180.0	100.0	50.0	15.0
(dry season)	380.0	90.0	60.0	30.0	5.5
Not to exceed more than 2% of the time					
(wet season)	800.0	300.0	150.0	80.0	25.0
(dry season)	600.0	170.0	80.0	55.0	10.0

pH – shall not deviate >0.5 units from ambient and not be < 5.5 nor > 8.0.

Dissolved oxygen – not less than 80% saturation.

Temperature – shall not vary more than 1 °C from ambient.

Conductivity – ≤ 300 µmhos/cm.

The unnamed stream system is not on the Department of Health list of impaired waters in Hawai'i (HDOH, 2014b) prepared under Clean Water Act, §303(d). Properly designed, installed, and maintained construction Best Management Practices (BMPs) will prevent degradation of the water of the unnamed stream system.

Botanical Resources

No plants proposed, or listed as threatened or endangered species as set forth in the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543; USFWS, 2016a; HDLNR, 1997), were seen in the Project area. For plants, state listing follows the federal listing. No native species of particular concern are present.

Aquatic Resources

No aquatic species protected by State of Hawai'i Administrative Rules (HDLNR, 1989, 2014, 2015), nor proposed or listed as federally threatened or endangered or species as set forth in the Endangered Species Act of 1973, as

amended (16 U.S.C. 1531-1543, USFWS, 2016a), were observed within the Project area.

The unnamed stream flows only intermittently, although isolated pools may be semi-permanent aquatic features. Isolated pools will support a variety of aquatic algae and insects, perhaps including native species. The stream system has no surface outlet to the ocean, precluding recruitment of native diadromous² stream fauna. Due to the intermittent nature of the stream system, aquatic habitat is very limited in the Project area and may be reduced or absent during extended dry periods. The Puna Subdivision Connector road project will have no adverse impacts on aquatic resources in the area.

Construction BMPs developed to prevent degradation of the water of the unnamed stream system will protect aquatic biota extant in the Project area.

Critical Habitat

No federal designated Critical Habitat for any plant or animal species currently protected under the endangered species act of 1973, as amended, occurs within the Project area (USFWS, 2016b). There is no equivalent statute under state law.

Wetlands

Wetlands were not delineated as part of our survey. Potential wetlands (standing water observed) in vicinity of the Project area include an area along S. Lauko Rd. south-southeast of Sta. Lauko 1 and an area near Sta. Lauko 2. Any wetland, if present, is likely isolated and not jurisdictional.

Jurisdictional Waters

The unnamed stream system flows intermittently and is not navigable, the stream does not have a surface connection to the Pacific Ocean, and the waters do not maintain a nexus to interstate commerce. In 2009, the U.S. Army Corps of Engineers (USACE) determined this stream system is not under federal jurisdiction (USACE, 2009). Because a federal jurisdictional determination is valid only for 5 years, on September 16, 2016, AECOS requested an approved jurisdictional determination from USACE.

² Diadromous – aquatic species that regularly migrate between the ocean and freshwater streams. In Hawai'i, native aquatic species—including *o'opu* (fishes), *hihiwai* (snail), and *opae* (prawns)—develop as larvae in the ocean, then migrate as juveniles into streams.

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September 9, 2016

AECOS No. 1477B

Tunis McElwain, Chief Regulatory Office
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**Subject: Puna Subdivision Connector Roads to Volcano Highway in Vicinity
of Mountain View**

On behalf of the County of Hawai'i, we are requesting an approved jurisdictional determination for an unnamed stream system in Mountain View on Hawai'i Island. The County of Hawai'i proposes to upgrade and extend one or both of two existing unimproved roads (South Lauko Road and South Pszyk Road) to connect Volcano Highway (State Route 11) and Pūhala Street in Mountain View ("Project"). Coordinates of the center of the project area are approximately 19°32'13.98"N and 155°06'28.96"W (NAD 83; see attached location map).

The purpose of the Project is to improve road accessibility during events such as floods, fires, automobile accidents, or other emergencies that block subdivision roads, connector roads, and Volcano Highway, and also to provide alternative permanent connection(s) to South Kulani Road for residents of Fern Acres, upper Hawaiian Acres, and potentially Kopua Farm Lots and Eden Roc Estates. The project addresses needs identified by the Connectivity and Emergency Response Subcommittee of the Puna Community Development Plan Action Committee. The local community has expressed considerable support for the Project.

The South Lauko Road extension option would require two stream crossings, while the extension of South Pszyk Road would require five stream crossings. The preferred alternative for the stream crossings are elevated fords with culverts. *AECOS, Inc.* scientists conducted a field survey of the unnamed stream system on June 12, 2016 at six accessible crossings along South Lauko Road and South Pszyk Road (see attached location map). The purpose of the survey was to determine biological and chemical properties of the stream and assess the jurisdictional status of the system. In the vicinity of the South Lauko Road extension (Lauko 1 and 2), channels of the two tributaries have distinct bed and banks and we observed aquatic biota (not amphidromous) in shallow pools. Surface flow was limited

but pools were numerous. In the vicinity of the South Pszyk Road extension, two tributaries and a ditch (P1, P2 and P3) contained at least a single ephemeral pool of water, but no aquatic biota was observed. No water and no channel were observed at a fourth tributary (P4). Two small tributary crossings along South Pszyk Road were not accessible and were not surveyed.

The unnamed stream system is an intermittently-flowing, interrupted stream. The US Geological Survey (USGS) maps for the area (Pu'umaka'ala Quadrangle, 2013; Mountain View Quadrangle, 2013; and Pāhoā North Quadrangle, 2013) show the unnamed stream system originating on the east slope of Mauna Loa, 2200 ft above sea level (ASL) in the Ola'a Homesteads region (see location map). Five tributaries cross South Pszyk Road and two tributaries cross South Lauko Road. A single channel of the unnamed stream system disappears just downslope from Kea'au-Pahoā Highway (Hwy 130) at 180 ft ASL at Waipāhoehoe, presumably where it flows out onto highly permeable Kīlauea lavas. The USGS map depicts the point at which the stream disappears underground to be approximately 7.6 miles downslope from South Pszyk Road and 3.5 miles upslope from the Pacific Ocean at Paki Bay.

AECOS conducted surveys of this stream system in 1998, 2004, and 2009 (AECOS, 1998, 2004, 2009). As reported in our 2009 report, downslope from the stream crossing at Highway 130, "[a]t Railroad Avenue there is no evidence of a stream or floodway of any kind. The report concluded, "this stream system is isolated from the ocean, is intermittent, and flow contributes only to the general groundwater aquifer of the Puna District." On October 26, 2009, the U.S. Army Corps of Engineers agreed with our assessment and prepared an approved jurisdictional determination form (POH-2009-00270-JD1), which determined the unnamed stream system is not jurisdictional because it "is isolated with no connection to the Pacific Ocean. All water infiltrates via fractures in the lava surface approximately 3.5 miles before reaching the ocean. The waters are not navigable nor do they maintain a nexus to interstate commerce."

The unnamed stream system does not have a surface connection to the Pacific Ocean. Despite having distinct bed and banks in the vicinity of the Project, the stream system does not appear to be jurisdictional because it is not tributary to a traditional navigable water. The unnamed stream system does not have the potential to impact the chemical, physical, and biological integrity of the Pacific Ocean.

Signed,



Chad Linebaugh
AECOS, Inc.

Attachment: Location map

Copies furnished to:

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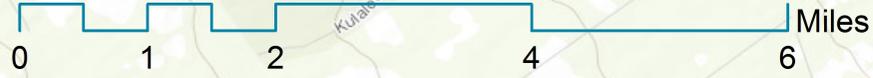
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SURVEY AREAS IN UNNAMED STREAM SYSTEM



Pacific Ocean

