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JUL - 8 2015

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June 19, 2015

Virginia Pressler, M.D., Director
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RECEIVED
'15 JUN 24 P1:04
OFFICE OF ENVIRONMENTAL QUALITY CONTROL

Dear Dr. Pressler:

SUBJECT: Draft Environmental Assessment (DEA)
Applicant: Kohala Shoreline, LLC
Request: 9-Lot Subdivision
TMK: (3) 5-9-001:008 Kahuāli'ili'i, North Kohala, Hawai'i

The Hawaii County Planning Department has reviewed the draft environmental assessment for the subject project and anticipates a Finding of No Significant Impact (FONSI) determination. Please publish notice of availability for this project in the July 08, 2015, OEQC Environmental Notice.

We have enclosed a completed OEQC Publication Form, one copy of the draft EA, and a copy of the draft EA and the project summary hardcopy on disk. If you have any questions, please feel free to contact Bethany Morrison at 961-8138.

Sincerely,

DUANE KANUHA
Planning Director

BJM:cs
P:\wpwin60\CH343\2015\LTerry-KohalaShoreline-AntFonsiDEA.doc

Enclosures: Draft EA (1 copy)
Completed OEQC Publication Form
Draft EA and Project Summary (on disk)
cc ltr. only: Mr. Ron Terry
GEOMETRICIAN ASSOCIATES LLC

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

Project Name: Kohala Shoreline, LLC Project

Island: Hawai'i

District: North Kohala

TMK: (3rd) 5-9-001:008

Permits:

County of Hawai'i, Department of Public Works, Engineering Division: Grading Permit.

County of Hawai'i, Planning Department, Variance and/or Planned Unit Development Permit and Subdivision Approval.

County of Hawai'i, Leeward Planning Commission, Special Management Area Use Permit and Change of Zone Recommendation.

County of Hawai'i, County Council, Change of Zone Approval.

State Department of Transportation: Approval for Work within State Roadway Right-of- Way.

State of Hawai'i, Department of Health: Underground Injection Control (UIC) permit. National Pollutant Discharge Elimination System (NPDES) permit.

Approving Agency:

Hawai'i County Planning Department

101 Aupuni Street, Suite 3

Hilo HI 96720

Bethany Morrison 808-961-8138

Applicant:

Kohala Shoreline, LLC

c/o Carlsmith Ball

121 Waianuenu Avenue

Hilo HI 96720

Consultant:

Geometrician Associates

PO Box 396

Hilo HI 96721

Ron Terry 808-969-7090

Status (check one only):

_x_DEA-AFNSI

Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day comment period ensues upon publication in the periodic bulletin.

_FEA-FONSI

Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov; no comment period ensues upon publication in the periodic bulletin.

_FEA-EISPN

Submit the approving agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov; a 30-day consultation period ensues upon publication in the periodic bulletin.

_Act 172-12 EISPN

Submit the approving agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov. NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.

_DEIS

The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.

- __FEIS
The applicant simultaneously transmits to both the OEQC and the approving agency, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqc@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.
- __ Section 11-200-23
Determination
The approving agency simultaneously transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the applicant. No comment period ensues upon publication in the periodic bulletin.
- __ Statutory hammer
Acceptance
The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it failed to timely make a determination on the acceptance or nonacceptance of the applicant's FEIS under Section 343-5(c), HRS, and that the applicant's FEIS is deemed accepted as a matter of law.
- __ Section 11-200-27
Determination
The approving agency simultaneously transmits its notice to both the applicant and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.
- __Withdrawal (explain)

Summary:

Kohala Shoreline, LLC proposes to develop a 9-lot subdivision makai of Akoni Pule Highway (on a 37.88-acre parcel 3 miles north of Kawaihae). The owner proposes to downzone from Single-Family Residential (RS-15) to Residential and Agricultural (RA-3a) to permit less dense development. The project includes an existing lateral shoreline access, planned public parking and a mauka-makai shoreline access, and planned accommodation of the Ala Kahakai National Historic Trail on the existing Ala Loa/jeep trail. Except for one lot configured to accommodate the trail, the setback from the shoreline to the building pads would be a minimum of 100 feet. No threatened or endangered plant species are present, and wide-ranging endangered vertebrates would be protected by construction timing and project design. Implementation of archaeological preservation, data recovery plans and burial treatment plans will mitigate impacts to historic sites. Cultural impacts on traditional gathering along the shoreline will be avoided by the large shoreline buffer and public access provisions. Due to 25-foot height restrictions, low density and setbacks from both the highway and shoreline on the sloped lot, visual effects will be minor. Water quality effects were calculated considering water extraction, wastewater infiltration and irrigation return, and they will be negligible.

DRAFT ENVIRONMENTAL ASSESSMENT

Kohala Shoreline, LLC Project

TMK: (3rd) 5-9-001:008

Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i

June 2015

**Prepared for:
County of Hawai‘i
Planning Department
Aupuni Center, Suite 3
101 Pauahi Street
Hilo, HI 96720**

DRAFT ENVIRONMENTAL ASSESSMENT

Kohala Shoreline, LLC Project

TMK: (3rd) 5-9-001:008
Kahuāliʻiliʻi, North Kohala District, Hawaiʻi Island, State of Hawaiʻi

APPLICANT:

Kohala Shoreline, LLC
c/o Carlsmith Ball
121 Waianuenue Avenue
Hilo HI 96720

APPROVING AGENCY:

County of Hawaiʻi
Planning Department
101 Pauahi Street, Suite 3
Hilo HI 96720

CONSULTANT:

Geometrician Associates LLC
PO Box 396
Hilo HI 96721

CLASS OF ACTION:

Use of State Land

This document is prepared pursuant to:

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

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SUMMARY OF THE PROPOSED ACTION, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

Kohala Shoreline, LLC proposes to develop a 9-lot subdivision *makai* of the Akoni Pule Highway (State Route 270) on a 37.88-acre parcel located approximately three miles north of Kawaihae Harbor. The lots would vary in size from about three to five acres. A Special Management Area Use Permit and a change of zone will be required. The project site is currently zoned Single-Family Residential (RS-15), which would be modified to Residential and Agricultural (RA-3a) to permit larger lots and less dense development when residences are built. Similar developments are located nearby at Kohala Ranch, Kohala Kai Subdivision and at Kohala by the Sea Subdivision. Road access would be from two permitted access locations along the highway, although one of these locations is proposed to be moved to avoid a gulch crossing. The lots would be provided with internal roadways and underground electricity, telephone and water service from existing lines along the highway. The homes to be built would utilize individual wastewater systems designed pursuant to the requirements of the State Department of Health. The project includes public parking and a *mauka-makai* shoreline access, as well as a continuous lateral shoreline access in the form of an existing easement near the shoreline. It is also expected that the Ala Kahakai National Historic Trail will utilize the Ala Loa, which meanders through the *makai* third of the property. In general, the setback from the shoreline to the building envelopes would be a minimum of 100 feet. To accommodate the Ala Loa/Ala Kahakai alignment, for one lot at the far north of the property the setback is proposed at 40 feet. Within the buffer there would be no homes or other structures.

A botanical survey conducted on the project site found no threatened or endangered plant species. Vegetation consists of introduced species, except for several common plants indigenous to Hawai‘i. Implementation of archaeological preservation, data recovery plans and burial treatment plans will mitigate impacts to historic sites. Cultural impacts on traditional and customary gathering rights along the shoreline will be avoided by the large shoreline buffer area and public access provisions that will preserve the landscape and cultural uses of the shoreline area. In the unlikely event that additional archaeological resources or human remains are encountered during future development activities, work in the immediate area of the discovery will be halted.

The home sites would be located a minimum of 100 feet *makai* of the highway on land with a moderate slope and scattered *kiawe* trees. Covenants will restrict homes to a height of 25 feet as measured according to Chapter 25 of the Hawai‘i County Code and will require a color scheme featuring earth-tones to minimize visual impacts. Due to these design features and the sloping nature of the site, the project would have only minor residual visual impacts for drivers on Akoni Pule Highway looking toward the sea. The project is not expected to have a negative impact on coastal water resources, as it would be low-density, with homes and other structures separated from the ocean by the wide shoreline setback. All construction will conform with County, State and federal regulations, including County flood control and Federal Emergency Management Agency requirements.

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PART 1: PROJECT DESCRIPTION, LOCATION, AND ENVIRONMENTAL ASSESSMENT PROCESS

1.1 Property Ownership and Project Location and Description

Kohala Shoreline, LLC (“Kohala Shoreline” or “the owner”) proposes to develop a 9-lot subdivision (the project) within its 37.88-acre property at TMK (3) 5-9-001: 008 at Kahuali‘ili‘i, North Kohala, County and State of Hawai‘i (the “property” or “subject property”) located along Akoni Pule Highway (State Route 270), approximately three miles north of Kawaihae Harbor (Figures 1-3). The property is within the County’s Special Management Area (SMA), and an SMA Use Permit application will be processed with the Hawai‘i County Leeward Planning Commission (Planning Commission). A change of zone application from the current Single-Family Residential (RS-15) zoning district to the Residential and Agricultural (RA-3a) zoning district will be concurrently processed through the Planning Commission and the County Council. The owner may or may not elect to pursue a variance, Planned Unit Development or any other administrative permit to modify road standards, lot sizes or other design elements during the subdivision or development process.

The Mission Statement for the owner of the property expresses the intent to develop and utilize the property with a minimum of impact:

Our mission is to set a new standard of stewardship for new, small-scale, coastal housing clusters for twenty first century Hawai‘i.

Hawai‘i is blessed with pristine beauty and rich biodiversity. Traditionally, its people lived in harmony with the land and the sea, protecting the natural wonderments that make Hawai‘i such an extraordinary place. To this end, we will work to protect and preserve the sensitive natural landscapes and seascapes along the Hawaiian coastline. Furthermore, we will serve as good neighbors to the local communities, respecting their values and cultural traditions. We believe that the built environment must be mindful of its intrusion into, and its framing within the natural environment. We will build an environmentally healthy house that minimizes its impacts to the earth, and possesses an aesthetic beauty in balance with its natural surroundings. To lessen the negative climate impacts caused by conventional structures, we will use best practices in design for energy efficiency and functionality, and for low carbon production and natural resource consumption. Natural materials such as wood and stone will be sustainably harvested, and all manufactured materials used will be environmentally sensitive. We will use construction methods that avoid or mitigate disruptions to the local ecology and wildlife, as well as to the archeological history of those who lived on this land before us.

This mission is a commitment made by ourselves, and by our partners in design and construction. We will ask our future neighbors on the property to join us in following this mission as well.

Pre-planning for the property is already involving students from Hawai'i Preparatory Academy in high-tech, automated meteorological research to help design energy efficient passive cooling systems (Figure 2). The sophisticated student-led research has involved unmanned aerial vehicles; real time streaming environmental sensors for seismic, chemical, meteorological and acoustic data; thermionic cooling studies; and whale studies with visual fixed cameras with local store/forward capability.

The property is currently zoned Single-Family Residential, with a minimum lot size of 15,000 square feet (RS-15), under Rezoning Ordinance No. 97-02. SMA Permit 379, which allowed for development of a 50-lot subdivision, was issued for the property but is in technical default for failure to timely comply with certain conditions of approval. Upon reviewing the project site and development options, the owner determined that a less dense development would be more in keeping with surrounding zoning and land uses and his Mission Statement. The owner is therefore proposing a change of zone to Residential and Agricultural 3-acres (RA-3a), which would decrease potential density from 50 lots on which residences would eventually be built down to 9 lots, reducing the impacts associated with denser development. The scale of the lots and character of the development would be similar to the A-3a and A-5a zoned lots immediately upslope at Kohala Ranch.

Road access would be from two locations along the highway, as shown in Figure 3a. The project has two existing permitted access points, one opposite Kohala Ranch Road and the other approximately 980 feet to the south. Because the southern third of the project site is separated from the remainder by Keawewai Gulch, which, under the present configuration, would require construction of a bridge or large culvert, the plan calls for relocating the southern road access point approximately 300 feet further south. The project would be served with underground water, electrical, and telephone service from existing lines located within a utility easement along Akoni Pule Highway. Homes will utilize individual wastewater treatment systems meeting with the requirements of the State Department of Health.

The future homes would be located a minimum of 100 feet *makai* of the highway on land with a moderate slope and scattered *kiawe* trees. Covenants, Conditions and Restrictions (CC&Rs) will restrict homes to a height of 25 feet as measured according to Chapter 25 of the Hawai'i County Code, and require a color scheme featuring earth-tones to minimize visual impacts. Landscaping will be installed along the development's two internal roadways and also on residents' lots, subject to CC&Rs. The project includes public parking and a *mauka-makai* shoreline access, as well as a continuous lateral shoreline access in the form of an existing easement near the shoreline. It is also expected that the Ala Kahakai National Historic Trail will utilize the Ala Loa, which meanders through the *makai* third of the property (see Figure 3a). In general, the shoreline setback to building envelopes would be a minimum of 100 feet. For one lot at the far north of the property the setback is proposed at 40 feet to accommodate the Ala Loa/Ala Kahakai alignment. Within the buffer there would be no homes or other structures. The project will also include gradual landscaping in selected areas near the shoreline intended to restore native species in order to enhance the biological environment and human enjoyment of the area (Figure 3b).

Figure 1a General Location Map

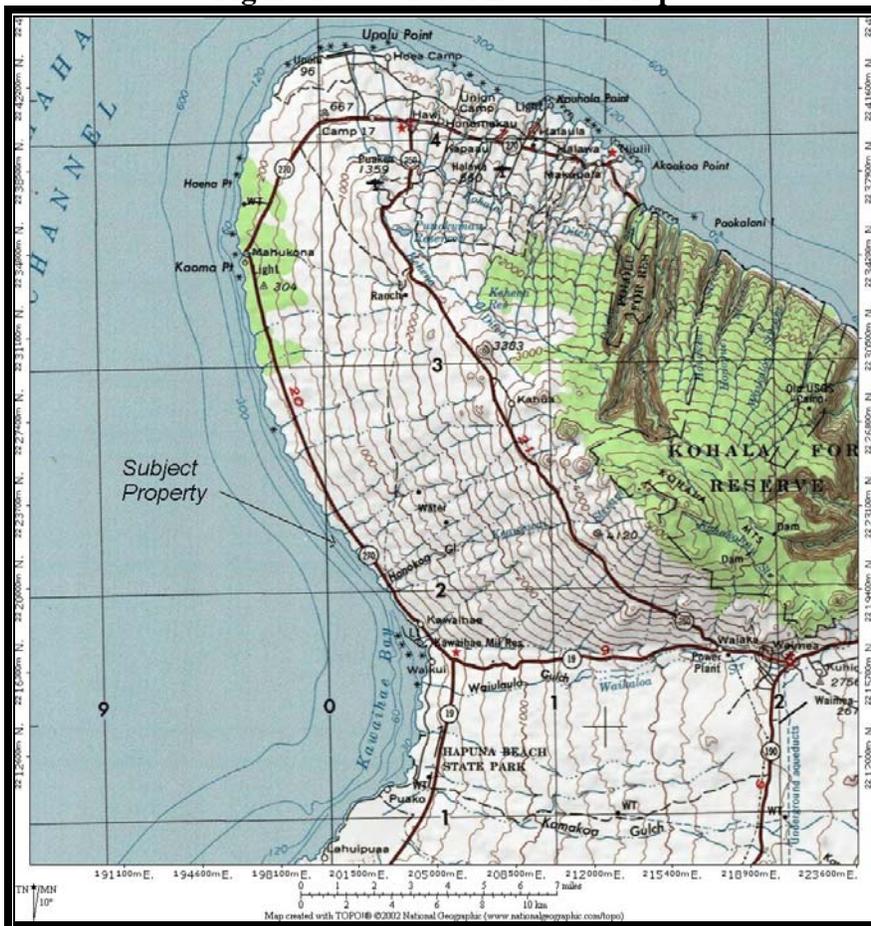


Figure 1b TMK Map

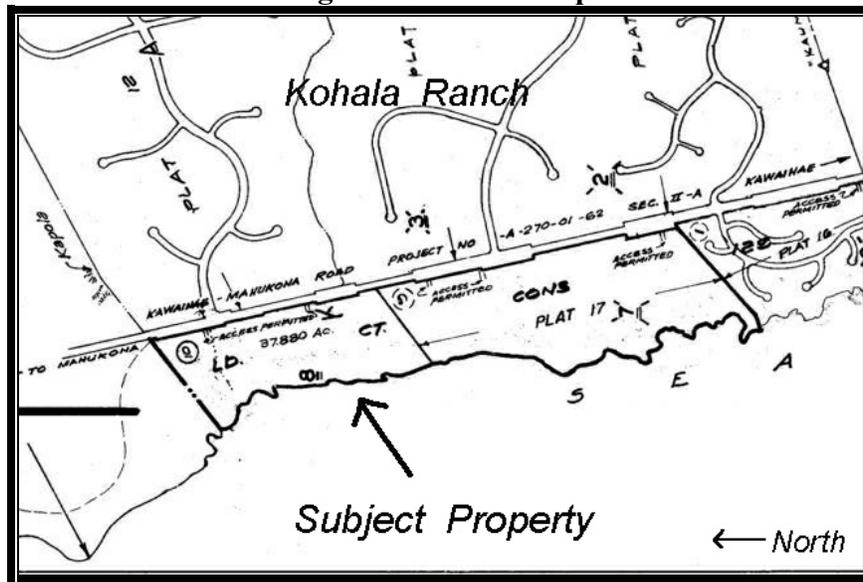
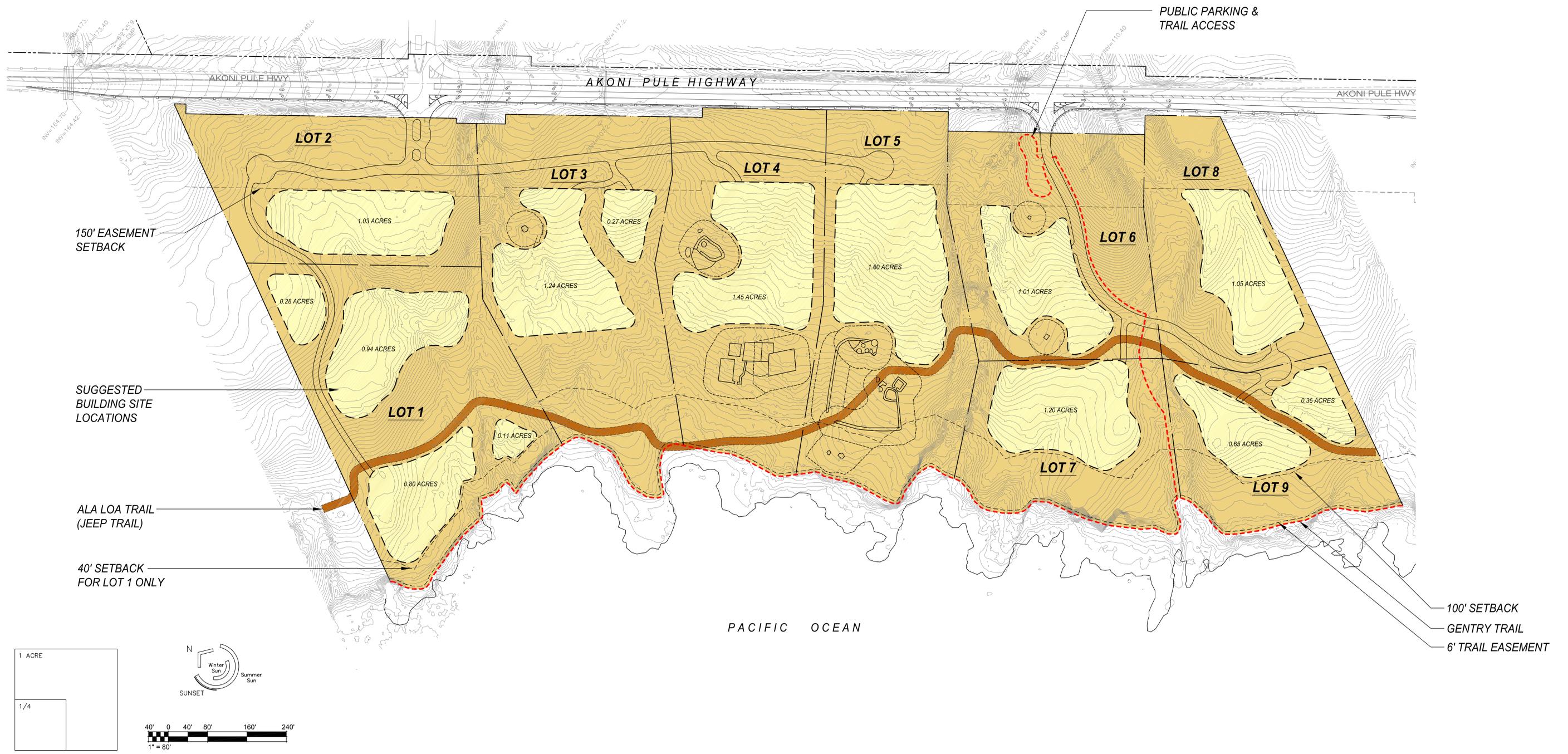


Figure 2 Project Site Photos



Typical Landscape ▲ ▼ Hawai'i Prep. Academy Students Investigating Site Meteorology





KOHALA SHORELINE

North Kohala Coast

APRIL 2015

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FIG. 3B: LANDSCAPE CONCEPT



*Kauna'oa and Pōhuehue,
spreading over near-
shoreline wave deposits*

*(Cuscuta sandwichiana and
Ipomoea pes-caprae)*

*Akulikuli and Ōhelo Kai,
low-lying on bare rock*

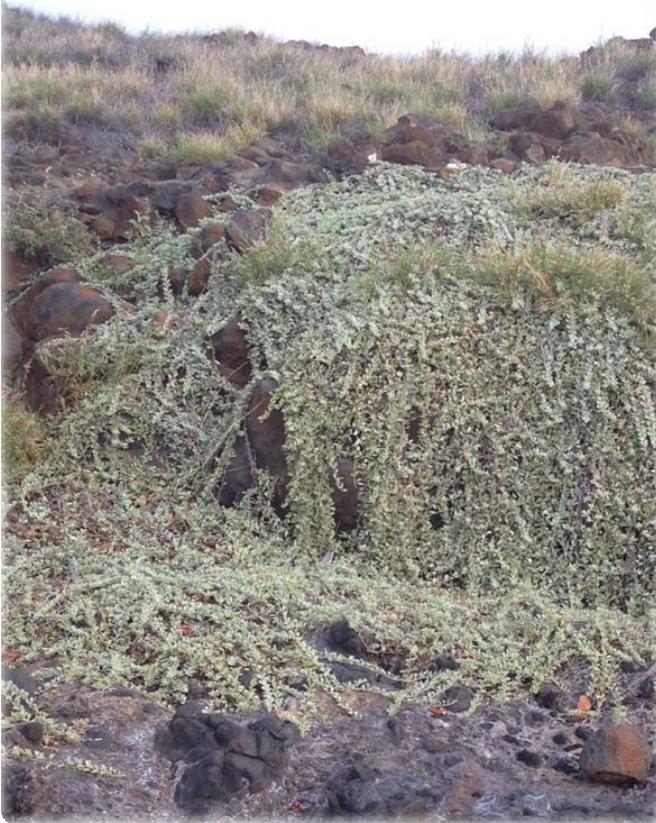
*(Sesuvium portulacastrum and Lycium
sandwicense)*



*'Ilima, low stature or
spreading*

(Sida fallax)

FIG. 3B: LANDSCAPE CONCEPT



*Pā'ū-O-Hi'iaka draping
over low cliffs near
shoreline*

(Jacquemontia ovalifolia)

Upright Pōhinahina clusters

(Vitex rotundifolia)



FIG. 3B: LANDSCAPE CONCEPT



*Alena sprawling
and draping over rocks*

*(Boerhavia repens)
Photo courtesy Forest and Kim
Starr*

*Low bushes of silvery
hinahina*

*(Heliotropium anomalum)
Photo courtesy Forest and Kim Starr*



FIG. 3B: LANDSCAPE CONCEPT



*Nohu sprawling
and draping over shore*

(Tribulus cistoides)

Photo courtesy Forest and Kim Starr

Rare 'Ihi with white flowers

(Portulaca villosa)

Photo courtesy Forest and Kim Starr



1.2 Environmental Assessment Process

Because the project involves a discretionary permit in the form of a Special Management Area Use Permit, its use of land within State rights-of-way for utility and access connections triggers the need for an Environmental Assessment analyzing these connections and the associated development pursuant to Chapter 343, Hawai‘i Revised Statutes (HRS), Hawai‘i’s EIS law. This Environmental Assessment (EA) process is being conducted in accordance with HRS Chapter 343. 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 HRS 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 findings that no significant impacts are expected to occur; Part 5 lists each criterion and presents the preliminary findings for each made by the County of Hawai‘i Planning Department, the approving agency. If, after considering comments to the Draft EA, the approving agency concludes that, as anticipated, no significant impacts would be expected to occur, the agency will issue a Finding of No Significant Impact (FONSI), and the action will be permitted to proceed to necessary permits and approvals. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, an Environmental Impact Statement (EIS) will be prepared.

1.3 Public Involvement and Agency Coordination

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

Federal:

National Park Service, Ala Kahakai National Historic Trail

State:

Department of Land and Natural Resources
Department of Health
Department of Transportation, Highways Division, Hawai‘i District
Office of Hawaiian Affairs, Honolulu and West Hawai‘i
State Historic Preservation Division

County:

County Council
Department of Public Works
Department of Environmental Management
Department of Water Supply
Planning Department
Police Department
Fire Department

Private:

Kawaihae Puaka‘ilima Community Association
Sierra Club, Moku Loa Group
Kona Hawaiian Civic Club
North Kohala Community Access Group
South Kohala Community Development Plan Action Committee
Kailapa Homesteads residents
South Kohala Hawaiian Civic Club

Copies of communications received during early consultation are contained in Appendix 1a. As discussed in Section 3.2.3, the project team has attended a number of meetings of the North Kohala Community Access Group and held several field visits for this and other community groups.

PART 2: ALTERNATIVES

2.1 Proposed Project

The *proposed project* is the proposed change of zone to Residential and Agricultural 3-acres (RA-3a), Special Management Area Use Permit and development of a 9-lot subdivision with related improvements (see Figure 3a for conceptual lot layout), with vehicular access and utility connections within the State of Hawai‘i’s Akoni Pule Highway right-of-way. It is expected that each lot would eventually be developed with a residence and accessory uses.

2.2 No Action

Under the No Action Alternative, development of the property would not occur. This would avoid any adverse environmental impacts related to the development. It would also preclude benefits including jobs, income, and tax revenues associated with the development, and would not enhance public access to or along the shoreline. The No Action Alternative forms the baseline against which environmental impacts associated with the proposed action are measured.

2.3 Alternatives Evaluated and Dismissed from Further Consideration

As stated in Section 1.1, the property is currently zoned Single-Family Residential, with minimum lot size of 15,000 square feet (RS-15), which could allow up to 110 dwelling units. The Planning Commission previously issued SMA Use Permit No. 379 (SMA 379) allowing a 50-lot single-family residential subdivision. SMA 379 is in technical default for failure to timely comply with certain conditions of approval. Upon reviewing the project site and development options, the owner determined that a less dense development alternative of 9 lots would decrease many of the impacts associated with the density permitted under RS-15 zoning, and would be more in keeping with his Mission Statement and the surrounding zoning and land uses. Therefore, a higher density alternative using existing zoning is not being considered at the present time and is not being advanced in this Environmental Assessment.

If the proposed rezoning is not approved, the owner may in the future consider a higher-density development consistent with the current RS-15 zoning, at which time the owner would comply with all applicable requirements of HRS Chapter 343.

Kohala Shoreline, LLC does not envision any other development scenarios that could reasonably satisfy its objectives and vision for the property, and therefore none are advanced or analyzed.

PART 3: ENVIRONMENTAL SETTING, IMPACTS AND MITIGATION MEASURES

Basic Geographic Setting

The Kohala Shoreline, LLC property is referred to throughout this EA as the *project site*. The term *project area* is used to describe the general environs in this area of Kohala.

The project site is a 37.88-acre parcel in the State Land Use Urban District, located approximately three miles north of Kawaihae Harbor. It reaches from the shoreline to approximately 160 feet above sea level, *makai* of the State-owned Akoni Pule Highway (see Figures 1-4). Adjacent land use is primarily rural residential and agricultural lots, with scattered undeveloped properties. The surface of the project area has been partially disturbed previously by ranching and fire, and the vegetation is composed of almost entirely of two non-native species, *kiawe* and buffel grass. The project is bounded by Akoni Pule Highway and Kohala Ranch subdivision to the east, the Pacific Ocean to the west, undeveloped State land to the north and Kohala Kai, an agricultural subdivision to the south.

3.1 Physical Environment

3.1.1 Climate, Geology, Soils and Natural Hazards

Environmental Setting

The climate in the project area is mild and arid, with a mean annual rainfall of about 10 inches and a mean annual temperature of 75 degrees (U.H. Hilo-Geography 1998:57). Geologically, the project site is located on the flanks of Kohala Volcano. The surface of the property consists of a lava flow that occurred more than 10,000 years before the present (Wolfe and Morris 1996).

The project site soil is classified by the U.S. Natural Resources Conservation Service (formerly Soil Conservation Service) as Kawaihae very rocky, very fine sandy loam (KOC). The KOC soil is typically found up to 2 inches thick, underlain by up to 31 inches of stony loam, on slopes of 6 to 12 percent. This pH neutral soil typically contains up to 30 percent rock outcroppings. Its permeability is moderate, runoff is medium and the erosion hazard moderate. The capability subclass for KOC is VIIs, which denotes soils that have very severe limitations that make them very unsuited for cultivation and restrict their use to mainly pasture and woodland (U.S. Soil Conservation Service 1973). It is unclassified in the Agricultural Lands of Importance in the State of Hawai'i maps, and

the Land Study Bureau classifies the land as E or “Very Poor.” Both ratings indicate the land’s poor agricultural potential.

The entire Big Island is subject to geologic hazards, especially lava flows and earthquakes. Volcanic hazard as assessed by the U.S. Geological Survey at the project site is Zone 9, on a scale of ascending risk from 9 to 1 (Heliker 1990:23). The low hazard risk is based on the fact that Kohala Volcano, the oldest volcano on the island, has not erupted for 60,000 years and is possibly extinct. In terms of seismic risk, the entire Island of Hawai‘i is rated Zone 4 Seismic Hazard (*Uniform Building Code, 1997 Edition*, Figure 16-2). Zone 4 areas are at risk from major earthquake damage, especially to structures that are poorly designed or built. The project site does not appear to be subject to subsidence, landslides or other forms of mass wasting.

Wildfire is an important concern in this part of North Kohala, which has burned on a number of occasions owing to arson, car exhaust, campfires and firecrackers, among other causes. Fires started on this property may harm not only the owner’s property but nearby property as well, including Kohala Ranch and State land immediately adjacent to the north.

Impacts and Mitigation Measures

In general, soil and geologic conditions impose no constraints on the area, and development of the project site is reasonable. Appropriate seismic standards would be followed during any building construction, per building codes.

Vegetation at the edge of each building pad will be kept low to act as a fuelbreak in order to reduce the spread of fire on or off the property. The shoulder of the access roads will be mowed to reduce fuel buildup, and no parking will be allowed on these roads in order to avoid ignition from catalytic converters. Finally, the roads will have fire hydrants to assist in fighting not only house fires but wildfires, should they originate on or off the property. Water service will be provided to each lot for potable and irrigation uses, and irrigated vegetation will have less potential to ignite or spread fires.

3.1.2 Drainage, Water Features and Water Quality

Existing Environment

The project area has no perennial freshwater bodies. Several ephemeral streams that form gulches are present. Four single culverts and one double culvert carry storm runoff from *mauka* lands under Akoni Pule Highway onto the project site. This storm water flows across and through the site in existing, natural, normally dry gulches to the shoreline. Culverts will be constructed at locations where roadways cross the gulches. Storm runoff from roads and house sites will be collected by a system of swales and disposed of in onsite shallow drywells or infiltration areas. The Federal Emergency Management Agency’s Flood Insurance Rate Map (FIRM) 1551660128C (9/16/1988) indicates that the majority of the project site is in Flood Zone X, outside of the 500-year floodplain. A narrow portion of the shoreline along the project site is in Flood Zone VE, indicating the 100-year flood coastal, high-hazard floodplain, incorporating storm surge inundation. No home development is planned for this area.

Maps printed by the Pacific Tsunami Warning Center and the Hawai'i County Civil Defense Agency indicate that areas *makai* of Akoni Pule Highway should be evacuated during a tsunami warning (<http://www5.hawaii.gov/tsunami/maps.asp>). Large extents of Hawai'i Island, including the project area, have been struck by highly destructive tsunami in historic times. The April 1, 1946 tsunami had a runup in the area of nearby Waiakailio Bay of 12 feet (*Atlas of Hawai'i*, 3rd edition) (well below the minimum elevation of 25 feet for all proposed development).

Marine Research Consultants performed an evaluation of existing nearshore water chemistry and marine biology offshore from the property, as well as an assessment of impacts from the proposed project. The report, which also incorporated research from Tom Nance Water Resource Engineering, is included as Appendix 2 and briefly summarized below and in the next section.

Water quality and the marine biotic community were analyzed based on fieldwork carried out in March 2010, and the results of that analysis are described below in Section 3.1.3. An additional 2015 survey to provide a second baseline is currently underway, as part of the owner's ongoing environmental research on the land and its surrounding environment. Water chemistry samples were collected offshore of the project site from three transect survey sites. Water samples were taken from ten locations on each transect. In addition, samples were taken from two high level wells located *mauka* of the project site.

These samples were assessed for the water quality parameters included in the Hawai'i State Department of Health (DOH) Water Quality Standards, including: (i) total dissolved nitrogen (TDN); (ii) nitrate + nitrite nitrogen (NO_3^-); (iii) ammonium nitrogen (NH_4^+); (iv) total dissolved phosphorus (TDP); (v) orthophosphate phosphorus (PO_4^{3-}); (vi) Chlorophyll *a* (Chl *a*); (vii) turbidity; (viii) temperature; (ix) pH; (x) salinity; and (xi) silica (Si). Silica was reported because this parameter is a sensitive indicator of biological activity and the degree of groundwater mixing.

Analysis of the samples indicated that the dissolved nutrients (Si, NO_3^- , TDN) levels were elevated and salinity levels lowered in the samples collected within about five meters of the shoreline. These normal patterns are the result of concentrated input of groundwater to the ocean near the shoreline. Similarly, the distribution of Chl *a* and turbidity also peak near the shoreline. Water chemistry parameters that are not associated with groundwater input, such as NH_4^+ , dissolved organic nitrogen and dissolved organic phosphorus, did not show the same uniformly progressive decreases with distance from the shore.

The western shore of the Island of Hawai'i has specific water quality standards under Hawai'i Administrative Rules §11-54-6(d) of the DOH. The major difference between these specific criteria and the general criteria for open coastal waters for the rest of the State is the consideration that high nutrient groundwater mixes with oceanic water within the nearshore zone. As a result, area specific criteria for nutrients that occur in high concentrations in groundwater relative to ocean water (NO_3^- , TDN, PO_4^{3-} , and TDP) are evaluated differently depending on salinity. In areas where nearshore marine water salinity is greater than 32‰ (parts per thousand), specific criteria for geometric means apply. Geometric means were calculated at each sampling station by using three values collected on

three sampling dates spaced within a 14-day period. For samples with salinity below 32‰, compliance with the DOH criteria is defined by the slope of the regression line of the nutrient concentration as a function of salinity.

For technical details on how the sample data were analyzed in conformance with these models, the reader is referred to Appendix 2. Although exceedances of standards for the parameters listed above were measured, they are in fact commonly observed in many undeveloped areas. The exceedances are likely the result of nearshore physical processes or the natural influence of land on the coastal ocean, neither of which are accounted for in the DOH standards. Overall, the water off the project site is very clear and clean, with no apparent human-induced pollution problems. Refer to Section 3.1.3 for a discussion of water quality in the context of marine biology.

Impacts and Mitigation Measures

The area proposed for homes and improvements is outside the designated flood zone, and no flood zone impacts will occur. The location of all house pads set back from the shoreline at a minimum elevation of about 25 feet above sea level (and generally above 50 feet) prevents exposure to tsunamis of the scale experienced in human history. The National Weather Service of the National Oceanic and Atmospheric Administration operates the Pacific Tsunami Warning Center and Alaska Tsunami Warning Center, which monitors sudden earth movements throughout the Pacific Basin. A tsunami from earth movements in South America would allow for as much as 15 hours warning time and events in the Aleutian Islands, 4.5 hours, providing sufficient time for evacuation of island residents. Warning sirens are present in Kawaihae but are not readily audible at the project site. The Hawai‘i County Civil Defense Agency recommends that residents in areas of the island where sirens are not audible sign up for mobile alerts. Sudden movement along faults close to Hawai‘i are unpredictable, and would allow for a few minutes to perhaps an hour of warning time, and evacuation would be more problematic.

Construction has the potential to produce uncontrolled excess sediment from soil erosion during and after clearing and excavation that may impact natural watercourses, water quality and flooding. Contaminants associated with heavy equipment and other sources during construction can impact surface water and groundwater if not mitigated effectively. In order to minimize the potential for sedimentation and erosion of shoreline areas, the contractor shall perform all earthwork and grading in conformance with Chapter 10, Erosion and Sediment Control, Hawai‘i County Code.

Because infrastructure development for the project will disturb more than one acre of soil, a National Pollutant Discharge Elimination System (NPDES) permit must be obtained by the contractor before the project infrastructure construction commences. This permit requires the completion of a Storm Water Pollution Prevention Plan (SWPPP). In order to properly manage storm water runoff, the SWPPP will describe the emplacement of a number of best management practices (BMPs) for the project. These BMPs may include, but will not be limited to, the following:

- Minimization of soil loss and erosion by revegetation and stabilization of slopes and disturbed areas of soil, possibly using hydromulch, geotextiles, or binding substances, as soon as possible after working;
- Minimization of sediment loss by emplacement of structural controls possibly including silt fences, gravel bags, sediment ponds, check dams, and other barriers, in order to retard and prevent the loss of sediment from the site;
- Minimizing disturbance of soil during periods of heavy rain;
- Phasing of large projects in order to disturb a minimum necessary area of soil at a particular time;
- Application of protective covers to soil and material stockpiles;
- Construction and use of a stabilized construction vehicle entrance, with designated vehicle wash area that discharges to a sediment pond;
- Washing of vehicles in the designated wash area before they egress the project site;
- Use of drip pans beneath vehicles not in use in order to trap vehicle fluids;
- Routine maintenance of BMPs by adequately trained personnel; and
- Clean up of significant leaks or spills and disposal at an approved site, if they occur.

At the point in time when individual homes are developed, there may be additional land clearing that involves areas of an acre or less which may not be subject to NPDES or grading permits. In order to ensure proper mitigation for potential sedimentation, the project will adopt relevant protocols for grading of the lots, similar to those in the *Recommended Construction Best Management Practices (BMPs) for Land Disturbance of Less Than One Acre* that was approved by Board of Directors of the Kohala Ranch Community Association, on August 9, 2007. Specifically, the following are proposed as both CC&Rs applicable to all lots in the project and as conditions of approval of the SMA Use Permit:

(a) Construction Management Techniques

- (1) Limit clearing and grubbing to the minimum necessary for grading and equipment operation.
- (2) Sequence construction to minimize the exposure time of the cleared surface area
- (3) Stage or phase construction for large projects. Stabilize the land surface in one phase before land disturbing activities are initiated in another phase. Stabilization must be accomplished by temporarily or permanently protecting the disturbed soil surface from rainfall impacts and runoff.
- (4) Erosion and sediment control measures must be in place and functional before earth moving operations begin. These measures shall be properly constructed and maintained throughout the construction period.
- (5) All control measures must be checked and repaired as necessary, for example, weekly in dry periods and within twenty-four hours after any rainfall of 0.5 inches or greater within a 24-hour period. During prolonged rainfall, daily checking may be necessary. Maintain records of checks and repairs.
- (6) Maintain records of the duration and estimated volume of storm water discharge(s).
- (7) A specific individual shall be designated to be responsible for erosion and sediment controls on each project site.

(b) Vegetation Controls

- (1) Pre-construction vegetative ground cover shall not be destroyed, removed, or disturbed more than twenty calendar days prior to land disturbance.
- (2) Temporary soil stabilization with appropriate vegetation must be applied on areas that will remain unfinished for more than thirty calendar days.
- (3) Permanent soil stabilization with perennial vegetation or pavement shall be applied as soon as practical after final grading. Irrigation and maintenance of the perennial vegetation must be provided for thirty calendar days or until the vegetation takes root, whichever is shorter.

(c) Structural Controls

- (1) Storm water flowing toward the construction area must be diverted by using appropriate control measures, as practical.
- (2) Erosion control measures shall be designed according to the size of disturbed or drainage areas to detain runoff and trap sediment.
- (3) Water must be discharged in a manner that the discharge shall not cause or contribute to a violation of State of Hawai'i Water Quality Standards.

On a long-term basis, evaluations of changes to groundwater flux and composition resulting from the project conducted by Tom Nance Water Resources Engineering indicate that groundwater flow along the half-mile of coastline fronting the property would potentially increase by about 0.8% compared to present conditions. This was calculated by subtracting an appropriate portion of the extracted groundwater from the increase due to infiltration associated with both the leach fields of individual wastewater units and irrigation from landscaping that would be associated with future use of the lots as residences. Accompanying the increase in flow rates are relatively small increases in nutrient loading of 1.2% for nitrogen and 0.1% for phosphorus, and decreases in salinity of 0.8%.

These increases will result in nutrient concentrations in groundwater entering the ocean off the property that are considerably lower than in naturally occurring groundwater in other areas of West Hawai'i. In addition, dilution of groundwater at the shoreline and within the nearshore zone by turbulent mixing will result in little or no change to groundwater-marine water dynamics. Even if measured concentrations of nutrients are increased by the projected amounts with the development in place, nearshore waters are so well-mixed by ocean waves that there is little likelihood that concentrations will increase beyond the present ranges of conditions.

Overall, results of the water chemistry analysis indicate that there does not appear to be any potential for substantial project-related adverse impacts to marine waters off the property. Changes of land use associated with the proposed project should not change water quality of the offshore area to any discernible extent.

Relevant conditions that were imposed by the Hawai'i County Planning Commission and/or Hawai'i County Council as part of SMA 379 and Rezoning Ordinance No. 97-102 have been considered in the mitigation sections of the appropriate resource sections.

Condition 9 of SMA 379 and Condition J of Rezoning Ordinance No. 97-02 required a drainage study of the project site for review and approval by the Department of Public Works, in conjunction with submittal of plans for subdivision review. Similar conditions are expected to be imposed as

part of the new Special Management Area Use Permit, Rezoning Ordinance and subdivision approval.

3.1.3 Flora, Fauna and Ecosystems

A terrestrial biological survey was conducted by Ron Terry, Ph.D., the results of which are presented in Appendix 6 and summarized below. Marine Research Consultants performed an evaluation of existing nearshore water chemistry and biology off the proposed property as well as, an assessment of impacts. The report is included as Appendix 2 and the biological portion is briefly summarized in this section.

Existing Terrestrial Biology

As typical for the region, the property is thickly covered with alien vegetation. Virtually the entire site is dominated by a low forest of scattered *kiawe* (*Prosopis pallida*) with an understory of buffel grass (*Cenchrus ciliaris*). A total of 29 plant species was identified. Only three, the common roadside herb *'uhaloa* (*Waltheria indica*), the common but cherished yellow-flowered *ilima* (*Sida fallax*), and the strand vine *pa 'ū O Hi 'iaka* (*Jacquemontia ovalifolia*), are indigenous to the Hawaiian Islands. No threatened or endangered plant species (USFWS 2015) are present or would be expected on the project site. All plant species observed in the survey are listed in Table 1 below.

Fauna

The mammalian fauna of the project area is composed mainly of introduced species, including small Indian mongooses (*Herpestes a. auropunctatus*), feral cats (*Felis catus*), roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*). None are of conservation concern and all are deleterious to native flora and fauna.

Almost all birds seen on the site were wide-ranging aliens such as Common Myna (*Acridotheres tristis*), Yellow-billed Cardinal (*Paroaria capitata*), Saffron Finch (*Sicalis flaveola*), Gray Francolin (*Francolinus pondicerianus*) and Zebra Dove (*Geopelia striata*). Other than the common shorebird *'Ulili* or Wandering Tattler (*Heteroscelus incanus*), which was observed right on the shoreline rocks, no birds indigenous to Hawai'i were identified during the survey.

Additionally, it is possible that small numbers of the endangered endemic Hawaiian Petrel (*Pterodroma sandwichensis*) and the threatened Newell's Shearwater (*Puffinus auricularis newelli*) over-fly the project area between the months of May and November. Hawaiian Petrels were formerly common on the Island of Hawai'i. This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea, as well as at the mid-to-high elevations of Hualālai and in the Kohala Mountains. It has within recent historic times been reduced to relict breeding colonies in a few locations. Hawaiian Petrels were first listed as an endangered species by the USFWS in 1967 and by the State of Hawai'i in 1973. Newell's Shearwaters were also once common on the Island of Hawai'i. This species breeds on Kaua'i, Hawai'i, and Moloka'i. Newell's Shearwater populations have dropped precipitously since the

1880s (Banko 1980, Day et al., 2003). This pelagic species nests high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris linearis*) fern. Newell's Shearwater was listed as a threatened species by the USFWS in 1975 and by the State of Hawai'i in 1973.

Table 1. Plant Species on Project Site

Scientific Name	Family	Common Name	Life Form	Status*
<i>Abutilon incanum</i>	Malvaceae	Hoary abutilon	Herb	A
<i>Atriplex semibaccata</i>	Chenopodiaceae	Australian saltbush	Herb	A
<i>Boerhavia coccinea</i>	Nyctaginaceae	Boerhavia	Herb	A
<i>Cenchrus ciliaris</i>	Poaceae	Buffel grass	Grass	A
<i>Cenchrus setaceus</i>	Poaceae	Fountain grass	Grass	A
<i>Chamaesyce hirta</i>	Euphorbiaceae	Garden spurge	Shrub	A
<i>Chenopodium murale</i>	Chenopodiaceae	Goosefoot	Herb	A
<i>Cleome gynandra</i>	Capparaceae	Spider flower	Herb	A
<i>Commelina benghalensis</i>	Commelinaceae	Hairy honohono	Herb	A
<i>Cucumis dipsaceus</i>	Cucurbitaceae	Hedgehog gourd	Vine	A
<i>Desmodium sp.</i>	Fabaceae	Desmodium	Vine	A
<i>Eragrostis amabilis</i>	Poaceae	Lovegrass	Grass	A
<i>Festuca bromoides</i>	Poaceae	Brome fescue	Grass	A
<i>Ficus microcarpa</i>	Moraceae	Chinese banyan	Tree	A
<i>Jacquemontia ovalifolia</i>	Convolvulaceae	Pa'ū O Hi'iaka	Vine	I
<i>Lantana camara</i>	Verbenaceae	Lantana	Shrub	A
<i>Leonotis nepetifolia</i>	Lamiaceae	Lion's ear	Herb	A
<i>Leucaena leucocephala</i>	Fabaceae	Haole koa	Tree	A
<i>Merremia aegyptia</i>	Convolvulaceae	Hairy merremia	Vine	A
<i>Portulaca oleracea</i>	Portulacaceae	Pigweed	Herb	A
<i>Portulaca pilosa</i>	Portulacaceae	Portulaca	Herb	A
<i>Prosopis pallida</i>	Fabaceae	Kiawe	Tree	A
<i>Ricinus communis</i>	Euphorbiaceae	Castor bean	Shrub	A
<i>Sida fallax</i>	Malvaceae	'Ilima	Shrub	I
<i>Sida rhombifolia</i>	Malvaceae	Broom weed	Herb	A
<i>Spergula arvensis</i>	Caryophyllaceae	Corn spurry	Herb	A
<i>Verbesina encelioides</i>	Asteraceae	Golden crown beard	Herb	A
<i>Tribulus terrestris</i>	Zygophyllaceae	Puncture vine	Herb	A
<i>Waltheria indica</i>	Sterculiaceae	'Uhaloa	Herb	I

* A = alien; I = indigenous; botanical names follow Wagner, Herbst and Sohmer 1990, as updated.

The only native Hawaiian land mammal, the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), may also occur in the area, as it has been observed in almost all parts of the island of Hawai'i. The biological surveys took place in daylight, and therefore the lack of bat observations does not signify an actual absence of bats. Although the sparse *kiawe*-buffel grass vegetation of the site would not be expected to represent essential habitat for this endangered species, they have been observed in *kiawe* scrub vegetation in other parts of West Hawai'i.

Impacts and Mitigation Measures to Terrestrial Biology

In order to frame impacts to flora and fauna, it is important to remember that the project site has been historically used for ranching, is now zoned for residential use, has been intensely affected by wildfire and is dominated by introduced plant species. As illustrated in Figure 3b, the project will include gradual planting of native plants near the shoreline intended to restore native species to enhance the biological environment and human enjoyment of the area. The plants envisioned – including *pohuehue* (*Ipomoea pes-caprae*), *pā‘ū-O-Hi‘iaka* (*Jacquemontia ovalifolia*), *‘ilima* (*Sida fallax*), *ōhelo kai* (*Lycium sandwicense*), *akulikuli* (*Sesuvium portulacastrum*), *hinahina* (*Heliotropium anomalum*), *kauna‘oa* (*Cuscuta sandwichiana*) and *pōhinahina* (*Vitex rotundifolia*) – were selected because they were observed to be thriving on the site and in nearby areas without benefit of irrigation. Although low-lying and often grayish green, with small flowers and fruit, they represent the natural vegetation and have rich cultural associations as well. These plants can be slowly added with gradual effort. Considering the existing environment and planned improvements to the flora, the development will produce almost no impacts to any species of flora and fauna other than the alien species already present. However, several mitigation measures that protect wide-ranging endangered animal species are recommended.

To minimize impacts to the endangered Hawaiian hoary bat, initial infrastructure contract conditions and homeowner construction CC&Rs will prohibit removal or trimming of woody plants taller than 15 feet from June 1 to September 15 each year. This period is the most vulnerable time in the bat birthing and pup rearing season, and refraining from vegetation removal or trimming is recognized as appropriate by the U.S. Fish and Wildlife Service in recent Endangered Species Act consultations (e.g., see Hawai‘i State DHHL 2009).

If the project incorporates outdoor lighting, it may attract Hawaiian Petrels and Newell’s Shearwaters, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of Hawaiian Petrels and Newell’s Shearwaters by their interaction with outdoor lighting, no construction or unshielded equipment maintenance lighting should be permitted after dark between the months of April and October. All permanent lighting would be shielded in conformance with Hawai‘i County Outdoor Lighting Ordinance (Hawai‘i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

Existing Marine Biota

Overall, the biotic composition of the coral reef communities fronting the property conforms to the typical zonation pattern that has been well documented for the West Hawai‘i area (Dollar 1983, Dollar and Tribble 1992). The majority of the shoreline throughout the property is composed of wave-cut vertical basaltic cliffs several meters high that extend below the waterline for an additional several meters, forming the intertidal zone. In several locations that are the shoreline termini of intermittent streams, the shoreline is composed of small beaches covered with boulders and rounded rocks. At these locales, the boulders continue through the nearshore area. The nearshore boulders are essentially devoid of macrobenthos, probably as a result of rolling during periods of large waves breaking on the shoreline.

In areas where boulders do not occur, the reef zone nearest to shore consists of submerged basaltic spurs and outcrops that are colonized primarily by the hemispherical branching coral *Pocillopora meandrina*. This coral has been termed a “pioneering” species in that it is generally the first to settle on newly bared substratum, and is often the only coral that has the ability to withstand the physical rigor of water movement within the nearshore zone. It is also of note that unlike many other species of reef building coral, *Pocillopora meandrina* has a “determinate” life history in that it only grows to maximum size or age before colonies die. Hence, natural communities of this species are often composed of a mixture of live colonies and dead skeletal remains.

The other common macroinvertebrates that occupy the nearshore zone are the boring sea urchins *Echinometra matheai* and *Echinostrephus aciculatus*. These urchins are major bioeroders on the rock surfaces, and are found in pits that are ground out of the basalt.

Within approximately 10 meters of the shoreline cliffs, the bottom is composed of a basalt platform that extends from depths of about 15 feet to about 30 feet. Off the project site, the reef platform is nearly completely covered with growth of living corals. The two species that cover the platform are helmet-shaped lobed colonies of *Porites lobata* and finely branching mats of *Porites compressa*. Density of *Porites lobata* is highest near the shoreline, with gradually increasing proportions of *P. compressa* in the offshore direction. The solid reef structure of the platform contains intermittent pockets and channels of coarse white sand. There was no evidence of any type of damage or environmental impacts (e.g., bleaching, disease) throughout the range of the survey. While species of the genus *Porites* dominated coral cover on the reef platform, several other species were observed in very low density, including *Montipora patula*, *M. capitata* and *Pavona varians*. There were no observations of any stands of macroalgae on the reef platform. Communities of reef fish were also typical of West Hawai‘i, with few observations of large fish that would be categorized as target species for spearfishers.

At approximately the 30-foot depth, the gently sloping reef platform terminates at an edge marked by a sharply increasing angle of the bottom. Coral community structure near the shelf break and on the shelf slope is composed primarily of solid interconnected mats of finely branched *Porites compressa*, which is commonly known as finger coral. As with the reef platform, no frondose algae were observed on the reef slope. At a depth of approximately 60 feet, the reef slope and mats of finger coral terminate in a sand plain with corals growing on isolated rocks and rock rubble.

The overall coral community composition off the project site can be characterized as a near-climax successional stage of Hawaiian reef development. Living coral of two species virtually covered the entire hard bottom on the reef platform and slope, eliminating competition for space for other coral species or other forms of bottom cover. The near complete cover indicates that the area is well protected from natural stresses, particularly the storm waves that are the major determinate of community structure on reefs in Hawai‘i.

Impacts and Mitigation Measures to Marine Biota

The health of the marine community is directly tied to water quality. The small predicted changes in water quality constituents are well within the natural variability of the groundwater-marine water mixing regimes on the coast of West Hawai'i. There is an anticipated increase of 1.8 percent groundwater flowrate, a 1.7 percent decline in salinity, an increase of 2.9 percent in nitrogen and 0.2 percent in phosphorus. The increase in nitrogen would result in a small change in the Total Nitrogen concentration in the high level groundwater (from 83.5 to 85.9 uM). Similar minimal increases in phosphorus (0.2%) are expected. These increases are well within the existing range of nutrient concentrations presently in groundwater discharging at the shoreline, and in fact will result in nutrient concentrations far below typical natural concentrations. Therefore development of the project should have no effect on marine communities.

Notably, the subsidies of nutrients are small in comparison to other documented situations in West Hawai'i where anthropogenic inputs have been quantified. For example, leaching of golf course nutrients resulted in an increase over natural flux of about 116% N and 22% P to a semi-enclosed embayment (Keauhou Bay). While these increases are orders of magnitude greater than predicted at the project site, there was no measurable nutrient uptake within Keauhou Bay, and no alteration of biotic composition (Dollar and Atkinson 1992). Similarly, nutrients subsidies resulted in increased N and P flux to anchialine ponds at Waikoloa of about 229% and 400%, respectively. Even with such high nutrient subsidies to ponds that reflect substantial nutrient subsidies to groundwater, offshore sites at Waikoloa downgradient from these ponds on wave-exposed coastlines showed no input over natural sources (Dollar and Atkinson 1992). As the wave-exposed shorelines at Waikoloa are probably less turbulent than off the project site, it can be expected that the small changes in groundwater nutrient concentrations will likewise have no effect to the marine environment.

In addition to consideration of the effects from nutrient additions, it is also important to consider the potential effect of sedimentation that may occur as a result of construction activities. The project site is presently comprised of extensive areas of soil and rock, with relatively little vegetative groundcover, especially during droughts. As discussed above in Section 3.1.2, Best Management Practices in association with grading and NPDES permits and additional BMPS to be required by CC&Rs will limit the area of excavation at any one time, control sediment on site, and require dust control measures. It should be noted that the reef reconnaissance surveys reveal that marine biotic communities in the area are naturally affected by episodic sediment input and are adapted to such conditions. Any small, temporary, residual sediment generation from construction activities should not cause significant effects on the marine environment.

All of these considerations indicate that the proposed 9-lot project will not have any significant negative, or likely even measurable, effect on marine biota in the coastal ocean offshore of the property. Because of small projected groundwater subsidies, which remain within the wide variation in nutrient concentrations of West Hawai'i, as well as the strong mixing characteristics of the nearshore environment, changes to the marine environment as a result of the project will likely be undetectable, with no change from the present conditions.

3.1.4 Air Quality, Noise, and Scenic Resources

Environmental Setting

Air pollution in West Hawai‘i 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. However, air quality in Kohala is generally good, with the most noticeable degradation occurring when occasional southerly winds carry the vog into the area.

Noise on the project site is low to moderate and is derived principally from roadway noise from the adjacent Akoni Pule Highway, as well as activities on developed land *mauka* of the highway.

Waiakailio Bay, on the northern end of the project site (see Figures 1-3), along with the entire coastal viewplane from Akoni Pule Highway, is listed in the Hawai‘i County General Plan as a place of natural beauty. The roughly eight-mile stretch along Akoni Pule Highway between Mahukona in the north and the 3,500-acre plus, upscale rural residential subdivision Kohala Ranch in the south, is mostly undeveloped shoreline, with highly scenic expansive vistas both *mauka* and *makai*. Hawai‘i State Senate Concurrent Resolution (SCR) 146 in 2001 summarized the long history of public sentiment to maintain viewplanes *makai* of Akoni Pule Highway as expressed in legislative resolutions, petitions, and plans. SCR 146 urged the State and County of Hawai‘i “to work collaboratively with the community and residents of Kohala to develop and implement a plan to protect the open nature of the Kohala coast, preserve its valuable historic sites, and provide greater awareness and appreciation of the history and cultural significance of the area for residents and visitors alike.” Concern with the viewplanes was subsequently evinced in the Hawai‘i County General Plan and the North Kohala Community Development Plan (North Kohala CDP). The County has acquired 238 acres of shorefront property at Kaiholena North and Pa‘o‘o, located approximately five miles north of the project site. These properties, which contain over 4,000 feet of shoreline, were identified in the North Kohala CDP as important areas for protection for recreational, historical and cultural reasons.

The North Kohala CDP identifies the project site on the North Kohala Environmental & Cultural Concept Map (p. 25) as generally within or near the “High Concentration of Cultural Sites” coastal area and also within or near the “Existing Upscale Development Area.” The project site, although currently having an undeveloped and scenic coastline, lies directly *makai* of the developed area of Kohala Ranch and immediately adjacent to the Kohala Kai agricultural subdivision. Additionally, the project site is within the State Land Use Urban District and is currently zoned by the County as Single-Family Residential (RS-15).

Impacts and Mitigation Measures

Construction of the project will involve excavation, grading, compressors, vehicle and equipment engine operation, and construction of new infrastructure. These activities have the potential to generate noise exceeding 95 decibels at times, impacting nearby sensitive noise receptors on the margins of the development. Whenever construction noise is expected to exceed the DOH’s “maximum permissible” property-line noise levels, contractors will be required to consult with

DOH per Title 11, Chapter 46, HAR (Community Noise Control) prior to construction. DOH would then review the proposed activity, location, equipment, project purpose and timetable in order to decide whether a permit is necessary and what conditions and mitigation measures, such as restriction of equipment type, maintenance requirements, restricted hours, and portable noise barriers, will be necessary. The contractor would consult with DOH to determine whether permit restrictions would consist of construction being limited to daylight hours.

On a permanent basis, future legal uses of the properties for single-family residences will also generate noise consistent with expectations and allowable limits in areas zoned for these uses, which is thus not considered an adverse impact.

SMA 379 required the following:

- Condition 5 required that above ground structures would be set back a minimum of 50 feet from the *mauka* property line along Akoni Pule Highway to meet concerns about visual impacts.
- Condition 6 required a preliminary site plan that would create *mauka-makai* view corridors from Akoni Pule Highway would be submitted in conjunction with the subdivision plans and approved by the Planning Department.

Condition I of Rezoning Ordinance No. 97-02 required that all electrical and communication lines within the subject property would be placed underground.

Similar conditions are expected to be imposed as part of the new Special Management Area Use Permit and Rezoning Ordinance for the project.

Project design will meet or exceed these conditions. The owner proposes to have all homes set back from Akoni Pule Highway by a minimum of 100 feet, with a maximum height of 25 feet as measured according to Chapter 25 of the Hawai'i County Code. CC&Rs will require a color scheme featuring earth-tone colors to harmonize with the existing landscape tones. As discussed in Section 3.1.3, the project will include gradual planting of native plants near the shoreline in order to enhance the biological environment and human enjoyment of the public access area. All electrical and communication lines within the project site will be placed underground.

Conceptual computer-generated simulations of the future appearance of the area after development have been prepared. Figures 4a and 4b, respectively, provide views from the vantages of a driver on Akoni Pule Highway and a low-flying aircraft just offshore. The point at Waiakailio Bay, listed in the General Plan as an example of natural beauty, will remain visible from the highway, albeit with a foreground that includes some developed structures. Although the homes will be visible, their visual impact has been minimized, and they will not appear out of character given the rural residential and agricultural lots being developed in the area surrounding the project, and the urban appearance of coastal developments just to the south and in Kawaihae. The project will maintain the view corridors and scenic resources of this coastal area, including *mauka-makai* and lateral views.

Figure 4a Simulated View from Road

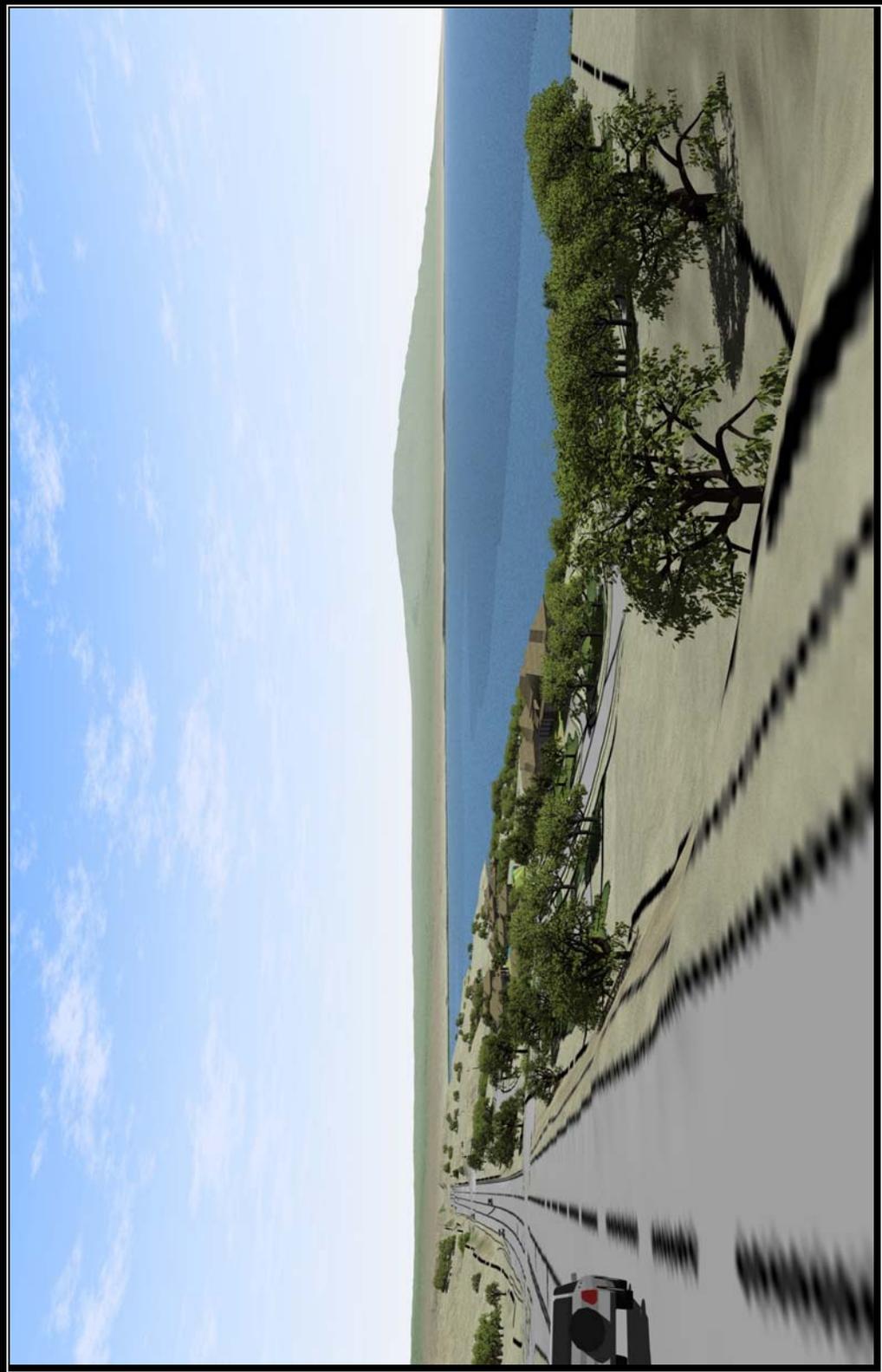


Figure 4b Simulated View from Ocean



3.1.5 Hazardous Materials, Toxic Substances and Hazardous Conditions

Environmental Setting, Impacts and Mitigation Measures

No Phase I Environmental Site Assessment was performed for the site, as there was no information on the presence of hazardous materials or toxic substances on the property. No conditions or activities that would lead to such site contamination are known to be present or are expected to be present on the project site. The project site is vacant and does not appear to have undergone any active land use in modern times. Although the project site has been grazed, no farming has been conducted in modern times, and there is no known use that would have involved pesticides or industrial uses. An abandoned vehicle and litter from Akoni Pule Highway are present, but the use history of the site and its surroundings as understood by the owner does not suggest the presence of hazardous materials or toxic substances. The project site does not contain quarries, former explosives sites, or other hazardous conditions.

3.2 Socioeconomic and Cultural

3.2.1 Socioeconomic Characteristics

Existing Environment

The proposed action would most directly affect the portions of rural North Kohala along Akoni Pule Highway and to a lesser extent the town of Kawaihae. Table 2 provides information on the socioeconomic characteristics of this part of North Kohala, along with those of Hawai'i County as a whole for comparison, from the 2010 U.S. Census of Population.

Impacts

The development of a 9-lot subdivision with lots that would all eventually contain residences would lead to only a minor increase in population. Based on the North Kohala average household size and vacancy rates, an increase of about 33 residents would occur, although some of the homes are expected to be occupied part-time by off-island residents. This would lead to minor shifts in demographic characteristics, unemployment rates, and demands on public services (see Section 3.3, below). Importantly, the population increase is consistent with the expectations of single-family zoning and low-density urban LUPAG designation.

Table 2. Selected Socioeconomic Characteristics

CHARACTERISTIC	Hawai'i Island	North Kohala
Total Population	187,044	6,579
Percent White	33.0%	19.5%
Percent Asian	17.1%	17.1%
Percent Hawaiian or Pacific Islander	12.5%	12.5%
Percent Two or More Races	28.9%	48.7%
Median Age (Years)	40.7	38.2
Percent Under 18 Years	22.5%	18.0%
Percent 65 Years and Over	15.4%	16.2%
Percent Households with Children	25.5%	29.0%
Average Household Size	2.83	3.34
Percent Housing Vacant	22.0%	20.8%
Percent Over 16 Years in Labor Force	61.2%	62.1%
Median Household Income	\$51,520	\$58,673
Percent Below Poverty Level	18.3%	18.1%
Percent 25 years and older with High School Degree	91.0%	93.3%
Percent with Disability	13.5%	12.6%
Percent Foreign Born	12.7%	8.06%

Source: U.S. Census Bureau American Fact Finder: <http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml>

Mitigation Measures

Rezoning Ordinance No. 97-02 required the following:

- Condition D. Restrictive covenants in the deeds of all proposed residential lots within the subject property shall prohibit the construction of a second dwelling unit on each lot. A copy of the proposed covenants to be recorded with the Bureau of Conveyances shall be submitted with the plans for subdivision to the Planning Director for review and approval. A copy of the approved covenant(s) shall be recited in an instrument executed by the applicant and the County and recorded with the Bureau of Conveyances in conjunction with the issuance of Final Subdivision Approval.

- Condition L. To ensure that the goals and policies of the Housing Element of the General Plan are implemented, the applicant shall secure the concurrence of the Office of Housing and Community Development that the applicant's affordable housing requirements, if any have been mutually agreed to prior to Final Subdivision Approval.

Similar conditions are expected to be imposed as part of the ordinance that would grant the change of zone to RA-3a.

3.2.2 Coastal Recreation

Site reconnaissance indicates that the property is lightly used by fishermen, shellfish gatherers, and hikers. Figure 11 of Appendix 3, the Cultural Impact Assessment for the Kohala Shoreline, LLC project, reproduces a portion of Register Map No. 2786 (dated 1917) indicating the presence of a lateral coastal trail projecting into the current project area. This trail is also shown on the 1935 edition of the Tax Map (Figure 16 of Appendix 3). As discussed in Section 3.2.4, this trail has been called the Ala Loa and has been assessed as a historic property subject to preservation in place.

Mauka-makai vehicular access is currently available on the State parcel adjacent to and north of the project site. *Mauka-makai* and lateral shoreline pedestrian public access is available on the Kohala Kai Subdivision, the private property immediately adjacent to and south of the subject property. There are a few lateral spurs of vehicular accesses onto the subject property, but there is no continuous lateral vehicular access across the project site. On the property itself, a six-foot wide lateral public access easement along the shoreline is shown on the Land Court Map for the project site.

Although focused broadly on a long stretch of the coastline of the island of Hawai'i, the planned development of the Ala Kahakai National Historical Trail (NHT) is also an important potential recreational resource for Kohala. Established in 2000 for the preservation, protection and interpretation of traditional Native Hawaiian culture and natural resources, the Ala Kahakai NHT is a 175-mile trail corridor acknowledged for its cultural and historical significance. The National Park Service (NPS) prepared an EIS and a Comprehensive Management Plan (U.S. Department of the Interior 2008), which provided some of the information in this EA.

The Ala Kahakai NHT traverses hundreds of ancient Hawaiian settlement sites through more than 200 *ahupua'a* currently owned by private interests and governmental bodies. Cultural resources along the Ala Kahakai include several important *heiau*, royal centers, *kahua* (house site foundations), *loko 'ia* (fishponds) *ko'a* (fishing shrines), *ki'i pohaku* (petroglyphs), *holua* (stone slides), and *wahi pana* (sacred places). Natural resources include anchialine ponds, *pali* (cliffs), nearshore reefs, estuarine ecosystems, coastal vegetation, migratory birds, native sea turtle habitat, and several threatened and endangered species of plants and animals.

The EIS for the Ala Kahakai NHT considered No Action (A), Single Trail (B), and Ahupua'a Trail System (C) alternatives. Alternative C, the preferred alternative, is based on the traditional Hawaiian trail system in which multiple trail alignments within the *ahupua'a* (mountain to sea land division) are integral to land use and stewardship. Under the action proposed by NPS, a continuous

trail parallel and adjacent to the shoreline would be protected with the consent and cooperation of the affected landowners; however, on public lands and where landowners wish it, the Ala Kahakai NHT could include inland portions of the *ala loa* or other historic trails that run lateral to the shoreline. The shoreline *ala loa* and Ala Kahakai alignment would be connected by *mauka-makai* (mountain to sea) trails equivalent or similar to those that would have traditionally been part of the *ahupua'a* system. During the 15-year planning period for the trail planning effort, the priority zone from Kawaihae south through Pu'uohonua o Hōnaunau National Park to Ho'okena (outside and to the south of the project site) would be the focus for developing a continuous publicly accessible trail, but trail administration and management would protect and preserve trail sections outside of that zone as feasible. Through an agreement, the State of Hawai'i could convey to the NPS a less-than-fee management interest in trail segments that are State-owned under the Highways Act of 1892 within the Ala Kahakai NHT corridor. The NPS would then be responsible for managing these segments and federal law would fully apply. However, in cooperation with the NPS, local communities of the *ahupua'a* would be encouraged to take responsibility for trail management using the traditional Hawaiian principles of land management and stewardship. The Ala Kahakai Trail Association would be expected to be robust enough to play a major part in trail management, promotion, and funding.

Maps contained with the EIS for Alternative C are general; however, they clearly indicate a possible lateral trail passing through the property. Although the scale of the map is so small that the exact alignments of these potential trails cannot be specified with precision, discussion with officials from the NPS as well as community members indicates that the Ala Loa, which is essentially located on the existing lateral jeep trail, would be the favored location for the Ala Kahakai. As such, for the purpose of this document, it is assumed that the alignment of the Ala Kahakai will be along the Ala Loa. The owner proposes that *mauka-makai* access to both the existing 6-foot wide lateral public access easement along the shoreline and the future Ala Kahakai be from a proposed 4-stall public access parking lot near the southern end of the property, as shown in Figure 3. Lateral and *mauka-makai* public access currently exists on both the northern, State-owned property and on the southern, private property, both of which will connect to the property's lateral public access easement and the future Ala Kahakai.

The history of the Ala Loa Trail at the project site has been well documented. Hawai'i Land Court records confirm that the historical alignment of the Ala Loa Trail within the project site is owned in fee simple by the owner. During the proceedings for Land Court Application No. 1036 in the 1930s, the Territory of Hawai'i originally claimed ownership of the five (5)-foot wide "Mahukona-Kawaihae Beach Trail," also known as the Ala Loa Trail, located within the project site. As documented in a Stipulation filed on April 27, 1938, the Territory of Hawai'i agreed to waive and withdraw its claims to the historical alignment of the Ala Loa Trail within the project site and other adjacent lands, in consideration of the agreement by the owner's predecessor-in-interest to convey certain roadway parcels in Waika, North Kohala, Hawai'i to the Territory of Hawai'i. Subsequently, the Land Court entered a Decision on May 9, 1938, confirming that title to the historical alignment of the Ala Loa Trail running through the project site was owned in fee simple by the owners of the surrounding lands. Therefore, the historical alignment of the Ala Loa Trail within the project site is not a State-owned trail. On November 20, 2014, the State Department of Land and Natural Resources Na Ala Hele Trail & Access System Abstractor confirmed that the

1930s Land Court proceedings covering the project site and adjacent lands resulted in a finding that “the Territory of Hawaii subsequently waived and withdrew its claim to all trails with the subject land.”

Impacts and Mitigation Measures

As shown in the Site Plan in Figure 3a, the owner proposes to provide *mauka-makai* and lateral pedestrian public access through the project site. Use of the shoreline area of the project site for fishing, gathering and hiking would not be affected by the proposed development, as these activities can occur within the area of the existing coastal public access easement, and, when accepted as a public access easement by the County Council, along the proposed Ala Kahakai/Ala Loa public access easement. The outdoor activities and public access experience will be accommodated by the wide setback from the shoreline that would prohibit development within the setback area. The owner will work with representatives from the federal Ala Kahakai NHT, the State’s Na Ala Hele Trail & Access program, and the North Kohala Community Access Group to identify and help construct, with the assistance of trail agencies, the Ala Kahakai trail, presumably on the existing Ala Loa/jeep road, with appropriate adjustments to provide buffers for burial sites that the jeep road currently intrudes upon. This Ala Loa alignment provides ample area for construction, maintenance and use of the Ala Kahakai. This trail alignment, expected to be 10 feet in width in conformance with both the design standards of the Ala Kahakai and Chapter 34 of the Hawai‘i County Code, will insure continued public access to and utilization of shoreline resources.

Pedestrian access to this shoreline area at the project site would be available from properties to the north or south using the lateral pedestrian shoreline trail, or by walking to the shoreline from the public parking area that would be built on the southern end of the project site. The proposed four-stall parking area (the same number of stalls required under SMA 379 for the 50-lot residential project) would be accessed from Akoni Pule Highway and the southern road access (see Figure 3a). The parking area, which would be open from a half hour before sunrise to a half hour after sunset, would access a new 800-foot long, 10-foot wide *mauka-makai* pedestrian trail. No direct vehicular access to the shoreline would be allowed, either by residents or the general public.

The establishment and maintenance of trail amenities on the project site will facilitate coastal access and the continued use of the shoreline for recreational purposes, providing a net benefit to hiking use on the Ala Kahakai NHT and fishing and gathering on the shoreline.

Discussion of construction of the Ala Kahakai NHT, including inventory and assessment of resources and possible side trails to coastal recreation locations or lookouts, is beyond the scope of this EA. These issues will be addressed during planning of the trail by the NPS and the State’s Na Ala Hele program. However, one aspect that does require analysis is the side-effect of increased public access on wildfire potential, as discussed in Section 3.1.1. If DLNR plans to intensify use of its property to the north in association with the Ala Kahakai NHT (or any other recreational amenity), it is recommended that the agency install signs warning of the possibility of fire, and also that it consider firebreaks. This recommendation is extended to any plans to encourage public use of trails along the North Kohala coastline; wildfire is a significant issue faced by the Ala Kahakai NHT. According to the EIS for the project, the NPS will prepare a fire management plan in

coordination with appropriate State and County agencies. The plan will account for sensitive cultural resources and incorporate guidelines that assist fire personnel in the choice of procedures, tools, and equipment used in fire suppression and post-fire rehabilitation to help protect resources land even during fire emergencies.

SMA 379 required the following:

- Condition 7: A *mauka-makai* road access of sufficient width to accommodate vehicle access 24 hours a day for drop off and pick up shall be provided along with the minimum 10-foot wide lateral public access walkway along the shoreline. The type of improvements and specific location of the walkway shall be determined at the time of subdivision approval review. Further, a minimum of four on-site public parking stalls to serve the walkway shall be provided and clearly identified. A shoreline setback variance shall be secured for any improvements to the public access which will be within the 40-foot shoreline setback area. Construction of the public walkway and parking stalls shall be completed prior to issuance of any building permit for any structures.
- Condition 8 (also Condition O of change of zone Ordinance No. 97-02): The applicant shall develop and submit a comprehensive public access plan for the subject property for review and approval to the Planning Director, in consultation with the Department of Land and Natural Resources (Na Ala Hele Trails Program), in conjunction with Final Subdivision Approval. The public access plan shall provide for *mauka-makai* and lateral shoreline pedestrian accessways, public parking stalls for users of the shoreline area, signage and restrictions on use (if any). Such public access improvements shall be completed prior to Final Subdivision Approval for any portion of the subject property.

With the exception of allowing vehicular access down to the shoreline area, similar conditions requiring a public access plan and a parking lot at the southern entrance to the development are expected to be imposed as part of the new Special Management Area Use Permit and the Rezoning ordinance that would grant the change of zone to RA-3a. The owner will request that the parking lot hours be from a half hour before sunrise to a half hour after sunset.

3.2.3 Cultural Resources

An archaeological inventory survey (AIS) report and cultural impact assessment (CIA) report for the proposed action were performed by ASM Affiliates, Inc. The CIA is included in this EA as Appendix 3, and the AIS is included as Appendix 4. In the interest of readability, the summary below, which also is derived from other sources, has eliminated most scholarly references; readers interested in sources may consult the appendices.

Cultural and Historical Background

The project site is located in the *ahupua'a* of Kahuā 1st (Kahuāli'ili'i) in the district of North Kohala. The concept of the *ahupua'a* was established in Hawai'i during the 15th century, adding a new component to what was already a well-stratified society. *Ahupua'a* were usually wedge or pie-shaped, encompassing all of the eco-zones from the mountains to the sea and extending several

hundred yards beyond the shoreline, assuring a diverse subsistence resource base. 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 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* (often translated as king).

According to the model developed by Kirch (1985) and later revised in terms of initial settlement date (Kirch 2011), the Settlement or Colonization period of Hawai'i was around A.D. 1000, with colonists possibly from the southern Marquesas Islands. Early Hawaiian farmers developed new subsistence strategies during this period, adapting familiar patterns and traditional tools for use in their new environment. Order was kept through adherence to their ancient and ingrained philosophy of life and through the principle of genealogical seniority. According to Fornander (1969), Hawaiians brought from their homeland a variety of Polynesian customs including the major gods of Kane, Ku and Lono; the *kapu* system of law and order; *pu'uhonua* or places of refuge or asylum; the *'aumakua* concept of a family or ancestral spirit and the concept of *mana*, or spiritual power.

The Development Period, which lasted from A.D. 1100-1350, brought changes that included an evolution of traditional tools as well as some distinctly Hawaiian inventions. The evolution of the adze was an example of the former, while the latter included the two-piece fishhook and the octopus-lure breadloaf sinker. Another invention was the *lei niho palaoa*, an item worn by those of high rank which represented a trend toward greater status differentiation.

The Expansion Period from A.D. 1350 to 1650 saw an increase in social stratification and major socioeconomic changes. It also was a time of expansive settling, with the development of the most favorable windward areas as well as more marginal areas on the island's leeward side. This was the time of the greatest population growth as large irrigated field systems were developed and expanded into more arid areas. *Loko* or fishpond aquaculture also flourished during this period.

The second major migration to Hawai'i also occurred during the Expansion Period, with the settlers for this expansion coming from Tahiti in the Society Islands.

An increase in war marked the Proto-Historic Period (A.D. 1650-1795), both locally and between islands. Some of that warfare involved Kohala and the Kawaihae area. Shortly before this period, around 1600, Maui chief Kamalalawalu sent spies to areas that included Kawaihae to gauge their population and how many warriors it would take to conquer the areas. According to one account:

The spies sent by Kama-lala-walu went to Hawaii and landed at Kawaihae in the evening. Ka-uhi-o-ka-lani ran about that same evening and returned before the canoes were dismantled and placed in the house. The keepers of the gods at Mailekini were servants of Kama, and so they concealed the canoes of the spies...[Kamakau 1992:56].

However, during the spies' visit to Kohala, which according to Kamakau was a "thickly-populated land," they found many empty houses because most of the men were in upland areas taking part in sports competitions. Kamalalawalu's forces first defeated the residents they found in the northern part of Kohala but when they arrived at Kawaihae they again found empty houses because their residents were attending services at Mailekini Heiau in Waimea. The grassy plains of Waimea soon became the setting for a battle between the Maui warriors and the forces of chiefs from Kohala, Waimea, Kona, Puna and Ka'u. The combined Hawai'i Island forces slew Kamalalawalu and many of his chiefs and warriors, with the remainder making their way back to Maui.

North Kohala is also known as the birthplace of Kamehameha I, who was born in the *ahupua'a* of Kokoiki. It has been said that when he was born, an army was assembling on the leeward Kohala coast, preparing for an attack on Maui, and his birth occurred on a night filled with rain, thunder and lightning. Also at that time, Maui chief Kekaulike was involved in a battle with Alapa'i of Kona. During the conflict, Kekaulike's men cut down trees in Kona and, according to Kamakau, all of the coconut trees in Kawaihae. According to Kamakau, he also "slaughtered the country people of Kohala" before seizing their possessions and returning to Maui, where he soon became ill and surrendered his power to Kamehamehanui.

This period was one of continual wartime strife. Ke'eumoku set up a fort at Pololu and Honokane where he was attacked by Kalaniopu'u, and then relocated to Maui. Kalaniopu'u also conquered East Maui, defeating Kamehamehanui, who was Kekaulike's successor and also Kalaiopu'u's wife's brother. Kalaniopu'u appointed one of his chiefs, Puna, to be governor of Hana and Kipahulu. When Kamehamehanui died of illness in 1766, he was succeeded as Maui's king by Kahekili. At about that time, Ke'eumoku took Kamehamehanui's widow, Namahana, who was Kamehameha's cousin, as his wife. Their daughter, Ka'ahumanu, who would eventually become the favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki in 1768.

In 1775, Kalaniopu'u and his forces from Hana overran the neighboring Kaupo district and raided Molokai, Lanai, Kaho'olawe and parts of West Maui. Kamehameha's efforts at the battle of Kalaeoka'ilio near Kaupo earned him recognition as a great warrior and the name of Pai'ea (meaning hard-shelled crab) from Maui chiefs and warriors. Ka'ahumanu and her parents left Maui for Hawai'i Island during the battles between Kalaniopu'u and Kahekili.

In 1790 two Western ships, the *Eleanora* and *Fair American*, were trading in Hawaiian waters. As retribution for the theft of a skiff and the murder of one of the sailors, the crew of the *Eleanora* massacred more than 100 natives at Olowalu, Maui. The *Eleanora* then sailed to Hawai'i Island, and one of its crew, John Young, went ashore, where he was detained by Kamehameha. The other vessel, the *Fair American*, was captured by the forces of Kamehameha off the Kekaha coast and its crew was killed except for one member, Isaac Davis. Kame'eiamoku, who resided in Ka'upulehu at the time, played a lead role in this incident. He and his followers recovered several foreign arms from the *Fair American*, including a cannon that they called "Lopaka", all of which were turned over to Kamehameha (Kamakau 1992).

Kamehameha made Young and Davis his advisors. He also kept the vessel as part of his fleet. With the aid of his new advisors, new ship, and foreign arms Kamehameha conquered Maui, and by 1796 he had conquered all the island kingdoms except Kauai. It wasn't until 1810, when Kaumuali'i of Kauai gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Kawaihae, located three miles south of the project site, eventually became one of the royal centers of the island at which Kamehameha resided, and one where he could make use of trade with foreign ships to acquire guns and ammunition. It was also the site of Pu'ukohola Heiau, dedicated to the war god Kuka'ilimoku, which Kamehameha built on the advice of a soothsayer. Subjects came from across Kamehameha's lands by the thousands to help him build the heiau. When it was completed in 1791, Kamehameha sent for Keoua, ruler of Ka'u, who was then killed and placed within the heiau, thus cementing Kamehameha's rule over Hawai'i Island.

When in Kawaihae, Kamehameha stayed at Pelekane, located below Pu'ukohola. After his death in 1819, the royal residence consisted of multiple houses now occupied by his successor, Liholiho, also known as Kamehameha II. The missionary William Ellis observed 100 houses at Kawaihae in 1823, although it was unlikely that the area's dry climate supported enough agriculture to sustain the court and its entourage as well as the commoners living there. The *Journal of a Trading Voyage Around the World* by an I. Iselin gave the following account of the Kawaihae area ca. 1806:

This bay of Toeigh is very open; an extensive reef runs near it nearly level with the water, and altogether it is no inviting place to anchor at. The country around it looks like a hilly barren desert; nothing grows within ten miles of it, except a few cocoanut trees, of which a fine grove stands near the beach. The inhabitants and huts are thinly scattered along the shore, far less numerous than about [Kealakekua], and seem more indigent, indeed, having to go so far for their subsistence, they are not seldom in want of the supports of life.

Kawaihae was described by Handy and Handy as surrounded by an arid countryside:

The terrain immediately around [Kawaihae] is dry and barren but formerly much dry taro was grown beyond in the lower forest zone, which formerly extended from the Kohala Mountains much farther seaward over what is now open pasture land. Wet taro was grown also in small pockets of land wherever streams, even intermittent ones, flowed down from the mountains in the wet seasons.

Ellis said the coast north of Kawaihae was similarly dry, although it appeared that agriculture was taking place upland:

The coast was barren; the rock volcanic. The inhabitants were all fishermen. Mr. Thurston was informed, that the inhabitants of the plantations, about seven miles in the interior, were far more numerous than those of the sea-shore.

The historian John Papa I‘i noted that fishermen traded their wares for poi at Kawaihae:

Soon the fishing canoes from Kawaihae, the Kana lands, and Ooma, drew close to the ship to trade for the pa‘i‘ai (hard poi) carried on board, and shortly a great quantity of aku lay silvery-hued on the deck. The fishes were cut into pieces and mashed; and all those aboard fell to and ate, the women by themselves.

According to Ellis, salt was another product of the Kawaihae area:

The natives of this district manufacture large quantities of salt, by evaporating the sea water. We saw a number of their pans, in the disposition of which they display great ingenuity.

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

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

The Protestant missionaries who arrived from Boston in 1820 soon were rewarded with land and government positions, as many of the *ali‘i* were eager to assimilate western-style dress and culture. But at the same time, the continuing sandalwood trade was becoming a heavier burden on commoners, as Ellis noted:

About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young. ... Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts.

The rampant sandalwood trade resulted in the first Hawaiian national debt, as promissory notes and levies granted by American traders were enforced by American warships. The assimilation of

Western ways continued with the short-lived whaling industry to the production of sugarcane, which was more lucrative but carried a heavy environmental price.

The remainder of the 19th century saw significant changes in Kawaihae as the practice of trade led many to abandon traditional lifestyles. The result was a loss of population and resources, leaving one observer to describe the town as a “small dreary village” entirely lacking foliage except for “a few sickly cocoa-nut trees.”

Evidence of the earliest permanent settlement in Kohala was obtained from Koai‘e, where a coastal settlement was believed to have existed as early as 1300. Inhabitants subsisted primarily on marine resources likely supplemented by small-scale agriculture. Rosendahl (1972) has proposed that early settlers of the area focused on fishing and other ocean-related activities during the summer and farming at upland sites during the winter.

As early as the 1830s, missionaries were noting population changes in Kohala, as deaths were observed outpacing births. An 1835 census showed the combined population of Kahuā 1st and 2nd to be 265. But only 11 years later, during the Māhele, there was only a single person making a kuleana claim, in Kahuānui.

The Mahele ‘Aina that took place in 1848 placed 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.

The leeward North Kohala coast has few known *heiau*; only three paved structures with large rock fill at Kukuipahu fit the descriptions. However, additional work and closer scrutiny of stone platforms on crests of rises, that are sometimes associated with walled precincts, could reveal more *heiau* along the coastal settlements. The narrow band of habitation settlements along the coast are separated from a broader upland band of agricultural walls and habitations by a barren zone with relatively few archaeological sites. Within individual *ahupua‘a*, trails that pass through the barren zone would have connected coastal settlements with upland fields. The width of the barren zone is inversely related to the abundance of rainfall; in the wetter north near ‘Upolu Point it is about half a mile wide, and it widens to three miles in the drier south at Kahuā. Surveys that have covered the uplands away from the coastline date back to the late 1960s when the University of Hawai‘i field schools mapped Lapakahi Ahupua‘a north of Kaiholena ahupua‘a, using aerial photographs and surveying instruments. Vast portions of Kahuā 1st and 2nd inland of the highway were surveyed by Hammatt and Borthwick (1986, 1987, 1990). During these upland surveys, which covered land up to the 3,000-foot elevation, archaeologists found trail markers, scattered agricultural terraces, temporary habitation shelters, and rock walls. The remains most probably relate to the upland agricultural fields mentioned in various oral and written histories.

The *ahupua‘a* of Kahuāli‘ili‘i, which is also known as Kahuā 1st, and which contains the project site, was awarded to Lot Kapuāiwa [Kamehameha V]. However, hearings held by the Boundary Commission of the Kingdom of Hawai‘i to determine the boundaries of Kahuāli‘ili‘i were not held until 1873, the year following Lot Kapuāiwa’s death, and the *ahupua‘a* apparently became part of

the estate of his father, M. Kekūānāo‘a. The boundaries were not officially established until 1903, by which time the *ahupua‘a* had been acquired by James Woods. There were apparently no *kuleana* (small awards to commoners) awarded in what is now the project area.

Woods started Pu‘u Hue Ranch in the early 1870s. Upon his death the ranching operations were taken over by his son, Frank Woods. By the 1920s, Woods was leasing much of the Kahuā lands to former O‘ahu residents Ronald Kamehameha o Ka Hae Hawaii von Holt and Herbert Montague Richards, Sr. By 1928, von Holt and Richards had purchased the lands they formerly leased, and began combining them with land from the Waika Ahupua‘a to the south. Through purchases and leases, they eventually accumulated nearly 30,000 acres which became known as Kahuā Ranch. Von Holt died in 1953, and control of the ranch eventually passed to Herbert “Monty” Richards Jr. In the 1980s, the ranch was divided between the two families, with the Richards operating Kahuā Ranch and the von Holts controlling the southern portion that formed Ponoholo Ranch. Kahuā Ranch sold the land that now makes up the project site.

Because of its arid nature, the Kawaihae area did not become a well-settled area until visits by trade and whaling ships made the bay a major port of call. There were no regularly flowing streams to support agriculture, which instead took place far inland.

The economy of Kawaihae received a boost from the introduction of cattle ranching. Cattle from Waimea were brought to Kawaihae via a road built in 1830, and held in pens for the trip to O‘ahu on cattle boats. The trade in hides and meat also helped turn Kawaihae into a major port. The Pacific Commercial Advertiser reported up to 50 whaling ships making a port call in Kawaihae in 1857. An 1883 map showed Kawaihae with a lighthouse, wool shed, native store, jail, boat house, church and other buildings which were likely houses. Twenty years later, a plant had been built to manufacture soap from cattle tallow.

Kawaihae continued to host harbor activities, and in 1959 a new deep-draft harbor was built by the federal government. However, the dredging of shallow reef resulted in the burying of Kawaihae Village, its salt pans, the Kauhuhue Heiau and the majority of the coastal Land Commission awards up to 13 feet deep in dredged material. Additional development in 1969 and 1970 further transformed the area into an industrial park.

Cultural Studies in Project Area

Maria E. Ka‘imipono Orr (2003) prepared a cultural impact assessment for a proposed radio communication tower and facility to be placed on Pu‘u Waiakanonula in the *mauka* portion of Kahuāli‘ili‘i. Her study included a detailed culture-historical background for the *ahupua‘a*. She also conducted interviews with Sherri Hannum, Genevieve Leina‘ala Hoopai, Bernard Hoopai, Bernelle Hoopai, Harold Glenn Kailiawa, Hannah Springer, and Harry Martens (Pono) von Holt II. Orr (2003) concluded that no cultural properties or practices would be affected by the project, but cautioned that “for over a hundred years, native Hawaiians have lived in a culturally repressed state. It has been only within the last thirty years, due to evolved awareness, that native Hawaiians have been aggressively trying to reclaim their *wahi pana* (sacred and/or legendary places).”

Kepā Maly prepared a detailed culture-historical background for Kaiholena Ahupua‘a (Maly 2000) that included information relative to the general region known as *Kohala waho* or Outer Kohala, of which the project site is a part. Maly’s (2000) extensive culture-historical information suggests that the archaeological resources present in the current study area are best understood within the context of the larger cultural landscape of *Kohala Waho*; a landscape with a long history, rich in cultural traditions. One could conclude from this that the significance of any one resource is enhanced by the presence of other resources, and together form a cohesive landscape that should be treated and managed in its totality.

In 2006, Rechtman Consulting prepared a cultural impact assessment for a coastal property within Kahuānui and Waikā *ahupua‘a* adjoining the current study area to the south (Rechtman 2006). That project site and the current project site share a common history, and were subject to similar land use dating back to the Precontact settlement of the area. As part of the study, William AhYou Akau, Jr., Herbert Montague (Monty) Richards Jr., and Harry Martens (Pono) von Holt II were interviewed. Rechtman (2006) concluded that as long as the archaeological sites were treated in accordance with State Historic Preservation Division (SHPD) approved treatment plans, and access to and along the shoreline was in no way inhibited, then there would be no cultural impacts.

In 2004, Rechtman Consulting prepared a cultural impact assessment (Rechtman 2004) for a small coastal parcel within Pāo‘o Ahupua‘a, some six miles north of the current project area. Interviewees for that study included Arthur Mahi, Isabella Mahi Medeiros, and Valerie Luhiau Ako. Collectively, the primary concerns of these individuals (all with cultural ties to the study *ahupua‘a*) revolved around the protection of the archaeological resources and the maintenance of access to the shoreline. The relevance of this study for the Kohala Shoreline, LLC study is not so much the specifics of Pāo‘o Ahupua‘a, but rather the general concept that the land needs to be cared for in appropriate ways; the concept of *mālama ‘āina*. This Pāo‘o project required a Conservation District Use Permit, the proceedings for which included oral and written testimony. Most of that testimony revolved around specific resources located on the Pāo‘o parcel, but there was other testimony of a more general nature that had broader implications that should be considered when assessing cultural impacts along this portion of the Kohala coastline.

These included the concepts of *malama ‘āina*, cultural trauma, and cultural disintegration fostering multigenerational psychopathologies. Several of those who testified suggested that the development of the currently undeveloped portions of coastal Kohala would be inconsistent with the traditional cultural practice of caring for the land (*mālama ‘āina*), although no basis for this assertion was cited. It should be noted that the project site was “developed” for use by generations of Hawaiians as a place of habitation, as evidenced by the numerous structural remains of residential complexes across the property. Testimony presented by Kamana‘opono Crabbe, Ph.D. and Dr. David Liu in relation to Pāo‘o with respect to cultural disintegration and cultural trauma distinguished traditional Hawaiian use of land and modern Western use of land. There are those who assert that all land in Hawai‘i is a cultural resource and that virtually all modern development (as opposed to traditional uses) has a severe and unmitigable cultural impact.

Section 3.2.4 discusses archaeological resources in detail. While a number of pre-contact and Historic archaeological sites not considered significant for preservation by SHPD are present, such

features are relatively common in the area and they do not appear to have cultural value aside from their value for interpreting historic patterns. However, there are features that have greater historic value requiring preservation, including burials and a number of other sites associated with habitation. Beyond their scientific-historic value, they also have cultural value.

Impacts and Mitigation Measures: Cultural Resources and Practices

To mitigate potential impacts to the cultural value of burial sites identified within the current project area, a burial treatment plan will be prepared in compliance with HAR §13-300 and implemented prior to the commencement of any ground-disturbing activities. To mitigate the potential impacts to the cultural value of the other archaeological sites identified within the project area, archaeological preservation and data recovery plans will be prepared in compliance with laws and regulations governing historic sites in the State of Hawai‘i. These actions must also be implemented prior to any ground-disturbing activities.

Aside from the archaeological sites that have both scientific-historic and cultural value, the only Hawaiian customary and traditional rights or practices known to be associated with the property are fishing and gathering near the shoreline. The project proposes a wide buffer from most of the shoreline area, with restriction on development of homes or other structures, partly in order to protect these practices. The vegetation of almost the entire property, and all areas potentially affected by construction, is heavily disturbed, alien *kiawe* forest with buffel grass, as discussed in Section 3.1.3, above. This vegetation does not include the quality and quantity of botanical resources that would be important for native gathering. No caves, springs, *pu‘u*, native forest groves, gathering resources or other natural features (aside from shoreline resources, discussed below) are present on or near the project site that would support any traditional resource uses.

With respect to the shoreline area (as a valued natural/cultural resource) within the current project site, conditions exist that may mediate the potential detrimental psychosocial effects mentioned above (and discussed in more detail in Appendix 3) with respect to cultural disintegration and cultural trauma. The fact is that within the local community these lands are known to have been private lands for over 100 years, and that access to the shoreline for traditional cultural practices has never been prohibited, a situation that will continue under the current proposed development. Also, in the spirit of *mālama ‘āina*, the current development plans call for a down-zoning from the current approved Single-Family Residential 15,000-square foot lot size to Residential and Agricultural 3-acre lot size, that locates building sites away from the immediate shoreline and in such a way as to preserve a significant portion of the archaeological and cultural landscape. The owner may or may not elect to pursue a variance, Planned Unit Development or any other administrative permit to modify road standards, lot sizes or other design elements during the subdivision or development process.

Other potential cultural impacts that may result from the proposed project specifically relate to coastal access and use. In a general sense, access to and use of the shoreline area of the project for recreational, subsistence, transportation, and spiritual purposes can be considered an ancient, as well as ongoing practice, and it is thus a valued cultural resource. The primary concern raised by one consulted party in a previous assessment (William Akau) was that of maintaining lateral pedestrian

access for fishing, transportation, and recreation. He has long been an advocate for the perpetuation of Hawaiian rights of access to, and use of, the traditional system of trails. As discussed in Section 3.2.2, above, old maps indicate the presence of a coastal trail or *ala loa* projecting into the project site, parts of which may have eventually become the coastal jeep road. The extensive trail amenities proposed for the project discussed in Section 3.2.2, which include a pedestrian lateral shoreline trail, a *mauka/makai* pedestrian trail, and a public parking area, will facilitate coastal access and the continued use of the shoreline for recreational, subsistence, transportation, and spiritual purposes, thus alleviating any potential impacts related to shoreline access and cultural use.

Extensive consultation with Native Hawaiian agencies, individuals and organizations has occurred throughout the research for this EA. The Office of Hawaiian Affairs in Honolulu and West Hawai‘i, a local Hawaiian Home Lands group, and the Hawaiian Civic Club were consulted by letter on January 10, 2010, to determine whether they had any information concerning whether cultural resources or practices might nevertheless be present. Response letters did not indicate any specific resources or practices of concern.

After a hiatus in the project, consultation resumed again in 2014. As part of the CIA, author Robert Rechtman, Ph.D., and project representatives met with the North Kohala Community Access Group (with whom project representatives had also met in 2010). Although this group’s membership is multicultural, they represent many of the Native Hawaiian community’s concerns with respect to access rights, and they were a forum to disseminate information about the project within the Native Hawaiian community and to invite comments on potential resources and impacts related to the property. The South Kohala Community Development Plan Action Committee and the Department of Hawaiian Home Lands Kailapa Community Association were also contacted. As a result of these contacts and communications, a field visit was set up with the intention of viewing the property and discussing any potential cultural impacts. On November 15, 2014, and January 31, 2015, Dr. Rechtman met on-site with several members of the North Kohala Community Access Group, the South Kohala Community Development Plan Action Committee, and residents of the Kailapa Homesteads.

According to Dr. Rechtman’s account of the first meeting, one attendee claimed ownership of the property and advised that none of the group had permission to enter the property. In the interest of avoiding conflict, the group decided not to visit the property. To date, there has been no legal action filed in court by any party to assert ownership to, or any interest in the property. Also present at the aborted meeting was Kaena Peterson, who is *kama ‘āina* to the area, a resident of Kailapa, and President of the South Kohala Hawaiian Civic Club. Kaena was contacted the following day and she requested Dr. Rechtman to meet with her and the Vice President of the South Kohala Hawaiian Civic Club to share information about the project and hear their concerns. On November 23, 2014, Dr. Rechtman met with Kaena Peterson and Lei Kihoi of the South Kohala Hawaiian Civic Club at the Kailapa residence of Kaena Peterson. Their concerns related to the protection of trails, other traditional sites and burial sites, as well as perpetuation of access to the property for traditional and customary practices. With respect to the former, they wanted to make sure that all burial sites are properly treated and that the traditional trail routes remain open for unrestricted pedestrian access. With respect to the perpetuation of traditional and customary practices they wanted to make sure that traditional coastal activities were not impacted and that Native Hawaiian individuals and

organized groups such as *hula halau* had unrestricted access to the trails and shoreline. Both Kaena and Lei stressed the importance of maintaining the traditional access routes that exist on the landscape.

During the second field trip conducted with members of the North Kohala Community Access Group and residents of the Kailapa Homestead in January 2015, much of the discussion revolved around trails and access. Present during this visit was Jojo Tanimoto, a *kupuna* of Native Hawaiian ancestry. She shared recollections of traveling the project area coastline for shoreline fishing activities with her father when she was a child. Jojo also talked about a shoreline pond in the general area that William Akau related to her was culturally significant, but was unsure of its exact location. Also present during this visit was Diane Kanealii and Parish Canon of the Kailapa Homestead. Mr. Canon, a younger generation Native Hawaiian and current president of the Kailapa Community Association expressed an interest in having community members take an active role in the preservation of cultural sites and resources within the development area.

Implementation of the above described measures relative to the identified archaeological sites, public access, cultural resources, and cultural practices and beliefs will help to minimize impacts to such resources, practices, or beliefs by the proposed development of the project site. The pedestrian public access easements proposed at the project site (which will be dedicated to the County of Hawai‘i) will allow the perpetuation of access to cultural resources for traditional and customary practices. In addition, continued coordination on the part of the owner and future residents with members of the local Native Hawaiian community is encouraged. Allowing these knowledgeable and committed residents to participate in the preservation of resources within the development area and maintain an on-going dialog with the current and future landowners would serve both cultural resources and community harmony. Agencies and groups who have been involved with the consultation process are asked to comment on these findings.

3.2.4 Archaeological Resources

As discussed above, an archaeological inventory survey report was performed by ASM Affiliates. The AIS is an update on an earlier survey prepared for a different project plan by Graves and Franklin in 1998. Because the previous AIS was predicated on the construction of only one residence on the project site, an updated survey was required. The new survey is included in Appendix 4 and summarized below.

At least eight archaeological studies of the property have been conducted since 1985, when M. Allen carried out a pair of limited archaeological reconnaissance surveys. Others include a data recovery plan for one archaeological site (Rosendahl 1994), an archaeological inventory survey (Graves and Franklin 1998), and data recovery excavations (O’Hare and Goodfellow 1999). Burial and site preservation plans were also prepared (PHRI 2000), followed by additional testing of burial features in 2005. Other archaeological studies performed in the area of the project site include three conducted in 1964 (Soehren), 1968 (Bonk), and 1983 (Rosendahl).

Initial fieldwork for the current archaeological inventory survey by Rechtman Consulting (the predecessor to ASM Affiliates, Inc.), was conducted, followed by additional survey, subsurface

testing at selected features, and further review of historic maps. The work identified all of the 39 archaeological sites previously recorded, and refined the site descriptions for five of those sites. The latter included a corrected location and characterization of Feature D at Site 2496, a previously unrecorded rock shelter feature at Site 4013, a previously unrecorded rough terrace feature at Site 161331, an unrecorded northern extension of Site 16147, and an unrecorded marine shell scatter at Site 16151. Additionally, a portion of a previously undocumented – Site 29271, the *ala loa* coastal trail/Jeep road, commonly labeled the “Mahukona-Kawaihae Trail” on maps produced prior to 1931 – was recorded across the project area. The 40 archaeological sites are mapped in Figure 5 and summarized in Table 3.

Impacts and Mitigation Measures

As a result of the current AIS, the original significance evaluation made by Graves and Franklin in 1998 and adopted in the subsequent DLNR-SHPD determination (DOC NO.: 9805PM21) has been recommended for modification for five of the previously recorded sites. Four of these (Sites 4000, 4010, 16132, and 16138) were not considered to be significant in the original study; however, all of these sites are part of a relatively intact archaeological landscape that documents evolving land use from Precontact times to the late Historic Period. As such, all four of these sites are now considered to be significant under Criterion D for their information content. Further, Site 2496 was originally determined to be significant solely under Criterion D; however, as this site is now known to contain a burial, it should also be considered significant under Criterion E. Given the current development proposal (a 9-lot subdivision) for the project site (see Figures 3a and 5), site treatments should be reconsidered and the existing preservation and burial treatment plans revised.

The four previously identified burial sites (Sites 4004, 4013, 16148, and 16162) shall continue to be preserved. In conformance with the recommendation of the latest archaeological inventory survey, the burial treatment plan (PHRI 2000a) will be updated to reflect the proposed change in land use and the newly identified burial site (Site 2496 Feature D). The 2000 burial plan had noted that any subsequent change in the project’s components could require that the applicant return to the Hawai‘i Island Burial Council for review of proposed preservation measures.

As noted in Table 3 below, data recovery is now recommended for 16 sites, plus portions of two additional sites (2496 and 4013) that contain preserved burial features. All of those sites were previously approved for data recovery based on the Graves and Franklin survey with the exception of Sites 4010 and 16138, which were earlier approved for no further work. It is believed that these two sites still retain information that could be recovered and aid in developing a specific chronology of land-use history for the project area. Pursuant to HAR 13-278, a plan addressing the data recovery of these sixteen sites will be prepared and submitted to DLNR-SHPD for review and approval.

Preservation is now recommended for 14 sites, all but one of which (Site 4000) was approved for data recovery based on the original inventory survey. A new preservation plan that addresses these 14 sites will be prepared and submitted to DLNR-SHPD for review and compliance.

Table 3 Archaeological Sites

SIHP Site No.	Site Type	Age	Significance	Recommended Treatment
2496	Habitation/Burial	P	D, E*	Data Recovery/Burial Preservation
2498	Habitation/Ceremonial	P	C, D, E	Preservation
2499	Habitation	P/H	C, D	Preservation
4000	Wall	P/H	D**	Preservation
4002	Rock Mound	P	D	Data Recovery
4003	Habitation	P/H	D	Data Recovery
4004	Burial	P/H	D, E	Burial Preservation
4005	Habitation	P/H	C, D	Preservation
4010	Animal Enclosure	H	D**	Data Recovery
4011	Habitation	P/H	D	Preservation
4012	Habitation	P/H	D	Data Recovery
4013	Habitation/Burial	P/H	D, E	Data Recovery/ Burial Preservation
4015	Habitation	P	D	Data Recovery Completed
15261	Trail	P/H	D, E	No Further Work
16131	Habitation	P/H	D	Preservation
16132	Wall	H	D**	No Further Work
16133	Well/Reservoir	H	D	Preservation
16134	Enclosure	H	D	Preservation
16135	Wall	P	D	Data Recovery
16136	Habitation	P	D	No Further Work
16137	Rock Mound	P	D	Data Recovery
16138	Platform and Cairn	P	D**	Data Recovery
16139	Habitation	P	D	Preservation
16140	Habitation	P	D	Data Recovery
16141	Habitation	P	D	Data Recovery
16142	Habitation	P	D	Preservation
16143	Habitation	P	D	Data Recovery
16144	Habitation	P	D	Data Recovery
16145	Habitation	P	D	Preservation
16146	Habitation	P	D	Data Recovery
16147	Habitation	P	D	Preservation
16148	Habitation/Burial	P	D, E	Burial Preservation
16149	Habitation	P	D	Preservation
16150	Habitation	P	D	Data Recovery
16151	Habitation	P	D	Data Recovery
16162	Burial	P	D, E	Burial Preservation
16163	Habitation	P	D	Preservation
16164	Habitation	P	D	Data Recovery
16167	Agricultural Terrace	P/H	D	Data Recovery
29271	Trail	P/H	D,E	Preservation***

Age: P – Precontact; H – Historic. **Significance Criteria:** **A** - Associated with events that have made an important contribution to the broad patterns of our history; **B** - Associated with the lives of persons important in our past; **C** - Embody the distinctive characteristics of a type, period or method of construction; represent the work of a master; or possess high artistic value; **D** - Have yielded, or be likely to yield, information important for research on prehistory or history; **E** - Have an important value to the native Hawaiian people or to another ethnic group of the state due to

associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts, these associations being important to the group's history and cultural identity. * Criterion E added because a burial was found at this site during the current study. ** These sites are considered significant under Criterion D in the current study; they were determined to not be significant in the earlier inventory. *** In conformance with standard treatments for linear features such as trails, roads and certain walls, the preservation plan for the trail will accommodate breaches for three driveways and the *mauka-makai* public access trail.

The AIS was submitted to SHPD for a 45-day review on December 29, 2014. The Final EA will report on the status of SHPD's review.

SMA 379 and Rezoning Ordinance No. 97-02 required the following:

- SMA Condition 10 and Rezoning Ordinance Condition M: A Data Recovery Plan and Preservation Plan shall be prepared for the review and approval by the Planning Director in consultation with the Department of Land and Natural Resources-Historic Preservation Division (DLNR-HPD). Proposed mitigation treatment (preservation in place or Disinterment-reinterment) for burial sites must be approved by the Historic Preservation Division's Hawai'i Island Burial Council before detailed mitigation plans are finalized for these sites. A copy of the approved Final Data Recovery Plan and Preservation Plan shall be submitted to the Planning Director for its files prior to submitting plans for subdivision review and prior to any approval for any land alteration permits.
- SMA Condition 11 and Rezoning Ordinance Condition N: Should any remains of historic sites, such as rock walls, terraces, platforms, marine shell concentrations or human burials, be encountered, work in the immediate area shall cease and the Department of Land and Natural Resources-Historic Preservation Division (SHPD) shall be immediately notified. Subsequent work shall proceed upon an archaeological clearance from the SHPD when it finds that sufficient mitigative measures have been taken.

Similar conditions are expected to be imposed as part of the new Special Management Area Use Permit and the Rezoning Ordinance that would grant change of zone to RA-3a, and will help mitigate any impacts to archaeological and cultural resources of the project site.

3.3 Infrastructure

3.3.1 Utilities, Energy, Public Facilities and Public Services

Existing Utilities, Impacts and Mitigation Measures

Electrical power would be supplied to the project area by the Hawai'i Electric Light Company (HELCO), a privately owned utility company regulated by the State Public Utilities Commission, via its island-wide distribution network. In the project area the network utilizes overhead lines in a utility easement that runs parallel to and approximately 2,000 feet east (*mauka*) of Akoni Pule Highway. Telephone service is available from Hawaiian Telcom, also located in the utility easement. Underground connections to those utilities will be established for the project, similar to

those utilized in the Kohala Ranch and Kohala Estates subdivisions located to the east and southeast.

Water will be provided to the project under an agreement with the Kohala Ranch Water Company through a 12-inch water line along Akoni Pule Highway fronting the site. Storage in the Kohala Ranch Water system is provided by an existing 500,000-gallon storage reservoir located approximately 1,400 feet east of the project site. This tank is sufficient to meet domestic and fire protection requirements for the project. Six-inch water lines will be installed at two locations along Akoni Pule Highway to provide water for the project's homes and fire hydrants. The capacity of the private system is adequate to accommodate the additional demand to serve the project's 9 lots. CC&Rs will require that the homes feature low-water-use landscaping, which is also in keeping with the natural vegetation of this part of Kohala.

No municipal wastewater treatment service is available in Kohala. Homes will utilize individual wastewater treatment systems meeting with the requirements of the State Department of Health.

The proposed addition of dwellings on the 9 lots is a relatively minor action in the context of existing utility systems would not have any adverse impact on existing public or private utilities. The design of the homes will incorporate features to minimize water use.

Existing Public Services and Facilities

Fire, police and emergency medical services are available at a full-time fire station and a police station in Kapa'au located approximately 16 miles to the north. There is also a volunteer fire station located at Kohala Ranch approximately 2 miles to the east. County medivac helicopter service is available seven miles south of the project site on Queen Ka'ahumanu Highway at the South Kohala Fire Station which also contains a police sub-station. Acute medical care service is available at Kohala Hospital in Kapa'au and at North Hawai'i Community Hospital located in Waimea, approximately 14 miles away.

Solid waste from the development will be hauled by residents and/or collected and hauled by commercial disposal operators to the County's West Hawai'i Sanitary Landfill in Pu'uana'hulu, which has several decades of capacity.

Public schools in the area include Kohala Elementary School and Kohala Intermediate & High School, both of which are located in Kapa'au. There are also elementary and middle schools located in both Waimea and Waikoloa. Two private K to 12 school, Hawai'i Preparatory Academy and Parker School, are located in Waimea. Several State and County beach parks are located within 18 miles of the project site, including Spencer County Beach Park, Hapuna Beach State Park, Lapakahi State Park, Mahukona County Park, Kapa'a County Beach Park, Kamehameha County Park and Keokea County Beach Park. As discussed in Section 3.1.4, above, additional recreational and open space land is being acquired by the County *makai* of Akoni Pule Highway at Kaiholena. Pu'ukohola Heiau, a federal historical site, is located near Kawaihae. Public boat ramps are located at Mahukona, Kawaihae Harbor and Puako.

Impacts and Mitigation Measures to Public Facilities and Services

The project may have an effect on public services and facilities through minor additional demand for fire, police, and emergency services, solid waste services, schools and recreational facilities. Taxes and a system of required fair share contributions will mitigate these impacts. Rezoning Ordinance No. 97-02 required the following:

- Rezoning Ordinance Condition P. The applicant shall make its fair share contribution to mitigate the potential regional impacts of the subject property with respect to parks and recreation, fire, police, solid waste disposal facilities, and roads.
- Rezoning Ordinance Condition E. In conjunction with Final Subdivision approval, the applicant shall construct the necessary distribution pipeline, service laterals, and fire hydrants, meeting with the requirements of the Department of Water Supply. No building permit for any of the residential structures shall be issued until units of water are available and committed to the subject property, as represented in the applicant's agreement with the Kohala Ranch Water Company (formerly Kohala Joint Venture).
- Rezoning Ordinance Condition K. The applicant, its successors or assigns shall prepare a Solid Waste Management Plan prior to securing Final Subdivision Approval for the proposed development within the subject property meeting with the approval of the Department of Public Works. A copy of the approved Plan shall be submitted to the Planning Director.

Similar conditions are expected to be imposed as part of the new Rezoning Ordinance that would grant change of zone to RA-3a.

It should be noted that high value rural residential/resort-residential homes in the County of Hawai'i tend to provide a significant net benefit in terms of public services and facilities. A 2003 economic study of resort-residential housing (Decision Analysts Hawai'i, Inc. 2003) in West Hawai'i determined that on balance it provides substantial economic benefits to the Big Island. Construction and occupant expenditures are important for employment and economic growth, and the support services required by those occupying the homes and condominiums cost far less to the County and State than the large amount of property taxes they pay. Revenues are high and steady because of the large numbers of very high value units, the low percentage of homeowners who qualify for homeowner exemptions, and the high property tax rate for properties that are not occupied by homeowners. Government costs are low because developers fund most or all of the infrastructure and amenity construction costs, and often much of the operating costs. Also, low occupancy rates mean lower demand for County services, and as most residents are well-off, they require little if any government assistance. According to the report:

“Thus, property-tax revenues from resort-residential projects exceed support expenditures by \$20.8 million per year for existing projects (\$22.2 million – \$1.4 million) and \$25 million per year for planned projects (\$26.7 million – \$1.7 million). In effect, resort-residential projects provide substantial tax revenues to subsidize support services to other Big Island residents and visitors” (Ibid: 6).

In summary, considering fair-share contributions and real property and other tax contributions, the Kohala Shoreline, LLC development would more than compensate for extra costs of public services and would also enable agencies to improve and expand their services.

3.3.2 Roadways and Traffic

Introduction

Pursuant to Section 25-2-46 (Concurrency Requirements), Hawai‘i County Zoning Code, a traffic impact analysis report (TIAR) is required with the application for any zoning amendment which can generate 50 or more peak hour trips. Although the proposed project will not generate this number of peak hour trips, Witcher Engineering prepared a TIAR for the project in order to quantify and describe the traffic-related characteristics of the project and precisely assess its impacts. The full report is contained in Appendix 5 and summarized below.

Existing and Proposed Facilities

The project’s internal roadways will be designed and constructed as private residential streets with minimum 50-foot rights-of-way, which may be modified in width to account for slope. They will consist of two 10-foot wide paved lanes with grassed or aggregate shoulders on which parking will not be allowed, to preclude serving as fuel for wildfire.

Akoni Pule Highway (State Highway 270) is the major north-south highway in the vicinity of the project site, conducting traffic between Hawi and Kawaihae and beyond. Other access to North Kohala is available on the Kohala Mountain Road, located approximately five miles to the east (a private road for Kohala Ranch residents only connects the Kohala Mountain Road and Akoni Pule Highway). The Akoni Pule Highway has one lane in each direction and a posted speed limit of 55 miles per hour. The highway has a south-bound turn lane and acceleration and deceleration lanes at the intersection with Kohala Ranch Road. Akoni Pule Highway is under the jurisdiction of the State of Hawai‘i.

As shown in Figure 3a, access and egress for the 9-lot subdivision will be from two new driveways along the west (*makai*) side of Akoni Pule Highway. Due to the lack of background traffic in this area, both intersections are proposed to be unsignalized. The north driveway will be the west leg of the existing intersection of the highway with Kohala Ranch Road; it will provide access and egress to five lots. Existing conditions at the Kohala Ranch Road intersection are as follows: a southbound through lane, a northbound through lane, northbound right lane, a westbound lane and a westbound right/out lane. There is a refuge pocket for the westbound left turn lane on Akoni Pule Highway. There is adequate area to make a lane for a northbound left refuge pocket and for a southbound right deceleration lane. The south driveway will also be located along the west side of the highway, approximately 1,300 feet south of Kohala Ranch Road (and the north driveway); it will provide access to four lots. The proposed intersection improvements to Akoni Pule Highway at the south driveway would include a northbound left turn refuge pocket, or a shared lane may suffice. Improvements to both intersections would require review by and approval from the Hawai‘i State Department of Transportation, Highways Division.

Impacts

Under the assumptions listed above, both driveways were analyzed in the TIAR. The TIAR undertook a number of procedural steps, including estimating the number of peak hour trips that the proposed project will generate according to methodology and data from the Institute of Transportation Engineers (*Trip Generation Handbook*, 1998; *Trip Generation*, 2003).

Existing traffic conditions were estimated from manual traffic counts performed at the intersection of Akoni Pule Highway at Kohala Ranch Road on February 12, 2015 (see Tables 1 and 2 of Appendix 5). Existing traffic operating conditions of the study intersections were determined using the methodology described in the *Highway Capacity Manual, Special Report 209* (2nd Edition of the Transportation Research Board, 1992), and the *Highway Capacity Software from the Federal Highway Administration by McTrans* (University of Florida, Gainesville, Florida). This included analysis of level-of-service (LOS). There are six levels-of-service, A through F, which relate to the driving conditions from best to worst, respectively. In general, LOS A represents free-flow conditions with no congestion. LOS F, on the other hand, represents severe congestion with stop-and-go conditions. LOS D is typically considered an acceptable level of service. The Hawai'i County Zoning Code defines "acceptable level of service" as am/pm peak hour LOS D or better. All movements are currently LOS A and B.

The next step was to determine how many peak-hour trips would be generated by the development, including residents, visitors, tradesmen, shoreline users, etc. The trip generation methodology used in this report is based upon applications developed by the Institute of Transportation Engineers and published in *Trip Generation*, 8th Edition, 2011. Trip generations have been developed for a variety of land uses (or facility types) which correlate trips with dwelling units, area, population, vehicle ownership and intensity of use. In order to obtain conservative estimates of potential traffic, no adjustments were made to reflect the impact of less than full-time residents, which could be the case in the proposed subdivision.

It was estimated that the project will generate nine trips during the morning peak hour and 12 trips during the afternoon peak hour. Because of this very minor level of impact, the TIAR was limited to the two driveway intersections described above. Table 4 shows the number of trips in the AM and PM peak hours, by driveway. As mentioned previously, five lots would be accessed by the north driveway at the Kohala Ranch Road intersection and four lots by the south driveway.

Table 4. Project Trip Generation

<i>Time</i>	<i>Number of Lots</i>	<i>Generator</i>	<i>Entering</i>		<i>Exiting</i>	
			<i>%</i>	<i>#</i>	<i>%</i>	<i>#</i>
<i>Akoni Pule Highway & Kohala Ranch Road</i>						
AM	5	0.77	26	1	74	3
PM	5	1.02	64	3	36	2
<i>Akoni Pule Highway & South Driveway</i>						
AM	4	0.77	26	1	74	2
PM	4	1.02	64	3	36	1

The project-related traffic determined by trip generation was then superimposed on background traffic volumes. Trip distribution was performed on the basis of direction of the existing turning movements at the Kohala Ranch Road intersection. Table 5 of Appendix 5 provides the trip distribution and trip assignment. The traffic impacts of the project were assessed by analyzing the existing and future LOS for 5-year, 10-year and 20-year horizons for project-generated traffic (Tables 5a and 5b). The purpose of this analysis was to identify potential operational deficiencies in the project area and to quantify changes in the intersection levels-of-service as a result of project generated traffic.

The north driveway generates four trips in the AM peak and five trips during the PM peak. The south driveway generates three trips during the AM peak and four trips during the PM peak. This is a maximum of nine peak hour trips per day; an insignificant amount of traffic in the area. The analysis determined that for the study periods of 5, 10 and 20 years, all traffic movements will operate at LOS A or B, which show good operating conditions and minimal delays. As all movements operate at LOS A or B, no additional local or area traffic mitigation is required or recommended, aside from lane striping changes discussed below.

For the north driveway at the Kohala Ranch Road intersection, the analysis was performed on the basis of providing a left turn lane pocket on Akoni Pule Highway into the Project. This can be accomplished by re-striping of the existing refuge pocket making it a northbound left turn lane. There is negligible potential for motor vehicle queues long enough to require storage lanes. Therefore, the need for storage for this movement is negligible. The same holds true for the south driveway. Without a dedicated northbound left turn lane, the LOS for this south driveway remains A throughout the twenty-year study period.

Overall, the development of the 9-lot subdivision will have little, if any, impact on local and/or area traffic in the study area. Nine lots only generate seven trips during the AM peak hour and nine trips during the PM peak hour. Comparing this to the 2% per annum growth in traffic over twenty years, these trips only represent about 5% of the growth in traffic in the AM and 4% in the PM during peak hours.

Table 5a. Level of Service, North Driveway

Direction	AM					PM				
	Existing	BO	5-Yr	10-Yr	20-Yr	Existing	BO	5-Yr	10-Yr	20-Yr
AKONI PULE HIGHWAY & KOHALA RANCH ROAD INTERSECTION										
EBL	—	A	A	A	A	—	A	A	A	A
EBT		A	A	A	A	—	A	A	A	A
EBR	—	A	A	A	A		A	A	A	A
WBL	A	A	B	B	B	B	B	B	B	B
WBT		A	B	B	B	—	B	B	B	B
WBR	A	A	A	A	A	A	A	A	A	A
NBL		A	A	A	A	—	A	A	A	A
NBT	—	A	A	A	A		A	A	A	A
NBR		A	A	A	A		A	A	A	A
SBL	A	A	A	A	A	A	A	A	A	A
SBT		A	A	A	A		A	A	A	A
SBR		A	A	A	A	—	A	A	A	A
Approach Delay	9.7	9.9	10.1	10.4	10.9	10.8	11.3	11.8	12.3	13.7
Approach LOS	A	A	B	B	B	B	B	B	B	B

Table 5b. Level of Service, South Driveway

Direction	AM					PM				
	Existing	BO	5-Yr	10-Yr	20-Yr	Existing	BO	5-Yr	10-Yr	20-Yr
AKONI PULE HIGHWAY & SOUTH DRIVEWAY										
EBL		A	A	A	A	—	A	A	A	A
EBT		—	—	—	—		—	—		-
EBR	—	A	A	A	A		A	A	A	A
WBL		—	—	—		—	—	—	—	—
WBT	—	—	—				—	—		
WBR	—	—	—	—		—	—	—		
NBL		A	A	A	A	—	A	A	A	A
NBT		A	A	A	A		A	A	A	A
NBR		—	—	—	—		—	—	—	—
SBL		—	—			—	—			
SBT		A	A	A	A		A	A	A	A
SBR	—	A	A	A	A	—	A	A	A	A
Approach Delay	—	9.1	9.2	9.4	9.6		9.3	9.4	9.5	9.9
Approach LOS		A	A	A	A		A	A	A	A

Mitigation Measures

Rezoning Ordinance No. 97-02 required the following related to roads and traffic:

- Rezoning Ordinance Condition F. Access to the subject property from Akoni Pule Highway and any improvements within the Akoni Pule Highway shall be constructed prior to Final Subdivision Approval meeting with the requirements and approval of the State Department of Transportation.
- Rezoning Ordinance Condition G. Roadway connections to the adjoining parcel of the subject property's southeastern boundary shall be provided meeting with the approval of the Department of Public Works and shall be delineated on the final subdivision plat map for the subject property.
- Rezoning Ordinance Condition H. All interior roadways within the subject property shall be constructed meeting with the requirements of Chapter 23 of the Subdivision Code and with the approval of the Department of Public Works.

Similar conditions are expected to be imposed as part of the new the Rezoning Ordinance that would grant change of zone to RA-3a, however, the project may require approval of a variance or planned unit development permit to address road standards, lot sizes and other design variances. Aside from this, the only mitigation required would be restriping of Akoni Pule Highway at the north driveway to convert the existing refuge pocket into a northbound left turn lane.

3.4 Secondary and Cumulative Impacts

Somewhat distinct from the direct effects that construction and occupation of a housing project can have on the environment are secondary impacts. These can include impacts from residents traveling to different parts of the island for work or recreation and inducing impacts in environmentally sensitive areas. Another potential secondary impact is economic; although generally positive, increased economic activity resulting from the expenditures of new residents can draw in workers who add to the existing demand for affordable housing. In the case of the subject project, its modest scale in relation to the existing population of the island indicates that any such secondary impacts would be negligible.

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. It is therefore appropriate to frame the setting in the context of ongoing and future developments. The North Kohala District is primarily residential in nature, with some ongoing agricultural activities including ranching. Some commercial activities occur in its two primary towns, Hawi and Kapa'au. This area supported some of the earliest wind farms in Hawai'i and is being explored for biomass and green farming. Between these and the project site in the very south of North Kohala lies an area of undeveloped shoreline, with expansive vistas both *mauka* and *makai*. Several subdivisions have been proposed that would alter the character of some areas of shoreline, prompting calls by citizens to acquire open space, which have been answered by the County with several property acquisitions, as discussed in Section 3.1.4. The project site itself is in the vicinity of several upscale agricultural and residential subdivisions, including the more than 3,500-acre Kohala Ranch, which is continuing

to be developed with homes. As discussed above, this is near the border of South Kohala, approximately three miles north of Kawaihae Harbor, one of only two deep-draft harbors on Hawai'i Island and the only one located on its western or leeward side. A small-boat harbor, which the State has expanded, is also located there. Also located in the Kawaihae area is the State Department of Hawaiian Home Lands' 10,152-acre Kawaihae Tract which, while currently mostly used for cattle and horse grazing, will eventually be developed with commercial, residential, agricultural and community use components. The town of Kawaihae itself has a small residential population and several commercial centers. Aside from the residential and industrial uses at the Department of Hawaiian Home Lands projects to the south of the project site, no major projects are known to be proposed for development in the area.

The proposed 9-lot project will have individually minor impacts for almost all categories of resources. It should be noted that the proposed change of zone limits future reduce potential density from the 50-lots approved under SMA 379 down to 9 lots. Cumulative effects are potentially of concern for the following resources:

- Traffic: Considered cumulatively, there is a negligible effect on Average Daily Traffic on Akoni Pule Highway and all other major roads, but a slightly more substantial effect with the interaction of left turns at the main entrance of Kohala Ranch. This is mitigable by the proposed project intersection improvements, which includes a northbound to westbound left-turn pocket and a southbound deceleration lane.
- Visual resources: The project will contribute to the slow transformation of the views of undeveloped coastal areas that is occurring in North Kohala. The effect is not severe in this part of North Kohala because of the extensive developed area that lies directly *mauka*, as well as the presence of other similarly developed coastal properties to the south. This is further mitigated by the proposed project design that locates house pads away from both the highway and the shoreline and restricts homes to 25 feet in height in a development concept significantly less dense than allowed by existing zoning. Furthermore, the prevalence of essentially undevelopable State properties adjacent to the north, and the continuing acquisition by the County of private properties *makai* of the highway will cumulatively build the inventory of undeveloped shoreline in North Kohala.

3.5 Required Permits and Approvals

The following permits and approvals would be required:

- County of Hawai'i, Department of Public Works, Engineering Division: Grading Permit.
- County of Hawai'i, Department of Planning, Variance and/or Planned Unit Development Permit and Subdivision Approval.
- County of Hawai'i, Leeward Planning Commission, Special Management Area Use Permit and Change of Zone Recommendation.
- County of Hawai'i, County Council, Change of Zone Approval.
- State Department of Transportation: Approval for Work within State Roadway Right-of-Way.

- State of Hawai‘i, Department of Health: Underground Injection Control (UIC) permits. National Pollutant Discharge Elimination System (NPDES) permit.

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 adding housing opportunities for the North Kohala district, 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. The property is in the State Land Use Urban District. The proposed use is consistent with intended uses for this land use district.

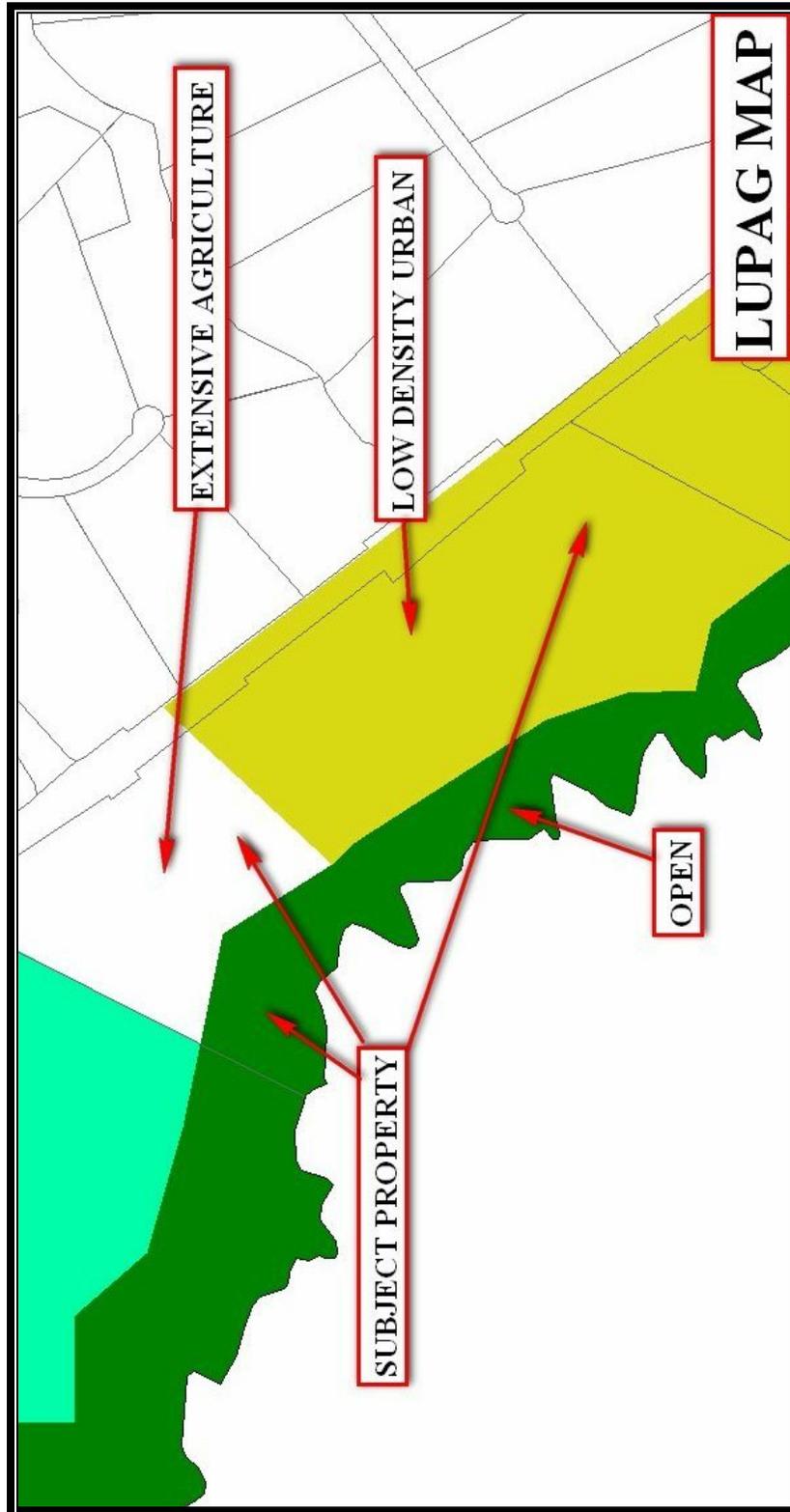
3.6.3 Hawai‘i County Zoning and General Plan

Hawai‘i County Zoning. The project site carries a zoning designation of RS-15 (single-family residential, with a minimum lot size of 15,000 square feet). The proposed action would reduce the allowed density to an average of one home per three acres.

The *Hawai‘i County General Plan Land Use Pattern Allocation Guide (LUPAG)*. The LUPAG map component of the *General Plan* is a graphic representation of the Plan’s goals, policies, and standards as well as of the physical relationship between land uses. It also establishes the basic urban and non-urban form for areas within the planned public and cultural facilities, public utilities and safety features, and transportation corridors. According to the Hawai‘i County Planning Department (see letter in Appendix 1a), the project site is classified as Low Density Urban, Extensive Agriculture, and Open in the LUPAG (Figure 6). Most of the project site is designated Low Density Urban, with a small portion designated Extensive Agriculture, and a strip of Open along the shore. The proposed 9-lot subdivision would be consistent with the Low Density Urban designation, which allows “residential, with ancillary community and public uses, and neighborhood and convenience-type commercial uses; overall residential density may be up to six units per acre.” The shoreline area would remain open under the proposed site plan (see Figure 3a).

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 Planning Department). The *General Plan* itself is organized into thirteen elements, with policies, objectives, standards, and principles for

Figure 6 LUPAG Map



each. There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawai‘i. Analysis for the EA confirms that it generally satisfies the following Goal and Policies, and Courses of Action of particular chapters of the General Plan:

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.

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, which occurs in an area designated by zoning for urban development, would not have a substantial adverse effect on the environment and would not diminish the valuable natural resources of the region. The project 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 inventoried. Certain sites will be subject to data recovery and preservation, and plans will be developed and approved by SHPD when appropriate.

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

Enact restrictive land use and building structure regulations in areas vulnerable to severe damage due to the impact of wave action. Only uses that cannot be located elsewhere due to public necessity and character, such as maritime activities and the necessary public facilities and utilities, shall be allowed in these areas.

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: Most of the property lies within Zone X, outside the 500-year flood zone. No home development will occur within the VE zone adjacent to the coast or within gulches. All standards regarding drainage, flooding and sedimentation will be adhered to and project design will be reviewed by and subject to permits from the Hawai‘i County Department of Public Works and the Hawai‘i State Department of Health.

NATURAL BEAUTY GOALS

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

Protect scenic vistas and view planes from becoming obstructed.

Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

NATURAL BEAUTY POLICIES

Increase public pedestrian access opportunities to scenic places and vistas.

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: The site plan for the project, which will be reviewed and approved by the Planning Department, creates *mauka-makai* view corridors and has all structures set back a minimum of 100 feet from Akoni Pule Highway and 100 feet from the shoreline (except for a minimum 40-foot setback near the northern edge of the property). All electrical and communication lines within the property will be placed underground. The Waiakailio Bay area is named in the 2005 General Plan as a place of natural beauty, and was also so listed in the 1989 General Plan. The subsequent granting of the RS-15 zoning and SMA Permit indicates that the proposed urban land use for the project site was considered compatible with this natural beauty designation. As discussed in Section 3.1.4, the point at Waiakailio Bay will continue to be visible from the highway, albeit with a foreground that includes some developed structures. CC&Rs will restrict homes to a height of 25 feet as measured according to Chapter 25, Hawai'i County Zoning Code and will require a color scheme featuring earth-tone colors to minimize visual impacts, as generally shown in the visual simulations. Although the homes will be visible, their visual impact has been minimized, and they will not appear out of character given the large residential-agricultural development directly adjacent to the project site, and the urban appearance of coastal developments just to the south and in Kawaihae.

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.

Encourage the use of native plants for screening and landscaping.

Discussion: The proposed action would locate all but one home (for which a 40-foot setback is proposed) and other structures a minimum of 100 feet from the shoreline. 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.

LAND USE GOALS

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

LAND USE POLICIES

Allocate appropriate requested zoning in accordance with the existing or projected needs of neighborhood, community, region and County.

LAND USE, OPEN SPACE GOALS

Provide and protect open space for the social, environmental, and economic well-being of the County of Hawaii and its residents.

Protect designated natural areas.

LAND USE, OPEN SPACE POLICIES

Open space shall reflect and be in keeping with the goals, policies, and standards set forth in the other elements of the General Plan.

Discussion: The proposed residential project on an urban-designated parcel would be in keeping with County and State land use plans and does not detract from important open space.

3.6.5 Chapter 205A and Special Management Area

Special Management Area. The property is situated within the County's Special Management Area (SMA) and an SMA major permit will be applied for before the Hawai'i County Leeward Planning Commission. The criteria for review of development within the Special Management Area are stated in HRS, Chapter 205a-26(2) (Special Management Area guidelines) and Rule 9-11(E) in the Planning Commission Rules. Planning Commission Rule 9-11(E) states that the Authority may permit the proposed development only upon finding that:

1. The development will not have any substantial adverse environmental or ecological effect except as such adverse effect is minimized to the extent practicable and is clearly outweighed by public health, safety, or compelling public interest;

2. The development is consistent with the objectives and policies and the Special Management Area guidelines as provided by Chapter 205A, HRS; and
3. The development is consistent with the General Plan, Zoning Code and other applicable ordinances.
4. The development will, to the extent feasible, reasonably protect native Hawaiian rights if they are found to exist, including specific factual findings regarding:
 - a. The identity and scope of valued cultural, historical or natural resources in the petition area, including the extent to which traditional and customary native Hawaiian rights are exercised in the petition area;
 - b. The extent to which those resources, including traditional and customary native Hawaiian rights, will be affected or impaired by the proposed action; and
 - c. The feasible action, if any, to be taken by the Authority to reasonably protect any valued cultural, historical or natural resources, including any existing traditional and customary native Hawaiian rights.

Based on the resources and impacts described in previous sections, the project is consistent with the above criteria, a subject which will be evaluated and discussed in detail as part of the SMA application.

3.6.5 North Kohala Community Development Plan

The North Kohala Community Development Plan encompasses the judicial district of North Kohala, and was developed under the framework of the February 2005 County of Hawai'i General Plan. Community Development Plans are intended to translate broad General Plan Goals, Policies, and Standards into implementation actions as they apply to specific geographical regions around the County. CDPs are also intended to serve as a forum for community input into land-use, delivery of government services and any other matters relating to the planning area. The General Plan now requires that a Community Development Plan shall be adopted by the County Council as an "ordinance," giving the CDP the force of law. This is in contrast to plans created over past years, adopted by "resolution" that served only as guidelines or reference documents to decision-makers. In November 2008, the North Kohala CDP was adopted by the County Council. The version referenced in this Environmental Assessment is at:
<http://www.herc.info/community-planning/community-development-plans/north-kohala>.

The purposes of the North Kohala CDP are to:

- Articulate North Kohala's residents' Vision and Values for their Community
- Identify North Kohala's residents' Priority Issues to be addressed by the CDP
- Develop Strategies and Action Programs to address those Priority Issues

The CDP states that its goal is:

To manage the future growth of the district in a manner that is consistent with the Kohala lifestyle and ideals of being a rural community with a strong cultural heritage, an agricultural base, and a small town feel.

The CDP, with a theme of “Keep Kohala, Kohala,” describes the district as a “Cultural and Historical Preservation Community” and emphasizes that all development decisions “shall be required to assess and disclose their potential impact on cultural sites and resources within the district, and shall be in keeping with the heritage and culture of North Kohala.”

The overall goal of the North Kohala CDP is:

“To manage the future growth of the district in a manner that is consistent with the Kohala lifestyle and ideals of being a rural community with a strong cultural heritage, an agricultural base, and a small town feel.”

That overall goal is expressed through four Priority Issues, each with its own Goal. The Kohala Shoreline, LLC project is compatible with Priority Issue 1 and its Goal - Growth Management. Under the CDP growth is to be directed “to areas within and near existing town centers in order to preserve the district’s open space and cultural resources; and to promote agriculture.”

The area proposed for the project is bounded on the *mauka* side by similar rural-residential and agricultural-residential developments, which are also present in many areas *makai* of the highway from the subject property towards the south. This is also in keeping with CDP Section 3.3, which calls for upscale developments to be limited to areas where they are already located, as depicted in the CDP’s “North Kohala Environmental & Cultural Concept Map” located on Page 25. The project is located within or immediately adjacent to the area depicted as “Existing Upscale Development” on this map.

Another relevant consideration from the North Kohala CDP is the protection of view planes and places of natural beauty.

“Strategy 1.9: Establish a View Plane Protection Program to identify and protect areas of significant beauty along the Kohala Mountain Road and Akoni-Pule Highway corridor.”

The project will have all but one home and other structures set back 100 feet from the shoreline and 100 feet from the Highway. Buildings will be limited to 25 feet in height as measured under the Zoning Code, and restricted to earth-tone color schemes to minimize visual impacts. These factors will protect view plans.

The development of Kohala Shoreline, LLC will help implement Strategy 2.5, which aims to:

“Encourage and increase cooperation and coordination between the community and private land owners regarding public access to coastal and mauka lands.” The proposed shoreline access and parking area and lateral shoreline trail will help maintain and improve public access to coastal lands.

PART 4: DETERMINATION

Kohala Shoreline, LLC expects that the Hawai‘i County Planning Department will determine that the proposed action will not significantly alter the environment, as impacts will be minimal, and that this agency will accordingly issue a Finding of No Significant Impact (FONSI). This determination will be reviewed based on comments to the Draft EA, and the Final EA will present the final determination.

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. Archaeological sites are being protected through preservation plans, and there will be a generally 100-foot wide setback zone from the shoreline (except for a minimum 40-foot setback near the northern edge of the property) to protect and promote public enjoyment of shoreline resources. The project site and surrounding areas support residential and open space uses that will not be affected by the proposed action.

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

The principal beneficial use of the area is for shoreline recreation, which will not be curtailed in any way by the proposed project.

3. The proposed project will not conflict with the State's long-term environmental policies.

The State’s long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The proposed action provides housing for residents of Hawai‘i County in an area identified in the General Plan for such uses, fulfilling needed County and State goals while avoiding significant impacts to the environment. It is thus consistent with all elements of the State’s long-term environmental policies.

4. The proposed project will not substantially affect the economic or social welfare of the community or State.

The project will not adversely affect the social welfare of the community and will contribute to the economy and to shoreline access.

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

No effects to public health are anticipated. Water quality will be protected through adherence to Best Management Practices that will be specified as part of NPDES and Grading permits.

6. The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities.

Only modest secondary effects are expected to result from the rural residential project. Because of the nature of the project, real property and other tax contributions would more than compensate for extra costs of public services and would also enable agencies to improve and expand their services.

7. The proposed project will not involve a substantial degradation of environmental quality.

The proposed action is taking place in a general area already impacted by ranching, construction and rural residential activities, and is being regulated by permits to avoid environmental degradation and thus would not contribute to environmental degradation.

8. 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.

Traffic impacts have been assessed with a cumulative perspective, and with mitigation the project will have only limited impacts on local traffic flow. The project will contribute to the transformation of views of undeveloped coastal areas that is occurring in North Kohala, but the effect is not severe because of the remaining extensive stretch of undeveloped coastal areas to the north, as well as the presence directly *mauka* and south of already developed areas. The project will minimally add to input of nutrients and other pollutants, but changes of land use associated with the project should not change water quality of the offshore area to any discernible extent.

9. The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.

The project site supports overwhelmingly alien vegetation. Impacts to rare, threatened or endangered species of flora or fauna will not occur.

10. The proposed project will not detrimentally affect air or water quality or ambient noise levels.

Due to the character of the proposed action, no adverse effects on these resources would occur.

11. The project does not affect nor would it likely to be damaged as a result of being located in environmentally sensitive areas such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal area.

Although the proposed action is located in an area with volcanic and seismic risk, the entire Island of Hawai‘i shares this risk, and the proposed action is not imprudent to construct.

12. The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.

The project has been designed to minimize impacts on protected scenic viewplanes, including views from Akoni Pule Highway of the coast.

13. The project will not require substantial energy consumption.

Although the project's infrastructure and dwelling unit construction will require energy, the development's electrical requirements are within HELCO's capacity and no major adverse effects to energy consumption would be expected. There is no feasible way to provide housing without energy consumption. The project design will include energy efficient lighting fixtures and low water use landscaping, which reduce energy use.

REFERENCES

- Armstrong, R. (editor). 1983. *Atlas of Hawai'i*. Honolulu: University of Hawai'i Press (2nd Edition).
- Banko, W. E. 1980. "Population Histories – Species Accounts Seabirds: Newell's Shearwater ('A'o)." Cooperative National Park Resources Studies Unit, University of Hawai'i at Manoa, Department of Botany, Technical Report #5A.
- Day, R. H., B. Cooper, and T. C. Telfer. 2003. "Decline of Townsend's (Newell's Shearwaters (*Puffinus auricularis newelli*) on Kauai, Hawaii." *The Auk* 120: 669-679.
- Decision Analysts Hawai'i, Inc. 2003. "Property Tax Revenues From Premium Resort-Residential Homes And Condominiums In West Hawai'i." Prep. for: Hawai'i Leeward Planning Conference, Kailua-Kona, Hawai'i.
- Dollar, S. J. 1982. "Wave stress and coral community structure in Hawaii." *Coral Reefs* 1:71-81.
- Dollar, S. J. and M. J. Atkinson. 1992. "Effects of nutrient subsidies to nearshore marine systems off the west coast of the Island of Hawaii." *Estuarine, Coastal and Shelf Science* 35:409-424.
- Dollar, S. J. and G. W. Tribble. 1993. "Recurrent storm disturbance and recovery: a long-term study of coral communities in Hawaii." *Coral Reefs* 12:223-233.
- Ellis, W. 1963. *The Journal of William Ellis, Narrative of a Tour of Hawai'i, of Owhyee*. Honolulu: Advertiser Publishing Co.
- FR. n.d. Foreign Register of Kuleana Claims Recorded by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Manuscript. Hawai'i State Archives.
- FT. n.d. Foreign Testimony Recorded by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Manuscript. Hawai'i State Archives.

- Gagne, W., and L. Cuddihy. 1990. "Vegetation," pp. 45-114 in W.L. Wagner, D.R. Herbst, and S.H. Sohmer, eds., *Manual of the Flowering Plants of Hawai'i*. 2 vols. Honolulu: University of Hawai'i Press.
- Grasshoff, K. 1983. *Methods of Seawater Analysis*. Verlag Chemie, Weinheim, Germany.
- Grigg, R.W. 1998. "Holocene reef accretion in Hawaii: a function of wave exposure and sea level history." *Coral Reefs* 17:263-272.
- Handy, E. S. C., and E. G. Handy. 1972. *Native Planters in Old Hawaii: Their Life, Lore, and Environment*. Bernice P. Bishop Museum Bulletin 233, Bishop Museum Press, Honolulu.
- Hawai'i County Planning Department. 2005. *The General Plan, County of Hawai'i*. Hilo.
- Hawai'i State Department of Hawaiian Home Lands (DHHL). 2009a. *Environmental Assessment for the Kamoleao Laulima Community Resource Center Incubator Kitchen and Associated Facilities*. Prep by Geometrician Associates for DHHL. Hilo.
- _____. 2009b. *Final Environmental Assessment, Kona Carbon Project*. Prep by Geometrician Associates for DHHL. Hilo.
- Hawai'i, Territory of. 1929. Indices of Awards Made by the Board of Land Commissioners to Quiet Land Titles in the Hawaiian Islands. Archives of Hawaii. Territory of Hawai'i, Honolulu.
- _____. n.d. Native Register of Kuleana Claims Recorded by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Manuscript. Hawai'i State Archives.
- _____. n.d. Native Testimony Recorded by the Board of Commissioners to Quiet Land Titles in the Hawaiian Islands. Manuscript. Hawai'i State Archives.
- Heliker, C. 1990. *Volcanic and Seismic Hazards on the Island of Hawai'i*. Washington: U.S. GPO.
- Kamakau, S. 1961. *Ruling Chiefs of Hawai'i*. Honolulu: The Kamehameha Schools Press.
- Kirch, P. 1985. *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. Honolulu: University of Hawai'i Press.
- _____. 2011. *When did the Polynesians Settle Hawai'i? A Review of 150 Years of Scholarly Inquiry and a Tentative Answer*. Hawaiian Archaeology Vol. 12:3-26.
- Kuykendall, R., and A. Day. 1976. *Hawaii: A History From Polynesian Kingdom to American Statehood*. Prentice-Hall, Inc., Englewood Cliffs.
- Malo, D. 1951. *Hawaiian Antiquities: Mo'olelo Hawai'i*. Bernice P. Bishop Museum, Special Publication 2, Second Edition. Bishop Museum Press: Honolulu, Hawai'i.

- Maly, K. 2000. Historical Background. In: Archaeological Inventory Survey of the Coastal Portion of Kaiholena *Ahupua'a*, North Kohala, Hawai'i. IARII Report prepared for Pohaku Kea LLC, Menlo Park. Dye and Maly (2000).
- Miller, E. "County acquiring Pao land in North Kohala." *West Hawaii Today*. Dec. 17, 2009.
- Newman, T. 1970. *Hawaiian Fishing and Farming on the Island of Hawai'i in AD 1778*. Department of Land and Natural Resources, Division of State Parks.
- Orr, M. 2003. *Cultural Impact Assessment Kahuā Ranch DAGS Rainbow Tower & Facilities Pu'u Waiakanonula, Kahua Ranch, Ahupua'a of Kahuāli'ili'i, District of Kohala, Hawai'i Island, Hawai'i*. Prepared for Haun & Associates.
- Pukui, M. S. Elbert and E. Mo'okini. 1976. *Place Names of Hawai'i*. University of Hawai'i Press, Honolulu.
- Pukui, M.K. and E.S.C. Handy. 1999. *The Polynesian Family System in Ka'u, Hawai'i*. Mutual Publishing. Orig. Ed. 1972.
- Rechtman, R. 2004. *Cultural Impact Assessment Associated with the Proposed Development of a Single-Family Residence in Conservation District Land, Pāo'o Ahupua'a, North Kohala District, Island of Hawai'i*. Rechtman Consulting Report RC-0019. Prepared for Jonathan Cohen, Lincoln, MA.
- _____. 2006. *Cultural Impact Assessment Associated with the Proposed Development of Kohala Kai, Kahuāli'ili'i, Kahuānui, and Waikā ahupua'a, North Kohala District, Island of Hawai'i*. Rechtman Consulting Report RC-0368. Prepared for Greg Mooers, Kamuela.
- Rosendahl, P. 1972 *Aboriginal Agriculture and Domestic Residence Patterns in Upland Lapakahi, Island of Hawaii*. Ph.D. Dissertation, University of Hawaii, Honolulu.
- Roy, K.J. and S.V. Smith. 1971. "Sedimentation and coral reef development in turbid water: Fanning Lagoon." *Pacific Science* 25:234-248.
- Sato, Ikeda, Paeth, Smythe & Takehiro, Jr. 1973. *Soil Survey of the Island of Hawai'i. U.S. Department of Agriculture*. Soil Conservation Service and University of Hawai'i Agricultural Experiment Station. Washington, D.C., GPO.
- Strickland J. D. H. and T. R. Parsons. 1968. "A practical handbook of sea-water analysis." *Fisheries Research Bd. of Canada*, Bull. 167. 311 p.
- Thrum, T.G. 1900. Excerpt from *Hawaiian Annual*. Honolulu, Hawai'i.

- Tom Nance Water Resource Engineering. 2015. *Assessment of the Impact on Water Resources of the Kohala Shoreline, LLC Project on TMK 5-9-1:08 in North Kona, Hawaii*. Prepared for Marine Research Consultants.
- U.S. Dept. of Commerce, Bureau of the Census. 2015. <http://factfinder.census.gov/> .
- U.S. Department of the Interior, National Park Service. 2008. Abbreviated Final Environmental Impact Statement & Comprehensive Management Plan, Ala Kahakai National Historic Trail.
- U.S. Environmental Protection Agency (EPA). 2000. *National Water Quality Inventory Report to Congress*. 2000, EPA. p. 100-101: Chapter 10: “State and Territory Summaries: Hawaii.”
- U.S. Soil Conservation Service. 1973. *Soil Survey of Island of Hawai‘i, State of Hawai‘i*. Washington: U.S.D.A. Soil Conservation Service.
- University of Hawai‘i at Hilo, Dept. of Geography. 1998. *Atlas of Hawai‘i*. 3rd ed. Honolulu: University of Hawai‘i Press.
- U.S. Fish and Wildlife Service (USFWS). 2015. *USFWS Threatened and Endangered Species System (TESS)*. Washington: GPO. http://ecos.fws.gov/tess_public/
- Waihona ‘Aina Corporation. 2000. The Mahele Database, Waihona.com.
- Wolfe, E.W., and J. Morris. 1996. *Geologic Map of the Island of Hawai‘i*. USGS Misc. Investigations Series Map i-2524-A. Washington, D.C.: U.S. Geological Survey.

ENVIRONMENTAL ASSESSMENT

Kohala Shoreline Project

TMK: (3rd) 5-9-001:008

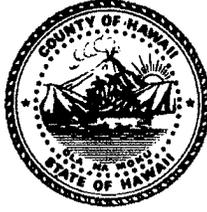
Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i

APPENDIX 1a

Comments in Response to Early Consultation

William P. Kenoi
Mayor

William T. Takaba
Managing Director



Lono A. Tyson
Director

Ivan M. Torigoe
Deputy Director

County of Hawai'i
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
25 Aupuni Street • Hilo, Hawai'i 96720
(808) 961-8083 • Fax (808) 961-8086
http://co.hawaii.hi.us/directory/dir_envmng.htm

January 29, 2010

Mr. Ron Terry
Principal
GEOMETRICIAN ASSOCIATES, LLC
P. O. Box 396
Hilo, HI 96721

RE: Early Consultation on Environmental Assessment for a 3-acre Lot Size Residential Development, TMK: 5-9-001:008, North Kohala, Island of Hawai'i

Dear Mr. Terry,

We have no comments to offer on the subject project.

Thank you for allowing us to review and comment on this project.

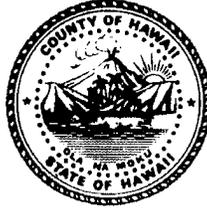
Best Regards and Aloha,

Lono A. Tyson
DIRECTOR

12/00 R

William P. Kenoi
Mayor

William T. Takaba
Managing Director



Warren H. W. Lee
Director

Tim T. Esaki
Deputy Director

County of Hawai'i
DEPARTMENT OF PUBLIC WORKS
Aupuni Center

101 Pauahi Street, Suite 7 - Hilo, Hawai'i 96720-4224
(808) 961-8321 · Fax (808) 961-8630
www.co.hawaii.hi.us

January 27, 2010

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

Subject: Early Consultation on Environmental Assessment (EA) for
3-acre lot size Residential Development
North Kohala, District, Island of Hawaii
TMK: [3] 5-9-001:008

We reviewed the subject Environmental Assessment and have the following comment:

Two culverts cross under Akoni Pule Highway draining onto the property. We recommend a drainage study be performed to identify drainage hazards within the proposed subdivision.

The Flood Insurance Rate Map shows a portion of this parcel lies within the VE flood zone. All construction plans must clearly delineate the limits of the flood zone. Any new construction, substantial improvements or watercourse alterations shall comply with Hawaii County Code Chapter 27, Floodplain Management.

If you have any questions, please contact Kiran Emler of our Kona office at 327-3530.

Galen M. Kuba, Division Chief
Engineering Division

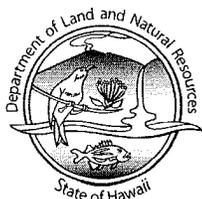
KE

c: Planning Director
ENG-HILO/KONA

LINDA LINGLE
GOVERNOR OF HAWAII



LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 10, 2010

Geometrician Associates, LLC
Box 396
Hilo, Hawaii 96721

Attention: Mr. Ron Terry, Principal

Ladies and Gentlemen:

Subject: Early Consultation on Environmental Assessment for a 3-acre Lot Size Residential Development at North Kohala

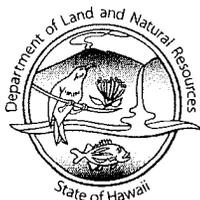
Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR), Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comment.

Other than the comments from Engineering Division, the Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,

A handwritten signature in cursive script that reads "Morris M. Atta".

Morris M. Atta
Administrator



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

January 20, 2010

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 –
- Historic Preservation

FROM:

for Morris M. Atta *Marline*

SUBJECT: Early Consultation on Environmental Assessment for 3-acre Lot Size Residential Development

LOCATION: Island of Hawaii

APPLICANT: Geometrician Associates, LLC on behalf of Kohala LLC

RECEIVED
LAND DIVISION
2010 FEB -9 A 9:12
DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII

10 JAN 22 AM 08:30 ENGINEERING

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by February 9, 2010.

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 my office at 587-0433. Thank you.

Attachments

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

Signed: *[Signature]*
Date: 2/8/10

DEPARTMENT OF LAND AND NATURAL RESOURCES
ENGINEERING DIVISION

LD/MorrisAtta

Ref.: Early Consultation EA3 Acre Residential Dev
Hawaii.466

COMMENTS

- () We confirm that the project site, according to the Flood Insurance Rate Map (FIRM), is located in Flood Zone ____.
- (X) **Please take note that according to the Flood Insurance Rate Map (FIRM), it appears that the project site is located in Zones X and VE. The National Flood Insurance Program does not have any regulations for developments within Flood Zone X, however, it does regulate developments within Zone VE as indicated in bold letters below.**
- () Please note that the correct Flood Zone Designation for the project site according to the Flood Insurance Rate Map (FIRM) is ____.
- (X) **Please note that the project must comply with the rules and regulations of the National Flood Insurance Program (NFIP) presented in Title 44 of the Code of Federal Regulations (44CFR), whenever development within a Special Flood Hazard Area is undertaken. If there are any questions, please contact the State NFIP Coordinator, Ms. Carol Tyau-Beam, of the Department of Land and Natural Resources, Engineering Division at (808) 587-0267.**

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

- () Mr. Robert Sumitomo at (808) 768-8097 or Mr. Mario Siu Li at (808) 768-8098 of the City and County of Honolulu, Department of Planning and Permitting.
- (X) **Mr. Frank DeMarco at (808) 961-8042 of the County of Hawaii, Department of Public Works.**
- () Mr. Francis Cerizo at (808) 270-7771 of the County of Maui, Department of Planning.
- () Mr. Mario Antonio at (808) 241-6620 of the County of Kauai, Department of Public Works.

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

- () Additional Comments: _____

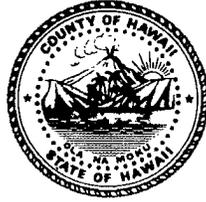
- () Other: _____

Should you have any questions, please call Ms. Suzie S. Agraan of the Planning Branch at 587-0258.

Signed: 
CARY CHANG, ACTING CHIEF ENGINEER

Date: 2/18/10

William P. Kenoi
Mayor



BJ Leithead Todd
Director

Margaret K. Masunaga
Deputy

County of Hawai'i

PLANNING DEPARTMENT

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

February 10, 2010

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

Dear Mr. Terry:

Subject: Early Consultation on Environmental Assessment
Land Owner: Kohala LLC
Project: 12-Lot Subdivision
Tax Map Key: 5-9-1:8, North Kohala, Hawai'i

Kohala LLC proposes a lower density 12-lot subdivision with a new zoning of Residential-3 acres.

We have the following comments to offer:

1. This 37.88 acre parcel is designated Urban by the State Land Use Commission.
2. For the subject parcel, the General Plan Land Use Pattern Allocation Guide Map designates the following categories:
 - a. Extensive Agriculture: *Lands not classified as Important Agricultural Land. Includes lands that are not capable of producing sustained, high agricultural yields without the intensive application of modern farming methods and technologies due to certain physical constraints such as soil composition, slope, machine tillability and climate. Other less intensive agricultural uses such as grazing and pasture may be included in the Extensive Agriculture category.*
 - b. Low Density Urban: *Residential, with ancillary community and public uses, and neighborhood and convenience-type commercial uses; overall residential density may be up to six units per acre.*
 - c. Open: *Parks and other recreational areas, historic sites, and open shoreline areas.*

Mr. Ron Terry
Geometrician Associates
February 10, 2010
Page 2

3. The County zoning is Single-Family Residential (RS-15). Please clarify what the new proposed zoning will be.
4. The North Kohala Community Development Plan was adopted by the County of Hawaii as Ordinance No. 08-151, effective November 5, 2008. A discussion of the proposed subdivision as it relates to this plan should be included in the Environmental Assessment.
5. This parcel is located within the County's Special Management Area. SMA 379 and Change of Zone Ordinance No. 97-102 were approved to allow for a 50-lot subdivision. Although the project was not completed in a timely fashion, the conditions of approval should still be incorporated as they are consistent with the vision, goal and values of the North Kohala Community Development Plan.
6. The Ala Kahakai National Historic Trail Comprehensive Management Plan was released in May 2009 and a Memorandum of Understanding amongst the County, State and National Park Service will be signed on February 21, 2010. The Environmental Assessment should include discussion on how the proposed subdivision will impact the establishment of the Ala Kahakai National Historic Trail.
7. Required permits and approvals should include Change of Zone, Special Management Area Use Permit (Major), Shoreline Setback Variance if improvements are proposed within the certified shoreline area, and Subdivision.

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

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

Sincerely,


BJ LEITHEAD TODD
Planning Department

ETI:cs
P:\Public\Wpwin60\ETI\Eadraftpre-Consul\Terry Subdivision 5-9-1-8.Rtf

cc: Mr. Alan Salavea, NKCDP Project Manager

Mr. Aric Arakaki, Ala Kahakai National Historic Trail

LINDA LINGLE
GOVERNOR



BRENNON T. MORIOKA
DIRECTOR

Deputy Directors
MICHAEL D. FORMBY
FRANCIS PAUL KEENO
BRIAN H. SEKIGUCHI
JIRO A. SUMADA

**STATE OF HAWAII
DEPARTMENT OF TRANSPORTATION
HIGHWAYS DIVISION**

HAWAII DISTRICT
50 MAKAAALA STREET
HILO, HAWAII 96720
TELEPHONE: (808) 933-8866 • FAX: (808) 933-8869

IN REPLY REFER TO:

HWY-H 10-2.0025

January 20, 2010

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

Dear Mr. Terry:

SUBJECT: Early Consultation on Environmental Assessment for a 3-acre Lot Size Residential Development
Kohala, LLC
TMK: 3rd Div. 5-9-001:008
Federal Aid Project No. A270-01-62 Sect 2A
Kahualiilii & Waiaka, North Kohala, Hawaii

Please be informed that the Akoni Pule Highway is under the jurisdiction of the State of Hawaii, Department of Transportation, Highways Division.

Please send copies of the Environmental Assessment to our Department for review and comment.

Our Department will then further distribute the copies to the appropriate division and branches at which time we will review and provide comments. After all comments are received and coordinated, a response from the director will be sent to the County Department approving agency.

Please note that at this time we will not be able to provide comments without preempting the departmental response.

If you have any questions please call Mr. Clinton Yamada at 933-1951.

Very truly yours,

A handwritten signature in black ink, appearing to read "Stanley M. Tamura".

STANLEY M. TAMURA
Hawaii District Engineer

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

January 19, 2010

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

Dear Mr. Terry:

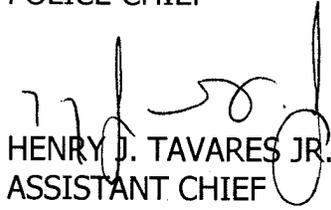
Subject: Early Consultation on Environmental Assessment for a 3-acre Lot Size
Residential Development
TMK 5-9-001:008
North Kohala, Island of Hawaii

Staff has reviewed the above Environmental Assessment and has no comments or recommendations at this time.

Should there be any questions, please contact Captain Richard Miyamoto, Commander of the North Kohala District, at 889-6540.

Sincerely,

HARRY S. KUBOJIRI
POLICE CHIEF



HENRY J. TAVARES JR.
ASSISTANT CHIEF
AREA II OPERATIONS

RM:dmv
RS100036

William P. Kenoi
Mayor



Darryl J. Oliveira
Fire Chief

Glen P. I. Honda
Deputy Fire Chief

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

January 22, 2010

Attention: Ron Terry
Geometrician Associates
PO Box 396
Hilo, HI 96721

Dear Mr. Terry,

SUBJECT: EARLY CONSULTATION ON ENVIRONMENTAL ASSESSMENT
3-ACRE LOT SIZE RESIDENTIAL DEVELOPMENT FOR KOHALA LLC
TMK: 5-9-001:008, NORTH KOHALA

The Hawai'i Fire Department does not have any comments to offer at this time regarding the above-referenced early consultation on Environmental Assessment.

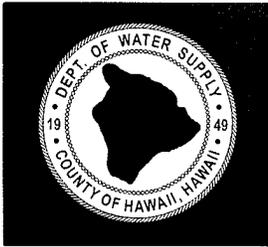
Thank you for the opportunity to comment.

Sincerely,


DARRYL OLIVEIRA
Fire Chief

RP:lc





DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII

345 KEKŪANAŌ'A STREET, SUITE 20 • HILO, HAWAII 96720

TELEPHONE (808) 961-8050 • FAX (808) 961-8657

January 26, 2010

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

**PRE-ENVIRONMENTAL ASSESSMENT CONSULTATION
TAX MAP KEY (3) 5-9-001:008**

This is in response to your letter dated January 12, 2010.

We have no comments to offer regarding environmental issues within the subject parcel. The subject parcel is in an area serviced by a private water system (Kohala Ranch).

Attached is a letter to Gentry-Pacific, Ltd., dated February 6, 1997, indicating our requirements for the previous SMA permit and Change of Zone Application.

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

Sincerely yours,

Milton D. Pavao, P.E.
Manager

RQ:dfg

Enc.



DEPARTMENT OF WATER SUPPLY • COUNTY OF HAWAII

25 AUPUNI STREET • HILO, HAWAII 96720
TELEPHONE (808) 969-1421 • FAX (808) 969-6996

February 6, 1997

TO: Planning Department

FROM: Milton D. Pavao, Manager

SUBJECT: SPECIAL MANAGEMENT AREA USE PERMIT APPLICATION NO. 97-001
CHANGE OF ZONE APPLICATION NO. 97-001
APPLICANT - GENTRY-PACIFIC, LTD.
TAX MAP KEY 5-9-001:008

We have reviewed the subject applications for the proposed subdivision. The water system in the area is privately owned and operated.

Pursuant to Section 23-84 of the Hawaii County Code regulating subdivisions, the following minimum requirements must be complied with for subdivision approval:

1. Provide a water system designed to deliver water at adequate pressure and volume under-peak and fire-flow conditions, in accordance with the Water System Standards, State of Hawaii, and the Rules and Regulations of the Department of Water Supply. The water system shall include, but not be limited to, the installation of the necessary distribution pipeline, fire hydrants, and service laterals.
2. Submit construction plans for our review and approval.
3. Pay a fee of four-tenths of one percent of the estimated cost for the construction of the water system, but not less than \$25.00 to cover the cost for plan review, testing, and inspection.

Should there be any questions, the applicant can contact our Water Resources and Planning Branch at 961-8660.


Milton D. Pavao, P.E.
Manager

WA:gms

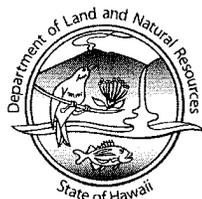
copy - Gentry-Pacific, Ltd.

Mr. Sidney M. Fuke ... *Water brings progress...*

LINDA LINGLE
GOVERNOR OF HAWAII



Laura H. Thielen
Chairperson
Board of Land and Natural Resources
Commission on Water Resource Management



STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
LAND DIVISION

POST OFFICE BOX 621
HONOLULU, HAWAII 96809

February 25, 2010

Geometrician Associates, LLC
Box 396
Hilo, Hawaii 96721

Attention: Mr. Ron Terry, Principal

Ladies and Gentlemen:

Subject: Early Consultation on Environmental Assessment for a 3-acre Lot Size Residential Development at North Kohala

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 Historic Preservation for their review and comment.

The Department of Land and Natural Resources has no other comments to offer on the subject matter. Should you have any questions, please feel free to call our office at 587-0433. Thank you.

Sincerely,


for Morris M. Atta
Administrator

LINDA LINGLE
GOVERNOR OF HAWAII



RECEIVED
LAND DIVISION



2010 FEB 23 P 12:30

DEPT. OF LAND & NATURAL RESOURCES
STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE OF HAWAII
STATE HISTORIC PRESERVATION DIVISION
601 KAMOKILA BOULEVARD, ROOM 555
KAPOLEI, HAWAII 96707

LAURA H. THIELEN
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

RUSSELL Y. TSUJI
FIRST DEPUTY

KEN C. KAWAHARA
DEPUTY DIRECTOR - WATER

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

February 11, 2010

LOG NO: 2010.0742
DOC NO: 1002MD23
Archaeology

MEMORANDUM

TO: Morris M. Atta
DLNR Land Division

FROM: Nancy McMahon, Deputy SHPO/State Archaeologist and Historic Preservation Manager

State Historic Preservation Division

Handwritten signature of Nancy A. McMahon in cursive script.

SUBJECT: Chapter 6E-42 Historic Preservation Review –
Early Consultation on Environmental Assessment for 3-acre Lot Size Residential
Development by Kohala LLC
Kahualilii Ahupua‘a, North Kohala District, Island of Hawai‘i
TMK: (3) 5-9-001:008

Thank you for the opportunity to comment on the aforementioned project, which we received on January 21, 2010.

A review of our records did not find a complete archeological inventory survey (“AIS”) for this parcel, which we recommend because at least a portion, or perhaps all, of this parcel lies within an historic complex area with large numbers of historic properties. The AIS should be prepared by a qualified archaeologist and submitted to us for our review and approval pursuant to HAR §13-276.

If you have questions about this letter please contact Morgan Davis at (808) 896-0514 or via email to: morgan.e.davis@hawaii.gov.

Cc:

Ron Terry, Principal, Geometrician Associates via email to: rterry@hawaii.rr.com

NORTH KOHALA COMMUNITY ACCESS GROUP

P.O. Box 776
Kapaau, HI 96755
July 7, 2010

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

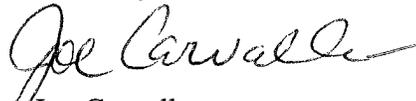
Dear Mr. Terry,

We are writing in reference to the environmental assessment you are preparing for Kohala LLC, the 12-lot subdivision subject of County REZ 866 and SMA No. 379 on TMK 5-9-1:8, North Kohala. It is our understanding that the County Planning Director has requested the EA and a discussion of the proposed subdivision as it relates to the North Kohala Community Development Plan.

As you know the NKCDP calls for community involvement in the planning process, particularly in coastal areas specifically identified for public access and those relating to the historic and cultural values of the community. This group has been working under mandate from the NKCDP to not only identify public accessways, both pedestrian and vehicular, but also to arrange longterm stewardship of access to mediate impacts on historic and cultural sites.

We would like to be a part of the information gathering process of preparing the EA. We invite you or anyone from Kohala LLC or Kohala Shoreline LLC to meet with us at our regular monthly meetings on the first Wednesday at 4:30pm at the Seniors' Center in Kapa'au. Or we can arrange a representative small group to meet with you.

Sincerely,



Joe Carvalho

ENVIRONMENTAL ASSESSMENT

Kohala Shoreline, LLC Project

TMK: (3rd) 5-9-001:008

Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i

APPENDIX 2

Water Quality/Marine Biology Reports

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ASSESSMENT OF
MARINE WATER CHEMISTRY
AND MARINE BIOTIC COMMUNITIES
KOHALA SHORELINE, LLC PROJECT (TMK 5-9-1:08)
NORTH KOHALA, HAWAII

Prepared for:

Mooers Enterprises LLC
P.O. Box 1101
Kamuela, HI 96743

By:

Marine Research Consultants, Inc.
1039 Waakaua Pl.
Honolulu, HI 96822

March 2010

I. INTRODUCTION AND PURPOSE

The proposed Kohala Shoreline LLC project is located on a 38-acre property in North Kohala approximately 2.5 miles north of Kawaihae Harbor. The project site is bounded on the mauka side by Akoni Pule Highway, and is directly makai of the Kohala Ranch development. The project consists of 12 residential lots varying in size from 1.9 to 3.9 acres. The intention of the development plan is to limit landscaping to the immediate vicinity of the homes, leaving most of the 38-acre project site undisturbed (Figure 1). Water for potable consumption and landscape irrigation will be provided by the Kohala Ranch system. Each home site will have its own enhanced septic system. Following degradation processes within the enhanced septic systems, wastewater will be disposed of in leach fields. Wastewater will percolate from the leach fields to underlying groundwater with eventual discharge at the shoreline of the marine environment. Estimates of changes in surface runoff indicate an increase of approximately 17% over existing conditions. Most of the increased runoff could be captured in drywells.

While all planning and construction activities will place a high priority on maintaining the existing relatively pristine nature of the marine environment, it is nevertheless important to address any potential impacts that may be associated with the planned development. None of the proposed land uses includes any direct alteration of the coastal areas or nearshore waters. As stated above the residential community will result in some changes to the composition and volume of groundwater that flows beneath the property, as well as surface runoff that may emanate from the community. As all groundwater that could be affected by the community subsequently reaches the ocean, it is recognized that there is potential for the community to affect the marine environment. Therefore, evaluating the potential for alterations to water quality and marine life from material input from the community constitutes an important factor in the planning process.

In the interest of addressing these concerns and assuring maintenance of environmental quality, a marine water quality and biological assessment and potential impact analysis of the nearshore areas off the Kohala Shoreline LLC property was conducted in December 2009 and March 2010. The rationale of the water quality assessment was to determine the contribution of groundwater to the marine environments offshore of the Kohala LLC site, and to evaluate the effects that this input has on water quality at the present time, prior to the commencement of any new construction activities. Combining this information with estimates of changes in groundwater and surface water flow rates and chemical composition that could result from the proposed project provides a basis to evaluate the potential future effects to the marine environment. Predicted changes in groundwater composition and flow rates have been supplied by Tom Nance Water Resource Engineering (TNWRE 2010). Results of the combined evaluation will indicate the degree of change to the marine environment that could occur as a result of Kohala Shoreline LLC project.

A rapid ecological assessment (REA) of the marine biotic community structure was also completed. The purpose of the REA was to determine the existing condition of the marine communities (particularly the coral reef communities) in the nearshore area fronting the project. In addition to examining the areas directly fronting the project site, REA surveys were also conducted in the nearshore area fronting the area where Honokoa Gulch connects with

the ocean. This phase of the survey was conducted as the area off Honokoa Gulch has been documented to have experienced impacts to the reef from human-related activities on land.

Evaluation of the existing condition of these communities provides an insight into the physical and chemical factors that influence the structure of biotic communities. As coral communities are both long-lived and attached to the bottom, they serve as the best indicators of the time-integrated forces that affect offshore reef areas. Understanding the existing conditions physical, chemical and biological conditions of the marine environment that presently occur provides a basis for predicting potential affects from the proposed land uses.

II. METHODS

A. Water Quality/Chemistry

Three transect survey sites were established in the vicinity of the Kohala Shoreline LLC property. Site 1 was located near off the northern portion of the project in Waiakailio Bay; Site 2 was located near the southern portion of the project, and Site 3 was located in a small embayment approximately 2,000 feet south of the southern property boundary. As Site 3 is well removed from the project site, it can serve both as a comparison site to evaluate any unique characteristics at the project area, and can serve as a control site for any future monitoring that may be required for implementation of the project (Figure 1).

All fieldwork was conducted on December 17, 2009. Water quality was evaluated at each site on transects that were oriented perpendicular to the shoreline and depth contours. Water samples were collected at ten locations on each transect from just seaward of the shoreline to approximately 200 meters (m) offshore (0, 1, 2, 3, 4, 5, 10, 50, 100 and 200 m). Such a sampling scheme was designed to span the greatest range of salinity with respect to potential freshwater efflux at the shoreline. Sampling was more concentrated in the nearshore zone because this area receives the majority of groundwater discharge, and hence is most important with respect to identifying the effects of shoreline modification.

Owing to the shallow depth of the near-shore shelf, at stations from the shoreline extending to 4 m from shore, a single sample was collected within 20 cm of the sea surface by swimmers working from shore. At stations 5 to 200 m from the shoreline, samples were collected at two depths; a surface sample was collected within approximately 20 (cm) of the sea surface, and a bottom sample was collected within 1 m of the sea floor.

In order to determine chemical concentrations in unaltered groundwater, samples were also collected from two high level wells above the project site (see report by Tom Nance Water Resources Engineering for locations of wells and results of well water analyses).

Water quality parameters evaluated included the ten specific criteria designated for open coastal waters in Chapter 11-54, Section 06 (d)(Area-Specific criteria for the Kona (west) coast of Island of Hawaii). Open Coastal waters) of the State of Hawaii Department of Health (DOH) Water Quality Standards. These criteria include: total dissolved nitrogen (TDN), nitrate + nitrite

nitrogen ($\text{NO}_3^- + \text{NO}_2^-$, hereafter referred to as NO_3^-), ammonium nitrogen (NH_4^+), total dissolved phosphorus (TDP), orthophosphate phosphorus (PO_4^{3-}), Chlorophyll a (Chl *a*), turbidity, temperature, pH and salinity. In addition, silica (Si) was also reported because these parameters are sensitive indicators of biological activity and the degree of groundwater mixing.

Surface water samples were collected by filling pre-rinsed, 1-liter polyethylene bottles. "Deep" water samples were collected using a Niskin-type oceanographic sampling bottle. The bottle is lowered to the desired sampling depth (approximately 1-2 off the bottom) with spring-loaded endcaps held open so water can pass freely through the bottle. At the desired sampling depth, a weighted messenger released from the surface triggers closure of the endcaps, isolating a volume of water.

Subsamples for nutrient analyses were immediately placed in 125-milliliter (ml) acid-washed, triple rinsed, polyethylene bottles and stored on ice. Analyses for Si, NH_4^+ , PO_4^{3-} , and NO_3^- were performed on filtered subsamples with a Technicon Autoanalyzer using standard methods for seawater analysis (Strickland and Parsons 1968, Grasshoff 1983). TDN and TDP were analyzed in a similar fashion following digestion. Dissolved organic nitrogen (DON) and dissolved organic phosphorus (DOP) were calculated as the difference between TDN and dissolved inorganic N, and TDP and dissolved inorganic P, respectively.

Water for other analyses was subsampled from 1-liter polyethylene bottles and kept chilled until analysis. Chl *a* was measured by filtering 300 ml of water through glass-fiber filters; pigments on filters were extracted in 90% acetone in the dark at -20°C for 12-24 hours. Fluorescence before and after acidification of the extract was measured with a Turner Designs fluorometer. Salinity was determined using an AGE Model 2100 laboratory salinometer with a readability of 0.0001‰ (ppt). Turbidity was determined using a 90-degree nephelometer, and reported in nephelometric turbidity units (NTU) (precision of 0.01 NTU). Vertical profiles of salinity, temperature and depth were acquired using a RBR-620 CTD calibrated to factory standards.

All fieldwork was conducted by Dr. Steven Dollar. All laboratory analyses were conducted by Marine Analytical Specialists located in Honolulu, HI (Labcode: HI 00009). This analytical laboratory possesses acceptable ratings from EPA-compliant proficiency and quality control testing.

B. Marine Biotic Community Structure

All fieldwork was carried out on March 27, 2010 with divers working from a 22-foot boat. Biotic composition of the survey area was assessed by divers using SCUBA swimming from the shoreline across the reef perpendicular to the shoreline to a water depth of 60 feet at the three locations where water chemistry sampling was conducted. During these survey these underwater investigations, notes on species composition were recorded, and numerous digital photographs recorded the existing conditions of the area. In addition to the swims, tow surveys perpendicular to shore across the length of the Kohala Shoreline LLC property were conducted to ensure that no major features were missed in the transect swims. The baseline assessment was conducted by S. Dollar, accompanied by M. Kusch.

III. RESULTS

A. Water Quality/Chemistry

1. Distribution of Chemical Constituents

Tables 1 and 2 show results of all water chemistry analyses for samples collected off the Kohala Shoreline LLC property in December 2009. Table 1 shows concentrations of dissolved nutrients in micromolar (μM) units; Table 2 shows concentrations in micrograms per liter ($\mu\text{g/L}$). Concentrations of eight dissolved nutrient constituents in surface and deep samples are plotted as functions of distance from the shoreline in Figure 2. Values of salinity, turbidity, Chl *a* and turbidity as functions of distance from shore are shown in Figure 3.

Several patterns of distribution are evident in Tables 1 and 2 and Figures 2 and 3. It can be seen in Figure 2 that at all three transects, the dissolved nutrients Si, NO_3^- and TN display distinctly elevated concentrations in the samples collected within about 5 m from the shoreline at transect sites 2 and 3. No such distinct nearshore peak is evident for these nutrients at transect site 1. Salinity displays the opposite trend, with sharply lower concentrations in the nearshore samples at sites 2 and 3 (Figure 3). While these gradients are evident at sites 2 and 3, they are most pronounced at Site 2.

These patterns are a result of concentrated input of groundwater to the ocean near the shoreline. Low salinity groundwater, which typically contains high concentrations of Si and NO_3^- , percolates to the ocean at the shoreline, resulting in a nearshore zone of mixing. In many areas of the Hawaiian Islands, such groundwater percolation results in steep horizontal gradients of increasing salinity and decreasing nutrients moving seaward. PO_4^{3-} is also generally elevated in groundwater relative to ocean water. However, the patterns of horizontal gradients of concentrations of PO_4^{3-} do not show the same uniformly progressive decreases with distance from shore as Si and NO_3^- . Horizontal gradients of TN and TP reflect the patterns of NO_3^- and PO_4^{3-} , respectively.

At the open coastal sampling locales off the Kohala Shoreline LLC, the zone of mixing is small, extending only to distances of several meters from shore. These gradients are far less pronounced than at other areas of West Hawaii where either semi-enclosed embayments occur or mixing processes are less vigorous.

Water chemistry parameters that are not associated with groundwater input (NH_4^+ , DON, DOP) do not show a sharp gradient of decreasing concentration with respect to distance from the shoreline. Rather, these constituents do not occur in any consistent pattern across the horizontal ranges of the sampling area.

Similar to the patterns of dissolved inorganic nutrients (Si and NO_3^-), the distribution of Chl *a* and turbidity also display peaks near the shoreline, with rapidly diminishing values seaward of the shoreline (Tables 1-2, Figure 3). Beyond 10 m from the shoreline, the concentration of Chl *a* in surface waters is essentially constant across the sampling scheme at values below $0.1 \mu\text{g/L}$ (Figure 3). Turbidity displays the same trend with peak values near the shoreline and rapidly

diminishing values beyond about 10 from the shoreline which extend across the remainder of the sampling regime (Figure 3).

It can be seen in Tables 1 and 2 that chemical concentrations at the most seaward sampling stations (200 m from shore) at all three sites are similar, and represent open coastal ocean waters with little influence from land.

2. Conservative Mixing Analysis

A useful treatment of water chemistry data for interpreting the extent of material input from land is application of a hydrographic mixing model. In the simplest form, such a model consists of plotting the concentration of a dissolved chemical species as a function of salinity. The concept of using such mixing models which scale nutrient concentrations to salinity is utilized by the State of Hawaii Department of Health for establishing a unique set of water quality standards for the West Coast of the Island of Hawaii [Hawaii Administrative Rules, §11-54-06 (d)]. As the northern limit of these regulations is Malae Point, the shoreline area containing the Kohala Shoreline LLC is included in the West Hawaii criteria.

Figure 4 shows plots of the concentrations of Si, NO_3^- , PO_4^{3-} , and NH_4^+ as functions of salinity for the samples collected at each transect site off the Kohala LLC property. Each graph also shows two conservative mixing lines constructed by connecting the endmember concentrations of open ocean water and groundwater from two high level potable wells located upslope of the Kohala Shoreline LLC property (See Table 2 in TNWRE 2008).

Comparison of the curves produced by the distribution of data with conservative mixing lines provides an indication of the origin and fate of the material in question. If the parameter in question displays purely conservative behavior (i.e., no input or removal from any process other than physical mixing), data points should fall on, or near, the conservative mixing line. If however, external material is added to the system through processes such as leaching of fertilizer nutrients to groundwater, data points will fall above the mixing line. If material is being removed from the system by processes such as biological uptake, data points will fall below the mixing line.

Dissolved Si represents a check on the method as this material is present in high concentrations in groundwater, low concentration in open coastal waters, and is not a major component of fertilizer or sewage effluent. In addition, Si is not utilized rapidly within the nearshore environment by biological processes. It can be seen in Figure 4 that all data points for all three transect sites fall in a linear array on the conservative mixing line created with endpoint concentrations from Well 6451-03. Linear regression of the concentrations of Si as a function of salinity results in a highly significant R^2 (proportion of variation explained) of 0.98-0.99 for Sites 2 and 3 indicating that the concentration of Si is dependant on salinity. Linear regression for Site 1, however, is not significant indicating that the concentrations of Si are not dependant on salinity. The significant R^2 supports the contention that Si is behaving as a conservative tracer and that well water sampled from the upslope wells is similar in composition to groundwater entering the ocean off the Kohala Shoreline LLC property.

The plots of NO_3^- versus salinity show a similar distribution as Si. All of the data points for Transects 2 and 3 fall in linear arrays above the mixing lines with points from Transect 3 prescribing a steeper line than Transect 2. Data points from Transect 1 fall in a cluster around the oceanic values. Linear regressions of these data indicate significant R^2 s of 0.98 - 0.99 for the two transects indicating that the concentrations of NO_3^- are functions of salinity. The concentration of NO_3^- in the two upslope wells is 70 and 92 μM . The upper and lower confidence limits of the Y-intercepts of the concentrations of NO_3^- versus salinity are 99-101 μM for Transect 2 and 153-177 μM for Transect 3. Hence, on both Transects 2 and 3 there is a subsidy of NO_3^- in the nearshore ocean relative to what would be predicted from mixing of natural groundwater and open coastal water. Such subsidies may result from either different composition of groundwater entering the ocean at the shoreline than in upslope wells, or from groundwater nutrient subsidies from developments upgradient of the Kohala Shoreline LLC site (Kohala Ranch and Kohala Estates).

While PO_4^{3-} is also generally found in groundwater in higher concentrations than open coastal water, it occurs in far lower concentrations compared to NO_3^- , owing in part to a high absorptive affinity of phosphorus in soils or rock. It can be seen in Figure 4 that when plotted as functions of salinity, concentrations of PO_4^{3-} do not prescribe linear patterns similar to Si and NO_3^- . In particular, some of the highest values are at the highest salinities, while some of the lowest values are at the lower salinities. Linear regression of PO_4^{3-} versus salinity is not statistically significant ($P=0.05$) for data from Transects 2 and 3 indicating that the distributions of these concentrations are not functions of salinity.

Plots of concentrations of NH_4^+ versus salinity show similar relationship as PO_4^{3-} . Plots of concentrations of NH_4^+ versus salinity exhibit no linear trends with respect to salinity (Figure 4). Data from Transects 1-3 do not result in statistically significant linear regression. As with PO_4^{3-} , some of the highest values of NH_4^+ occurred at the highest salinities, suggesting that the source of most of the NH_4^+ in the nearshore ocean is not from the land but rather from biological processes occurring in the ocean.

3. Compliance with DOH Criteria

The West Coast of the Island of Hawaii has area specific water quality standards [Chapter §11-54-6(d)]. The major difference between these specific criteria and the general criteria for open coastal waters for the rest of the state is the consideration that high nutrient groundwater mixes with oceanic water within the nearshore zone. As a result, area specific criteria for nutrients that occur in high concentrations in groundwater relative to ocean water (NO_3^- , TDN, PO_4^+ , and TDP) are evaluated by two criteria based on salinity. In areas where nearshore marine water salinity is greater than 32‰, specific criteria for geometric means apply. Geometric means are calculated at each sampling station from three values collected on three sampling dates, spaced within a 14-day period. For samples with salinity below 32‰, compliance with the DOH criteria is defined by the slope of the regression line of the nutrient concentration as a function of salinity. Slopes greater than the “not to exceed” values stated in the standards are deemed out of compliance. (Note that for the present assessment, three separate samplings within a 14-day period were not conducted).

It can be seen in Tables 1 and 2 that Transect 2 was the only sampling location with at least one sample with salinity less than 32‰. Hence, it can be interpreted that the relevant DOH compliance criteria are the regression statistics shown in §11-54-6(d)(1)(ii). Table 3 shows the slopes and upper and lower 95% confidence limits of linear regressions of NO_3^- , TDN, PO_4^{3-} , and TDP as functions of salinity from each of the three ocean transects. Also shown in Table 3 are the “compliance slopes” listed in the West Hawaii area specific water quality standards. As stated in the WQS, “...the absolute value of the upper 95% confidence limit for the calculated sample regression coefficient (i.e., slope) shall not exceed the absolute value listed in the regulations.” Transect 1 is not included in this analysis, however, as none of the regression slopes of nutrient concentration as functions of salinity were significant. When linear regression analyses are performed with data in units of $\mu\text{g/L}$, the absolute values of confidence limits of the slope of the regression line of NO_3^- versus salinity exceeded the absolute values of the specific criteria slope (-31.92) on Transects 2 and 3. The upper confidence limit of TDN, PO_4^{3-} or TDP on Transect 2 also exceeded the specific criteria slope (Table 4).

The area specific DOH standards for West Hawaii also include three parameters (NH_4^+ , Chl *a* and turbidity) that are not subjected to the conditions of salinity based on the 32‰ boundary. Rather, the specific geometric mean criteria apply to all values of these parameters regardless of salinity. It can be seen in Table 2 that many values of NH_4^+ on all three transects within 50 m of the shoreline exceed the geometric mean standard. Similarly, most of the values of turbidity exceed standards. As stated above, with no development presently on the Kohala Shoreline LLC site, the offshore conditions represent essentially the natural setting of the area. It is possible that the geometric mean values that are presently DOH compliance criteria do not fully take into account the natural setting of at least some nearshore areas in West Hawaii.

B. Coral Reef Community Structure

1. Kohala Shoreline LLC Area

Overall, the biotic composition of the coral reef communities fronting the Kohala Shoreline LLC property conform to the typical zonation pattern that has been well documented for the West Hawaii area (Dollar 1983, Dollar and Tribble 1992). The majority of the shoreline throughout the property is composed of wave-cut vertical basaltic cliffs several meters high that extend below the waterline for an additional several meters, forming the intertidal zone (Figure 5). In several locations that are the shoreline termini of intermittent streams, the shoreline is composed of small beaches covered with boulders and rounded rocks. At these locales, the boulders continue through the nearshore area (Figure 5). The nearshore boulders are essentially devoid of settlement of macrobenthos, probably as a result of rolling during periods of large waves breaking on the shoreline.

In areas where boulders do not occur, the reef zone nearest to shore consists of submerged basaltic spurs and outcrops that are colonized primarily by the hemispherical branching coral *Pocillopora meandrina* (Figure 6). This coral has been termed a “pioneering” species in that it is generally the first to settle on newly bared substratum, and is often the only coral that has the ability to withstand the physical rigor of water movement within the nearshore zone. It is also of note that unlike many other species of reef building coral *Pocillopora meandrina* has a

“determinate” life history in that it only grows to maximum size or age before colonies die. Hence, natural communities of this species are often composed of a mixture of live colonies and dead skeletal remains.

The other common macroinvertebrates that occupies the nearshore zone is the boring sea urchins *Echinometra matheai* and *Echinostrephus aciculatus*. These urchin are major bioeroders on the rock surfaces, and are found in pits that are ground out of the basalt (Figure 6).

Within approximately 10 m of the shoreline cliffs, the bottom is composed of a basalt platform that extends from depths of about 15 feet to about 30 feet. Off the Kohala Shoreline LLC site, the reef platform is nearly completely covered with growth of living corals. The two species that dominate cover of the platform are helmet-shaped lobed colonies of *Porites lobata*, and finely branching mats of *Porites compressa* (Figure 7). Density of *Porites lobata* is highest with near the shoreline, with gradually increasing proportions of *P. compressa* with distance seaward. The solid reef structure of the platform contains intermittent pockets and channels of coarse white sand. There was no evidence of any type of damage or environmental impacts (e.g., bleaching, disease) throughout the range of the survey. While species of the genus *Porites* dominated coral cover on the reef platform, several other species were observed in very low density including *Montipora patula*, *M. capitata* and *Pavona varians*. There were no observations of any stands of macroalgae on the reef platform. Communities of reef fish were also typical of West Hawaii, with few observations of large fish that would be categorized as target species for spearfishers.

At approximately the 30 foot depth, the gently sloping reef platform terminates at an edge marked by a sharply increasing angle of the bottom. Coral community structure near the shelf break, and on the shelf slope is composed primarily of solid interconnected mats of finely branched *Porites compressa*, which is commonly known as finger coral (Figures 8 and 9). As with the reef platform, no frondose algae were observed on the reef slope. At a depth of approximately 60 feet, the reef slope and mats of finger coral terminate to a sand plain interspersed with corals growing on isolated rocks and rock rubble (Figure 9).

The overall coral community composition off the project site can be characterized as a near-climax successional stage of Hawaiian reef development. Living coral of two species virtually covered the entire hard bottom on the reef platform and slope, eliminating competition for space for other coral species or other forms of bottom cover. The near complete cover as indicates that the area is well protected from natural stresses, particularly storm waves which are the major determinate of community structure on reefs in Hawaii (Dollar 1982, Grigg 1998).

Transect site 3 was located off an intermittent stream mouth approximately 2,000 feet south of the southern boundary of the Kohala Shoreline LLC project site (Figure 1). Inspection of the nearshore area fronting the location of the discharge point of the stream bed revealed a substantially different benthic community composition than off the Kohala Shoreline LLC site. The ocean floor within the small indentation of the coastline near the stream mouth was covered with large basaltic boulders. Many of these boulders, particularly on their upper surfaces, were covered with numerous small recruits of living corals (Figures 10 and 11). Many of these new recruits were recognizable as *Pocillopora meandrina* and *Porites lobata*. While there were numerous new recruits on the boulders, there was no evidence of dead corals that

might have been recently killed. Beyond the boundary, reef community structure on the platform and slope in this area is similar to that described above off the Kohala Shoreline LLC site.

Inspection of the nearshore area also revealed a distinct boundary between the area of newly colonizing boulders and older well-developed colony growth (Figure 11). A scenario that likely occurs in this area is that intermittent heavy rainfall results in discharge of sediment laden water at the shoreline. This sediment settles out in the nearshore region and may be of a magnitude to smother corals that have settled on the rocky bottom. Following the storm event, normal wave action flushes the sediment from the area, re-exposing the boulder surfaces. If corals previously inhabiting the rocks were smothered and killed, the remaining skeletons may be bioeroded from rock surfaces, or removed by wave impacts.

Following the removal of sediment, rock surfaces are suitable for settlement of new colonies, which is the stage observed during the present survey. Growth of these new recruits continues until another episode of sediment input occurs. Hence, if there is a relatively small interval between incidents of sediment input, the nearshore zone may remain essentially devoid of mature coral colonies. However, if there is a period between episodes of sediment input that large relative to the growth cycle of corals, the new recruiting corals may develop into larger "mature" colonies. Within this scenario is the compounding effect of stress from wave energy. Once colonies reach a certain size, impacts from extreme wave forces may limit development. In any event, it is evident that coral community structure is dynamic in nature, and dependent on the magnitude of natural stresses, and the interaction between these stresses.

2. Honokoa Gulch Area

In 2006, reports in the public media detailed supposed pollution of the reef fronting Honokoa Gulch located between Kawaihae Harbor and the Kohala Shoreline LLC property (Figure 12). The assumed pollution resulted in lethal effects to corals from sediment input to the ocean resulting from human activities on land. In order to evaluate the potential for similar events to occur as a result of construction and operation of the Kohala Shoreline LLC, an underwater reconnaissance survey was conducted in the waters fronting Honokoa Gulch.

It can be seen in Figure 12 that Honokoa Gulch is a very large geographic and geologic feature on the North Kohala coastline, and is substantially larger than any of the other dry stream channels in the area. The Gulch originates near the peak of the Kohala Mountains at elevations near 5,000 feet, and attains depths of up to 200 feet from the upper rim to the floor along the approximate length of 13 kilometers (~8 miles). Honokoa Gulch is an erosional feature created by runoff originating from rainfall within the watershed of the Gulch. Erosion is a gravity driven process that moves water and associated solids (sediment, soil, rock and other particles) in the natural environment from their source and deposits them elsewhere. While human influences may slightly affect the volume of sediment discharge, the natural processes that created the Gulch were clearly in operation long before human presence, and sediment eroded to form the deep gully have been unquestionable deposited in the ocean over geologic time scales, and not only since modern human habitation.

Inspection of the marine environment fronting the point of discharge of Honokoa Gulch revealed a very different situation than off the Kohala Shoreline LLC. As at Transect site 3, the shoreline fronting the discharge point of Honokoa Gulch is comprised of boulders that extend into the nearshore submerged zone (Figure 13). While the water column in the nearshore area was highly turbid during the survey owing to wave-resuspended sediment, most of the boulders near the shoreline were colonized by small corals, predominantly consisting of the species *Pocillopora meandrina* and *Porites lobata* (Figure 13).

Beyond the nearshore boulder zone, bottom composition consisted of a mud sediment floor of undetermined thickness with rocky protrusions and ledges extending above the surface of the sediment (Figure 14). With increasing distance from shore, elevated rock surfaces became more frequent, although the area of ocean floor between the rocks remained covered with a layer of red sediment (Figure 14).

Seaward of approximately 50 feet from the shoreline, a large fraction of the elevated rock surfaces were colonized by numerous coral colonies (Figures 14-16). These coral colonies were very abundant, and generally covered more than 50% of the hard bottom area. Areas of bare rock between corals were coated by a thin layer of red sediment. Species composition of the corals was primarily *Pocillopora meandrina* and *Porites lobata*, which are described above as the two most abundant corals in the reef platform zones of areas north of Honokoa Gulch.

Of particular interest is that these colonies were all of generally the same size class, with almost no colonies larger than approximately 20 cm in diameter (Figures 15 and 16). The uniform size distribution indicates that the entire coral community is of approximately the same age. A likely scenario that could explain the community structure is that episodes periodic torrential rainfall result in significant erosion and discharge of sediment to the ocean. Such large sediment input may cover in rocks in the inner reef zones, which if not cleared by wave action may result in mortality to the coral community. Suspended sediments in the water column have also have lethal effects to corals from abrasion and light inhibition. Subsequent removal of the sediment by water motion will leave the rock surfaces and water column suitable for settlement by corals. As the neighboring reefs beyond the range of sediment input contain substantial coral communities, there is abundant seed stock to facilitate planular settlement on the new bared hard bottom. Following successful colonization, corals grow until the next extreme sedimentation event repeats the process. Thus, the reef communities likely remain in early reef successional stages with the degree of development within the interval between episodes of maximum sediment input. The relative equitability of distribution of coral species during these early successional stages also results in higher community diversity than observed in the "near-climax" reefs which are not periodically stressed by sediment effects.

The observation of a thin veneer of terrigenous sediment on rock surfaces between coral colonies suggests that intermediate levels of sediment input, or resuspension of deposited sediment that likely occurs on a regular seasonal basis, are within the tolerance limits of corals. Corals possess a variety of physiological and behavior adaptations to remove sediment from living colonies, and the community structure of many reef areas is dictated by the hierarchy of competitive advantages of species ability to withstand sediment deposition. It is readily apparent from the composition of the coral community in the nearshore areas off of Honokoa Gulch that

there is a threshold of intensity of sediment input events below which corals are able to successfully settle and grow.

Further from shore, rock outcrops and ridges are spaced farther apart, and extend higher off the sediment surface (Figure 17). With one exception, these outcrops are colonized by essentially the same species as the inner rocks, although the size of colonies is often substantially larger. It is evident by the colony size of corals growing on these elevated boulders that they are high enough off the sediment floor to be less affected by episodes of significant sediment input from land, or by wave resuspension of deposited sediment.

The exception to the species assemblages in the outer areas is the common occurrence of *Porites rus*. While this species occurs in other locales throughout the Hawaiian Islands, it is not considered one of the dominant Hawaiian reef corals, and was not observed during any of the reef surveys off the Kohala Shoreline LLC site. Offshore of Honokoa Gulch *Porites rus* was observed growing as amalgamated colonies of overlapping plates on steeply sloping surfaces (Figure 17). In many areas, portions of colonies were dead and sediment covered, while neighboring areas were in good condition with no apparent sub-lethal effects. Recent surveys by the author in Apra Harbor, Guam revealed that *Porites rus* was the dominant coral (~75% of cover) in a turning basin subjected to substantial sediment input from terrigenous sources. The similarity of this habitat to the area fronting Honokoa Gulch suggests that *Porites rus* is a particularly suited to settle and proliferate in areas of high sediment loading.

In summary, Honokoa Gulch is a major geologic erosional feature on the North Kohala coast, and has been delivering sediment to the nearshore ocean likely since the area was formed in the geologic past. As a result, both the physical structure and biotic composition of the marine areas are strongly influenced by the sediment input. Composition of the sea floor consists of a permanent layer of red sandy mud with a large terrigenous component. Boulders that are the seaward extension of the rock shoreline, and rocks and ledges that extend above the sediment floor are colonized by dense communities of reef building corals, limited in size to less than about 20 cm diameter. Further offshore, larger rocky projections are colonized by larger corals, with a sizeable population of a species that is not common in other locales that are not regularly influenced by substantial sediment loading.

This scenario suggests a natural cycle of change within coral community structure that is a function of magnitude of sediment input, turnover time for sediment to be removed from the reef area, and the time-interval between peak sediment events. Coral community structure at any point in time will be function of these processes, and will be in a continual state of change. Corals will grow during the periods between sediment events, die as result of smothering or abrasion from peak events, and then resume a new cycle of settlement and growth. Corals with superior physiological and behavioral adaptations to withstand sediment stress will likely predominate over species will higher susceptibility to sediment stress. The scientific literature is replete with reports of similar situations on other reefs where community structure is varies as a function of sediment effects (e.g., Roy and Smith 1971).

While it is possible that human activities in upland watersheds may have some effect on bulk sediment erosion rates, and hence sediment input to the ocean, such effects are likely to be small in relation to natural processes of erosion. This is particularly true for an erosional feature

of the magnitude of Honokoa Gulch. Without unequivocal data showing that the erosional processes and subsequent effects to marine community structure are primarily a response to some form of human activity, such a viewpoint lacks scientific credibility, particularly based on the low level of development within the North Kohala area (see Figure 12).

IV. DISCUSSION and CONCLUSIONS

The purpose of this assessment is to assemble the information to make valid evaluations of the potential for impact to the marine environments from the proposed Kohala Shoreline LLC community. The information collected in this study provides the basis to understand the processes that are operating in the nearshore ocean, so as to be able to address any concerns that might be raised in the planning process.

The proposed Kohala Shoreline LLC does not include any plans for any direct alteration of the shoreline or offshore areas. Therefore, potential impacts to the marine environment can only be considered from activities on land that may result in delivery of materials (primarily fresh water and nutrients) to the ocean through infiltration to groundwater on land with subsequent discharge to the ocean, and surface runoff. To evaluate the possible magnitude of these processes, a report has been prepared by Tom Nance Water Resource Engineering entitled *"Assessment of the Potential Impact on Water Resources of the Proposed Kohala Shoreline LLC Project on TMK 5-9-1:08 in North Kona, Hawaii"* (TNWRE 2010).

Four aspects of development of the project have the potential to impact water resources: 1) use of groundwater for potable consumption and landscape irrigation; 2) generation, treatment, and disposal of domestic wastewater; 3) increase in rainfall-runoff; and 4) percolation to groundwater of excess water applied to landscaping.

For the purposes of analyses of impact on water resources on the property, it is assumed that water for potable consumption and landscape irrigation will be provided by the Kohala Ranch system, with a total water use expected to average about 40,000 GPD. Each home site will have its own enhanced septic system with disposal in leach fields. Wastewater will percolate from the leach fields to the groundwater below, eventually to discharge into the marine environment along the shoreline. As a year-round average, it is assumed that wastewater disposal will average 300 GPD per home site or 3600 GPD for the entire project. Runoff is projected to increase by about 17% on the project site over existing conditions. It would be possible to capture and retain most of this runoff in drywells. As a first order approximation, it is assumed that 15 percent or 5460 GPD is applied in excess of plant uptake and, as a result, percolates to the groundwater below.

Taking into account the changes to groundwater flow rate, salinity and nutrient loading that will potentially result from the Kohala Shoreline LLC project, TNWRE (2010) computed changes to groundwater discharging along the shoreline. These changes are relatively small: 1.8% increase in flowrate; 1.7% decline in salinity; and increases of nitrogen and phosphorus of 2.9% and 0.2%, respectively.

Further evaluation of the potential changes to groundwater composition indicate that there is little or no potential for alteration of the marine environment. Converted to a molar basis, the projected increases of 2.9% would result in a change of the average high level groundwater TN concentration from 83.5 to 85.9 μM (based on data in Table 2 of TNWRE 2010). Similarly, TP would increase in high level groundwater from 3.450 to 3.457 μM .

Such changes would cause no impact to the marine environment for several reasons. First, the average TN concentration in existing basal wells of brackish quality in the Keahole to Kailua area is about 100 μM , which is 14 μM higher than the maximal potential increase in high level groundwater water resulting from the project. As groundwater in areas of West Hawaii is mixed with ocean water with considerably higher nitrogen concentrations that at the build-out maximum for Kohala Shoreline LLC, it is apparent that the projected increases are well within the existing range of nutrient concentrations presently in groundwater discharging at the shoreline. Similarly, the average concentration of TP in high level groundwater is about 4.6 μM , or about 25% higher than the project maximum at the Kohala Shoreline LLC site. Increasing this concentration of nitrogen and phosphorus by 2.9% and 0.2%, respectively as a result of the Kohala Shoreline LLC project will result in nutrient concentrations far below typical natural concentrations, hence there is no potential for effects to marine communities.

With respect to the additional nutrient concentration in marine waters, it can be seen in Tables 1 and 2 that the lowest measured salinities at the shoreline are about 27‰, with an average shoreline value of 31‰. This average salinity represents a dilution of groundwater with ocean water of about 91%. Hence, the 2.9% projected N increase to groundwater would result in only about a 0.2% increase at the shoreline. The shoreline fronting the entire property consists of a basaltic cliff and boulder pocket beaches that are continually exposed to waves. As a result, physical processes rapidly mix seaward flowing groundwater with oceanic water, essentially diluting the groundwater to background ocean levels within meters of the shoreline. At a distance of 10 m (33 feet) from the shoreline, the average salinity on the three transects surveyed for this study was about 34.6‰, which is the same value as measured at the most seaward offshore station. Dilution of the projected small increase in nutrients at the shoreline would result in essentially no difference over existing, or natural conditions. In addition, these calculations do not take into account the increased groundwater flowrate (~1.8%) which would further dilute the projected increase in nutrient loading.

Such small changes are well within the natural variability of the groundwater-marine water mixing regimes on the coast of West Hawaii. In addition, these subsidies are small in comparison to other documented situation in West Hawaii where anthropogenic inputs have been quantified. For example, leaching of golf course nutrients resulted in an increase over natural flux of about 116% N and 22% P to a semi-enclosed embayment (Keauhou Bay). While these increases are orders of magnitude greater than could possible occur at the Kohala Shoreline LLC site, there was no measurable nutrient uptake within Keauhou Bay, and no alteration of biotic composition (Dollar and Atkinson 1992). Similarly, nutrients subsidies resulted in increased N and P flux to anchialine ponds at Waikoloa of about 229% and 400%, respectively. Even with such high nutrient subsidies to ponds that reflect substantial nutrient subsidies to groundwater, offshore sites at Waikoloa downgradient from these ponds on wave-exposed coastlines showed no input over natural sources (Dollar and Atkinson 1992). As the wave-exposed shorelines at Waikoloa are probably less turbulent than off the Kohala Shoreline

LLC area, it can be expected that the small changes in groundwater nutrient concentrations will likewise have no effect to the marine environment.

In addition to consideration of effects from nutrient additions, it is also important to consider the potential effect of sedimentation that may occur as a result of construction activities. The property is presently comprised of extensive areas of soil and rock, with relatively little vegetative groundcover. During the construction phases, it is likely that permit regulations will limit the area of excavation at any one time, and require dust control measures. In addition, results of the reef reconnaissance surveys reveal that marine biotic communities in the area are periodically affected by episodic sediment input, and are adapted to such conditions. Small, and temporary potential increases to sediment generation from construction activities should not have any significant effects on the marine environment.

All of these considerations indicate that the proposed Kohala Shoreline LLC community will not have any significant negative or likely even measurable, effect on water quality or marine biota in the coastal ocean offshore of the property. Because of small projected groundwater subsidies, which remain within the wide variation in nutrient concentrations of the entirety of West Hawaii, as well as the strong mixing characteristics of the nearshore environment, changes to the marine environment as a result of Kohala Shoreline LLC will likely be undetectable, with no change from the present conditions.

V. SUMMARY

1. Evaluation of nearshore water chemistry off the proposed Kohala Shoreline LLC property was carried out in December 2009. Forty-five water samples were collected along three transects oriented perpendicular to shore, extending from the shoreline to a distance of approximately 200 m offshore. Analysis of fourteen water chemistry constituents included all specific constituents in DOH water quality standards.

2. Several dissolved nutrients (Si , NO_3^- , TDN) displayed distinct horizontal gradients with highest values closest to shore and lowest values at the most seaward sampling locations. Correspondingly, salinity was lowest closest to the shoreline. These patterns were detectable at two of the three sampling sites, they were most pronounced at Site 2 located near the southern boundary of the property, and were not evident at Site 1, located at the northern boundary of the property.

3. Water chemistry constituents that are not major components of groundwater (NH_4^+ , DON, DOP) did not display clear gradients with respect to distance from the shoreline, or depth in the water column. Chl *a* and turbidity were elevated in nearshore samples with decreasing values moving seaward.

4. Application of a hydrographic mixing model to the water chemistry data was used to indicate if increased nutrient concentrations are the result of mixing of natural groundwater with oceanic water, or are the result of inputs from activities on land. The model indicates that during the 2009 survey there were small external subsidies of NO_3^- nitrogen to the ocean above what would be expected from natural groundwater mixing. There was no statistically

significant input of PO_4^{-3} or NH_4^+ from activities on land that could subsidize groundwater nutrient concentrations. The discernible nutrient subsidies in the nearshore groundwater mixing zone indicates detectable input to the ocean from sources of nutrients such as fertilizers from upslope of the project site.

5. Application of a linear regression model which is a component of DOH water quality standards specific for West Hawaii showed an exceedance for NO_3^- on Transects 2 and 3. Comparison of measurements of water chemistry with DOH geometric mean criteria for constituents not associated with groundwater (NH_4^+ , turbidity, Chl a) indicate that samples with salinities below 32‰ reveal numerous exceedances of geometric mean standards. Such exceedances are likely the result of the natural influence of land on the coastal ocean, or nearshore physical processes, which are not accounted for in the DOH standards.

7. Evaluations of changes to groundwater flux and composition resulting from the project performed by Tom Nance Water Resources Engineering indicate that there will be a potential increase of groundwater flow of about 1.8% over present conditions along the in the one-half mile of coastline fronting the property. Accompanying the increase in flow rates are relatively small increases in nutrient loading of 2.9% for nitrogen and 0.2% for phosphorus. These increases will result in nutrient concentrations in groundwater entering the ocean off the Kohala Shoreline LLC property that are considerably lower than in naturally occurring groundwater in other areas of West Hawaii. In addition, dilution of groundwater at the shoreline and within the nearshore zone by turbulent mixing will result in little or no change to groundwater-marine water dynamics. Even if measured concentrations of nutrients are increased by the projected amounts with the development in place, nearshore waters are so well-mixed that there is little likelihood that concentrations will increase beyond the present ranges of conditions.

9. Reconnaissance surveys of the marine communities off the project site reveal well developed coral assemblages that reflect the typical structure of reefs in West Hawaii. Near complete coverage of available hard substratum by corals from the shoreline to the sand plain at the base of the reef slope at the 60-foot contour suggest that the area has reached a near "climax successional" stage of reef development. Such a climax stage is the result of shelter from episodic wave events with sufficient energy to cause mechanical breakage of coral colonies. Effects to reef structure from substantial sediment input are not evident throughout the area fronting the Kohala Shoreline LLC property.

10. Reconnaissance of the offshore areas fronting the discharge point of Honokoa Gulch, located to the south of the Kohala Shoreline LLC revealed a completely different marine environmental setting that off the project. As a major erosional feature, drainage from Honokoa Gulch has been depositing terrigenous (land-derived) sediments to the ocean through over geologic timescales. As a result, the bottom in the area is composed of a layer of red sand-mud. Rocky surfaces protruding from the mud layer in the nearshore zone are presently colonized by substantial living corals, nearly all of which are of a size that indicates settlement occurred uniformly within the last several years. Further seaward, rocky protrusions

are covered with corals that are often larger in size, likely as a result of elevation from the sand-mud surface. Coral community structure in the area likely reveals a cyclic process of community response to infrequent peak episodes of sediment discharge from Honokoa Gulch. These peak episodes result in mortality to corals unable to withstand the stresses associated with sediment deposition. Subsequent removal of sediment by wave action results in exposing bare rock surfaces that are re-colonized by planulae from nearby reefs. Coral growth continues until the next episode of sediment input which sets the successional clock back to near zero. The present phase of coral growth suggests the last major destructive event was on the order of 5-10 years ago. While there may be slight alteration to sediment input from the Gulch as a result of upslope human land uses, there is no indication that the cycle is not a natural phenomenon, and has been operating over geologic time long before human habitation.

11. Overall, results of the water chemistry analysis indicate that there does not appear to be any potential for project-related negative to marine waters off the Kohala Shoreline LLC property. Changes of land use associated with the Kohala Shoreline LLC should not change water quality of the offshore area to any discernible extent.

12. The water quality study conducted for this report can serve as an initial baseline for any monitoring programs that may be required for the Kohala Shoreline LLC.

REFERENCES CITED

- Dollar, S. J. 1982. Wave stress and coral community structure in Hawaii. *Coral Reefs* 1:71-81.
- Dollar, S. J. and M. J. Atkinson. 1992. *Effects of nutrient subsidies to nearshore marine systems off the west coast of the Island of Hawaii*. *Estuarine, Coastal and Shelf Science*. 35:409-424.
- Dollar, S. J. and G. W. Tribble. 1993. Recurrent storm disturbance and recovery: a long-term study of coral communities in Hawaii. *Coral Reefs* 12:223-233.
- Grasshoff, K. 1983. *Methods of seawater analysis*. Verlag Chemie, Weinheim, 419 pp.
- Grigg, R.W. 1998. Holocene reef accretion in Hawaii: a function of wave exposure and sea level history. *Coral Reefs* 17:263-272.
- Roy, K.J. and S.V. Smith. 1971. Sedimentation and coral reef development in turbid water: Fanning Lagoon. *Pacif. Sci.* 25:234-248.
- Strickland J. D. H. and T. R. Parsons. 1968. *A practical handbook of sea-water analysis*. Fisheries Research Bd. of Canada, Bull. 167. 311 p.
- Tom Nance Water Resource Engineering. 2010. *Assessment of the Impact on Water Resources of the Kohala Shoreline LLC Project on TMK 5-9-1:08 in North Kona, Hawaii*. Prepared for Marine Research Consultants.

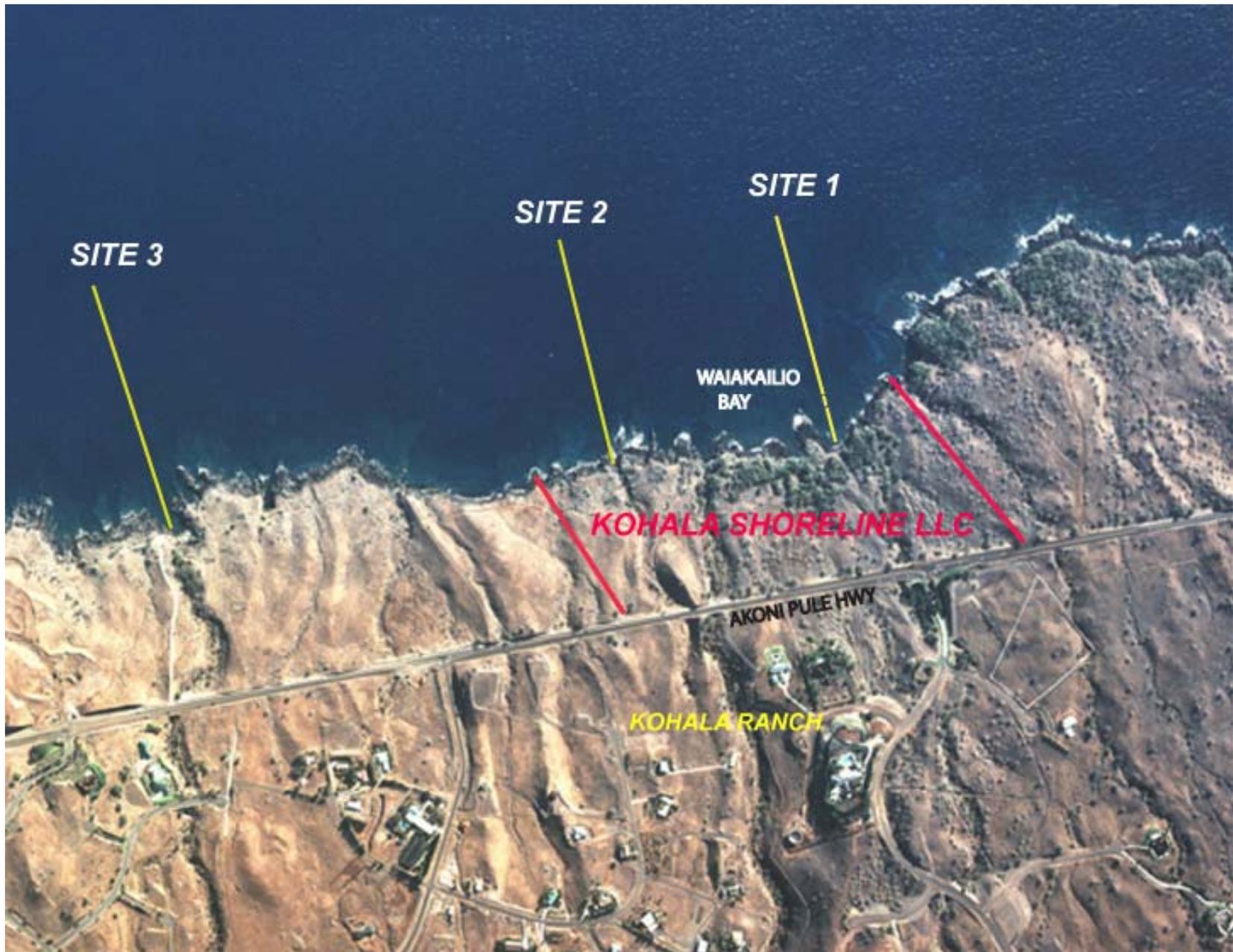


FIGURE 1. Aerial photograph of section of North Kohala shoreline showing the shoreline and inland boundary (Akoni Pule Hwy) of the Kohala Shoreline LLC project. Also shown are the locations of the three offshore water chemistry sampling transects that extend from the shoreline to open coastal waters.

TABLE 1. Water chemistry measurements at three locations off of the Kohala coastline collected December 17, 2009 as part of the Kohala Shoreline LLC project. Data from two groundwater wells located upslope from the ocean sampling area are also presented. Abbreviations as follows: S=surface; D=deep; DFS=distance from shore, BDL= below detection limit. Red line separates samples with salinity of 32 ‰. For sampling transect locations, see Figure 1.

TRANSECT	DFS (m)	DEPTH (ft)	PO ₄ ³⁻ (μM)	NO ₃ ⁻ (μM)	NH ₄ ⁺ (μM)	Si (μM)	TOP (μM)	TON (μM)	TP (μM)	TN (μM)	TURB (NTU)	SALINITY (o/oo)	CHL a (μg/L)	TEMP (deg.C)	O2 (%sat.)	pH
TRANSECT 1 (NORTH)	0 S	0	0.04	0.12	0.85	4.90	0.34	11.16	0.38	12.13	0.49	34.557	0.50	25.35	97.40	8.18
	1 S	1	0.02	0.22	0.34	4.57	0.30	9.62	0.32	10.18	0.65	34.549	0.24	25.46	99.43	8.19
	2 S	1	0.03	0.05	0.14	4.83	0.29	8.04	0.32	8.23	0.20	34.543	0.14	25.48	99.34	8.21
	3 S	2	0.04	0.28	0.23	4.58	0.28	8.07	0.32	8.58	0.25	34.594	0.12	25.53	100.23	8.16
	4 S	3	0.05	0.19	0.06	3.55	0.32	9.51	0.37	9.76	0.19	34.575	0.09	25.51	100.53	8.17
	5 S	1	0.06	0.53	0.45	5.36	0.35	11.76	0.41	12.74	0.24	34.576	0.09	25.53	99.53	8.16
	5 D	9	0.03	0.25	0.14	3.78	0.30	9.11	0.33	9.50	0.16	34.574	0.13	25.48	98.34	8.17
	10 S	1	0.06	0.52	0.31	5.19	0.34	10.44	0.40	11.27	0.28	34.601	0.09	25.56	99.34	8.16
	10 D	14	0.04	0.13	0.04	3.07	0.28	10.44	0.32	10.61	0.13	34.599	0.07	25.43	97.45	8.17
	50 S	1	0.11	0.33	BDL	4.21	0.32	9.97	0.43	10.30	0.18	34.626	0.07	25.58	100.32	8.16
	50 D	27	0.05	0.21	0.36	2.82	0.32	11.77	0.37	12.34	0.12	34.610	0.05	25.45	99.43	8.16
	100 S	1	0.06	0.02	0.05	3.00	0.31	8.94	0.37	9.01	0.14	34.653	0.06	25.59	101.23	8.20
	100 D	54	0.05	0.09	0.05	1.91	0.29	7.76	0.34	7.90	0.10	34.644	0.07	25.45	99.42	8.21
	200 S	1	0.05	0.01	0.15	1.56	0.32	8.36	0.37	8.52	0.09	34.647	0.03	25.61	100.34	8.24
200 D	73	0.06	BDL	0.15	1.33	0.42	7.65	0.48	7.80	0.11	34.644	0.03	25.46	99.34	8.23	
TRANSECT 2 (CENTER)	0 S	0	0.04	20.72	0.05	181.56	0.51	12.48	0.55	33.25	0.27	27.474	0.17	24.99	95.34	8.29
	1 S	1	0.04	10.30	0.52	92.77	0.35	13.09	0.39	23.91	0.42	31.148	0.20	25.28	97.34	8.29
	2 S	2	0.06	1.44	0.40	18.46	0.34	9.38	0.40	11.22	0.40	34.050	0.24	25.43	98.34	8.18
	3 S	2	0.12	0.56	0.11	8.67	0.33	9.36	0.45	10.03	0.48	34.468	0.05	25.49	99.84	8.09
	4 S	3	0.13	0.11	0.21	4.36	0.30	8.85	0.43	9.17	0.26	34.601	0.06	25.53	99.98	8.20
	5 S	1	0.04	0.07	0.38	4.26	0.29	8.30	0.33	8.75	0.23	34.607	0.03	25.53	99.76	8.19
	5 D	6	0.03	0.01	0.26	2.91	0.30	8.47	0.33	8.74	0.22	34.644	0.07	25.55	98.34	8.19
	10 S	1	0.02	0.03	0.12	1.88	0.29	9.19	0.31	9.34	0.08	34.655	0.02	25.76	100.23	8.20
	10 D	10	0.09	0.07	0.06	2.10	0.29	6.88	0.38	7.01	0.08	34.658	0.05	25.47	100.34	8.14
	50 S	1	0.04	0.05	0.02	1.76	0.28	8.25	0.32	8.32	0.08	34.656	0.05	25.67	101.24	8.14
	50 D	22	0.03	0.01	0.08	1.64	0.27	8.97	0.30	9.06	0.10	34.648	0.04	25.45	99.34	8.13
	100 S	1	0.03	0.03	0.06	1.67	0.27	7.54	0.30	7.63	0.08	34.662	0.03	25.68	101.23	8.20
	100 D	36	0.03	0.01	0.06	1.78	0.26	7.01	0.29	7.08	0.08	34.655	0.03	25.49	98.30	8.21
	200 S	1	0.05	0.01	0.05	1.55	0.25	7.46	0.30	7.52	0.09	34.646	0.03	25.59	101.24	8.24
200 D	54	0.05	0.01	0.07	1.23	0.35	7.04	0.40	7.12	0.07	34.643	0.03	25.48	100.42	8.23	
TRANSECT 3 (SOUTH)	0 S	0	0.12	3.54	0.23	28.49	0.28	7.67	0.40	11.44	1.11	33.927	0.17	25.27	96.34	8.24
	1 S	1	0.05	3.46	0.79	26.41	0.28	9.41	0.33	13.66	0.75	33.979	0.14	25.29	97.83	8.25
	2 S	1	0.09	3.25	0.07	26.63	0.27	6.34	0.36	9.66	0.68	33.970	0.18	25.31	99.82	8.17
	3 S	2	0.06	1.40	0.16	14.26	0.25	8.60	0.31	10.16	0.84	34.418	0.12	25.45	99.10	8.19
	4 S	3	0.09	0.77	0.36	9.55	0.27	8.68	0.36	9.81	0.55	34.499	0.12	25.49	99.39	8.20
	5 S	1	0.05	0.40	0.43	4.48	0.27	8.09	0.32	8.92	0.25	34.607	0.09	25.53	100.20	8.05
	5 D	6	0.07	0.28	0.29	4.74	0.28	8.47	0.35	9.04	0.26	34.590	0.07	25.51	98.43	8.05
	10 S	1	0.05	0.32	0.27	3.85	0.25	6.25	0.30	6.84	0.24	34.629	0.08	25.57	100.35	8.05
	10 D	14	0.18	0.32	0.36	2.81	0.27	7.87	0.45	8.55	0.16	34.650	0.07	25.45	99.34	8.05
	50 S	1	0.10	0.27	0.41	2.00	0.29	6.68	0.39	7.36	0.09	34.664	0.10	25.58	101.24	8.06
	50 D	25	0.04	0.25	0.06	2.73	0.27	9.74	0.31	10.05	0.18	34.640	0.05	25.51	99.43	8.06
	100 S	1	0.12	0.02	0.16	2.25	0.25	8.65	0.37	8.83	0.11	34.655	0.04	25.57	100.23	8.08
	100 D	38	0.08	0.01	0.06	1.78	0.21	7.02	0.29	7.09	0.08	34.601	0.03	25.49	99.35	8.21
	200 S	1	0.06	0.02	0.05	1.56	0.23	7.72	0.29	7.79	0.08	34.666	0.03	25.45	101.32	8.24
200 D	62	0.04	0.01	0.04	1.24	0.23	7.10	0.27	7.15	0.06	34.642	0.03	25.43	100.93	8.22	
WELL 1 (6549-01)			3.30	70.45	1.05	875	0.15	12.00	3.45	83.50	-	0.228	-			-
WELL 2 (6451-03)			1.50	92.05	1.30	962	0.65	1.75	2.15	95.10	-	1.712	-			-

TABLE 2. Water chemistry measurements (in $\mu\text{g/L}$ at three locations off of the Kohala coastline collected December 17, 2009 as part of the Kohala Shoreline LLC project. Data from two groundwater wells located upslope from the ocean sampling area are also presented. Abbreviations as follows: S=surface; D=deep; DFS=distance from shore, BDL= below detection limit. Red line separates samples with salinity of 32 ‰. For sampling transect locations, see Figure 1.

TRANSECT	DFS (m)	DEPTH (ft)	PO ₄ ³⁻ ($\mu\text{g/L}$)	NO ₃ ⁻ ($\mu\text{g/L}$)	NH ₄ ⁺ ($\mu\text{g/L}$)	Si ($\mu\text{g/L}$)	TOP ($\mu\text{g/L}$)	TON ($\mu\text{g/L}$)	TP ($\mu\text{g/L}$)	TN ($\mu\text{g/L}$)	TURB (NTU)	SALINITY (o/oo)	CHL α ($\mu\text{g/L}$)	TEMP (deg.C)	O2 (%sat.)	pH
TRANSECT 1 (NORTH)	0 S	0	1.24	1.68	11.90	137.7	10.54	156.2	11.78	169.8	0.49	34.557	0.50	25.35	97.40	8.18
	1 S	1	0.62	3.08	4.76	128.4	9.30	134.7	9.92	142.5	0.65	34.549	0.24	25.46	99.43	8.19
	2 S	1	0.93	0.70	1.96	135.7	8.99	112.6	9.92	115.2	0.20	34.543	0.14	25.48	99.34	8.21
	3 S	2	1.24	3.92	3.22	128.7	8.68	113.0	9.92	120.1	0.25	34.594	0.12	25.53	100.23	8.16
	4 S	3	1.55	2.66	0.84	99.8	9.92	133.1	11.47	136.6	0.19	34.575	0.09	25.51	100.53	8.17
	5 S	1	1.86	7.42	6.30	150.6	10.85	164.6	12.71	178.4	0.24	34.576	0.09	25.53	99.53	8.16
	5 D	9	0.93	3.50	1.96	106.2	9.30	127.5	10.23	133.0	0.16	34.574	0.13	25.48	98.34	8.17
	10 S	1	1.86	7.28	4.34	145.8	10.54	146.2	12.40	157.8	0.28	34.601	0.09	25.56	99.34	8.16
	10 D	14	1.24	1.82	0.56	86.27	8.68	146.2	9.92	148.5	0.13	34.599	0.07	25.43	97.45	8.17
	50 S	1	3.41	4.62	BDL	118.3	9.92	139.6	13.33	144.2	0.18	34.626	0.07	25.58	100.32	8.16
	50 D	27	1.55	2.94	5.04	79.24	9.92	164.8	11.47	172.8	0.12	34.610	0.05	25.45	99.43	8.16
	100 S	1	1.86	0.28	0.70	84.30	9.61	125.2	11.47	126.1	0.14	34.653	0.06	25.59	101.23	8.20
	100 D	54	1.55	1.26	0.70	53.67	8.99	108.6	10.54	110.6	0.10	34.644	0.07	25.45	99.42	8.21
	200 S	1	1.55	0.14	2.10	43.84	9.92	117.0	11.47	119.3	0.09	34.647	0.03	25.61	100.34	8.24
	200 D	73	1.86	BDL	2.10	37.37	13.02	107.1	14.88	109.2	0.11	34.644	0.03	25.46	99.34	8.23
	TRANSECT 2 (CENTER)	0 S	0	1.24	290.1	0.70	5101.8	15.81	174.7	17.05	465.5	0.27	27.474	0.17	24.99	95.34
1 S		1	1.24	144.2	7.28	2606.8	10.85	183.3	12.09	334.7	0.42	31.148	0.20	25.28	97.34	8.29
2 S		2	1.86	20.16	5.60	518.7	10.54	131.3	12.40	157.1	0.40	34.050	0.24	25.43	98.34	8.18
3 S		2	3.72	7.84	1.54	243.6	10.23	131.0	13.95	140.4	0.48	34.468	0.05	25.49	99.84	8.09
4 S		3	4.03	1.54	2.94	122.5	9.30	123.9	13.33	128.4	0.26	34.601	0.06	25.53	99.98	8.20
5 S		1	1.24	0.98	5.32	119.7	8.99	116.2	10.23	122.5	0.23	34.607	0.03	25.53	99.76	8.19
5 D		6	0.93	0.14	3.64	81.77	9.30	118.6	10.23	122.4	0.22	34.644	0.07	25.55	98.34	8.19
10 S		1	0.62	0.42	1.68	52.83	8.99	128.7	9.61	130.8	0.08	34.655	0.02	25.76	100.23	8.20
10 D		10	2.79	0.98	0.84	59.01	8.99	96.32	11.78	98.14	0.08	34.658	0.05	25.47	100.34	8.14
50 S		1	1.24	0.70	0.28	49.46	8.68	115.5	9.92	116.5	0.08	34.656	0.05	25.67	101.24	8.14
50 D		22	0.93	0.14	1.12	46.08	8.37	125.6	9.30	126.8	0.10	34.648	0.04	25.45	99.34	8.13
100 S		1	0.93	0.42	0.84	46.93	8.37	105.6	9.30	106.8	0.08	34.662	0.03	25.68	101.23	8.20
100 D		36	0.93	0.14	0.84	50.02	8.06	98.14	8.99	99.12	0.08	34.655	0.03	25.49	98.30	8.21
200 S		1	1.55	0.14	0.70	43.56	7.75	104.4	9.30	105.3	0.09	34.646	0.03	25.59	101.24	8.24
200 D		54	1.55	0.14	0.98	34.56	10.85	98.56	12.40	99.68	0.07	34.643	0.03	25.48	100.42	8.23
TRANSECT 3 (SOUTH)		0 S	0	3.72	49.56	3.22	800.6	8.68	107.4	12.40	160.2	1.11	33.927	0.17	25.27	96.34
	1 S	1	1.55	48.44	11.06	742.1	8.68	131.7	10.23	191.2	0.75	33.979	0.14	25.29	97.83	8.25
	2 S	1	2.79	45.50	0.98	748.3	8.37	88.76	11.16	135.2	0.68	33.970	0.18	25.31	99.82	8.17
	3 S	2	1.86	19.60	2.24	400.7	7.75	120.4	9.61	142.2	0.84	34.418	0.12	25.45	99.10	8.19
	4 S	3	2.79	10.78	5.04	268.4	8.37	121.5	11.16	137.3	0.55	34.499	0.12	25.49	99.39	8.20
	5 S	1	1.55	5.60	6.02	125.9	8.37	113.3	9.92	124.9	0.25	34.607	0.09	25.53	100.20	8.05
	5 D	6	2.17	3.92	4.06	133.2	8.68	118.6	10.85	126.6	0.26	34.590	0.07	25.51	98.43	8.05
	10 S	1	1.55	4.48	3.78	108.2	7.75	87.50	9.30	95.76	0.24	34.629	0.08	25.57	100.35	8.05
	10 D	14	5.58	4.48	5.04	78.96	8.37	110.18	13.95	119.7	0.16	34.650	0.07	25.45	99.34	8.05
	50 S	1	3.10	3.78	5.74	56.20	8.99	93.52	12.09	103.0	0.09	34.664	0.10	25.58	101.24	8.06
	50 D	25	1.24	3.50	0.84	76.71	8.37	136.4	9.61	140.7	0.18	34.640	0.05	25.51	99.43	8.06
	100 S	1	3.72	0.28	2.24	63.23	7.75	121.10	11.47	123.6	0.11	34.655	0.04	25.57	100.23	8.08
	100 D	38	2.57	0.14	0.84	50.02	6.42	98.28	8.99	99.26	0.08	34.601	0.03	25.49	99.35	8.21
	200 S	1	1.86	0.28	0.70	43.84	7.13	108.1	8.99	109.1	0.08	34.666	0.03	25.45	101.32	8.24
	200 D	62	1.24	0.14	0.56	34.84	7.13	99.40	8.37	100.1	0.06	34.642	0.03	25.43	100.93	8.22
	WELL 1 (6549-01)			102.3	986.3	14.70	24597	4.65	168.0	107.0	1169.0	-	0.228	-	-	-
WELL 2 (6451-03)			46.50	1288.7	18.20	27042	20.15	24.50	66.65	1331.4	-	1.712	-	-	-	-
WH GM std			5.00	4.50	2.50				12.50	100.00	0.10		0.30			

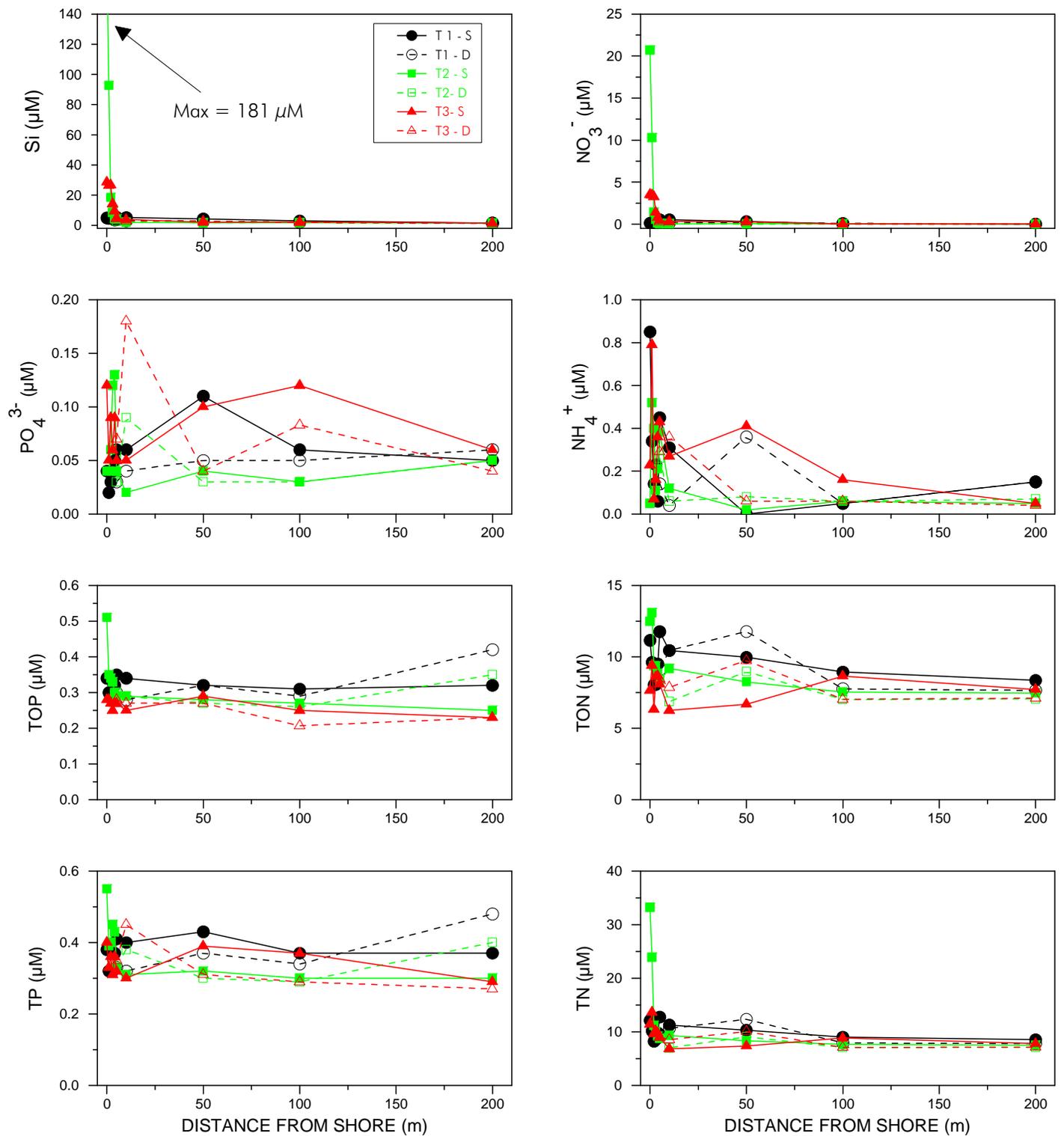


FIGURE 2. Plots of dissolved nutrients in surface (S) and deep (D) samples collected along transects offshore of the Kohala Shoreline LLC property collected on December 17, 2009 as functions of distance from the shoreline. For transect locations, see Figure 1.

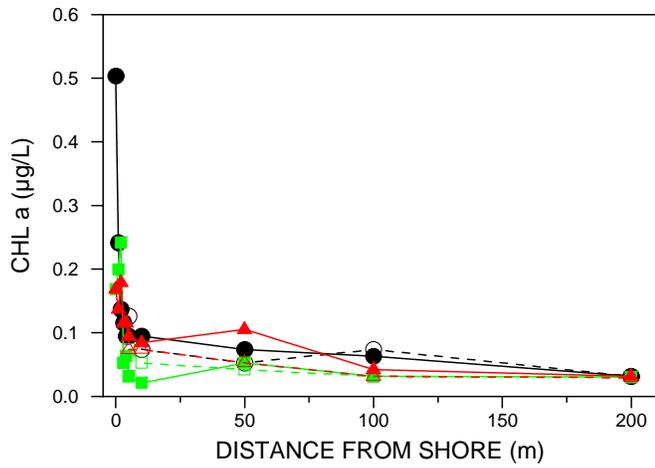
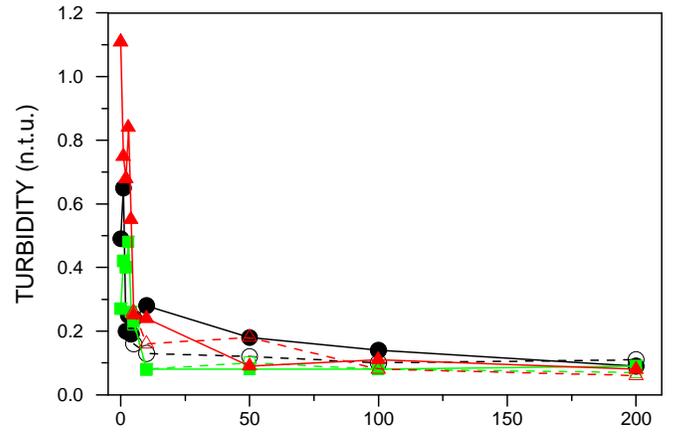
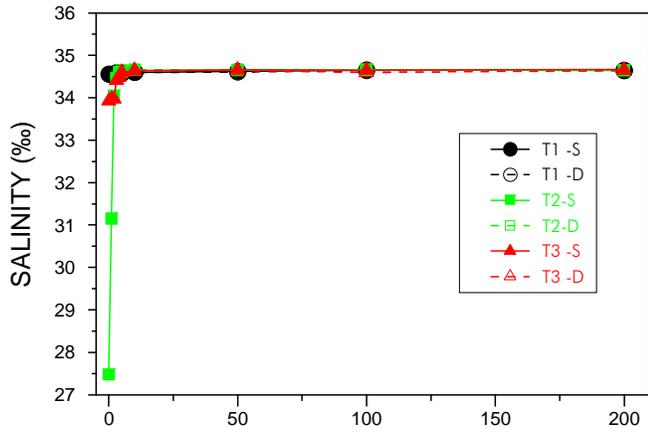


FIGURE 3. Plots of water chemistry constituents in surface (S) and deep (D) samples collected along three transects off the Kohala Shoreline LLC property on December 17, 2009 as functions of distance from the shoreline. For transect locations, see Figure 1.

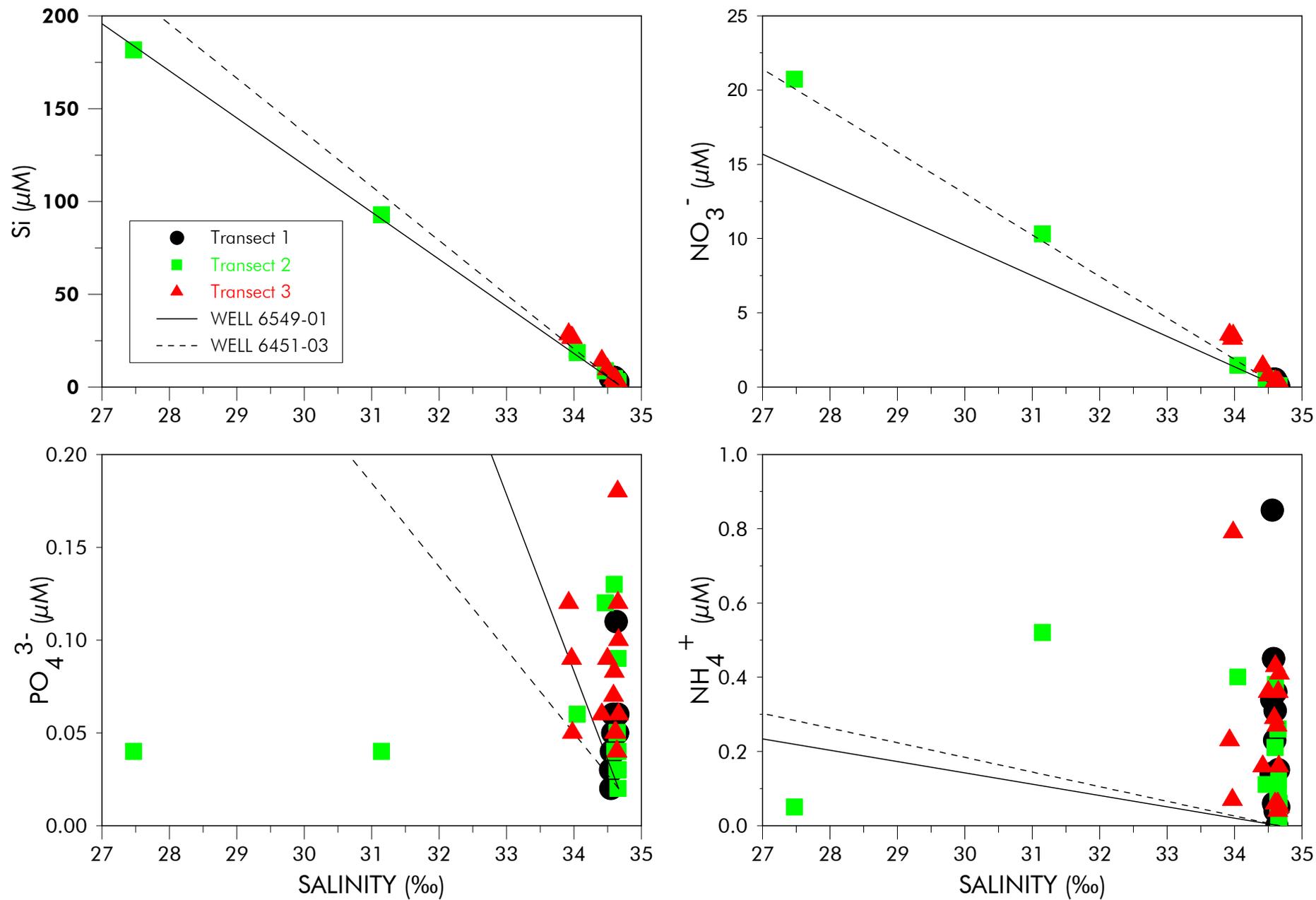


FIGURE 4. Mixing diagram showing concentration of dissolved nutrients from samples collected along three transects offshore of Kohala on December 17, 2009 as functions of salinity. Straight lines in each plot are conservative mixing lines constructed by connecting the concentrations in open ocean water with water from two groundwater wells upslope of the sampling area. For transect locations, see Figure 1.

TABLE 3. Slopes of linear regressions of nutrient concentrations (in units of $\mu\text{g/L}$) as functions of salinity for surface samples on three transects offshore of the Kohala Shoreline LLC project. Also shown are West Hawaii DOH compliance slopes. Shaded values indicate absolute value of upper confidence limit exceeding the DOH compliance slope.

NUTRIENT	DOH SLOPE	TRANSECT 1			TRANSECT 2			TRANSECT 3		
		SLOPE	LOWER CI	UPPER CI	SLOPE	LOWER CI	UPPER CI	SLOPE	LOWER CI	UPPER CI
NO_3^-	-31.92	-19.01	-54.88	16.87	-40.52	-40.09	-40.95	-66.69	-71.43	-61.96
TDN	-40.35	-230.00	-573.00	112.00	-51.23	-56.30	-46.31	-70.86	-107.12	-34.61
PO_4^{3-}	-3.22	9.64	1.03	18.24	0.06	-0.24	0.37	-0.25	-2.83	2.32
TDP	-2.86	16.90	-4.26	38.07	-0.81	-1.29	-0.33	-1.22	-4.44	2.00



FIGURE 5. View of typical shoreline cliffs along the coastal boundary of the Kohala Shoreline LLC property (top). Underwater view of rock bottom at base of cliffs (bottom).

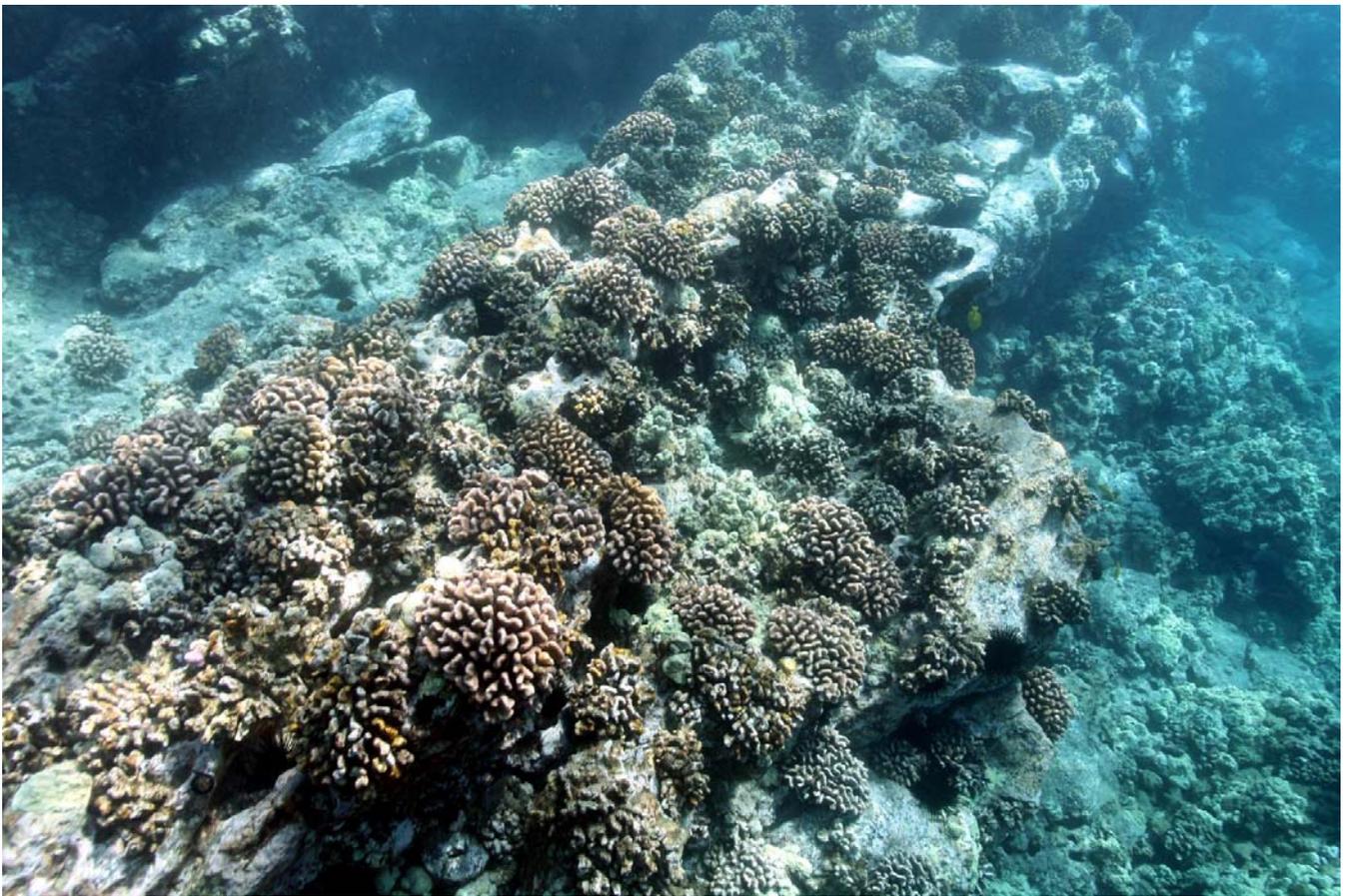


FIGURE 6. Two views of nearshore *Pocillopora* zone near northern boundary of Kohala Shoreline LLC property. Pitted surface on spur in bottom photo is the result of bioeroding action of the sea urchins *Echinometra matheai* and *Echinostrphus aciculatus*. Water depth is approximately 8-10 feet.

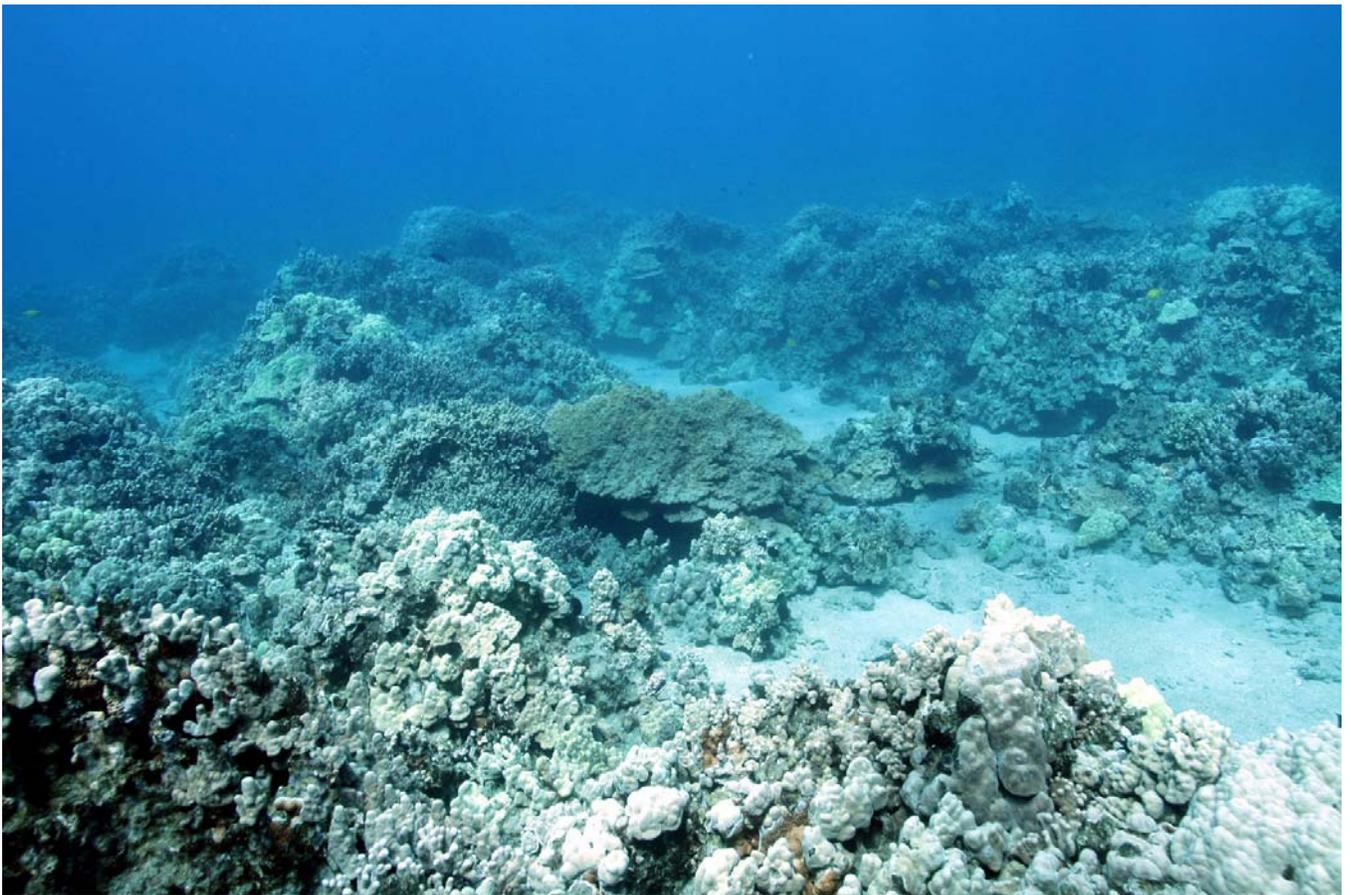
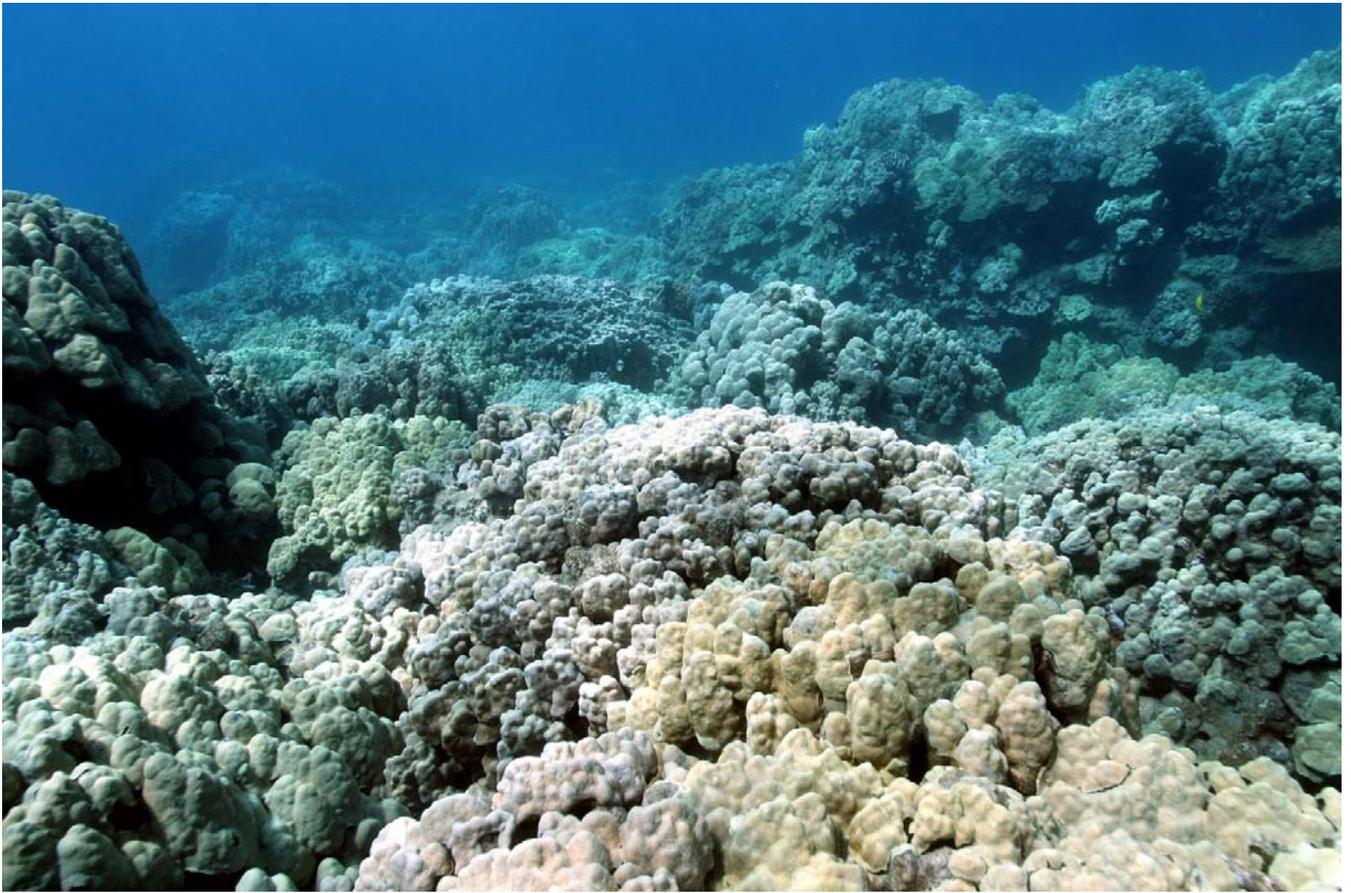


FIGURE 7. Two views of *Porites lobata* reef platform zone that extends throughout the Kohala Shoreline LLC property. Water depth is approximately 25-30 feet.



FIGURE 8. Two views of *Porites compressa* slope zone that extends throughout the Kohala Shoreline LLC property. Water depth is approximately 40-50 feet.



FIGURE 9. *Porites compressa* slope zone that extends throughout the Kohala Shoreline LLC property (top). Slope zone terminates in sand plain with interspersed corals and coral rubble at a depth of about 60 feet (bottom).



FIGURE 10. Two views of boulders in the nearshore area fronting the stream mouth south of the Kohala Shoreline LLC property showing extensive recent recruitment of small coral colonies. In upper photo, small corals can be identified as branching *Pocillopora*. In bottom photo, all white spots are new living coral recruits. Water depth is approximately 10 feet.

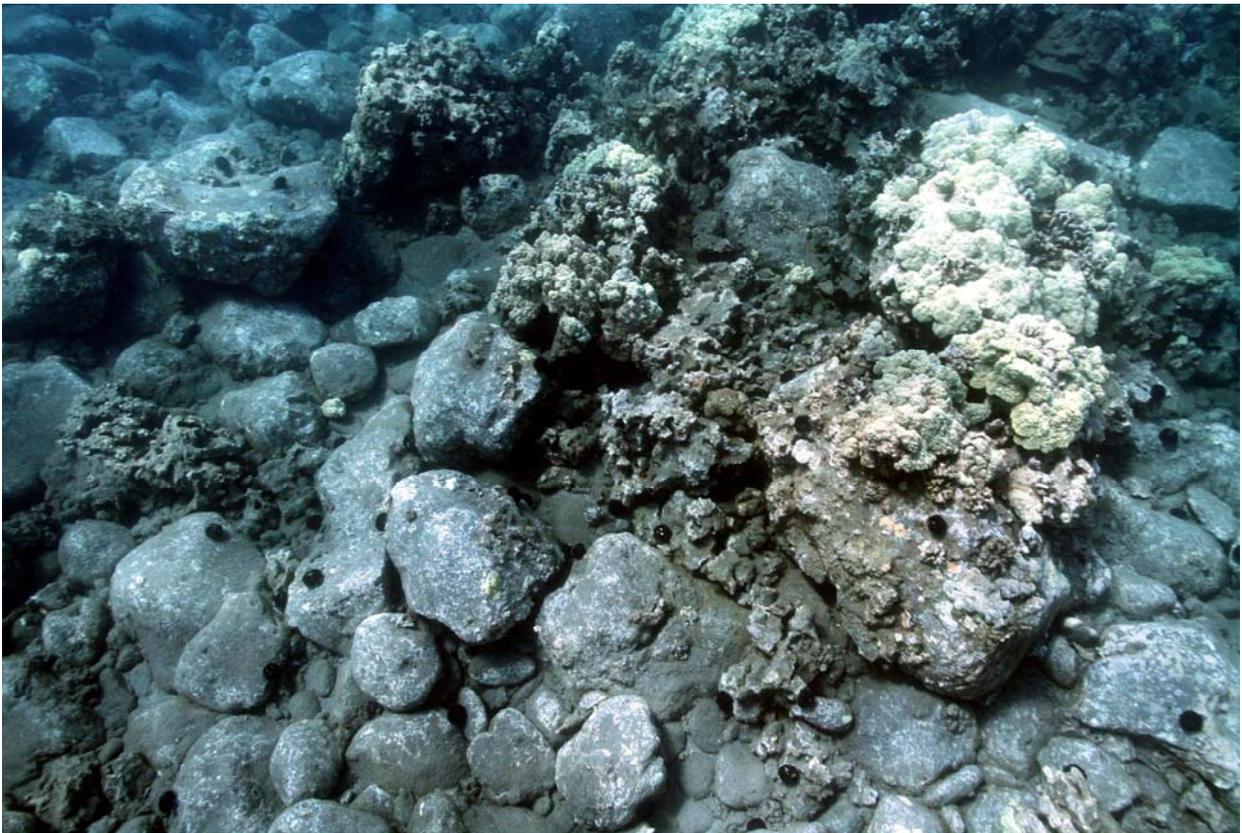


FIGURE 11. Upper photo shows numerous new coral recruits to otherwise barren boulders in nearshore area south of Kohala Shoreline LLC property (recruits are visible as white dots). Bottom photo shows distinct boundary between area of primarily barren boulders with new recruits (bottom left) and area of well-established corals (upper right). The distinct boundary likely represents the seaward margin of the effects of natural sediment input from land to reef community structure. Water depth is approximately 18 feet.

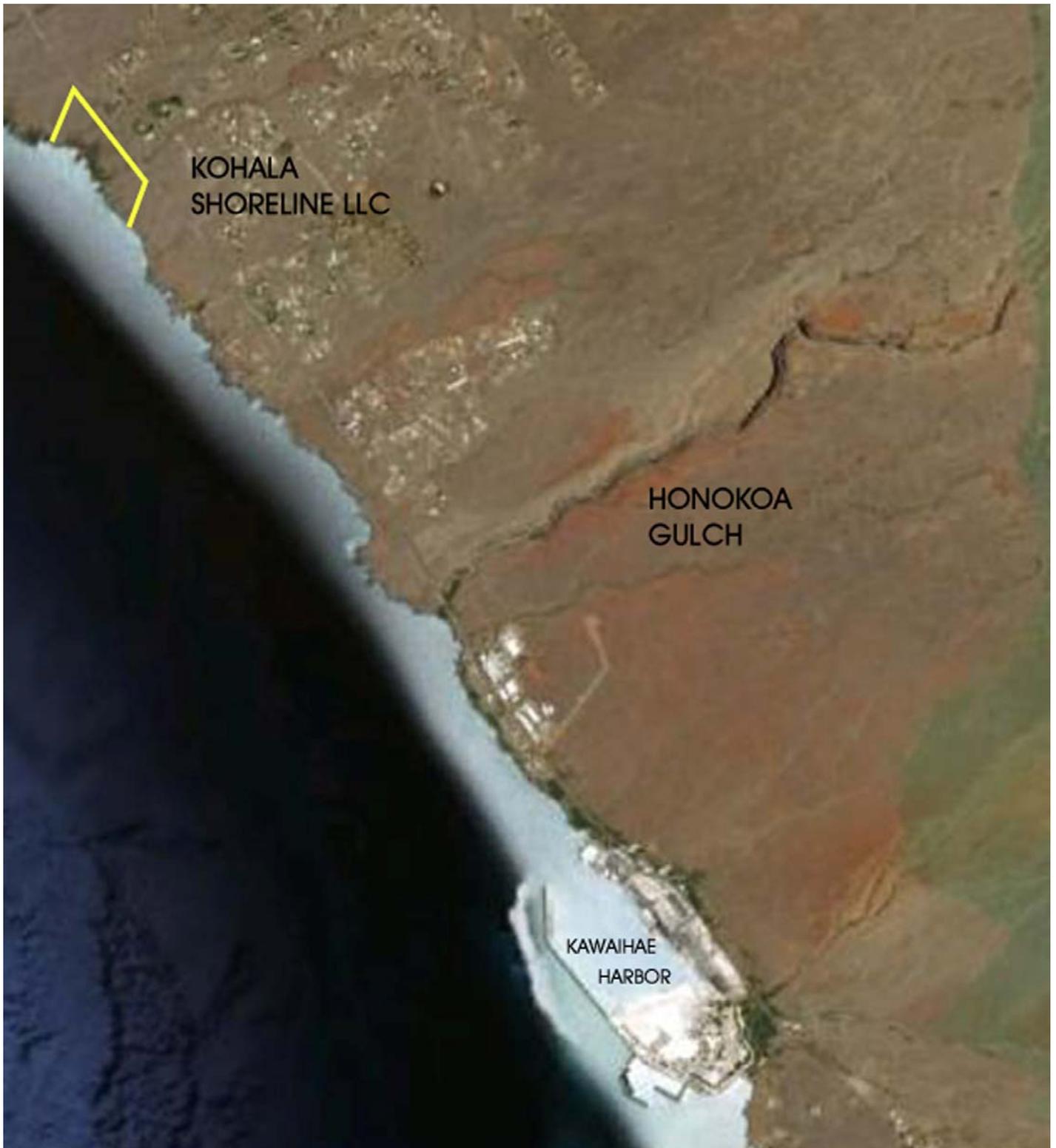


FIGURE 12. Aerial photograph of section of North Kohala coastline extending from Kawaihae Harbor to Kohala Shoreline LLC property. Also shown is Honokoa Gulch north of Kawaihae. Honokoa Gulch is a major geological feature and discharge from episodes of high rainfall and runoff have influenced the offshore marine environment through geologic time.



FIGURE 13. Top photo shows boulder beach at shoreline discharge point of Honokoa Gulch. Bottom photo shows boulders near the shoreline directly off the discharge point of Honokoa Gulch. Boulders are colonized by numerous small coral colonies recognizable primarily as *Porites lobata* and *Pocillopora meandrina*. Water depth is approximately 6 feet.



FIGURE 14. Two views of ocean floor directly off of Honokoa Gulch covered with thick layer of land-derived sediment from upland erosion of the gulch. The large extent of the sediment cover, in terms of both depth and area suggests that such input has been a normal occurrence of the area through geologic time, and is not solely a response to activities of humans. Water depth is approximately 20 feet.

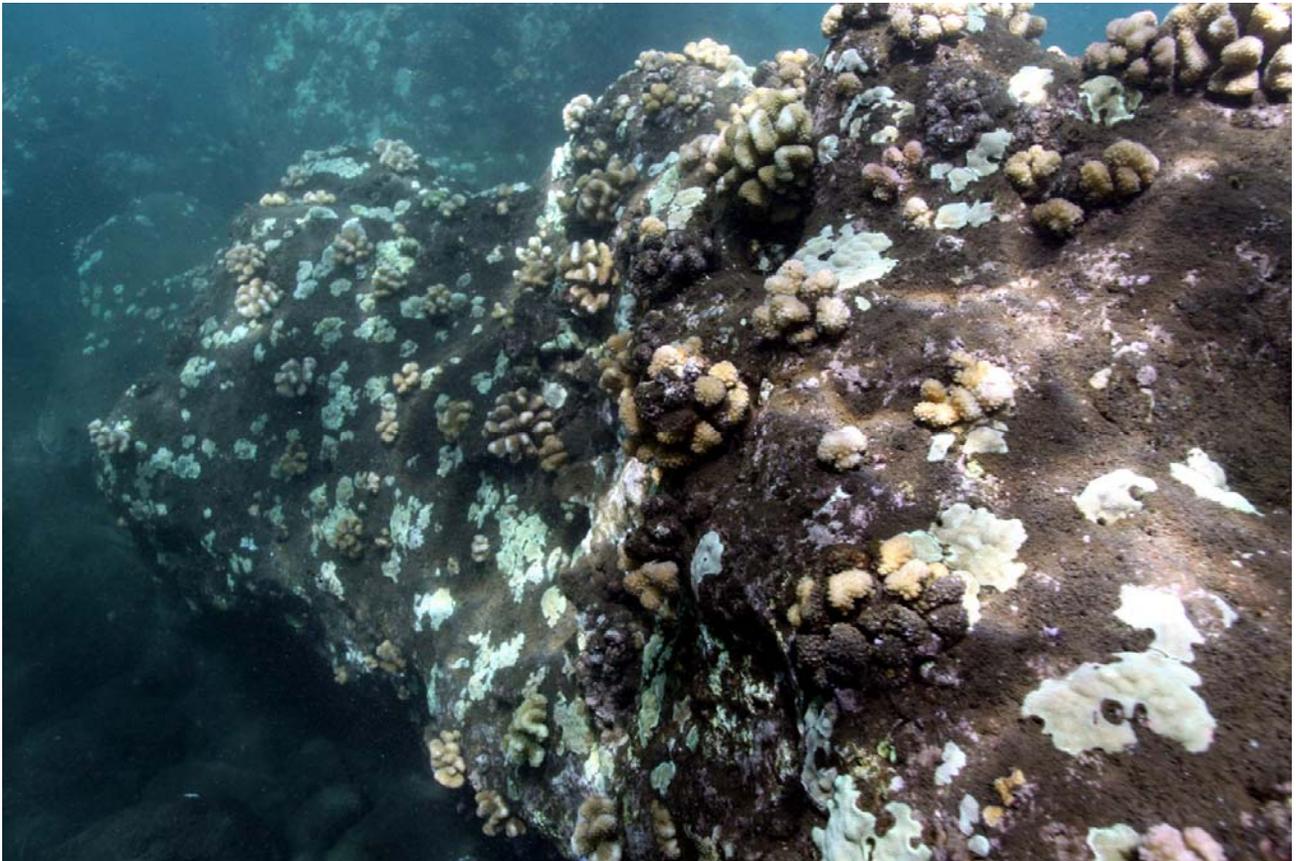


FIGURE 15. Two views of rock surfaces on ocean floor directly off of Honokoa Gulch. Substantial recolonization of the rock surfaces by corals is evident. Brown areas between living coral colonies contain a thin layer of fine-grained mud that is likely a permanent feature of the area. No dead corals are evident in either photo. Water depth is approximately 20 feet.

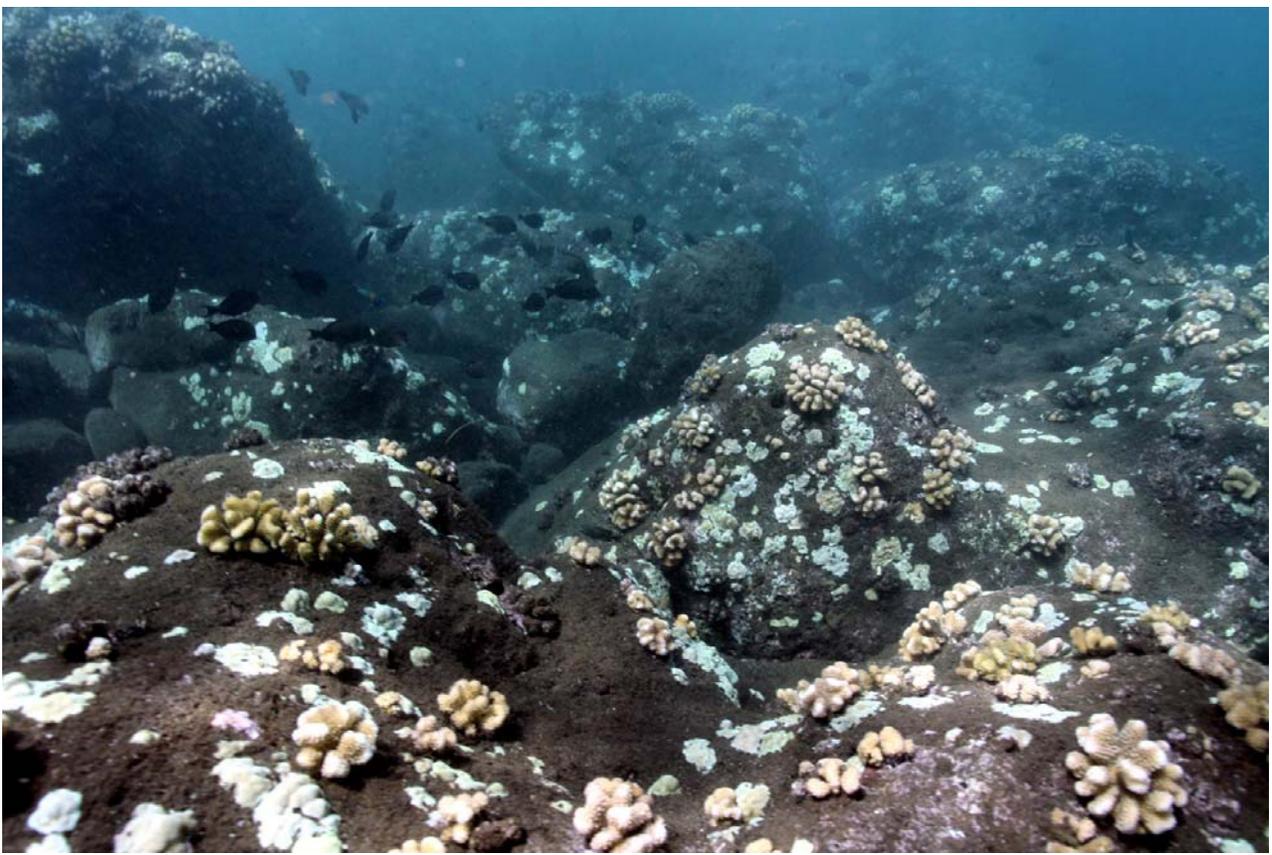


FIGURE 16. Two views of rock surfaces on ocean floor directly off of Honokoa Gulch. Substantial recolonization of the rock surfaces by corals is evident. Brown areas between living coral colonies contain a thin layer of fine-grained mud that is likely a permanent feature of the area. No dead corals are evident in either photo. Water depth is approximately 20 feet.

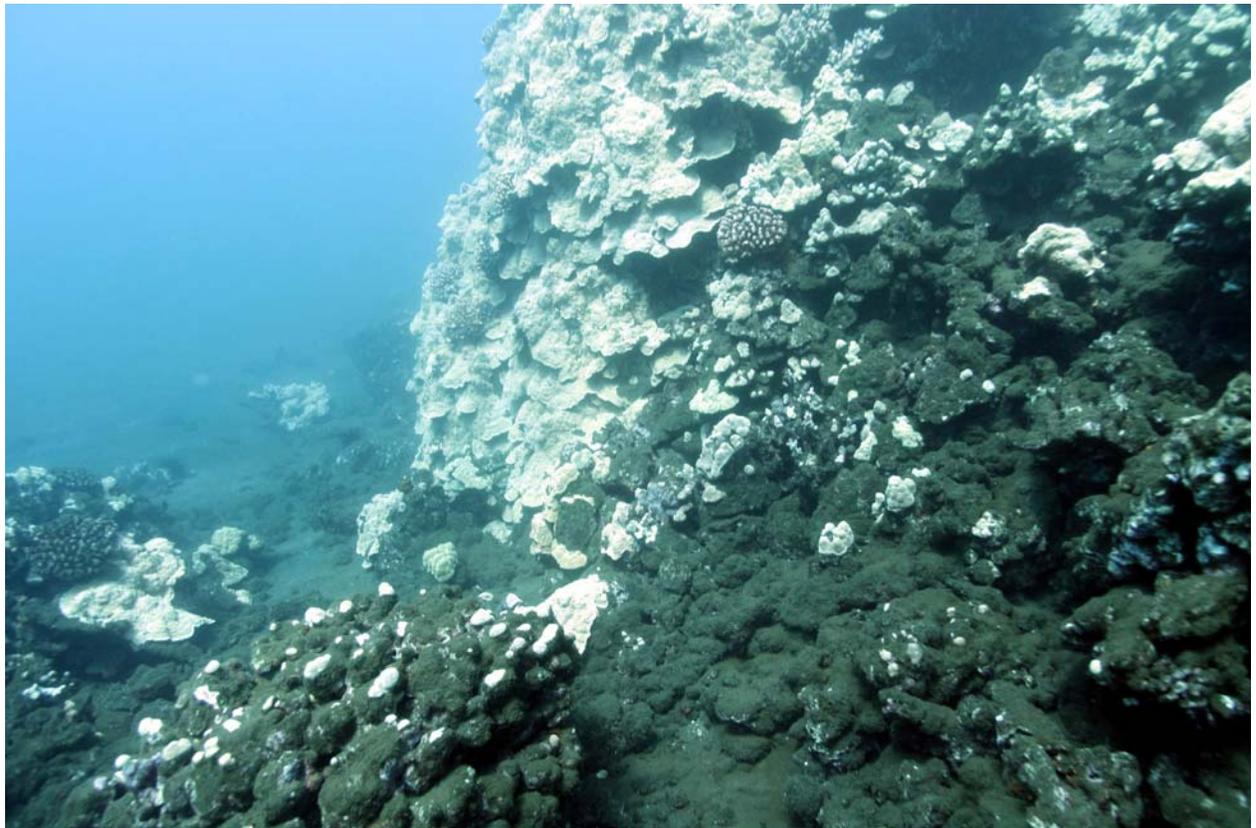
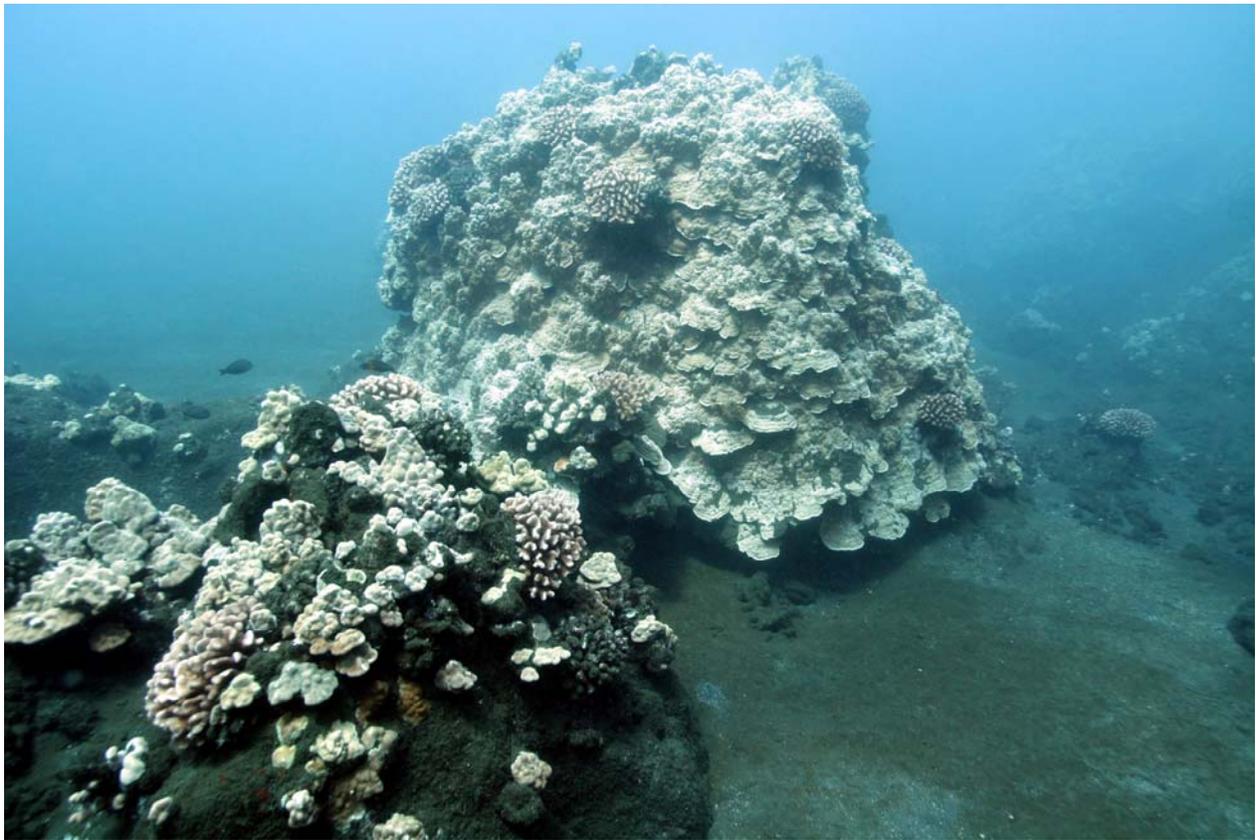


FIGURE 17. Top photo shows large colony of *Porites rus* growing above sediment surface off Honokoa Gulch, North Kohala. Bottom photo shows overlapping plates of *P. rus* on side of rock outcrop in same area as top photo. Note areas of dead, sediment covered coral in lower right of bottom photo adjacent to areas of living colonies. *Porites rus* was not observed in other areas of North Kohala that were not subjected to intermittent extreme sediment input. Water depth is approximately 35 feet.

Assessment of the Impact on
Water Resources of the Kohala Shoreline LLC Project on
TMK 5-9-1:08 in North Kohala, Hawaii

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Introduction

This report provides an assessment of the potential impacts on water resources of the proposed Kohala Shoreline LLC project on TMK 5-9-1:08 in North Kohala, Hawaii. Figure 1 shows the location of the 38-acre project site. It is on the makai side of Akoni Pule Highway and directly across from the Kohala Ranch development. The project's development plan is shown on Figure 2. It consists of nine (9) lots. The intention of the development would be to limit landscaping to the immediate vicinity of the homes, leaving most of the 38-acre project site undisturbed.

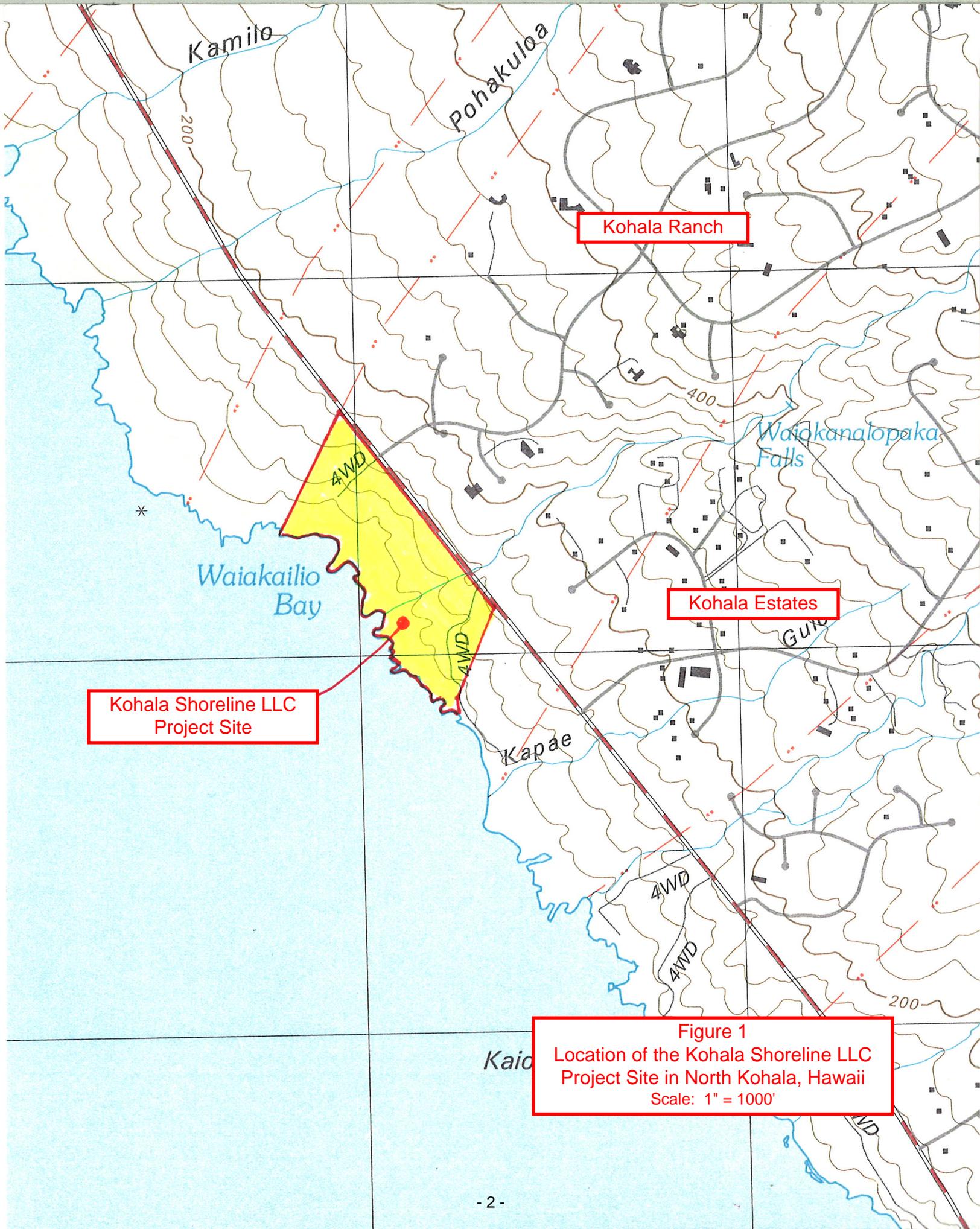
Aspects of the Project With the Potential to Impact Water Resources

Four aspects of the project's development have the potential to impact water resources. These are: use of groundwater for potable consumption and landscape irrigation; generation, treatment, and disposal of domestic wastewater; increase in rainfall-runoff; and percolation to groundwater of excess water applied to landscaping. Each of these is described and quantified in the sections following.

Use of Groundwater. Water for potable consumption and landscape irrigation will be provided by the Kohala Ranch system. Sources of supply for that system currently consist of two wells (Nos. 6549-01 and -02 on Figure 3). Typical water use in the occupied lots of Kohala Ranch is about 2500 gallons per day (GPD), although there are a number of lots with use in excess of 10,000 GPD. With the Kohala Shoreline LLC developer's commitment to limit the area of landscaping around each homesite and to use drought-tolerant plants, an average use rate of 2500 GPD per lot is assumed for the calculations herein. Another 5000 GPD is the expectable use for landscaping of the entry feature and another 5000 GPD for grassed swales along the project's roadways. Along with the 2500 GPD for each of the nine homesites, total water use is expected to average about 32,500 GPD.

Wastewater Generation, Treatment, and Disposal. Each homesite will have its own enhanced septic system with disposal in leach fields. Wastewater will percolate from the leach fields to the groundwater below, eventually to discharge into the marine environment along the shoreline. As a year-round average, it is assumed that wastewater disposal will average 300 GPD per homesite or 2700 GPD for the entire project.

Increase in Rainfall-Runoff. Average annual rainfall across the 38-acre project site is about ten inches. Runoff at present may be about 30 percent of this, equivalent to an annual volume of 414,000 cubic feet or 3.1 million gallons (MG). Based on the project's plan presented on Figure 2, an estimated 3.0 acres would be developed as impervious surfaces (roads, parking, driveways, rooftops, and other hardscape). If runoff from these surfaces amount to 95 percent of the annual rainfall and runoff from the balance of the project area (including landscaping) remains about the same, then the annual runoff volume would be increased by about 0.5 MG. This would amount to an increase of about 17 percent from the project site over existing conditions. It would be possible to capture and retain most of this runoff in drywells.



Kohala Shoreline LLC
Project Site

Figure 1
Location of the Kohala Shoreline LLC
Project Site in North Kohala, Hawaii
Scale: 1" = 1000'

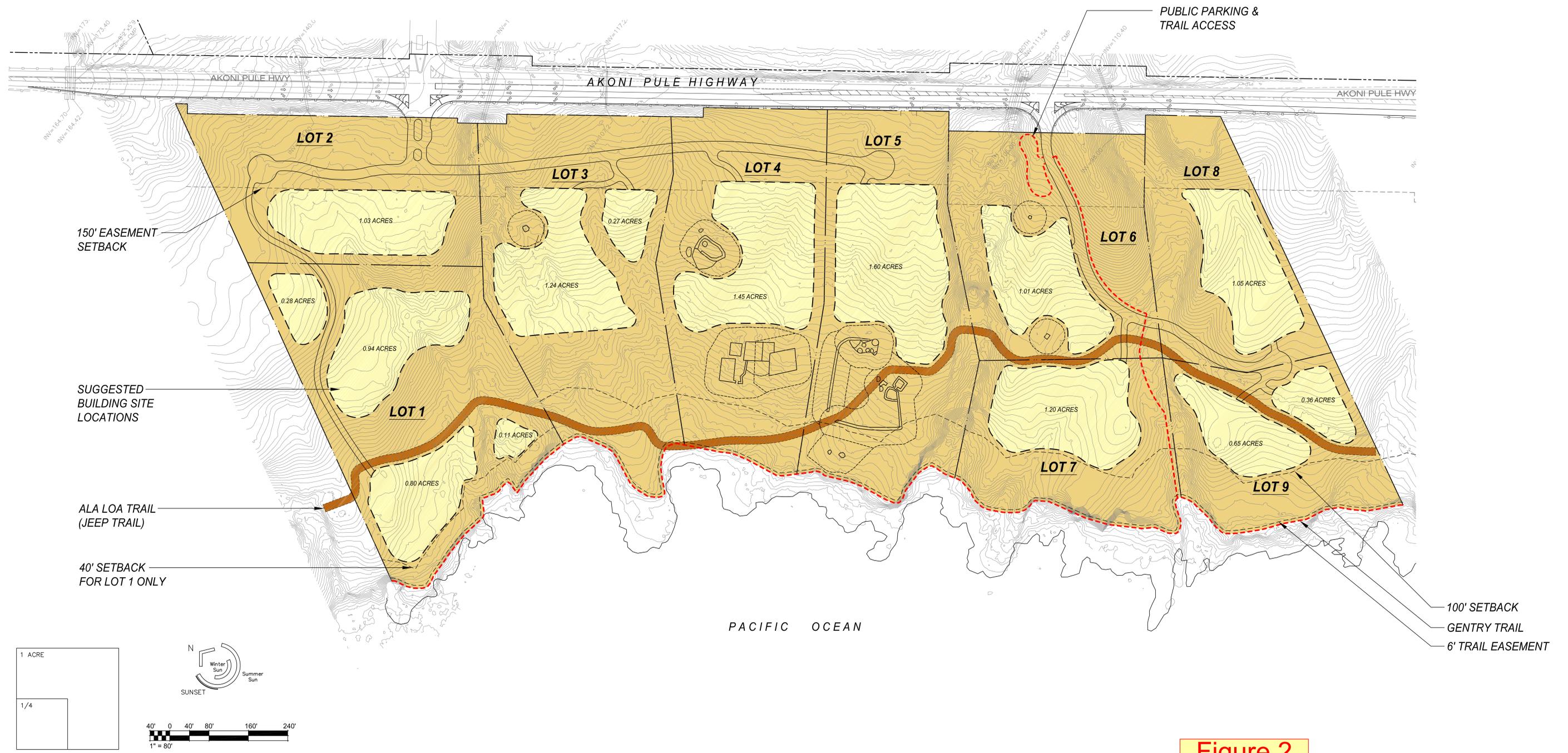


Figure 2

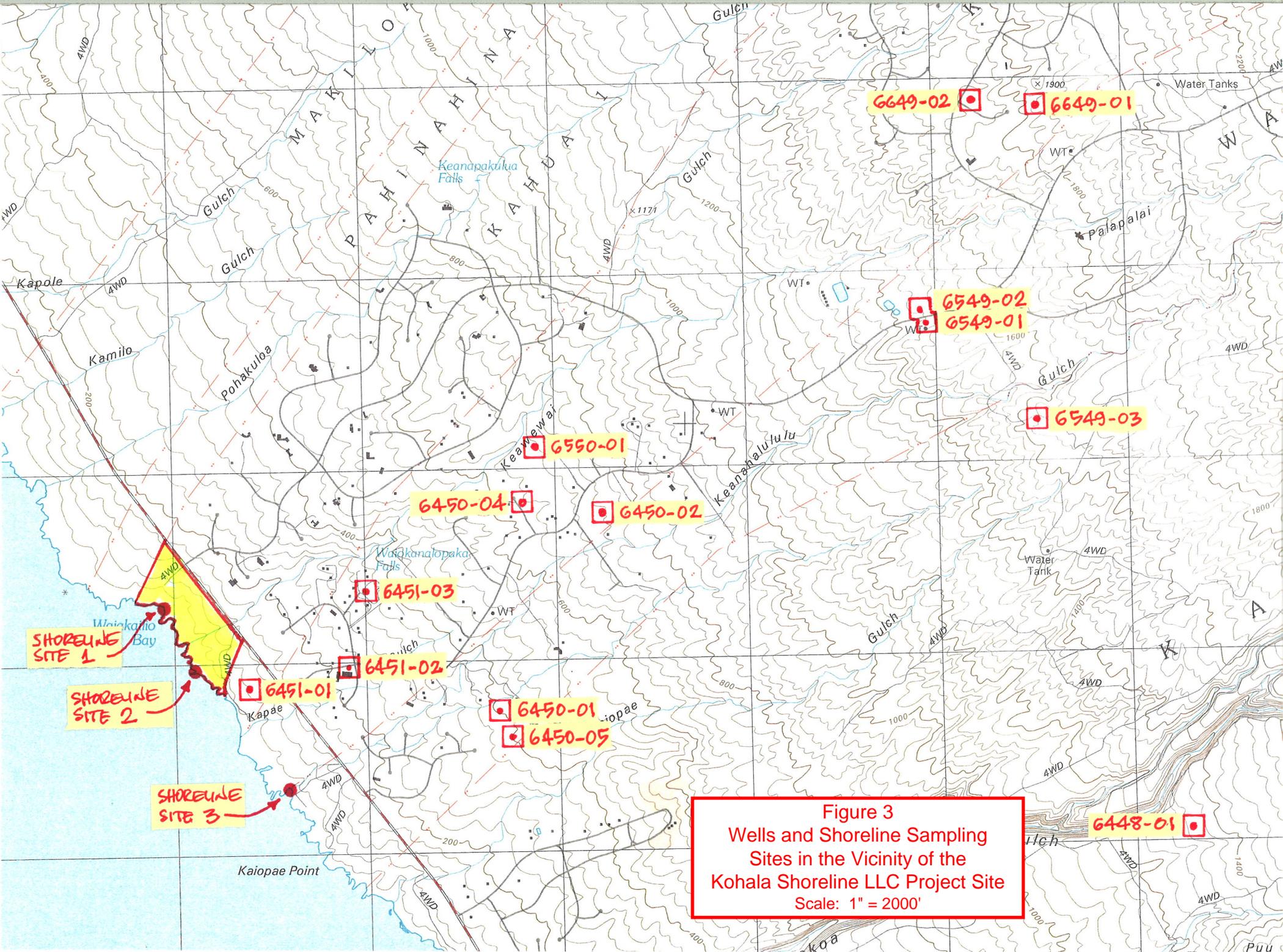


Figure 3
Wells and Shoreline Sampling
Sites in the Vicinity of the
Kohala Shoreline LLC Project Site
Scale: 1" = 2000'

Percolation to Groundwater of Excess Landscape Irrigation. The project's total landscape irrigation is estimated to be 29,800 GPD, of which 10,000 GPD would be on common areas and the remainder within the lots at an average of 2200 GPD per lot. As a first order approximation, it is assumed that 15 percent or 4470 GPD is applied in excess of plant uptake and, as a result, percolates to the groundwater below.

Water Resources in the Project Area

Groundwater. Knowledge of groundwater conditions in the vicinity of the project site comes primarily from the wells identified on Figure 3 and also listed in Table 1. Groundwater beneath the project site exists as a thin, brackish to saline lens overlying saltwater and depth and in hydraulic contact with seawater at the shoreline. The best estimate of the rate of groundwater flow in this area is in TNWRE (1992). Based on computed rainfall-recharge over a 3.2-mile wide mauka-makai corridor with a total area of 18 square miles, the average groundwater flowrate is estimated to be about 1.7 MGD per coastal mile. As the project site spans 0.5 miles of the coastline, the groundwater flow moving beneath the site and discharging along the shoreline is on the order of 0.85 MGD.

In contrast to the relatively simplistic description of groundwater beneath and near to the site, several of the wells at high elevations have demonstrated some interesting anomalies, including the following:

- The two wells that are furthest inland in the Kohala Ranch property (Nos. 6649-01 and -02 on Figure 3) encountered high level (rather than basal) groundwater, an unexpected result. Subsequent geophysical surveys (Blackhawk, 1990) indicated that this non-basal condition exists over a relatively wide area. Given the location, the subsurface features creating this anomaly are likely to be layers of poorly permeable lava flows or extensive ash deposits that have been weathered to clay.
- The State DHHL test well (No. 6549-03), located near to and south of the two Kohala Ranch Water System wells (Nos. 6549-01 and -02) was more saline than expected. It may be that subsurface features which create high level groundwater further inland are also limiting the mauka-to-makai groundwater flow at this test well site.
- Another State DHHL test well further to the south (No. 6448-01) had completely anomalous results. It had a very low static water level (only 1.0 feet as compared to an expected 4 to 5 feet) and high salinity (chlorides of 2500 mg/l as compared to an expected 150± mg/l). Due to these results, the borehole was not pump tested or completed as a production well.

To provide an indication of groundwater quality, two wells in the mauka-makai corridor of the project were sampled. Sampling was also done at the three shoreline locations shown on Figure 3 to

Table 1

Summary of Available Information on the
14 Wells in the General Vicinity of the Kohala Shoreline LLC Project Site

State Well No.	Well Name or Owner	Year Drilled	Ground Elevation	Casing Diameter	Total Depth	Static Water Level	Chlorides (MG/L)	Hydraulic Performance (Drawdown @ GPM)	Present Use
6549-01	Kohala Ranch 1	1979	1460	12	1550	7.2	65	6.4 @ 700	} Potable Supply for Kohala Ranch Water System
6549-02	Kohala Ranch 2	1982	1449	12	1560	--	70	3.0 @ 600	
6649-01	Kohala Ranch 3	1989	1840	18	1925	136	35	3.0 @ 1200	} Unused Kohala Ranch Water System Wells
6649-02	Kohala Ranch 4	1993	1746	18	1830	17.7	45	18.6 @ 1200	
6448-01	Kawaihae (DHHL)	1990	1341	Uncased	1465	1.0	2500	Not Tested	Unused
6549-03	Kawaihae (DHHL)	1992	1651	18	1700	6.3	170	4.2 @ 130	Unused
6450-02	Walsh Lot 39	1984	801	12	835	--	180-200	--	Landscape Irrigation
6550-01	Kahua (Sherrod)	1986	675	8	700	3.7	260	--	Landscape Irrigation
6450-04	Waika-Fischer	1996	653	6	670	2.0	230	0.0 @ 16	Landscape Irrigation
6450-01	Virgil Place	1980	395	4	412	--	1320 (?)	--	Unused
6450-05	Virgil Place	1996	370	8	383	2.81	960	0.45 @ 60	Agricultural Irrigation
6451-01	Kahuna Ranch Test Hole	1963	60	2	90	--	--	--	Unused
6451-02	Kawamata 1	1987	238	6	245	2.6	1235	--	Landscape Irrigation
6451-03	Kawamata 2	1987	395	6	405	--	700	--	Landscape Irrigation

Note: Information from the files of the State Commission on Water Resource Management.

attempt to characterize the groundwater at its point of shoreline discharge. All of these water quality results are compiled in Table 2.

Figure 4 plots these results for NO_3 and PO_4 on mixing lines of these constituents. The mixing lines are linear plots using two end points, the well furthest inland (No. 6549-01) and the ocean offshore. If the intervening samples plot above the line, it demonstrates an enrichment of that constituent in the groundwater's travel to and discharge at the shoreline. If the intervening sample plots on the mixing line, it would be a simple dilution of the two endpoints and indicate no change to that constituent. Finally, if the intervening sample plots below the mixing line, it indicates a depletion of that constituent. These results show that there is an enrichment of NO_3 by natural processes and/or inputs from the upgradient Kohala Ranch and Kohala Estates developments. In contrast, there appears to be a depletion of PO_4 .

Potential Impacts to Water Resources

This impacts section is divided into three sections, the first dealing with the use of groundwater supplied by the relatively remote Kohala Ranch Water System wells (Nos. 6549-01 and -02), the second focused on impacts to groundwater due to activities on the project site itself, and the third dealing with increased rainfall-runoff.

Use of Groundwater From the Kohala Ranch Water System Wells. At present, supply for the Kohala Ranch Water System is provided by Wells 6549-01 and -02. These wells are 2.6 miles inland and at about 1460-foot elevation. Year-round average pumpage is approximately 0.70 MGD (Dan Bowles, personal communication). The project's estimated average use of 32,500 GPD would represent an increase of pumpage of almost five (5) percent. It is estimated that this groundwater withdrawal affects the shoreline groundwater across a width of about 1.4 miles, including the southern portion of the Kohala Shoreline LLC project site. Based on information presented previously, the pre-development discharge along this 1.4 miles of shoreline was on the order of 2.4 MGD. Pumpage by the Kohala Ranch Water System wells has reduced this by about 37 percent. The addition of the pumpage for the Kohala Shoreline LLC project would change the total reduction to about 39 percent. Several aspects of this ongoing pumpage are notable:

- The 0.7 MGD average pumpage by the Kohala Ranch Water System wells has reduced the input of nitrogen and phosphorus into the marine environment by 7.8 and 0.39 pounds per day, respectively. The additional pumpage for the Kohala Shoreline LLC project will amount to additional reductions of 0.36 and 0.018 pounds per day, respectively.
- Quite surprisingly, the magnitude of pumpage by the Kohala Ranch wells relative to estimates of the natural groundwater flowrate has not resulted in a demonstrable salinity increase in either of these two wells or in the downgradient houselot irrigation wells in Kohala Estates.

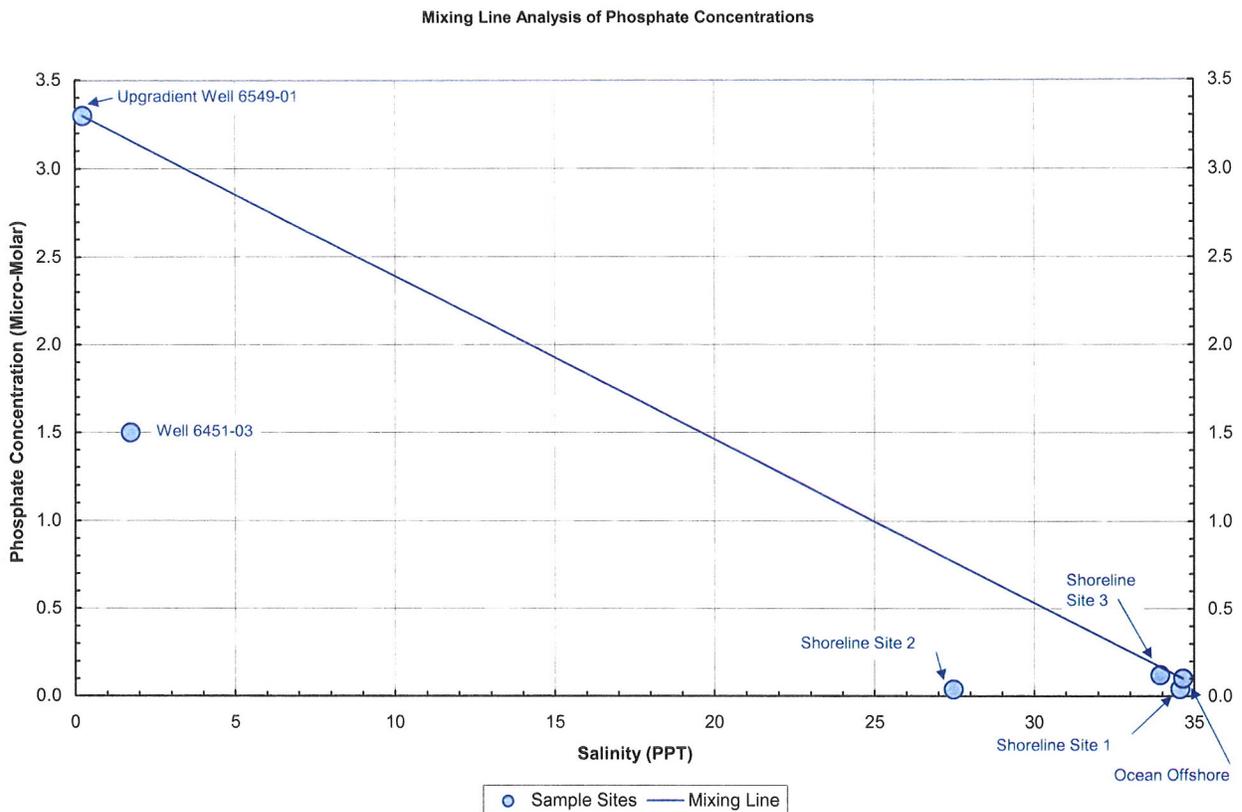
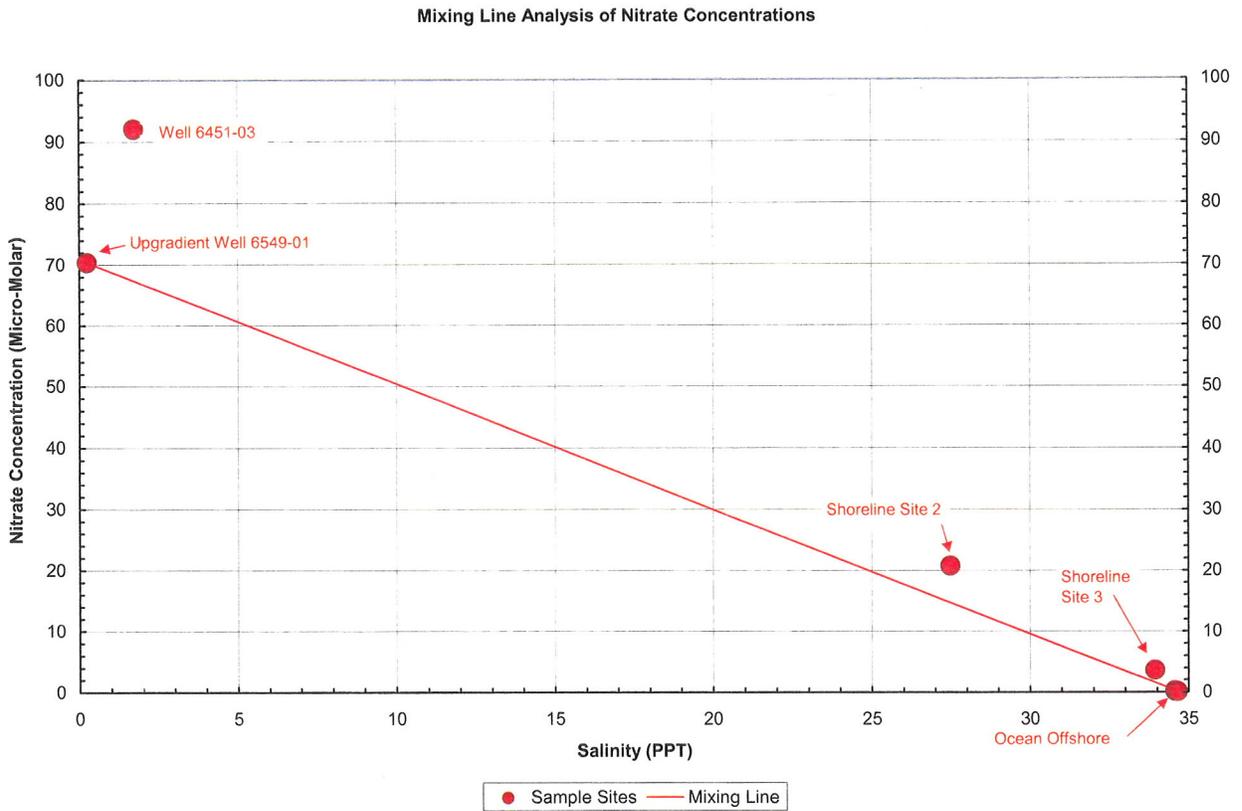
Table 2

Laboratory Results of Samples Collected in the
Mauka-Makai Corridor of the Kohala Shoreline LLC Project Site

Sample Location	NO ₃ (μM)	NH ₄ (μM)	DON (μM)	TN (μM)	PO ₄ (μM)	DOP (μM)	TP (μM)	Silica (μM)	Salinity (PPT)
Well 6549-01	70.4	1.05	12.0	83.5	3.30	0.15	3.45	875	0.228
Well 6451-03	92.1	1.30	1.75	95.1	1.50	0.65	2.15	962	1.712
Shoreline Site 1	0.12	0.85	11.2	12.1	0.04	0.34	0.38	4.90	34.56
Shoreline Site 2	20.7	0.05	12.5	33.2	0.04	0.51	0.55	182	27.47
Shoreline Site 3	3.54	0.23	7.7	11.4	0.12	0.28	0.40	28.5	33.93
Ocean Offshore	0.01	0.12	7.8	7.9	0.10	0.28	0.38	1.8	34.65

- Notes:
1. Samples collected on December 17, 2009 by Steve Dollar and Tom Nance.
 2. Laboratory analyses by Marine Analytical Specialists (EPA Labcode: HI 00009).
 3. Results presented in micro-molar (μM) units can be converted to milligrams per liter by multiplying by the atomic weight and dividing by 1000.

Figure 4. Mixing Line Analyses of Nitrate and Phosphate Concentrations



- The "safe yield" of the two Kohala Ranch wells, defined as their capacity with one well as standby, is about 1.0 MGD. This amount is being approached by their current summertime pumpage. A necessary increase in supply capability is foreseeable. It will entail outfitting one or the other of its two unused wells on the Kohala Ranch property (Nos. 6649-01 or -02 on Figure 3).

Potential Impacts to Groundwater of Activities on the Kohala Shoreline LLC Project Site. Table 3 is compilation of potential impacts to groundwater flowrate, salinity, and nitrogen and phosphorus loading due to activities on the project site. In addition to the data and calculations presented previously, the following assumptions are incorporated in the results on Table 3.

- Of the 0.85 MGD of groundwater flowing beneath the project site and discharging at the shoreline, its average salinity is 5.0 PPT and its nitrogen and phosphorus concentrations are the same as in Well 6451-03 (Table 2).
- Of the 2700 GPD of wastewater generated and treated in advanced septic systems in each house lot, salinity of the effluent percolating from the leach field disposal lines will have been increased by 20 percent (over the Kohala Ranch Water System supply) and will have nitrogen and phosphorus concentrations of 775 μM (10.85 mg/l) and 165 μM (2.00 mg/l), respectively. Removals of nitrogen and phosphorus by the soil bedding of the leach field will be 30 and 90 percent, respectively.
- Of the 29,800 GPD from the Kohala Ranch Water System that is used for landscape irrigation, 15 percent will be applied in excess of plant evapotranspiration and will percolate to groundwater. In moving through the root zone, this water will have a 20 percent increase in salinity, a 50 percent reduction in nitrogen, and a 90 percent reduction in phosphorus.
- The total landscaped area will be eight acres. Fertilizer applications over these areas will average four pounds per 1000 square feet per year of nitrogen and 0.5 pounds per 1000 square feet per year of phosphorus. Ten percent of the applied nitrogen and two percent of the applied phosphorus will be carried with excess irrigation water below the root zone.
- The amount of onsite rainfall which percolates to groundwater before and after the project's development will remain essentially unchanged. This amount is estimated to be one-third of the ten inches of average annual runoff. For the portion of rain percolating from the eight acres of landscape irrigation, nitrogen and phosphorus increases will be 10 and 1.0 μM , respectively.
- In the vertical travel through the vadose zone (the unsaturated lavas between the ground surface and groundwater below) and lateral travel with groundwater to shoreline discharge, natural

processes will remove 70 percent of the dissolved nitrogen and 95 percent of the dissolved phosphorus.

As shown in the bottom line of Table 3, the computed changes to groundwater discharging along the project's shoreline are quite small: 0.8 percent increase in flowrate; 0.8 percent decline in salinity; and nitrogen and phosphorus increases of 1.2 and 0.1 percent.

Increase in Rainfall-Runoff. If the increase in runoff from the project's impervious surfaces is not captured and disposed of in drywells, then, as presented previously, the increased runoff volume to shoreline discharge might be on the order of 0.5 MG annually. Several dry gulches cross the project site, the largest of which is Keawewai Gulch (refer to Figure 3). It and its tributary Palapalai Gulch have continuous topographic definition for 6.4 miles inland to an elevation of 3800 feet. Their total tributary area extends to the top of Puu Pili and encompasses about 4.9 square miles. Creating 3.0 acres of impervious surfaces is equivalent to altering runoff from 0.1 percent of the watershed area. The impact will be inconsequential.

Table 3

Potential Changes to Groundwater Discharging
 Along the Shoreline of the Kohala Shoreline LLC Project Site

Component of Flow	Flowrate (MGD)	Salinity (PPT)	Nitrogen (lbs / day)	Phosphorus (lbs / day)
Pre-Development Flowrate	0.85	5.00	9.43	0.47
Percolation of Wastewater From Leach Field Disposal Systems	0.0027	0.274	0.0154	0.00003
Excess Landscape Irrigation	0.00447	0.274	0.0065	0.000025
Fertilizer Carried in Excess Landscape Irrigation	--	--	0.0938	0.00039
Rainfall Percolate on Landscaped Areas	No Change	No Change	0.0007	0.00002
Resulting Post-Development Flowrate				
▪ Calculated Amounts	0.85717	4.960	9.5464	0.47046
▪ Change Over Pre-Development Condition	+ 0.8%	- 0.8%	+ 1.2%	+ 0.1%

References

- Belt Collins & Associates. 1983. New Potable Water Source, Kohala Ranch Water System, North Kohala, Hawaii. Consultant Report Prepared for Kohala Ranch and Submitted to the State Department of Health.
- Blackhawk Geosciences, Inc. 1990. Geophysical Survey, Groundwater Evaluation, Kohala Ranch, Island of Hawaii. Consultant Report Prepared for Kohala Joint Venture.
- Bowles, S.P. 1979. A Water Review of Kohala Estates and Vicinity. Consultant Report Prepared for the Hilton Head Co., Inc.
- Nance T. 1988. Recommended Locations for Kohala Ranch Water Company's Third and Future Wells. Consultant Report Prepared for Kohala Ranch.
- TNWRE. 1990. Engineering Report, Kohala Ranch Well No. 3, New Potable Water Source, Kohala Ranch Water System, North Kohala, Hawaii. Consultant Report Prepared for Kohala Ranch Water Company and Submitted to the State Department of Health.
- TNWRE. 1992. Estimated Sustainable Yields of the High Level and Basal Aquifers Beneath the Kohala Ranch Property. Consultant Report Prepared for Kohala Joint Venture.
- TNWRE. 1994. Engineering Report, Kohala Ranch Well No. 4, New Potable Water Source, Kohala Ranch Water System, North Kohala, Hawaii. Consultant Report Prepared for Kohala Ranch Water Company and Submitted to the State Department of Health.
- TNWRE. 1994. Evaluation of Well No. 4 of the Kohala Ranch Water System. Consultant Report Prepared for Kohala Joint Venture.

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ENVIRONMENTAL ASSESSMENT

Kohala Shoreline, LLC Project

TMK: (3rd) 5-9-001:008

Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i

APPENDIX 3

Cultural Impact Assessment

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Cultural Impact Assessment for the Proposed Development of TMK: (3) 5-9-01:008

Kahuāliʻiliʻi Ahupuaʻa
North Kohala District
Island of Hawaiʻi

DRAFT VERSION



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March 2015



Archaeology • History • Ethnography • Architectural History

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Cultural Impact Assessment for the Proposed Development of TMK: (3) 5-9-01:008

Kahuāli‘ili‘i Ahupua‘a
North Kohala District
Island of Hawai‘i

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1. INTRODUCTION

At the request of Mr. Greg Mooers of Mooers Enterprises LLC, on behalf of his client Kohala Shoreline, LLC, ASM Affiliates, Inc. has prepared this Cultural Impact Assessment (CIA) associated with the proposed subdivision and development of TMK: (3) 5-9-01:008 (Figure 1). The project area is within the State Urban District, on land zoned by the County of Hawai'i as RS-15 (single-family residential with minimum lots of 15,000 square feet) in the *ahupua'a* of Kahuāli'ili'i, North Kohala District, Hawai'i Island (Figure 2). Early archaeological work on the subject property included studies by Soehren (1964) and Bonk (1968). Soehren (1964) recorded two small rock cairns, a rock platform, and two open-ended enclosures with associated marine shell and coral within the *ahupua'a* of Kahuā 1 and 2. Bonk (1968) recorded 24 stone features within Kahuā 1. The concentration of Bonk's features that were recorded on the northern side of the current project area was later designated SIHP 4156 during the 1972 Statewide Inventory as the Waiakailio Bay Complex. These studies were of a regional nature and included archaeological survey of large tracts of land of which the study area was only a small part.

Starting in 1983 Paul H. Rosendahl, Ph.D., Inc (PHRI) began a series of archaeological studies that focused on the current project area and adjoining land to the south (Allen 1985a, 1985b; Corbin 2000, 2003, 2004; Graves and Franklin 1998; Kubo and Rosendahl 2003; O'Hare and Goodfellow 1999; PHRI 2000, 2005; Rosendahl 1994). The resultant reports include reconnaissance surveys, an inventory survey, mitigation (preservation and data recovery) plans, and burial treatment plans. More recent work conducted by Rechtman Consulting, LLC and ASM Affiliates, Inc. as follow-up to those studies includes an archaeological data recovery project (Loubser and Rechtman 2007) in coastal Kahuānui, preservation planning (Rechtman 2014) for coastal sites in Waikā, and Kahuānui, and an archaeological inventory survey update for the current study area (Rechtman and Clark 2010). This latter study contains a map that shows the locations of the archaeological sites recorded within the current project area (Figure 3), and contains recommendations for the preparation of additional data recovery, preservation, and burial treatment plans.

Four additional studies are relevant for the current investigation. Maria Ka'imipono Orr completed a cultural impact assessment for a *mauka* portion of Kahuāli'ili'i Ahupua'a associated with a communication tower facility (Orr 2003). Her study contains detailed historical information for both of the Kahuā *ahupua'a*. Kepā Maly prepared a detailed culture-historical background for Kaiholena Ahupua'a (Maly 2000) that included information relative to the general region known as *Kohala waho* or Outer Kohala, of which the current project area is a part. And, the current author prepared two cultural impact assessments, one for the land immediately adjacent to the current project area (Rechtman 2006), and another for a coastal parcel in nearby Pāo'o Ahupua'a (Rechtman 2004). Oral interviews conducted during the former study contain information applicable to the current study area, and information presented during a contested case hearing associated with the latter study is also reviewed in the current study. The information contained in these earlier studies, combined with additional research specific to Kahuāli'ili'i, Ahupua'a, and additional consultation with members of both the North and South Kohala communities form the basis for the interpretations and evaluation presented in the current study.

This report was prepared in support of an environmental assessment in compliance with HRS Chapter 343, and in accordance with the Office of Environmental Quality Control (OEQC) *Guidelines for Assessing Cultural Impact*, adopted by the Environmental Council, State of Hawai'i, on November 19, 1997.

Below is a description of the general project area and the proposed development activities. This is followed by a detailed background section providing setting and context (cultural, historical, and regional) to facilitate a more complete understanding of the potential significance of the cultural landscape and the historic and cultural properties within that landscape. Next, the consultation process is described, which is followed by a discussion of potential cultural impacts and the appropriate actions and strategies that mitigate any potential impacts.

1. Introduction

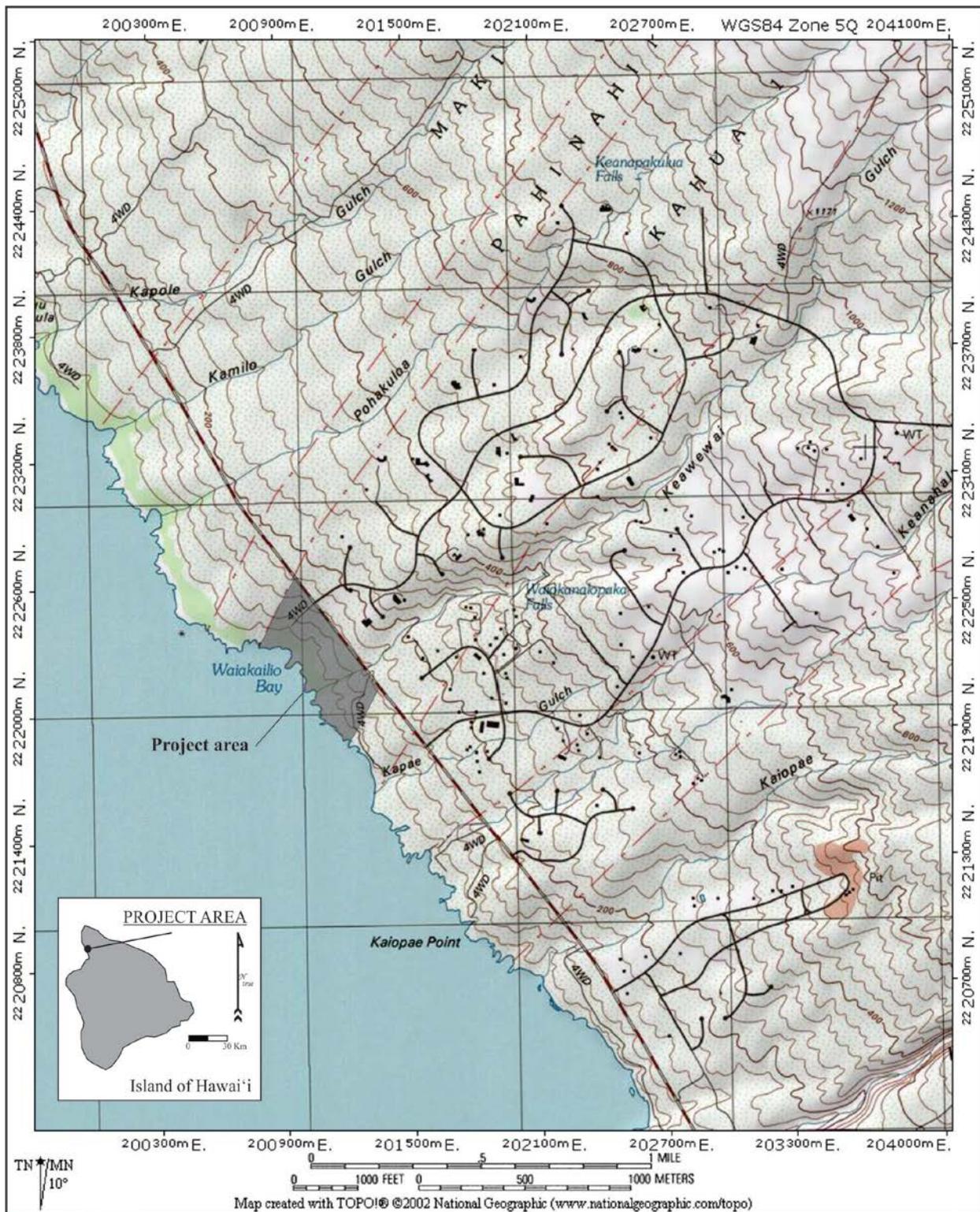


Figure 1. Project area location map.

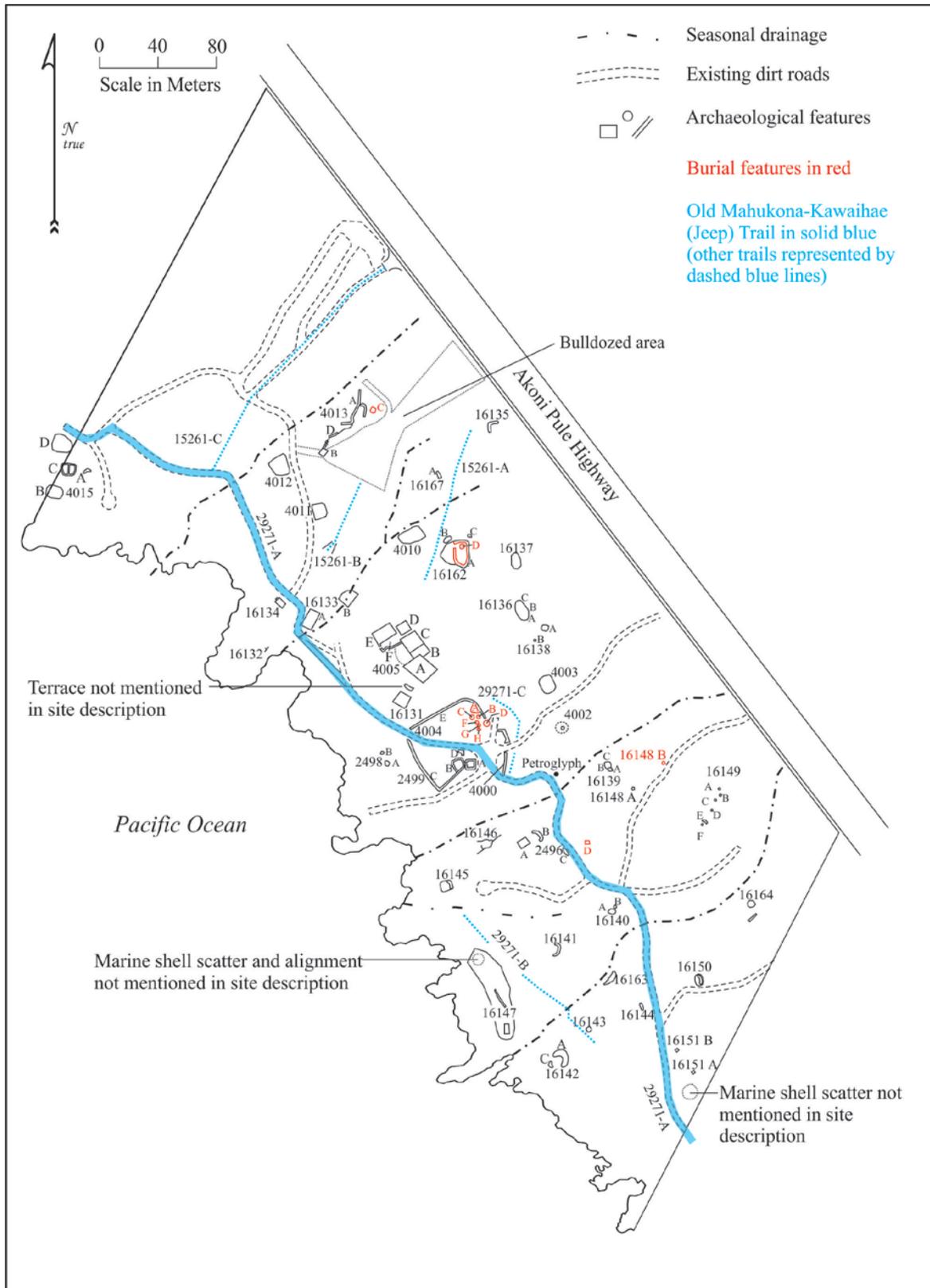


Figure 3. Archaeological sites recorded within the current project area.

2. PROJECT AREA DESCRIPTION AND PROPOSED DEVELOPMENT ACTIVITIES

The project area occupies 37.8 acres along the North Kohala coast, bounded by the ocean to the west and Akoni-Pule Highway (Hwy 270) to the east (see Figure 2). To the north the project area is bounded by undeveloped state land, and to the south by a partially developed privately-owned subdivision (see Figure 2). Elevation within the project area ranges from sea level to about 160 feet above sea level and the surface geology consists of basaltic lava flows from Kohala volcano dating from at least 120,000 years ago (Wolfe and Morris 1996). Soil within the study area is classified as Kawaihae very rocky very fine sandy loam. The sloping terrain is dissected in a few locations by steeply incised drainage channels (Figure 4) and the vegetation is almost exclusively low grasses and *kiawe* (Figure 5). The typical shoreline in this area is rocky (Figure 6) with a few small coral, rock, and sand beach areas (Figure 7). Waiakailio Bay (Figure 8), at the northern end of the property, is the least rocky and most sheltered area along this portion of the coast, and it offers the easiest ocean access.

The proposed development plans (Figure 9) include the establishment of a nine-lot gated subdivision. The property is currently zoned for single-family residential with minimum lots of 15,000 square feet (RS-15), which could allow for the development of over 100 unit. Upon reviewing the project site and development options, the property owner determined that a less dense development would be more appropriate, and is proposing a change of zone to Residential Agricultural 3-acres (RA-3a), which would decrease potential density and lessen impacts to archaeological resources. Road access would be from two locations along Akoni-Pule Highway. The project would be provided with water, electrical, and telephone service from existing lines located within a utility easement above Akoni-Pule Highway. The house sites would be located a minimum of 150 feet below the highway and covenants, conditions and restrictions (CC&Rs) would limit homes to a single story and require color schemes that minimize visual impacts. Landscaping would be installed along the subdivision's two internal roadways and also on the residential lots, subject to CC&Rs. The project includes public shoreline access and associated parking and will preserve a coastal buffer through the establishment of a 100-foot no development shoreline setback for all but Lot 1, which would be subject to the normal 40 foot setback.

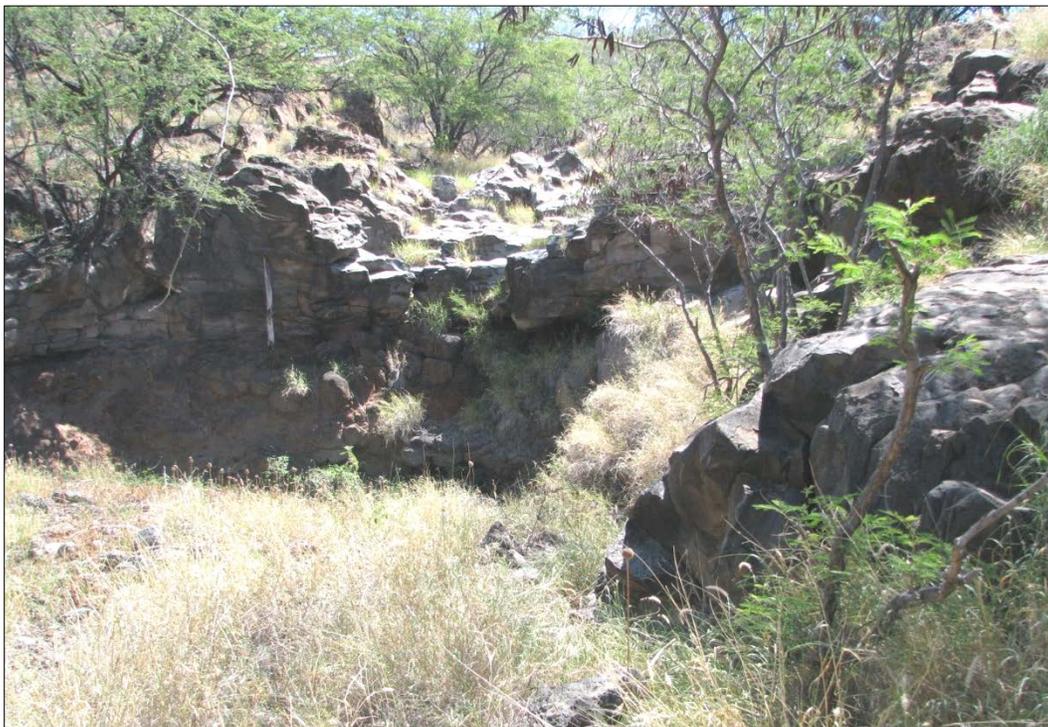


Figure 4. Keawewai Gulch drainage.



Figure 5. Typical vegetation cover across the study parcel.



Figure 6. Typical rocky shoreline along the study parcel.



Figure 7. Typical rocky beach area.



Figure 8. Waiakailio Bay.

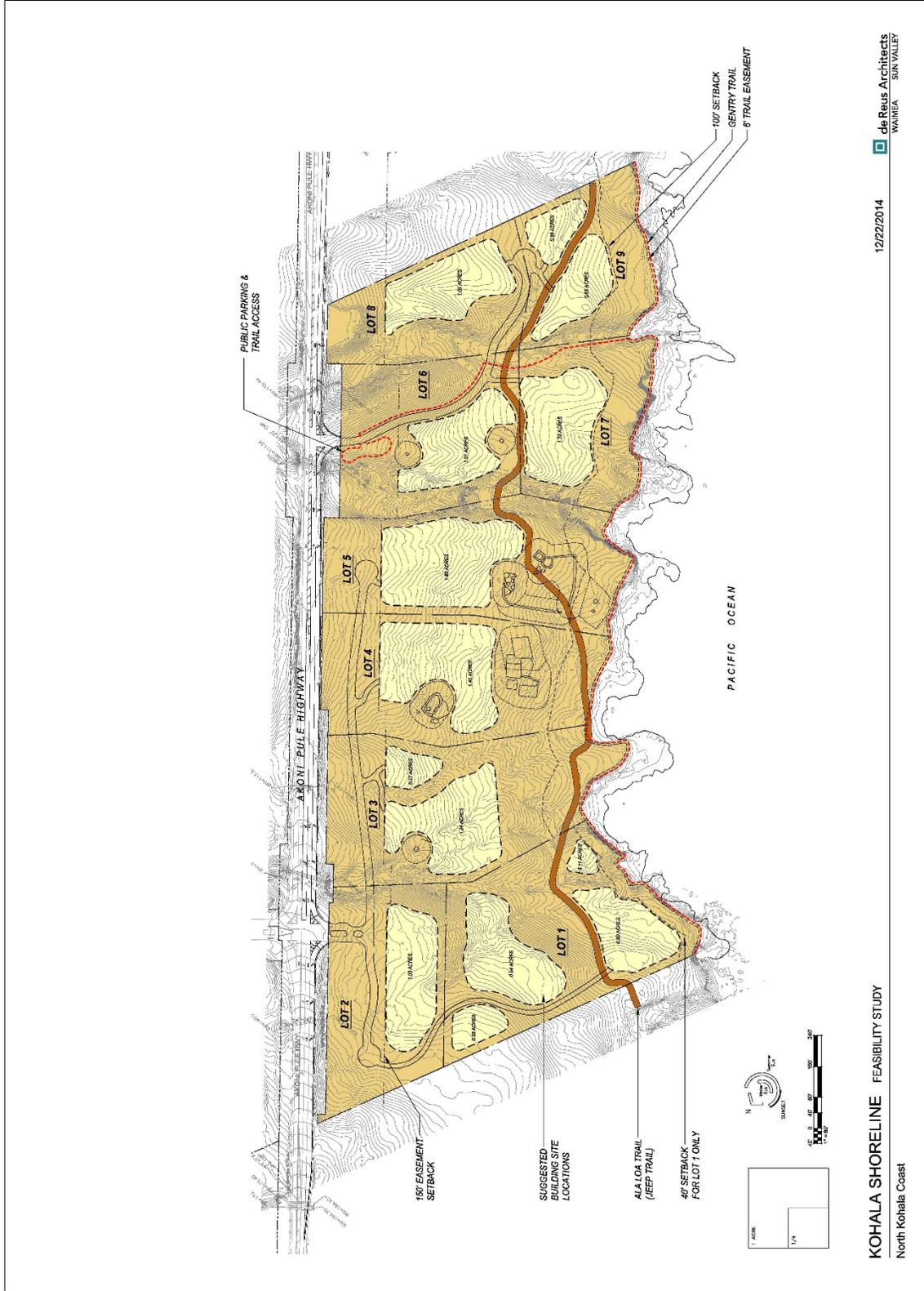


Figure 9. Proposed Kohala Shoreline LLC development plan.

3. CULTURE-HISTORICAL CONTEXT

A GENERALIZED MODEL OF HAWAIIAN PREHISTORY

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

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

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 was 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 later was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985).

The Expansion Period is characterized by the greatest social stratification, major socioeconomic changes, and intensive land modification. Most of the ecologically favorable zones of the windward and coastal regions of all major islands were settled and the more marginal leeward areas were being developed. Early dates from leeward Kohala (Kapa'anui) were reported by Dunn and Rosendahl (1989); these sites are believed to have been temporary campsites (Wulzen et al. 1995). The greatest population growth occurred during the Expansion Period. Subsistence patterns intensified as crop farming evolved into large irrigated field systems and expanded into the marginal dryland areas. The *loko* or fishpond aquaculture flourished during this period (Bellwood 1978; Kirch 1985).

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* Pa'ao settled in the islands during the 13th century. Pa'ao was the keeper of the god Ku'ka'ilimoku, who had fought bitterly with his older brother, the high priest Lonopele. After much tragedy on both sides, Pa'ao escaped Lonopele's wrath by fleeing in a canoe. Kamakau (1991:100–102) told the following story in 1866:

Puna on Hawai'i Island was the first land reached by Pa'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, Pa'ao went on to land in Kohala, at Pu'uepa. He built a *heiau* there called Mo'okini, a *luakini*. It is thought that Pa'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. There were seventeen generations during which Hawai'i Island was without chiefs—some eight hundred years.

There are several versions of this story that are discussed by Beckwith (1976), including the version where Mo'okini and Kaluawilinau, two *kāhuna* of Moikeha, decide to stay on at Kohala. The bones of the *kahuna* Pa'ao are said to be deposited in a burial cave in Kohala in Pu'uwepa [possibly Pu'uepa?] (Kamakau 1964:41).

The concept of the *ahupua'a* was established during the A.D. 1400s (Kirch 1985), adding another component to a then well-stratified society. This land unit became the equivalent of a local community, with its own social, economic, and political significance. *Ahupua'a* were ruled by *ali'i 'ai ahupua'a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua'a* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986).

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* was further divided into smaller sections such as the *'ili*, *mo'o'aina*, *pauku'aina*, *kihapai*, *koele*, *hakuone*, and *kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mo'i* (king). *Heiau* building flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206).

The Proto-Historic Period (A.D. 1650–1795) is marked by both intensification and stress. Wars occurred between intra-island and inter-island polities. Sometime between A.D. 1736 and 1758, Kamehameha I was born in the *ahupua'a* of Kokoiki, North Kohala near the Mo'okini Heiau [there is some controversy about his birth year, see Kamakau 1992:66–68]. The birth event is said to have occurred on a stormy night of rain, thunder, and lightning, signified the night before by a very bright, ominous star, thought by some to be Halley's comet [this is also controversial] (Kamakau 1992). Kamehameha's ancestral homeland was in Halawa, North Kohala (Williams 1919).

This period was one of continual conquest by the reigning *ali'i*. Ke'eaumoku, son of Keawepoepoe, set up a fort at Pololu and Honokane; he was attacked there by Kalaniopu'u, so he moved to Maui. About A.D. 1759 Kalani'opu'u conquered East Maui, defeating his wife's brother, the Maui king Kamehamehanui, by using Hana's prominent Pu'u Kau'iki as his fortress. He appointed one of his Hawai'i chiefs, Puna, as governor of Hana and Kipahulu. Kahekili became king of Maui in A.D. 1766 when Kamehamehanui died following an illness. Ke'eaumoku took his widow, Namahana, a cousin of Kamehameha I, as his wife. Their daughter, Ka'ahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki, Hana, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalani'opu'u and his Hana forces raided and destroyed the neighboring Kaupo district, then launched several more raids on Molokai, Lanai, Kaho'olawe, and parts of West Maui. It was at the battle of Kalaeoka'ilio that Kamehameha, a favorite of Kalaniopu'u, was first recognized as a great warrior and given the name of Pai'ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniopu'u and Kahekili (1777–1779), Ka'ahumanu and her parents left Maui to live on the island of Hawai'i (Kamakau 1992).

HISTORY AFTER CONTACT

Captain James Cook landed in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniopu'u, who was at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. The following January [1779], Cook and Kalaniopu'u met again in Kealakekua Bay and exchanged gifts. In February, Cook set sail; however, a severe storm off the Kohala coast damaged a mast and they had to return to Kealakekua. Cook's return occurred at an inopportune time, and this misfortune cost him his life (Kuykendall and Day 1976).

In 1779 King of the Cook expedition explored the North Kohala country and reported:

As far as the eye could reach, seemed fruitful and well inhabited. [Three and four miles inland, plantations of taro and potatoes and *wauke*] neatly set out in rows. The walls that separate them are made of the loose burnt stone, which are got in clearing the ground; and being entirely concealed by sugar-canes planted close on each side, make the most beautiful fences that can be conceived. [The exploring party stopped six or seven miles from the sea.] To the left a continuous range of villages, interspersed with groves of coconut trees spreading along the sea-shore; a thick wood

behind this; and to the right, an extent of ground laid out in regular and well-cultivated plantations . . . as they passed, they did not observe a single foot of ground, that was capable of improvement, left unplanted. (Handy and Handy 1972:528)

Around A.D. 1780 Kalani'opu'u proclaimed that his son Kiwalao would be his successor, and he gave the guardianship of the war god Ku'ka'ilimoku to Kamehameha. Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalao did not seem to honor, so after usurping Kiwalao's authority with a sacrificial ritual, Kamehameha retreated to his district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). After Kalani'opu'u died in A.D. 1782 civil war broke out: Kiwalao was killed. The wars between Maui and Hawaii continued until A.D. 1795 (Kuykendall and Day 1976; Handy and Handy 1972).

In 1790 two Western ships, the *Eleanora* and *Fair American*, were trading in Hawaiian waters. As retribution for the theft of a skiff and the murder of one of the sailors, the crew of the *Eleanora* massacred more than 100 natives at Olowalu [Maui]. The *Eleanora* then sailed to Hawai'i Island, and one of its crew, John Young, went ashore, where he was detained by Kamehameha. The other vessel, the *Fair American*, was captured by the forces of Kamehameha off the Kekaha coast and its crew was killed except for one member, Isaac Davis. Kame'eiamoku, who resided in Ka'ūpulehu at the time, played a lead role in this incident. He and his followers recovered several foreign arms from the *Fair American*, including a cannon that they called "Lopaka", all of which were turned over to Kamehameha (Kamakau 1992). Kamehameha made Young and Davis his advisors. He also kept the vessel as part of his fleet. With the aid of his new advisors, new ship, and foreign arms Kamehameha conquered Maui, and by 1796 he had conquered all the island kingdoms except Kauai. It wasn't until 1810, when Kaumuali'i of Kaua'i gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *ali'i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners had introduced the concept of trade for profit, and by the time Kamehameha I had conquered O'ahu, Maui and Moloka'i, in 1795, Hawai'i saw the beginnings of a market system economy (Kent 1983). This marked the end of an era of uniquely Hawaiian culture.

Hawai'i's culture and economy continued to change drastically as capitalism and industry established a firm foothold. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Kamehameha I died on May 8, 1819 at Kamakahonu in Kailua-Kona, and once again the culture of Hawai'i was to change radically. Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death a period of *'ai noa* (free eating) was observed along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs saw a change:

The death of Kamehameha was the first step in the ending of the tabus; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating (*'ainoa*) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-ali'i, and in most of the histories of ancient rulers. Free

eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992: 222)

Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After purification ceremonies Liholiho returned to Kamakahonu:

Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief's tabu and the freeing of the eating tabu. The *kahu* said to the chief, "Make eating free over the whole kingdom from Hawaii to Oahu and let it be extended to Kauai!" and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali'i consented to the free eating and it was accepted on Kauai. (Kamakau 1992: 225)

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstated the eating *kapu* but others appear to have thought otherwise. Liholiho's cousin, Kekuaokalani, caretaker of the war god Kū'kā'ilimoku, revolted, but by December of 1819 the revolution was quelled. With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai'i to Kaua'i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. Kamehameha II sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the 'aumakua worship, to continue (Oliver 1961; Kamakau 1992).

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawaii. They arrived in Kailua-Kona on March 30, 1820 to a society with a religious void to fill. Many of the *ali'i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopt their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the sandalwood trade was wreaking havoc on the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali'i* who were no longer under any traditional constraints (Oliver 1961; Kuykendall and Day 1976). On a stopover in the Kohala district Ellis wrote:

About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young. . . . Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Kuykendall and Day 1976:42, 43; Ellis 1963:397)

The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai'i went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry. The windward portions of North Kohala became a center of sugarcane production, although sugarcane cultivation in Kohala had its origins in prehistory.

Pukui (1983) cites two proverbs that reference both Kohala and sugarcane. She provides an explanation and notes that Hawaiian proverbs have layers of meaning that are best left to the imagination of the reader:

He pa'a kō kea no Kohala, e kole ai ka waha ke 'ai
A resistant white sugar cane of Kohala that injures the mouth when eaten.

Pukui explains this proverb as follows:

A person that one does not tamper with. This was the retort of Pupukea, a Hawai‘i chief, when the Maui chief Makakuikalani made fun of his small stature. It was later used in praise of the warriors of Kohala, who were known for valor (1983:95).

I ‘ike ‘ia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha.

One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed.

Pukui interprets this proverb as follows:

When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong (1983:127).

Sugarcane (*Saccharum officinarum*) was a Polynesian introduction and served a variety of uses. The *kō kea* or white cane was the most common, usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy and Handy 1972:185). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children’s teeth by chewing on it (Handy and Handy 1972:187). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odoratissimus*) were not abundant (Malo 1903). Sugarcane was also used in relation to taro and sweet potato. Handy and Handy (1972:186) explain:

In wet-taro farming, cane was planted along the embankments separating the flooded terraces and flats. In dry-taro and sweet-potato fields on the sloping *kula* or in the lower forest zone, cane was planted as hedges along the lines of stone and rubbish thrown up between the fields. Thus it helped the planter to utilize to the maximum his soil and water, and acted as a windbreak against the gusty breezes which blow in most valley bottoms, along the coasts, and on the uplands where taro is grown.

Sugarcane was grown on all islands, and when Cook arrived he wrote of seeing sugarcane plantations. The Chinese on Lāna‘i are credited with producing sugar first, as early as 1802. However, it was not until 1835 that sugar became established commercially, replacing the waning sandalwood industry (Oliver 1961, Kuykendall and Day 1976).

Kohala became a land in transition and eventually a major force in the sugar industry with the arrival of American missionary Elias Bond (KTF 1975). In her comprehensive study of North Kohala, Tomonari-Tuggle relates this transition:

The arrival in 1841 of Elias Bond, of the Protestant American Board of Commissioners for Foreign Missions, to Kohala marked the beginning of a 22-year period of transition in the district’s history. In those years a new religion, a new land tenure system, and a changing economy altered the lifestyles and world view of the indigenous population of the district. The Kohala community was in flux, attempting to find a firm footing in a changing world, in a much larger network of social, political, and economic interactions than had previously existed. (Tomonari-Tuggle 1988:I-23)

When Elias Bond directed his efforts to initiating sugar as a major agricultural industry in Kohala, he could not have foreseen the incredible success of his modest venture. His primary concern was to develop a means for the Hawaiian people of the district to compete successfully in the market economy that had evolved in Hawaii. What resulted was a vigorous, stable, and competitive industry which survived over a century of changing economic situations. For the Hawaiian people, however, the impact was not what Bond anticipated. (Tomonari-Tuggle 1988:I-39)

In 1860 Rev. Bond engaged Samuel N. Castle in founding the Kohala Sugar Company on lands owned by Bond and his neighbor Dr. James Wight. The first crop was harvested in January 1865 (KTF 1975). Kohala’s transition was a reflection of what was happening elsewhere in Hawai‘i as the sugar industry grew. The industry brought in tens of thousands of laborers from Asia, Europe, the Americas, Oceania, and Africa to work on the many plantations and mills that were being established on all major islands (Oliver 1961). This influx not only radically changed the culture, but also drastically altered agricultural lands and destroyed traditional architectural features in the process. The drier leeward portions of Kohala were not suited for cane cultivation and thus became vast pasturelands for grazing cattle.

A GENERALIZED SETTLEMENT MODEL FOR *KOHALA WAHO*

The following summary of settlement patterns for the leeward coast of North Kohala follows earlier regional models (Rosendahl 1972; Griffin et al. 1971; Tomonari-Tuggle 1988) and takes into account observations and information contained in traveler, missionary, and Kingdom records (Maly 2000).

Evidence for early occupation of Kohala has been collected from Kapa'anui. Dunn and Rosendahl (1989) recovered radiocarbon samples that potentially date to as early as A.D. 460 (Site 12444). This early date may be related to the establishment of small, short-term camps to exploit seasonal, coastal resources. Data recovered from Mahukona suggest initial occupation there by A.D. 1280 (Burgett and Rosendahl 1993:36). The earliest date range for permanent settlement in Kohala (A.D. 1300) was obtained from Koai'e, a coastal settlement where subsistence primarily derived from marine resources. According to Tomonari-Tuggle (1988:13), these resources were probably supplemented by small-scale agriculture.

The period from A.D. 1300–1500 was characterized by population growth and expanded efforts to increase upland agriculture. Rosendahl (1972) has proposed that settlement at this time was related to seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites were occupied during the winter months, with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well, according to Hommon (1976). Hommon argues that kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua'a* system. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to permanent dispersed occupation of both coastal and upland areas.

This pattern continued to intensify from A.D. 1500 to Contact (A.D. 1778), and there is evidence that suggests that there were substantial changes to the political system as well. Within Kohala, the Great Wall complex at Koai'e is organized with platforms in the complex apart from contemporaneous features. Griffin et al. (1971) interpret this as symbolizing class stratification. By AD 1600, 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 this unification 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).

By the time of contact, numerous coastal villages and extensive dryland agricultural systems were in place in North Kohala. The *ahupua'a* system of social organization was also firmly established by this time, with defined land units extending from the mountains to the sea. The *ahupua'a* were controlled by local chiefs, and were integrated at the district level. Districts were ruled by paramount chiefs through a system of taxation and redistribution. Social stratification was defined by a class separation between the ruling *ali'i* (chiefs) at one end, and the *maka'ainana* (commoners) at the other. Kamehameha I eventually united the Island of Hawai'i, and ultimately all of the Hawaiian Islands, and freely participated in the European-introduced market economy.

The earliest detailed written descriptions of the region are contained in the Journal of William Ellis (1963), an English Missionary who traveled through the area in 1823. Two of his journal entries are of particular relevance: a visit to the villages of Owawarua [Awalua] (just south of Kukuipahu) and Hihiu (Māhukona), and an account of the coast between Towaihae [Kawaihae] and Māhukona related to him by one of his companions: Lorrin Thurston.

About three p.m. we reached Owawarua, a considerable village on the north-west coast, inhabited mostly by fisherman. Here we tried to collect a congregation, but only three women and two small children remained in the place, the rest having gone to Waimea to fetch sandalwood for Karaiomoku. From Owawarua we passed on to Hihiu, where we had an opportunity to speak to a small party of natives.

In these villages we saw numbers of canoes and many large fishing nets, which are generally made with a native kind of flax, very strong and durable . . . In taking fish out of the sea, they commonly make use of a net, of which they have many kinds, some very large, others mere hand-nets; they occasionally employ the hook and line, but never use the spear or dart which is a favourite weapon with the southern islanders.

Quantities of fish were spread out in the sun to dry, in several places, and the inhabitants of the northern shores seem better supplied with this article than those of any other part of the island. . . .

Being considerably fatigued, and unable to find any fresh water in the village, we procured a canoe to take us to Towaihae, from which we were distant about 20 miles. Though we had numbered, in our journey today, 600 houses, we had not seen a thing like four hundred people, almost the whole population being employed in the mountains cutting sandalwood. It was about seven o'clock in the evening when we sailed from Hihii, in a single canoe. (Ellis 1963:285-286)

On the 23d Mr. Thurston left Towaihae, and walked along the shore towards the north point ['Upolu]. About noon he reached the small village, called Kipi [North of Kahuāli'ili'i], where he preached to the people; and as there was only one village between Kipi and the place where I had preached on Wednesday evening [Hihii/Māhukona], he retraced his steps to Towaihae. He preached at another four villages on his return [perhaps at settlements within or adjacent to the current project area], where the congregations, though not numerous, were attentive . . . The coast was barren; the rocks volcanic; the men were all employed in fishing; and Mr. Thurston was informed that the inhabitants of the plantations, about seven miles in the interior, were far more numerous than on the shore. In the evening he reached Towaihae. (Ellis 1963:288)

Ellis (1963), whose colleague Thurston traveled through the project area in 1823, not only noted a barren coastline, but also limited cultivation around settlements. Early travelers' accounts indicate that managed stands of trees normally occurred near settlements; these included coconut, *lauhala* (*Pandanus* sp.), *loulu* (*Prichardia* sp.), *milo* (*Thespesia populnea*), and *kou* (*Cordia subcordata*). Hawaiians in general cultivated a number of tropical root, tuber, and tree crops, the most important being taro (*kalo*, *Colocasia esculanta*) and sweet potato ('*uala*, *Ipomoea batatas*). Planting, tending, and harvesting crops was typically men's work, although women weeded and maintained dry land fields (Kirch 1997:2).

Dry taro was grown in the lower forest zone farther up the slopes of Kohala Mountain (Handy and Handy 1972:531). According to Handy and Handy this forest used to extend further *makai* over what is now open pasture. Wet taro was grown in small pockets wherever even intermittent streams flowed (ibid.). However, sweet potato was probably the main source of carbohydrates for people who lived in the dry *kula* lands (ibid. 532). According to Maly (1999), mounds were mulched with sugarcane refuse, known as *Pu'u-'aina-ko*; and this is recorded as a regional name for the fields that once occurred within the general vicinity of the project area. Taken together, orally transmitted accounts and documented eyewitness accounts seem to suggest that the project area was far more luxuriant than what is currently the case.

In 1825 Thurston told Ellis (1963:408) that people living in the wooded and upslope part of the Kohala coast interior "were far more numerous than those of the sea-shore." It is conceivably the people from this area that Menzies (1920:56) observed in 1793 as carrying timber from the uplands to the coast. That people laboring in the uplands were the same as those fishing along the coast, however, is attested by Ellis's 1823 observation of "inhabitants of the northern shores...being employed in the mountains cutting sandalwood" (Ellis 1963:409). Apart from cultivating fields and using inland resources, Ellis (1963:408) observed that inhabitants of the settlements in the project area fished extensively in the nearby ocean. This is substantiated by Varigny's (1981:73) observation in the 1850s that within leeward Kohala "are rich in fishing grounds...the seas was covered with small native canoes, shaped from hollowed logs and balanced by a cross-beam, or outrigger, and nearly all equipped with triangular sails." In Hawai'i it was the ocean that yielded the greatest variety and abundance of protein. Hawaiian fishermen used varied techniques and tools to obtain food from inshore reefs to deeper benthic waters, including bone and shell fishhooks, spears, traps, nets, and weirs. Women gathered mollusks, sea urchins, and seaweed from rocky headlands and bays (Kirch 1997:3).

In addition to being accomplished extractors of food from the ocean, Polynesians brought domestic pigs, dogs, and fowl with them to Hawai'i and raised a substantial number of these animals for food. Within the vicinity of the project area, much of the produce and pigs seem to have been raised in the uplands and brought down to the shore. Furthermore, it is in the uplands that commoners mostly labored, while aristocrats tended to live along the shoreline. The use of *mauka/makai* trails facilitated transhumance between the different ecological areas. Old Hawaiian tales also bear witness to this spatial link between coast and interior and the social relationship between aristocrat and laborer. It is to some of these traditional stories that the discussion now turns, dealing specifically with those that mention natural features in the vicinity of the project area by name. Many of the place names are no longer used, but their meanings indicate particular uses or features of the named locations or their direct or metaphorical associations with historical personages (Maly 2000:53).

3. Culture-Historical Background

According to Maly (2000:28), traditional Hawaiians see all things and people within their environment as being interrelated; those from the coastal lowlands were linked to those from the interior uplands. The *ahupua'a* as a land unit was the thread that bound these things and people together. An *ahupua'a* was typically under the control of an appointed *konohiki*, or chief-landlord of lower rank. This person answered to an *ali'i-ai-ahupua'a*, or chief who controlled the *ahupua'a* resources. The *ali'i-ai-ahupua'a* in turn answered to an *ali'i 'ai moku*, or chief who claimed the produce from the entire district that combines a number of *ahupua'a*. Produce from the *ahupua'a* accordingly not only supported the laborers, or *maka 'āinana*, but also supported the royals, or *ali'i*. The ideology that accompanied the social relations of production between these two classes and its representation of the environment are aptly recalled in various traditional Hawaiian tales.

Native Hawaiians succinctly compare the Kohala peninsula with a built structure. According to the Hawaiian language newspaper *Ka Hoku o Hawai'i* (1917) (as quoted by Maly 1999), two prominent volcanic cinder cones on Kohala Mountain are referred to as “the ridge pole” of the area, “which bear the winds, rain and sun of this famous land on their back.” Traditions reputedly dating back to the 1600s described the leeward coast of Kohala as “containing many houses” (Kamakau 1961:56) “with men to every point of the land.” (Pukui 1983:1973). What we see here then is conceivably a portrayal of the Kohala landscape as one massive house containing many people. That this structure is animated by the strong winds can be seen in the poetic allusion of the paired cinder cones as being “two traveling hills...which follows behind one like a lover.” In another account the “two traveling hills” on Kohala Mountain act “like a sweetheart nestled fondly in the bosom of love . . .” (Maly 2000:38). In a third story these two traveling hills are said to “mystify men.” (Maly 2000:40). Accounts such as these strongly suggest that certain landscape features were anthropomorphized; not only was the environment intricately linked to human affairs and actions, at times the environment behaved in a human fashion.

According to Pukui et al. (1974) the name *Kahuā* means “the jealous one.” Interestingly, *Kahuā* is also called *koai'e*, a native hard wood (*Acacia koaia*) similar to *koa* that is associated in a traditional chant with a commoner who was in close pursuit of his aristocratic girlfriend (Colum 1937). All-in-all, indigenous tales seem to intricately link landscape features and legendary personages within the general project area. Closer scrutiny of such tales, some of which could have great antiquity, may throw light on former ideological conceptions, social divisions, and how these affected the general use of the environment and its resources.

The term *kahuā* is mentioned in a legend that supposedly dates back to the thirteenth-century joint reign of two Kohala paramount chiefs known as *Hikapoloa* and *Kapa'au-iki-a-Kalana* (Maly 1999). In this legend *kahuā* is the name given to comparatively open and level locales where people gathered for competitive sports, not unlike the flat pebble beaches at the mouths of *Keanahalululu* and *Keawewai* gulches. In the legend, *Keanahalululu* is the name of a male commoner who tended the sugarcane of a local female chief known as *Keawe*. *Keanahalululu* also refers to the roaring sound that wind makes when blowing through a cave or narrow gulch. In the legend it is *Keanahalululu* who accompanies royal visitors from a neighboring area to his female chief *Keawe*, very much like the virtually ever-present wind that greets travelers through the district of Kohala. To the south of the current project area is *Keanahalululu* Gulch, and *Keawewai* Gulch is within the project area. The term *Ke-awe-wai* in fact means narrow watercourse, or the water of the female chief *Keawe* (Maly 1999).

The pairing of *Keanahalululu* and *Keawewai* Gulches on the natural landscape is perhaps echoed by the pairing of legendary personages with the same names in the following ways: male and female, commoner and aristocrat, wind and water. These related sets of oppositions also seem to be expressed in another legend where a commoner male named *Hiku* follows an aristocratic female known as *Kawelu* below the water of the ocean from his farming abode in the Kohala uplands. This brings to mind the *mumuku* wind that sweep down the slopes of Kohala Mountain into the sea immediately below, which forces the surface of the water to boil and seemingly open up in places. Moreover, the commoners *Keanahalululu* and *Hiku* were not allowed to consume certain foods reserved for the aristocrats *Keawe* and *Kawelu*. Though resentful of this prohibition the male commoners nonetheless came to the aid of their female rulers when they were in jeopardy. Perhaps this shows that the opposition between commoner and aristocrat is reminiscent of the opposition between persistent winds (i.e., constant labor) versus fluctuating rains (i.e., change of rulers and/or their power). Like the ultimate interdependence between wind and rain, traditional Hawaiians conceivably used this observable natural relationship as an apt metaphor for an idealized interdependence between socioeconomic classes; commoners supplied aristocrats with food but in the end relied on aristocratic mediation with the spirit world and maintenance of intra- and inter-regional affairs (e.g., Kirch 1997:6-7).

As early as the 1830s, missionaries in Kohala noting that “deaths are more numerous than births; [h]ence the population is decreasing” (Doyle 1953:72), began compiling census records by *ahupua‘a*. In an 1835 census, Kahuā (combined) is listed as having a resident population of 256 (Schmidt 1973:27), documenting a sizeable population. Traditional and historical accounts indicate that the residents of the *ahupua‘a* in *Kohala waho* lived both along the coast in fishing villages and in the uplands near the agricultural systems. It is interesting that within Kahuā there were 256 residents recorded in 1835, and that eleven years later in 1846 there was only one claimant for a *kuleana* in Kahuānui during the *Māhele*; the claim was not awarded having been contested by Kekūānāo‘a.

Traditional land use patterns saw a rapid shift after the *Māhele* in 1848. By the mid-19th century, leeward settlement shifted to the windward side of North Kohala as the leeward, agriculturally marginal, areas were abandoned in favor of more productive and wetter sugarcane lands. In addition, native populations were decimated by disease and a depressed birth rate. According to Tomonari-Tuggle (1988:37), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. Settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. At this point most communities were centered on sugar mills and became part of the plantation social hierarchy. Much of the coastal land in leeward North Kohala was used as cattle pasture. Walled complexes became the dominant residential structure for those remaining leeward settlements as families enclosed their holdings to protect them from feral cattle and to clearly define their *kuleana* boundaries.

Kahuāli‘ili‘i Ahupua‘a

Kahuāli‘ili‘i Ahupua‘a is one of the three southernmost *ahupua‘a* of the North Kohala District (only Kahuānui Ahupua‘a and Waikā Ahupua‘a, along the North Kohala/South Kohala boundary, are further south; see Figure 2). During the *Māhele* of 1848 all three of these *ahupua‘a* were awarded to *ali‘i*. Kahuāli‘ili‘i was awarded to Lot Kapuāiwa (Kamehameha V) as LCAw. 7715:5, Kahuānui was awarded to Victoria Kamamalu (Lot’s Sister and last Kahina-Nui of Hawai‘i) as LCAw. 7713:4, and Waikā was awarded to Gina Lahilahi (daughter of John Young) as LCAw. 8020-B:2. Pahinahina Ahupua‘a, bordering Kahuāli‘ili‘i Ahupua‘a to the north, was retained as Government Land. There were no *kuleana* awarded within Kahuāli‘ili‘i Ahupua‘a during the *Māhele* of 1848.

By 1857 Kahuāli‘ili‘i had been leased by Lot Kapuāiwa to G. W. Macey, who also leased Waikā Ahupua‘a from Victoria Kamamalu in 1859 (Graves and Frankilin 1998). An 1859 map of Kahuāli‘ili‘i prepared by S. C. Wiltse (Figure 10) shows a “Road to Macy [sic] and Vida’s Ranch” that extends from the coast within the current project area (labeled “Waiakailio Landing”) inland towards Kahuānui and Waikā *ahupua‘a*, suggesting that Macey had leased the lands for ranching purposes, and that Waiakailio Bay was the landing for the ranch. Later Boundary Commission testimony (in 1873; see below) indicates that the houses belonging to Macey and Vida were located near the Kahuānui/Waikā boundary close to the Government Road, well *mauka* of the current project area. Ownership of Kahuāli‘ili‘i and Waikā, which would eventually become part of Kahuā Ranch, changed hands several times during the second half of the nineteenth century. In the 1890s these lands sold (along with other lands) to John Maguire, who managed Huehue Ranch in Kona. In about 1895 Mr. Maguire sold a half interest in the Kahuā lands to James Frank Woods, who then assumed management of the property and later purchased the half interest that John Maguire still held (Henke 1929).

In 1862, to certify the boundaries of the *ahupua‘a* awarded during the *Māhele*, the Kingdom of Hawai‘i established the Boundary Commission. The primary informants for the boundary descriptions were elder native residents. Their testimony provides a wealth of information concerning the locations of place names and landmarks. Some of the witnesses also inform about the functions of certain areas on the landscape (e.g., resting places, residential areas, agricultural plots, fishing grounds, boundary markers). This information is very useful when interpreting archaeological features as elements of a cultural landscape. Many of the locations referenced in the boundary testimony are depicted on a map of the lands of Waikā and Kahuāli‘ili‘i prepared by A. B. Lobenstein in 1903, the year when the boundaries of those *ahupua‘a* were officially set (Hawai‘i Registered Map No. 2231; Figure 11). The 1903 map also shows the route of the *ala loa* (coastal trail) between Kawaihae and Mahukona across the current project area.

3. Culture-Historical Background



Figure 10. 1859 map of Kahuāliʻiliʻi prepared by S. C. Wiltse showing the current project area.

Hearings for establishing the boundaries of Kahuāli‘ili‘i (also known as Kahuā 1st) began in November of 1873, roughly one year after Lot Kapuāiwa died; apparently the *ahupua‘a* became part of his father’s (M. Kekūānāo‘a) estate. The boundaries were not officially set until December of 1903, by which time the land in question had been acquired by James Woods. The 1873 boundary testimony reads as follows:

Kaili, kane, sworn, I was born in Kohala at the time of the great famine, now live in Kokio; know the boundaries of Kahualilii. Kiha, my Father and Pohina, my Uncle, showed them to me. I do not know all the boundaries between Kahuanui and Kahualilii. Bounded on the north side at shore by the land of Pahinahina, commencing at a cave called Lehua, the boundary runs makai to a point at the sea shore called Kananakauwa; thence it runs mauka to a pile of rocks at Lehua; thence mauka to an ahu named Panipani; thence mauka to another pile of stones and thence to a place, called Kilohana where there is a pile of stones that Kahuhu and I built when Wiltse was surveying. Kilohana is an old resting place; thence mauka to Ahuaele; an ahua with a pile of stones on it; thence mauka to Pahukinikini, [page 139] a small ahua with a pile of rocks on it; thence to Puuolani hill, this is along the land of Pahinahina; that was sold to Makuaole and is now owned by Kanehaloa of Puuehuehue; thence to Lolelole, the mauka corner of land sold; thence mauka to Ahaloa, an old kauhale at the mauka corner of Pahinahina; thence along Makeloa (belonging to Kamehameha & Estate); thence the boundary runs mauka to Kalolo, a water hole in a gulch, thence across the gulch and mauka along the land of Kalala; thence mauka to Puukoa; a hill of Koa, at the mauka corner of Kanehalo’s land; thence along Kailikea, a land mauka of Puukoa (Wiltse, in surveying, cut off a corner of Kalala, and ran the line to Holeipalaoa gulch); there is a rock there on the mauka side of the gulch marked KK; thence it is bounded by Kehena to Kilohana on Honokane pali (Note See Certificate of boundaries of Kehena); Thence along Honokane pali towards Waimea, to the Waimea side of Puuwau hill, the boundary being some distance this way of the kauhale; Bounded at shore by a small gulch called Haaho, a rock marked K is at this place; thence up the gulch to an ahua; thence up to where Keawewai gulch crosses Haolo gulch; thence the boundary runs up the north side of the gulch; thence to a place called Kapakamakahonu; thence to Pohakuloa, a large rock in the gulch; thence to an ahua; thence to Kawaihae Government road; thence to Puuala; thence to Niupaa, a bullock pen, the boundary passing through the center of the pen. Thence it crosses the Government road to the wire fence some distance to the north of Upida’s [Vida’s?] old house; thence to Puumanu; thence to the south side of Ahumoa; thence on the north side of Waiakananaula, a water place; thence to Puuiki and from thence to Honokane pali.

Boundary Commission hearings for Kahuānui Ahupua‘a (also known as Kahuā 2nd), which shares a boundary with Kahuāli‘ili‘i Ahupua‘a also began in November of 1873, but the boundaries were not set until June of 1905. The petitioner and owner of the land was James W. Austin, who had acquired the land from Victoria Kamamalu and M. Kekūānāo‘a in 1862 (Graves and Franklin 1998). By the time the boundaries were set in 1905 Austin had died and the lands had passed on to the Austin Estate. The 1873 boundary testimony for Kahuānui reads as follows:

Kekua, kane, sworn, I was born at the time of Aepapa and have always lived at Kahua until lately. Kahuanui is bounded on the Kona side by Waika. Commencing at the mouth of a gulch the boundary between the Ahupuaa and Kuponon begins at a landing place called Kaiopae; thence mauka along the Kuponon to Ahukuli, a pile of stones; thence mauka to Puueoka, a heiau; thence to along stone named Pohakuloa; thence to Kamakaiwi, a resting place; thence to Kapio; thence to Ahumoa, the boundary running through the hills; thence to Puuiki; thence to Kanoa, where fire used to be; Thence to Kahawaikukae, to pali of Kahawaiki; thence to Kahawaiholopapa; thence to Ainamakanui at the head of Honokane Gulch.

The kuponon Kahawainui, Kukui runs up here. Waika ends at Pahoakala, a place where they used to gather mamaki. This is as far as I [page 145] know the boundaries on this side. I have heard that the land runs down to Mahiki in Hamakua. When Lyons surveyed Waika he cut across the kuponon of Kahua and included them in Waika. Know a place called Ahuanaha. The real boundary is from Oneloa to Kapai, a pile of stones by the road; thence to Kamamukaa, where the gulch is the boundary between Waika and Kahua. The boundary crosses the gulch to the Kohala side at Ahuanaha; thence it runs to Ahuakapaakea; thence mauka to Kalehua; thence up the gulch to Moalau (The pile of stones is way on the Kohala side of the gulch, but the boundary is at the gulch). Thence past Macy’s (G.W. Macy’s) old house and mauka to Hookeke; thence to kahawai Palapalai; thence mauka to the pali of Kaloloulaula on Pili; thence to Kapohoakala; thence along to Kahaliaina, a place below

Puupala, where Kawaihae joins Kahua. From Kahaliaina the boundary runs along the foot of the pali to just above Puuwau on Kahuanui. Puuwau is a hill a short distance back from Pili; thence to Hinamakanui, a cabbage garden on the brow of Honokane pali. The boundary at shore between Kahuanui and Kahualiili is a rock in the middle of the sea called Kahuapopolo. (Note: Kaauwai, kane puts the boundary a few rods on the Kohala side of this rock.)

Thence to Waiakanalopaia, a pool of water at the end of the gulch, thence to Pohakupalalaha, a wall below the road to Kawaihae, now called Kamakahonu; thence to Waiklio gulch; thence the boundary runs to a stone called Pohakulao; thence mauka across Pohakulao gulch to Puanau, a resting place; thence to Puuala; thence Kipawale, a resting place at the Government road; thence to a hill called Ahuamanu; thence to Waiakapiai; thence to Ahumoa, part of which is on Kahua and part on another land. This is all I know of the boundaries.

Frank Woods continued to ranch the Kahuā lands throughout the first half of the twentieth century. The 1913 U.S.G.S. Kawaihae quadrangle shows some of the ranch's infrastructure, including a trail labeled "Beach Trail" that leads to the coast within the current project area (Figure 12). This trail alignment appears to be similar to the road alignment (to Macy and Vida's Ranch) that is shown on the 1859 map of Kahuāli'ili'i prepared by S. C. Wiltse (see Figure 10). By the 1920s, Woods was leasing much of the area to Ronald Kamehameha o Ka Hae Hawaii von Holt and Herbert Montague Richards, Sr., who had both come to Hawai'i from O'ahu to pursue cattle ranching. By the late 1920s to early 1930s, von Holt and Richards had purchased the lands they were leasing from Woods as well as Kahuānui from the Austin heirs, thus consolidating the Kahuā *ahupua'a* with Waikā Ahupua'a into what has become known as Kahuā Ranch (Langlas 1994). A map of Kahuāli'ili'i, Kahuānui, and Waikā *ahupua'a* filed on July 15, 1931 with Land Court Application 1043 (Figure 13) shows some additional ranching infrastructure within these *ahupua'a* including a fence line that extends to the coast within the current project area and a trail, labeled "Ancient Trail", that follows the southern edge of the fence to the coast where it meets the *ala loa*. Both of the trail alignments depicted on the 1931 map are different than the alignments depicted on older maps. The *ala loa*, which is also labeled as the "Mahukona-Kawaihae Trail", is shown further inland at the southern end of the current project area than it is on the 1903 map (see Figure 11). Also, the *mauka/makai* trail is located further north than the road shown on the 1859 map (see Figure 10) and the trail shown on the 1913 U.S.G.S. map (see Figure 12), suggesting that both of these trails had been realigned by 1931. It was during the court proceedings associated with these land court applications that the pre-Jeep road Mahukona-Kawaihae Beach Trail was described as having a five foot width. The legal proceedings were conducted over a seven year period and were focused on establishing legal ownership of several adjoining parcels and roadway corridors traversing those parcels. The final ruling of the courts during these proceedings was that the Territory of Hawai'i would relinquish any claims to the Mahukona-Kawaihae Beach Trail in exchange for ownership of the Kohala to Kawaihae Road (the current Kohala Mountain Road), thus the current project area remained in the ownership of Kahuā Ranch with no encumbrances. Although no longer a public right-of-way, the coastal *ala loa* continued to serve as a non-vehicular access corridor between Mahukona and Kawaihae. The *ala loa* trail was improved for vehicular travel in the early 1940s in conjunction with the U.S. Army's efforts to provide an adequate coastal defense system during WWII. Subsequent to WWII, Kahuā Ranch maintained the roadway across their lands for ranching, transportation, and recreational uses.

According to Langlas (1994), the partners, Richards and von Holt, eventually expanded Kahuā Ranch through leases and purchases of private land to almost 30,000 acres. Orr (2003:46) describes that although Herbert, Sr. served on the board of Kahuā Ranch, Atherton Richards (Herbert's brother) was von Holt's "the real partner." In 1953 von Holt died and Herbert, Jr. (better known as Monty) returned to Hawai'i after finishing school on the mainland; gradually Monty took over as manager of the Ranch (OCA 2000). The 1956 U.S.G.S. Kawaihae quadrangle shows some of the Kahuā Ranch lands and infrastructure (Figure 14), including a fence line and "Beach Trail" extending to the coast within the current project area. A windmill (recorded as part of Site 16133) is shown adjacent to the fence line at the coast within the current project area. Both the fence line and trail are different alignments than are shown on the 1931 Land Court Application 1043 map (see Figure 12). A trail is also shown extending parallel to the coast through the project area on the 1956 map (following an alignment similar to that of the Mahukona-Kawaihae Trail shown on the 1931 map). In 1973, when construction of the current Akoni-Pule Highway was completed, most if not all of the vehicular traffic between Mahukona and Kawaihae shifting away from the coastal Jeep road to the newly constructed highway. By 1982, the coastal trail is no longer shown on the

3. Culture-Historical Background

U.S.G.S. Kawaihae quadrangle. The Richards and von Holt families jointly operated Kahuā Ranch until the 1980s at which point it was legally split into two entities. The current project area was severed from the ranch and sold around this time. Today, the Richards family operates Kahuā Ranch and the von Holt family operates Ponoheolo Ranch.

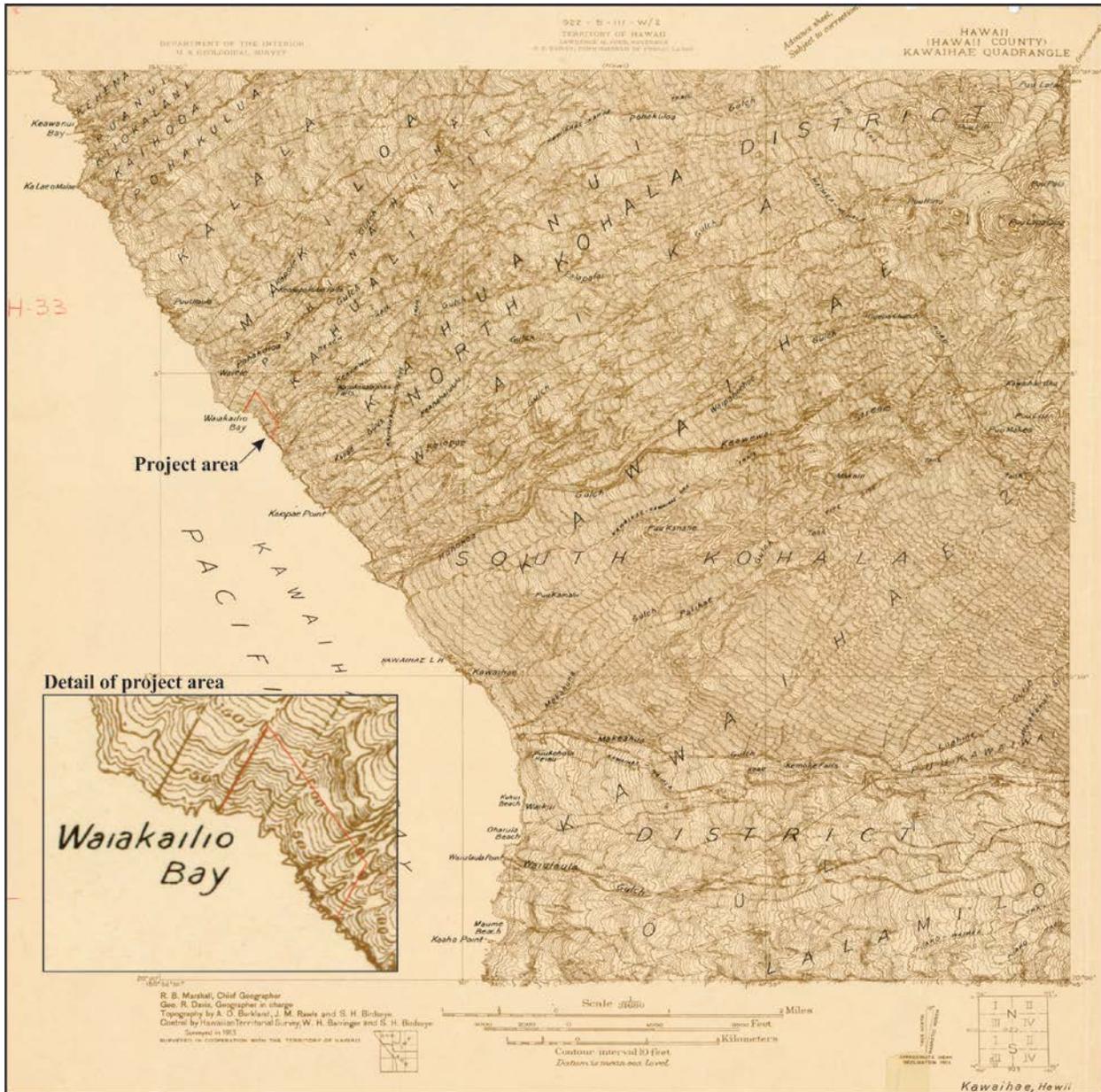


Figure 12. 1913 U.S.G.S. Kawaihae quadrangle showing the current project area.

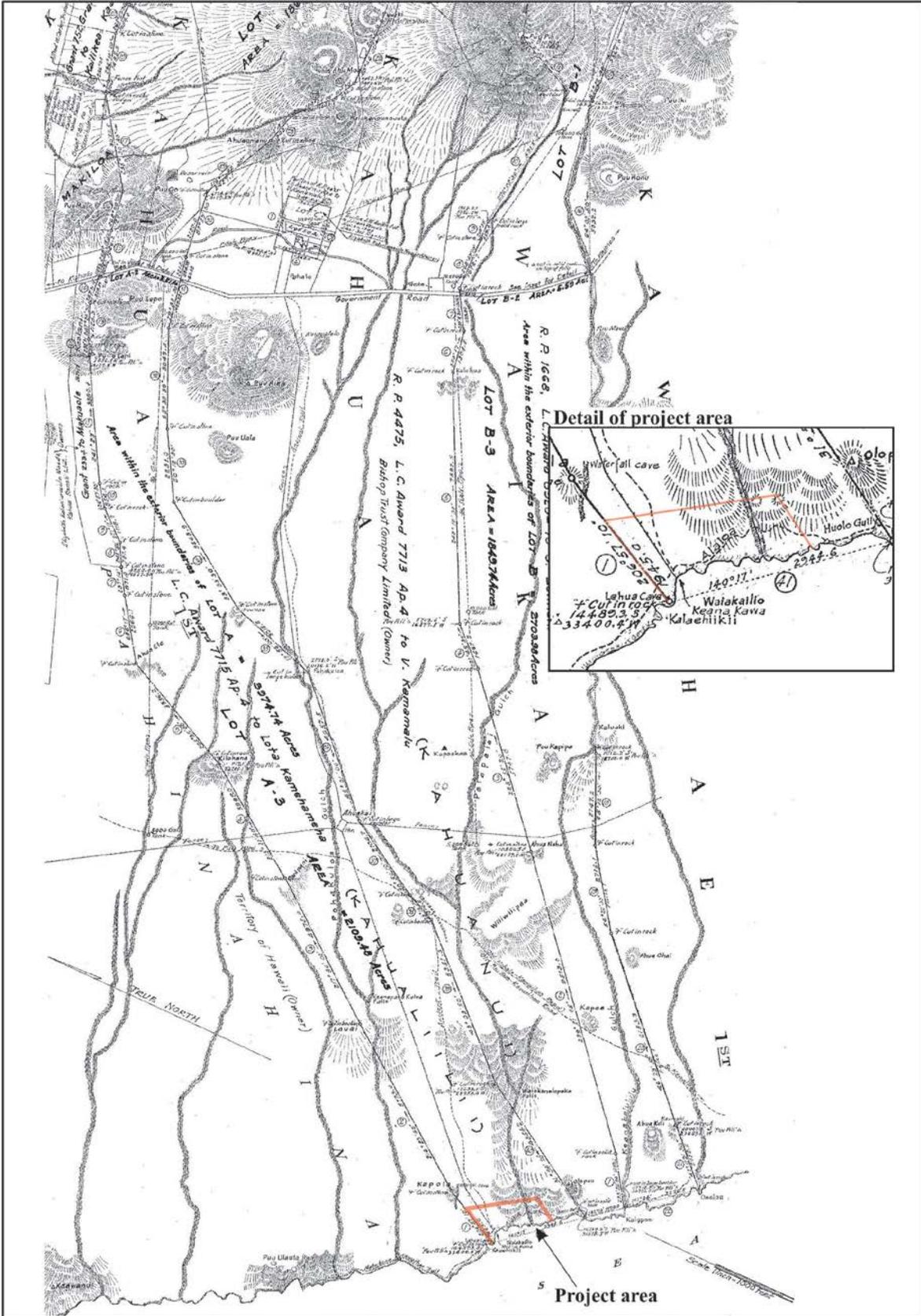


Figure 13. Portion of the 1931 Land Court Application map 1043 showing the current project area.

3. Culture-Historical Background



Figure 14. 1956 U.S.G.S. Kawaihāe quadrangle showing the current project area.

4. DISCUSSION OF PRIOR CULTURAL STUDIES

Maria E. Ka'imipono Orr (2003) prepared a cultural impact assessment for a then proposed radio communication tower and facility to be placed on Pu'u Waiakanonula (perhaps the *pu'u* referred to as Waiakananula in the above-cited boundary testimony) in the *mauka* portion of Kahuāli'ili'i. Her study included a detailed culture-historical background for the *ahupua'a*, as well as a specific history of land use from Precontact times to the historic and modern use of the area by Kahuā Ranch. She also conducted oral interviews with Sherri Hannum, Genevieve Leina'ala Hoopai, Bernard Hoopai, Bernelle Hoopai, Harold Glenn Kailiawa, Hannah Springer, and Harry Martens (Pono) von Holt II. Orr (2003) concluded that no cultural properties or practices would be affected by the project, but cautioned that "for over a hundred years, native Hawaiians have lived in a culturally repressed state. It has been only within the last thirty years, due to evolved awareness, that native Hawaiians have been aggressively trying to reclaim their *wahi pana* (sacred and/or legendary places)."

As previously stated, Kepā Maly prepared a detailed culture-historical background for Kaiholena Ahupua'a (Maly 2000) that included information relative to the general region known as *Kohala waho* or Outer Kohala, of which the current project area is a part. Maly's (2000) extensive culture-historical information suggests that the archaeological resources present in the current study area are best understood within the context of the larger cultural landscape of *Kohala Waho*; a landscape with a long history, rich in cultural traditions. One could conclude from this that the significance of any one resource is enhanced by the presence of other resources, and together form a cohesive landscape that should be treated and managed in its totality.

In 2006, the present author prepared a cultural impact assessment for a coastal property within Kahuānui and Waikā *ahupua'a* adjoining the current study area to the south (Rechtman 2006). That study area and the current study area share a common history, and were subject to similar land use dating back to the Precontact settlement of the area. As part of the study, William AhYou Akau, Jr., Herbert Montague (Monty) Richards Jr., and Harry Martens (Pono) von Holt II were interviewed. Rechtman (2006) concluded that as long as the archaeological sites were treated in accordance with DLNR-SHPD approved treatment plans; and that access to and along the shoreline was in no way inhibited; then there would be no cultural impacts.

In 2004, the present author prepared a cultural impact assessment (Rechtman 2004) for a small coastal parcel within Pāo'o Ahupua'a, some six mile north of the current project area. Interviewees for that study included Arthur Mahi, Isabella Mahi Medeiros, and Valerie Luhiau Ako. Collectively, these individuals' (all with cultural ties to the study *ahupua'a*) primary concerns revolved around the protection of the archaeological resources and the maintenance of access to the shoreline. The relevance of this study for the current study is not so much the specifics of Pāo'o Ahupua'a, but rather the general concept that the land needs to be cared for in appropriate ways; the concept of *mālama 'āina*. This Pāo'o project required a Conservation District Use Permit, and resulted in a contested case hearing. The testimony presented in both written and oral form as part of the contested case hearing process is also reviewed here as several perspectives were offered that should be considered when assessing cultural impacts along this portion of the Kohala coastline.

The contested case for the Pāo'o project took place in 2008, and resulted in the landowners withdrawing their Conservation District Use Application. While much of the cultural testimony revolved around specific resources located on the Pāo'o parcel, there was other testimony of a more general nature that had broader implications. These included the concepts of *mālama 'āina*, cultural trauma, and cultural disintegration fostering multigenerational psychopathologies. Several of those who testified suggested that the development of the currently undeveloped portions of coastal Kohala would be inconsistent with the traditional cultural practice of caring for the land (*mālama 'āina*), although no basis for this assertion was cited. It should be noted that the land within the current study area was "developed" for use by generations of Hawaiians as a place of habitation as evidenced by the numerous structural remains of residential complexes across the property. It is perhaps the testimony presented by Kamana'opono Crabbe, Ph.D. and Dr. David Liu with respect to cultural disintegration and cultural trauma that may account for the distinction made between traditional Hawaiian use of land and modern Western use of land.

In his testimony Dr. Liu contended that:

. . . the theory of cultural trauma posits that . . . certain historical events experienced by a group continue to be experienced by that group, even decades or perhaps centuries after the initial event:

the events or processes are a “traumatic loss of identity or meaning, a tear in the social fabric.” These experiences transform communities, oftentimes in negative aspects.

There are both biological and psychological bases for the transmittal of the traumas. Biologically, trauma is transmitted through the formation of emotional memory, involving both the autonomic and higher level nervous systems. Psychologically, cultural trauma is transmitted through struggles for meaning and interpretation, which are expressed through means such as stories and songs.

The experience of cultural trauma is as a group, but its expression is on an individual basis. Such expression of individual knowing of trauma may take forms ranging from non-adherence to medication to self-destructive behaviors, such as substance abuse or overeating. Hawaiians may subconsciously choose to resist dominant models of “health” through behaviors which are ultimately self-destructive.

Hawaiians have experienced and continue to experience cultural trauma, from the coming of Captain Cook, through massive depopulation and alienation from the land to invasion, occupation, annexation and continuing depredation of the islands. Infrastructure, from the economic to political, social and spiritual saw significant degradation and destruction, processes which continue today. Perhaps one of the most fundamental institutions which continues to be eroded by the current political economy is that of the connection of Hawaiians to land, through the genealogy of Papahānaumoku, Wākea, Ho‘ohōkūikalani, and Hāloa, which leads to the Hawaiian. Because of these connections and the sacred nature of the land . . . Hawaiians have a kuleana, or duty to mālama, or take care of the ‘āina. To fail in this duty, to allow desecration or destruction, is to invite retribution from the Akua (God, or gods) or ‘aumākua (family gods).

Kamana‘opono Crabbe, Ph.D. added that proposed modern development on or nearby traditional sites:

. . . would be considered sacra religious and conflict with traditional-cultural norms. . . Consistent with theories of cultural loss and/or disintegration as well as psychosocial models of pathological illness, the discontinuance of specific cultural practices has multiple implications. The struggle to perpetuate cultural lifestyles is challenged constantly on a daily basis due to acculturation or the dynamic cultural exchange . . . between two or more distinct cultural-ethnic groups. This psychosocial process occurs on many levels typically affecting the non-dominant group within the larger dominant society, which in this case is Native Hawaiians. The long-term outcome of acculturation leads to the progressive social or cultural disintegration [of] infrastructures . . . as well as ongoing deterioration in a particular society.

If the above contentions are taken as valid, and all land within Hawai‘i is to be considered a valued resource, then there is potentially a direct conflict between Western private property rights (which were established under the Hawaiian Kingdom during the reign of Kamehameha III) and traditional Hawaiian cultural values. It is then perhaps the role of the state’s regulatory agencies to take such factors into account when making land use decisions that might have unexpected long-term psychological effects on a particular cultural group within our modern-day multicultural society.

5. SUMMARY OF CONSULTATION

As stated in the OEQC Guidelines for Assessing Cultural Impacts, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present author's further contention that the oral interviews should also be used to augment the process of assessing the significance of any traditional cultural properties that may be identified. It is the researcher's responsibility, therefore, to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary.

As part of the current study the author met with the North Kohala Community Access Group. Although this group's membership is multicultural, they represent many of the Native Hawaiian community's concerns with respect to access rights, and they were a forum to present the project and to help get the word out to folks within the Native Hawaiian community who may have comments and concerns about the project. The South Kohala Community Development Planning Group was also contacted to help get the word out to potential interested parties, and the Department of Hawaiian Home Lands Kailapa Community Association was also contacted. As a result of these contacts and communications, a field visit was set up with the intention of viewing the property and discussing any potential cultural impacts. On November 15, 2014, Robert Rechtman, Ph.D. met on-site with several members of the North Kohala Community Access Group, the South Kohala Community Development Planning Group, and residents of the Kailapa Homesteads. Among others (e.g., Diane Kanealii, Jojo Tanimoto, Toni Withington), present at the site visit were Kelvin Kaho'opi'i and his wife Anna. Kelvin immediately explained that he believed that he owned the property, not the current landowner, and that he [Kelvin] would consider it to be trespassing if the assembled group were to leave the highway where we had met and go onto the property. He further suggested that there would be "serious consequences" if we violated this order. It was explained to him that the landowner (and the project consultants) felt comfortable in the ownership rights and that if he had a legitimate complaint he should file legal papers. He then showed some sort of Hawaiian Kingdom title document and explained that it is incumbent on the person claiming to be landowner to show him Royal Patent documents to prove ownership (see discussion of chain of property ownership above). We agreed to disagree on this issue, and none of the assembled people felt comfortable continuing with the planned site visit, and so further field consultation did not occur.

Present at this aborted meeting was Kaena Peterson, who is *kama'āina* to the area, a resident of Kailapa, and President of the South Kohala Hawaiian Civic Club. Kaena was contacted the following day and she asked me to meet with her and the Vice President of the South Kohala Hawaiian Civic Club to share information about the project and hear their concerns. On Sunday November 23, 2014, Robert Rechtman, Ph.D. met with Kaena Peterson and Lei Kihoi of the South Kohala Hawaiian Civic Club at the Kailapa residence of Kaena Peterson. Their concerns were related to both the protection of trails along with other traditional sites and burial sites, and the perpetuation of access to the property for traditional and customary practices as protected under state statutes. With respect to the former, they wanted to make sure that all burial sites are properly treated and that the traditional trail routes remain open for unrestricted pedestrian access. With respect to the perpetuation of traditional and customary practices they wanted to make sure that traditional coastal activities were not impacted and that Native Hawaiian individuals and organized groups such as *hula halau* had unrestricted access to the trails and shoreline. Both Kaena and Lei stressed the importance of maintaining the traditional access routes that exist on the landscape.

A second, this time successful, field visit was conducted on January 31, 2015 with members of the North Kohala Community Access Group and residents of the South Kohala Department of Hawaiian Home Lands Kailapa community. Much of the discussion during this visit revolved around trails and access. Present during this visit was JoJo Tanimoto, a *kupuna* of Native Hawaiian ancestry. She shared recollections of traveling the project area coastline with her father when she was a child for shoreline fishing activities. Jojo also talked about a shoreline pond in the general area that William Akau related to her was culturally significant, but was unsure of its exact location. Also present during this visit was Diane Kanealii and Parish Canon of the Kailapa community. Mr. Canon, a younger generation Native Hawaiian and current president of the Kailapa Community Association expressed an interest in having community members take an active role in the preservation of cultural sites and resources within the development area.

No other individuals have come forward with any specific information about significant cultural resources or traditional and customary practices that have occurred or are still taking place on the current study property.

5. Summary of Consultation

Information obtained from three prior interviews is also directly relevant to the current study area. As part of the cultural impact assessment for a coastal property within Kahuānui and Waikā *ahupua'a* adjoining the current study area to the south (Rechtman 2006), William AhYou Akau, Jr., Herbert Montague (Monty) Richards Jr., and Harry Martens (Pono) von Holt II were interviewed. That study area and the current study area share a common history, and were subject to similar land use dating back to the Precontact settlement of the area. The interview questions asked during that study and the responses given apply equally to the current study area. The interviews were informal unrecorded phone conversations and the consultants were asked specific questions concerning their personal knowledge of the general project area and the former Kahuā Ranch lands.

William Akau was a life-long resident of Kawaihae with genealogical ties to the area dating back to at least 1791. As a child in the 1930s, William Akau walked the coastal trails, fished the near shore and gardened sweet potatoes in the then *'auwai* watered lands near Pu'u Koholā. He was asked if he knew of any specific cultural sites or practices that have taken place or are ongoing within the general project area. He knew of nothing specific, but did relate that the area was and is used for shoreline fishing. When asked about his concerns for development of the area, he was strong in his reply that the traditional trail systems be protected and kept open for pedestrian access. He related that in the 1980s it was he who entered into a lawsuit with the Mauna Kea Hotel to stop their blocking of the coastal trails. William Akau prevailed in his lawsuit, and access rights to the trails along the Kawaihae and 'Ōuli shoreline were protected.

Monty Richards, born at Kahuā Ranch in 1929, is a descendant of both the Reverend William Richards who arrived in Hawai'i in 1823, and Amos Starr Cooke who arrived in Hawai'i in 1837. Monty's father moved from O'ahu to Hawai'i in the 1920, and along with his brother Atherton and Ronald von Holt established Kahuā Ranch. Monty was asked if he knew of any specific cultural sites within former coastal ranch lands. He indicated that there are many archaeological sites recorded and that the late Henry Auwae showed him a place in Kahuānui (to the south of the current study area) that he called a turtle shrine.

Pono von Holt, born in 1938, is the third child of Ronald von Holt and Dorothy Erdman. Pono was named after his paternal grandfather (Harry Martens von Holt), who was called Hale Ponoholo by Hawaiians. Hale's father (Pono's great grandfather) arrived in Hawai'i from Hamburg, Germany in 1851. Pono also described Henry Auwae showing him a *honu* shrine located near the mouth of the Kai'ōpae drainage. When asked about past ranching activities on the coastal lands, he explained that the entire area had been grazed by cattle for many years.

While it is abundantly clear from the archaeological and historical records that the property was used during Precontact and early historic times for the entire range of traditional Hawaiian cultural activities and practices (residential, burial, ceremonial, subsistence production and procurement, etc.); none of the consultants had knowledge of any specific traditional cultural practices currently being exercised on the property; although William Akau suggested (and the present author observed) that the shoreline is actively being accessed for fishing, and both Monty and Pono concurred that such activities are and have commonly been practiced along the Kahuā shoreline. Also, during earlier Pāo'o consultations, Arthur Mahi and Valerie Luhiau Ako discussed the general practice of *mālama 'āina*, and many within the Hawaiian community, along with the Office of Hawaiian Affairs, recognize such caretakership of the land as an ongoing cultural practice with traditional roots.

6. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs that are subject to assessment. Essentially these are nature features of the landscape and historic sites, including traditional cultural properties. In the Hawai‘i Revised Statutes—Chapter 6E a definition of traditional cultural property is provided.

“Traditional cultural property” means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community’s history and contribute to maintaining the ethnic community’s cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

The origin of the concept of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service. “Traditional” as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. “Cultural” refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term “Property” defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of “Property” wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties. As the OEQC guidelines do not contain criteria for assessing the significance for traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

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

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion D at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion E. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Pa‘akai O Ka‘āina v Land Use Commission* court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical, or natural resources are present; and identify the

extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

As a result of the archaeological studies conducted within the project area forty archaeological sites were identified (see Figure 3). These include five sites with burials (SIHP Sites 2496, 4004, 4013, 16148 and 16132) evaluated as significant under Criteria D and E, two multi feature trail sites (SIHP Site 15261 and Site 29271) also evaluated as significant under Criteria D and E, one habitation/ceremonial sites evaluated as significant under Criteria C, D, and E, two habitation sites (SIHP Sites 2499 and 4005) evaluated as significant under Criteria C and D, and thirty additional archaeological sites (SIHP Sites 4000, 4002, 4003, 4010, 4011, 4012, 4015, 16131, 16132, 16133, 16134, 16135, 16136, 16137, 16138, 16139, 16140, 16141, 16142, 16143, 16144, 16145, 16146, 16147, 16149, 16150, 16151, 16163, 16164 and 16167) evaluated as significant under Criterion D.

Thirty-seven of these archaeological sites are considered to be valued cultural resources and retain the potential to be impacted by the current development proposal. DLNR-SHPD is the state agency that has been empowered to make determinations with respect to impacts to archaeological sites and to assure that appropriate measures are implemented to mitigate any potential impacts. To mitigate potential impacts to the burial sites identified within the current project area, a revised burial treatment plan should be prepared in compliance with HAR 13§13-300 and implemented prior to the commencement of any ground-disturbing activities. To mitigate the potential impacts to the non-burial archaeological sites identified within the project area, archaeological preservation and data recovery plans should be prepared in compliance with HAR13§13-277 and HAR 13§13-278, respectively, and implemented prior to any ground-disturbing activities.

With respect to the land (as a valued natural/cultural resource) within the current project area and the current proposed Kohala Shoreline LLC development, conditions exist that may mediate the potential detrimental psychosocial effects postulated by Kamana‘opono Crabbe, Ph.D. and Dr. David Liu with respect to cultural disintegration and cultural trauma. The fact is that within the local community these lands are known to have been private lands for over 100 years, and that access to the shoreline for traditional cultural practices has never been prohibited, a situation that will continue under the current proposed development. Further, in the spirit of *mālama ‘āina*, the current development plans call for a down zoning from the current approved Single-Family Residential 15,000 square foot lot size to Agricultural Residential 3 acre lot size, and a planned unit development that locates building sites away from the immediate shoreline and in such a way as to preserve a significant portion of the archaeological landscape; and although seemingly not currently practiced within the study area, ongoing *mālama ‘āina* could and should be resurrected for the current project area. In this vein, Lei Kihoi suggested that if a community association is established to maintain the preserved cultural sites on the property, that a member(s) of the local Hawaiian community with ties to the land be retained for this task. Parish Canon also expressed a desire to have members of the local Native Hawaiian community be encouraged to participate in the preservation of resources within the development area, and to maintain an on-going dialog with the developer and the individual landowners. In this way the traditional concept of *mālama ‘āina* could be perpetuated.

Other potential cultural impacts that may result from the proposed project specifically relate to coastal access and use. In a general sense access to and use of the entire shoreline within the study area for recreational, subsistence, transportation, and spiritual purposes can be considered an ancient as well as ongoing practice; thus the shoreline itself could be considered a traditional cultural property and would be significant under Criterion E. The primary concern raised by William Akau was that of maintaining long-shore pedestrian access for fishing, transportation, and recreation. He was a longtime advocate for the perpetuation of Hawaiian rights of access to, and use of, the traditional system of trails. These same concerns for maintaining traditional and customary access rights were raised by Kaena Peterson and Lei Kihoi during more recent consultation. Figure 15 is a portion of Land Court Application 1043 Map 1 (dated 1931) indicating the presence of a coastal trail within the current project area. This trail is also shown on the 1935 edition of the Tax Map (Figure 16) and based on an overlay with current maps it appears as though this trail eventually became the coastal Jeep road, which was recorded in the most recent archaeological study (Rechtman 2014) as Site 29271.

Along much of the Kohala coast, this Jeep road followed the course of an existing *ala loa* that had been in use for centuries. The *ala loa* is depicted on several historical maps dating back at least to 1903; however, its location was perhaps most accurately recorded on the detailed survey map prepared in 1931 (see Figure 15) to accompany a set of land court applications (L.C.App. 1036 and 1043) that contain information relevant to the

current project area. It was during the court proceedings associated with these land court applications that the pre-Jeep road Mahukona-Kawaihae Beach Trail was described as having a five foot width. The legal proceedings were conducted over a seven year period and were focused on establishing legal ownership of several adjoining parcels and roadway corridors traversing those parcels. The final ruling of the courts during these proceedings was that the Territory of Hawai'i would relinquish any claims to the Mahukona-Kawaihae Beach Trail in exchange for ownership of the Kohala to Kawaihae Road (the current Kohala Mountain Road), thus within the current project area there are no state-owned (public) trail encumbrances. Although no longer a public right-of-way, the coastal *ala loa* continued to serve as a non-vehicular access corridor between Mahukona and Kawaihae. The *ala loa* trail was improved for vehicular travel in the early 1940s in conjunction with the U.S. Army's efforts to provide an adequate coastal defense system during WWII.

However, within the current study property, in 1994 the then landowner recorded a map within the Land Court system that specified a shoreline setback for coastal public access in the area between the highwater mark and six feet inland of the "highwater mark as is from time to time established" (Figure 17); re-establishing a public access easement on the property. This access corridor in conjunction with an access alignment coincident with Site 29271 will continue to provide lateral access across the property. Additionally, there will be a public access parking lot within the property and a *mauka/makai* pedestrian trail leading to the lateral access corridors and shoreline (see Figure 9). The establishment and maintenance of these trail easements will facilitate coastal access and the continued use of the shoreline for recreational, subsistence, transportation, and spiritual purposes; thus alleviating any potential impacts related to shoreline access and related cultural use.

Implementation of the above described measures relative to the identified archaeological and cultural resources, and cultural practices and beliefs will help to ensure that no such resources, practices, or beliefs will be adversely affected by the proposed subdivision and subsequent development of the subject property

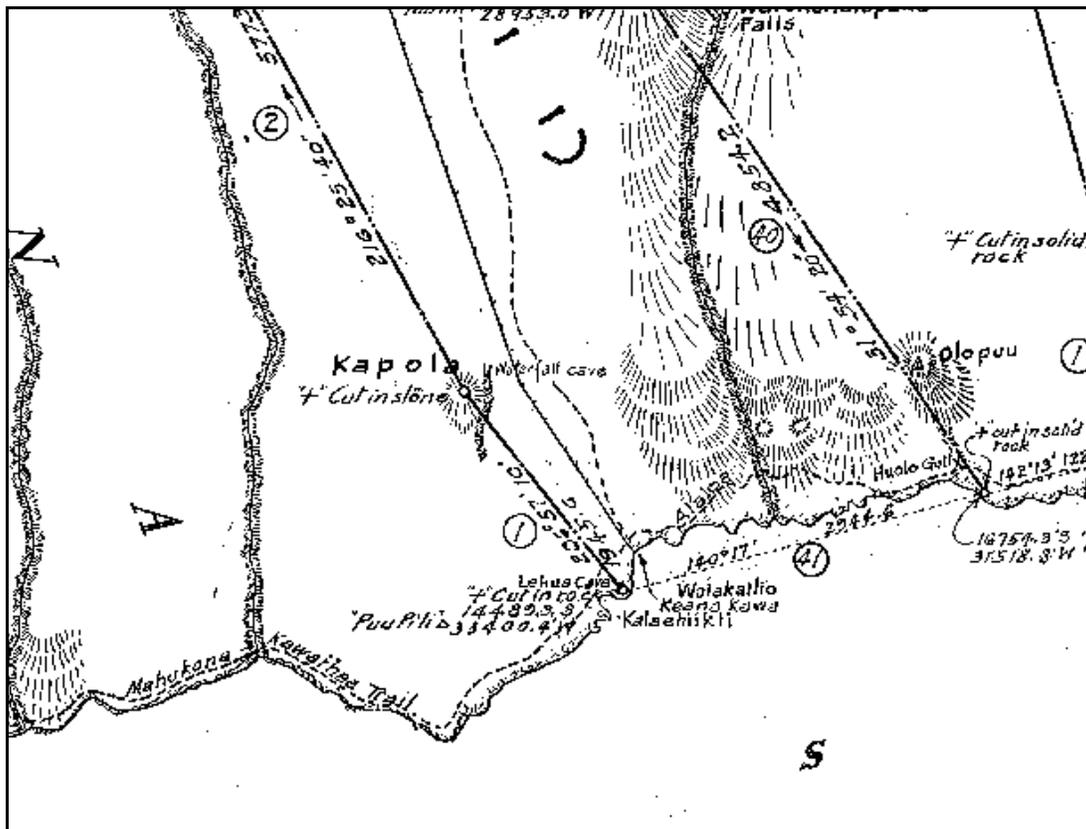


Figure 15. Portion of Land Court Application 1043 Map 1 (dated 1931).

5. Summary of Consultation

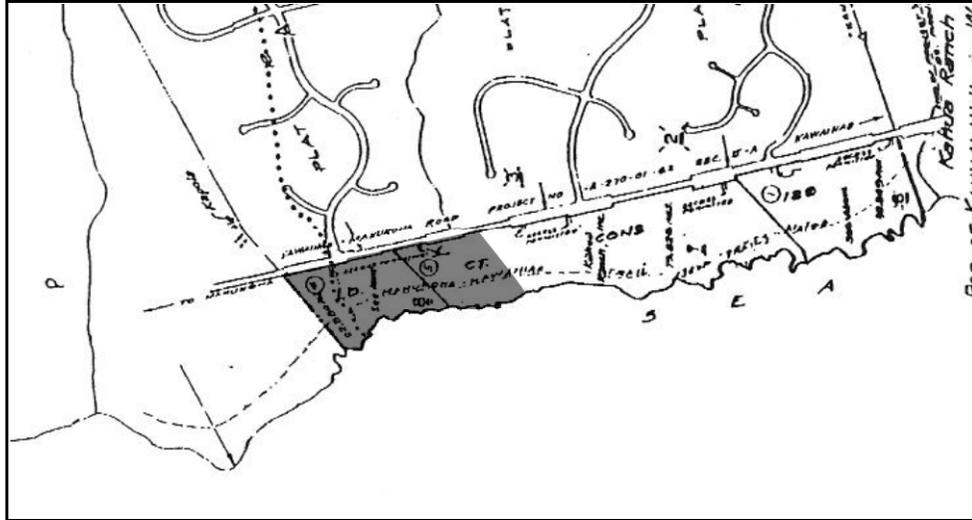


Figure 16. Portion of 1935 Tax Map showing coastal "Hawaiian trail," current project area shaded.

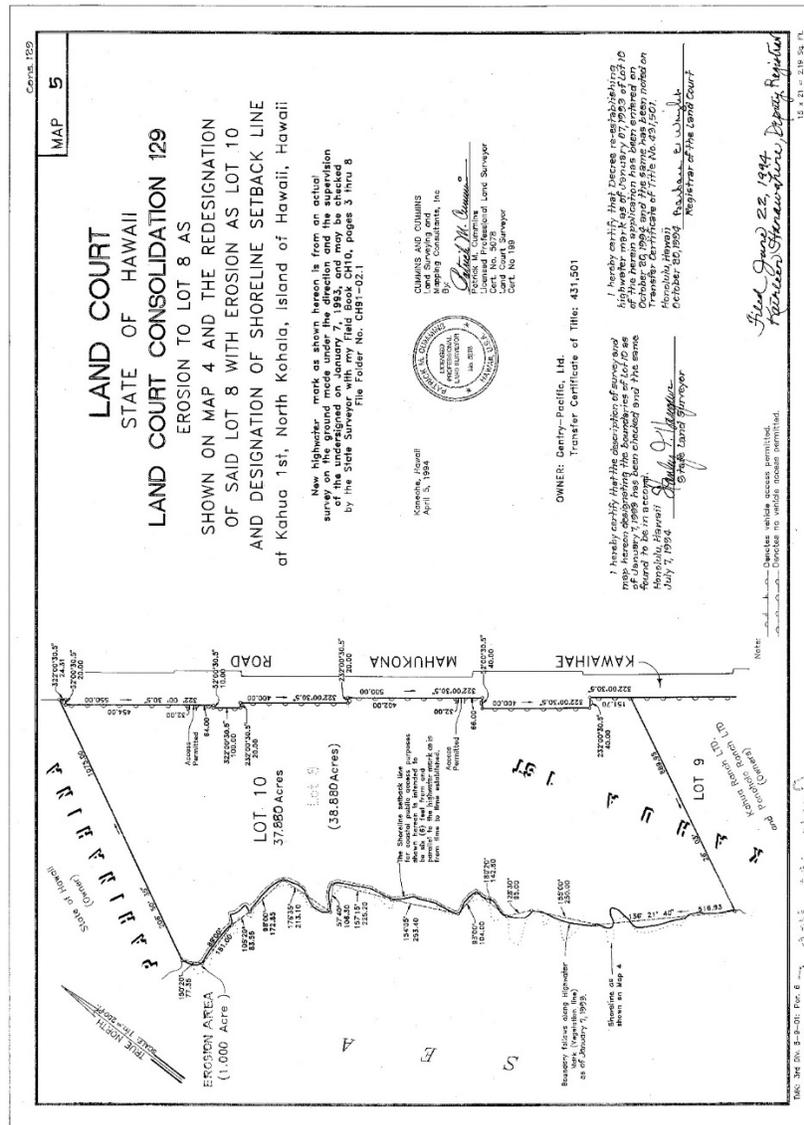


Figure 17. 1994 map showing the establishment of a coastal public access along the shoreline.

REFERENCES CITED

- Allen, M.
- 1985a Limited Archaeological Reconnaissance Survey Kahua Shores Coastal Parcel: Kahua 1, North Kohala, Island of Hawaii (TMK:3-5-9-01:8). PHRI Report 74-031883. Prepared for Kahua Shores, Ltd.
- 1985b Limited Archaeological Reconnaissance Survey Kahua Shores Coastal Parcel: Kahua 1-2 and Waikā, North Kohala, Island of Hawaii (THK:3-5-9-01:8). PHRI Report 76-030183. Prepared for Kahua Shores, Ltd.
- Barrera, W.
- 1971 Anaehoomalu: A Hawaiian Oasis. Preliminary Report of Salvage Research in South Kohala, Hawaii. *Pacific Anthropological Records* No. 15. Department of Anthropology, B.P. Bishop Museum, Honolulu.
- Beckwith, M.
- 1976 *Hawaiian Mythology*. University of Hawai'i Press, Honolulu.
- Bellwood, P.
- 1978 *The Polynesians: Prehistory of an Island People*. Thames and Hudson, Ltd., London.
- Bonk, W.
- 1968 The Archaeology of North and South Kohala - from the Ahupua'a of Kawaihae to the Ahupua'a of Upolu: Coastal Archaeology Surface Survey. *Hawaii State Archaeological Journal* 68-3. Division of State Parks, Department of Land and Natural Resources.
- Burgett, B., and P. Rosendahl
- 1993 Summary of Archaeological Inventory Surveys, Kapaanui Agricultural Subdivision and Mahukona Property, Lands of Kapaanui, Kou, Kamano, Mahukona 1st and 2nd, Hihii, and Kaoma, North Kohala District, Island of Hawaii. (TMK:3-5-7-02:11 and TMK:3-5-7-03:1-3,10-14,16-18). PHRI Report 743-020993. Prepared for Chalons International of Hawaii, Inc.
- Burtchard, G.
- 1995 Population and Land Use on the Keauhou Coast, the Mauka Land Inventory Survey, Keauhou, North Kona, Hawai'i Island. Part I: Narrative Volume. International Archaeological Research Institute, Inc. (IARII). Prepared for Belt Collins and Associates and Kamehameha Investment Corporation, Honolulu.
- Colum, P.
- 1937 *Legends of Hawaii*. Yale University Press, New Haven and London.
- Corbin, A.
- 2000 Archaeological Data Recovery at Kohala Makai-I Project Area, Land of Waika, North Kohala District, Island of Hawaii (TMK:5-9-01:006). PHRI Report No. 2034-080100. Prepared for Kohala Waterfront Joint Venture.
- 2003 Additional Archaeological Inventory Survey Project IV of Kohala Ranch Development Lands of Waikā, and Kahuā 1 and 2, North Kohala District Island of Hawai'i (TMK:3-5-9-multiple plats and parcels).
- 2004 Archaeological Mitigation Plan, Kahua Makai Project, Lands of Kahua 2 and Waika, North Kohala District, Island of Hawaii. PHRI Report 2284-042104. Prepared for P-Ohana Makai/K-Ohana Makai c/o G. Mooers.

References Cited

- Doyle, E.
1953 Makua Laiana: the Story of Lorenzo Lyons. Compiled from manuscript journals 1832-1886. *Honolulu Star Bulletin*.
- Dunn, A., and P. Rosendahl
1989 Archaeological Inventory Survey, Kapaanui Agricultural Subdivision, Lands of Kapaanui and Kou, North Kohala District, Island of Hawaii. PHRI Report 568-100289. Prepared for Ahualoa Development, Inc.
- Ellis, W.
1963 *Journal of William Ellis*. Advertiser Publishing Company Ltd., Honolulu.
- Fornander, A.
1969 *An Account of the Polynesian Race: Its Origin and Migrations*. Tokyo: Charles E. Tuttle Co., Inc.
- Graves, D. and L. Franklin
1998 Archaeological Inventory Survey, Kahua Makai/Kahua Shores Coastal Parcels, Lands of Kahua 1 and 2 and Waika, North Kohala District, Island of Hawai'i (TMK:3-5-9-01:7,8). PHRI Report 1024-033198. Prepared for Gentry Hawaii, Ltd.
- Griffin, P., T. Riley, P. Rosendahl, and H. Tuggle
1971 Archaeology of Halawa and Lapakahi: Windward Valley and Leeward Slope. *New Zealand Archaeological Association Newsletter* 14(3):101-112.
- Handy, E.S.C., and E.G. Handy
1972 *Native Planters in Old Hawaii: Their Life, Lore and Environment*. B.P. Bishop Museum Bulletin 223. Bishop Museum Press, Honolulu. (with M.K. Pukui)
- Henke, L.
1929 A Survey of Livestock in Hawaii. Research Publication No. 5. University of Hawaii, Honolulu.
- Hommon, R.
1976 The Formation of Primitive States in Pre-Contact Hawaii. Ph.D. Dissertation (Anthropology), University of Arizona, Tucson. University Microfilms, Inc., Ann Arbor, Michigan.
1986 Social Evolution in Ancient Hawai'i. IN Kirch, P.V. (ed.), *Island Societies: Archaeological Approaches to Evolution and Trans-formation*: 55-88. Cambridge: University Press.
- Hono-ko-hau Study Advisory Commission
1974 The Spirit of Ka-Loko Hono-Ko-Hau. National Park Service, U.S. Department of the Interior.
- Kamakau, S.
1964 Ka Po'e Kahiko: The People of Old. B.P. *Bishop Museum Special Publication* 51. Bishop Museum Press, Honolulu.
1976 The Works of the People of Old, Na hana a ka Po'e Kahiko. B.P. *Bishop Museum Special Publication* 61. Bishop Museum Press, Honolulu.
1991 *Tales and Traditions of the People of Old*. Honolulu: Bishop Museum Press.
1992 *Ruling Chiefs of Hawaii*. The Kamehameha Schools Press, Honolulu (revised edition).
- Kent, N.
1983 *Hawaii: Islands Under the Influence*. University of Hawai'i Press, Honolulu.
- Kirch, P.
1984 *The Evolution of the Polynesian Chiefdoms*. Cambridge University Press, New York.

- 1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory.* University of Hawaii Press, Honolulu.
- 1990 Monumental Architecture and Power in Polynesian Chiefdoms: A Comparison of Tonga and Hawaii. *World Archaeology* 22(2).
- 1997 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory.* Honolulu: University of Hawaii Press.
- 2011 When did the Polynesians Settle Hawai'i? A Review of 150 Years of Scholarly Inquiry and a Tentative Answer. *Hawaiian Archaeology* Vol. 12:3-26.
- KTF (Kohala Task Force)
1975 Kohala: A Candid View. Report of the Kohala Task Force [March].
- Kubo, L. and P. Rosendahl
2003 Burial Treatment Plan, Sites 50-10-05-2491 (Feature B) and 50-10-05-16130 (Features A and B) at Kohala Bay Estates, Land of Kahua 1 and 2, North Kohala District, Island of Hawai'i (TMK:3-5-9-01:7). PHRI Report 2283-101603. Prepared for P-Ohana Makai c/o Mr. John Michael White, Hawaii Land Company.
- Kuykendall, R., and A. Day
1976 *Hawaii: A History From Polynesian Kingdom to American Statehood.* Prentice-Hall, Inc., Englewood Cliffs.
- Langlas, C.
1994 Pu'u of Mauka Kawaihae and Kalalā Ahupua'a, District Kohala, Hawai'i Island: Report of an Investigation of the Hawaiian Cultural Significance of Candidate Sites for the Kamuela Area (Hawai'i) NEXRAD Installation. Part 1: Candidates Sites for the NEXRAD Installation: Ethnographic Background and Site Assessment. Prepared for SRI International.
- Loubser, J., and R. Rechtman
2007 Archaeological Data Recovery Investigation at SIHP Sites 2492, 16177, 16122, 2494, 16129, 2485, and 16154, within Site Complex 50-10-05-4157, Kahuā 2nd and Waikā ahupua'a, North Kohala District, Island of Hawai'i, Rechtman Consulting Report RC-0400. Prepared for Kohala Kai LLC.
- Malo, D.
1903 *Hawaiian Antiquities.* B.P. Bishop Museum Special Publication 2. Bishop Museum Press, Honolulu.
- Maly, K.
1999 *Ka'ao Ho'oniua Pu'uwai No Ka-Miki* (Heart Stirring Story of Ka-Miki) Published in the Hawaiian newspaper *Ka Hōkū o Hawai'i* (1914-1917). (Translation done between 1992-1999).
2000 Historical Background. In: Archaeological Inventory Survey of the Coastal Portion of Kaiholena Ahupua'a, North Kohala, Hawai'i. IARII Report prepared for Pohaku Kea LLC, Menlo Park. Dye and Maly (2000).
- Menzies, A.
1920 *Hawaii Nei, 128 Years Ago.* Edited by William F. Wilson. Honolulu: The New Freedom Press.
- OCA
2000 *Paniolo Hall of Fame Oral History Interviews.* O'ahu Cattlemen's Association, Ewa Beach.
- Oliver, D.
1961 *The Pacific Islands.* University of Hawaii Press, Honolulu.

References Cited

- O'Hare and S. Goodfellow
1999 Archaeological Mitigation Program, Data Recovery Excavations, Site 50-10-05-4015, Kahua Makai/Kahua Shores Coastal Parcels. Land of Kahua 1, North Kohala District, Island of Hawai'i (TMK:5-9-01:7,8). PHRI Report 1572-081799. Prepared for Gentry Hawaii, Ltd.
- Orr, M.
2003 Cultural Impact Assessment Kahua Ranch DAGS Rainbow Tower & Facilities Pu'u Waiakanonula, Kahua Ranch, Ahupua'a of Kahuali'ili'i, District of Kohala, Hawai'i Island, Hawai'i. Prepared for Haun & Associates.
- PHRI
2000 Burial Treatment Plan, Kohala LLC Residential Compound Project. Land of Kahua 1, North Kohala District, Island of Hawaii (TMK:3-5-9-01:8). PHRI Report 2003-041100. Prepared for Gentry-Pacific, Limited.
2005 Documentation on Testing of Possible Burial Features, Kahua Makai/Kahua Shores Coastal Parcels. PHRI Report 2510-041305. Prepared for P-Ohana Makai/K-Ohana Makai.
- Pogue, J.
1978 *Mooleo Hawaii*. Hale Paipalapala Aupuni, Honolulu (Revised Edition).
- Pukui, M.
1983 'Olelo Noeau, Hawaiian Proverbs & Poetical Sayings. *B.P. Bishop Museum Special Publication 71*. Bishop Museum Press, Honolulu.
- Pukui, M., S. Elbert, and E. Mo'okini
1974[1966] *Place Names of Hawaii*. Revised and Expanded Edition. Honolulu: University of Hawaii Press, Honolulu.
- Rechtman, R.
2004 Cultural Impact Assessment Associated with the Proposed Development of a Single-Family Residence in Conservation District Land, Pāo'o Ahupua'a, North Kohala District, Island of Hawai'i. Rechtman Consulting Report RC-0019. Prepared for Jonathan Cohen, Lincoln, MA.
2006 Cultural Impact Assessment Associated with the Proposed Development of Kohala Kai, Kahuāli'ili'i, Kahuānui, and Waikā ahupua'a, North Kohala District, Island of Hawai'i. Rechtman Consulting Report RC-0368. Prepared for Greg Mooers, Kamuela.
2014 A Preservation Plan for Ten Sites Within the Kohala Kai Subdivision, TMKs: (3) 5-9-17:006 and 007, Kahuā 2 and Waikā ahupua'a, North Kohala District, Island of Hawai'i. ASM Report Number 21890.00. Prepared for Kohala Kai, LLC, Kamuela.
- Rechtman, R., and M. Clark
2010 Archaeological Inventory Survey Update for TMK:3-5-9-01:008, Kahuā 1st Ahupua'a, North Kohala District, Island of Hawai'i. Rechtman Consulting Report RC-0657. Prepared for Gregory R. Mooers, Kamuela.
- Rosendahl, P.
1972 Aboriginal Agriculture and Domestic Residence Patterns in Upland Lapakahi, Island of Hawaii. Ph.D. Dissertation, University of Hawaii, Honolulu.
1994 Archaeological Mitigation Program. Phase I: Mitigation Plan for Data Recovery Excavations, Laboratory Analyses and Report, Sites 4015, 4016, 4017 and 4018. Kahua Makai/Kahua Shores Coastal Parcels, Lands of Kahua 1 and 2, and Waika, North Kohala District, Island of Hawaii. PHRI Letter Report 1555-082394. Prepared for Gentry Hawaii, Ltd.

-
- Schilt, R., and A. Sinoto
1980 Limited Phase I Archaeological Survey of Mahukona Properties, North Kohala, Island of Hawai'i. B.P. Bishop Museum, Honolulu. Prepared for Belt, Collins and Associates.
- Schmidt, R.
1973 The Missionary Census of Hawaii. *Pacific Anthropological Records* No. 20, Department of Anthropology B.P. Bishop Museum, Honolulu.
- Soehren, L.
1964 An Archaeological Reconnaissance of the Mahukona-Kawaihae Highway, Kohala, Hawaii. Department of Anthropology, B.P. Bishop Museum, Honolulu.
- Tomonari-Tuggle, M.
1988 North Kohala: Perception of a Changing Community. A Cultural Resource Management Study. Prepared for Division of State Parks, Outdoor Recreation, and Historic Sites, Department of Land and Natural Resources, State of Hawaii.
- Varigny, C.
1981 *Fourteen Years in the Sandwich Islands, 1855-1868*. Translated by Alfons Korn, University of Hawaii and Hawaii Historical Society, Honolulu.
- Williams, J.
1919 A Little Known Engineering Work in Hawaii. IN *Thrum's Hawaiian Almanac and Annual for 1919*. Thos. G. Thrum, Honolulu.
- Wolfe, E., and J. Morris
1996 *Geological Map of the Island of Hawaii*. U.S. Department of the Interior, U.S. Geological Survey.
- Wulzen, W., J. Head, and S. Goodfellow
1995 Final Report: Archaeological Inventory Survey, Chalon International Mahukona Mauka Parcel; Lands of Kamano, Mahukona 1st and 2nd, Hihiu and Kaoma, North Kohala District, Island of Hawaii (TMK:3-5-7-02:por.36). PHRI Report 1520-080895. Prepared for Chalon International of Hawaii, Inc.

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ENVIRONMENTAL ASSESSMENT

Kohala Shoreline, LLC Project

TMK: (3rd) 5-9-001:008

Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i

APPENDIX 4

Archaeological Inventory Survey

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Archaeological Inventory Survey Update for TMK: (3) 5-9-01:008

Kahuā 1st Ahupua'a
North Kohala District
Island of Hawai'i

DRAFT VERSION



Prepared By:

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November 2014

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Archaeological Inventory Survey Update for TMK: (3) 5-9-01:008

Kahuā 1st Ahupua‘a
North Kohala District
Island of Hawai‘i



EXECUTIVE SUMMARY

At the request of Gregory R. Mooers of Mooers Enterprises LLC, on behalf of his client Kohala Shoreline, LLC, ASM Affiliates, Inc. (ASM) has prepared this update to an earlier DLNR-SHPD approved archaeological inventory survey of an approximately 37.8 acre project area in Kahuā 1st Ahupua‘a, North Kohala District, Island of Hawai‘i (TMK: 3-5-9-01:008). The earlier archaeological inventory survey report contained site treatments based on the then planned subdivision development of the parcel. Subsequent archaeological work on the property included the preparation of a data recovery plan for one site (Rosendahl 1994) and the data recovery of that site (O’Hare and Goodfellow 1999), additional burial testing at three sites (PHRI 2005) and the preparation of a burial treatment plan (PHRI 2000a), along with the preparation of an archaeological sites preservation plan (PHRI 2000b). These follow-up studies were conducted with the understanding that the development of the subject parcel would be limited to one single-family residence occupying the extreme western end of the parcel, and that the remaining bulk of the parcel would be left in its natural state. Thus the site treatments approved in the earlier inventory survey report were reconsidered and revised such that the treatment all of the sites previously approved for data recovery was changed to preservation. The current proposed development plan for the parcel is no longer restricted to the construction of one single-family residence, but rather includes the creation of a nine lot subdivision. This new proposed land use necessitates revising the site treatments once again, bringing them back more into conformance with what was approved in the original inventory survey. The purpose of the current inventory study is to assess current site conditions and identify any previously unrecorded sites/features, and to provide new site treatments appropriate for the newly proposed twelve lot subdivision development plan as well as to provide a map showing accurate site locations. To that end, ASM completed an intensive resurvey of the study area, identified and replotted the previously recorded sites, and documented additional features that had not been previously recorded.

Intensive archaeological survey of the current project area was conducted on December 1–3, 2009 by J. David Nelson, B.A., Christopher S. Hand, B.A., Johnny R. Dudoit, B.A., and Ashton K. Dircks Ah Sam, B.A. under the direction of Robert B. Rechtman, Ph.D. Additional survey and subsurface testing at selected features was conducted on February 23 and 24, 2010 by Robert B. Rechtman, Ph.D., Matthew R. Clark, B.A., and by J. David Nelson, B.A. A search for remnants of the trails shown on the various Historic maps reviewed for this study was undertaken by Robert B. Rechtman, Ph.D., and Matthew R. Clark, B.A. on August 22, 2013 and on July 16, 2014. During the intensive pedestrian survey of the study area, the entire parcel was subject to north/south transects with fieldworkers spaced at 10-meter intervals. All thirty-nine of the previously recorded sites were identified, and while the earlier plotting of site locations was not wholly accurate, in all but six cases, the site description seem to be adequate. Additionally, a portion of a previously unrecognized site – Site 29271, the *ala loa* coastal trail/Jeep road, commonly labeled the “Mahukona-Kawaihae Trail” on maps produced prior to 1931 – was recorded across the project area. Of these seven total omissions from the previous inventory survey (Graves and Franklin 1998), four were deemed potentially significant enough to warrant further inventory survey investigation (Site 2496 Feature D, Site 4013 new rock shelter, Site 15261 additional trail branches, and the Site 29271 Mahukona-Kawaihae Trail section); the other three omissions are relatively minor can be easily rectified during subsequent data recovery and preservation work. The current fieldwork revealed the presence of a burial at Site 2496 Feature D and an additional habitation feature at Site 4013.

As a result of the current study the original significance evaluation and the subsequent DLNR-SHPD determination has been modified for five of the previously recorded sites. Given the current development proposal for the study property, site treatments should be reconsidered and the existing preservation and burial treatment plans revised. Data recovery is now recommended for sixteen sites (4002, 4003, 4010, 4012, 16135, 16137, 16138, 16140, 16141, 16143, 16144, 16146, 16150, 16151, 16164, and 16167) plus portion of two additional sites (Sites 2496 and 4013) that also contain preserved burial features. All of these sites were previously approved for data recovery based on the prior inventory survey with the exception of Sites 4010 and 16138, which were earlier approved for no further work. A plan addressing the data recovery of these sixteen sites should be prepared and submitted to DLNR-SHPD for review and approval. Preservation is now recommended for sixteen sites (2498, 2499, 4000, 4005, 4011, 15261, 16131, 16133, 16134, 16139, 16142, 16145, 16147, 16149, 16163, and 29271), all but two of which (Sites 4000 and 15261) were approved for no further work as a result of the original inventory survey and another (Site 29271) went unrecorded in the earlier survey. A new preservation plan that addresses these sixteen sites should be prepared and submitted to DLNR-SHPD for review and approval.

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1. INTRODUCTION

At the request of Gregory R. Mooers of Mooers Enterprises LLC, on behalf of his client Kohala Shoreline, LLC, ASM Affiliates, Inc. (ASM) has prepared this update to an earlier DLNR-SHPD approved archaeological inventory survey (Graves and Franklin 1998) of an approximately 37.8 acre project area in Kahuā 1st Ahupua‘a, North Kohala District, Island of Hawai‘i (TMK: (3) 5-9-01:008; Figures 1 and 2). The earlier archaeological inventory survey report contained site treatments based on the then planned subdivision development of the parcel. Subsequent archaeological work on the property included the preparation of a data recovery plan for one site (Rosendahl 1994) and the data recovery of that site (O’Hare and Goodfellow 1999), additional burial testing at three sites (PHRI 2005) and the preparation of a burial treatment plan (PHRI 2000a), along with the preparation of an archaeological sites preservation plan (PHRI 2000b). These follow-up studies were conducted with the understanding that the development of the subject parcel would be limited to one single-family residence occupying the extreme western end of the parcel, and that the remaining bulk of the parcel would be left in its natural state. Thus the site treatments approved in the earlier inventory survey report (Graves and Franklin 1998) were reconsidered and revised such that the treatment all of the sites previously approved for data recovery was changed to preservation.

The current proposed development plan for the parcel is no longer restricted to the construction of one single-family residence, but rather includes the creation of a nine lot subdivision. This new proposed land use necessitates revising the site treatments once again, bringing them back more into conformance with what was approved in the original inventory survey. The purpose of the current inventory study is to assess current site conditions and identify any previously unrecorded sites/features, and to provide new site treatments appropriate for the newly proposed nine lot subdivision development plan, as well as to provide a map showing accurate site locations. To that end, ASM completed an intensive resurvey of the study area, identified and re-plotted the previously recorded sites, and documented additional features that had not been previously recorded.

The current report documents the findings of the resurvey of the study area and has been prepared as a companion document to a cultural impact assessment (Rechtman 2014), fulfilling the requirements of the County of Hawai‘i Planning Department and the Department of Land and Natural Resources (DLNR) with respect to permit approvals for land-altering and development activities.

This report begins with a description of the general project area and the proposed development activities. This is followed by a presentation of the archaeological background for the specific study area, as well as a discussion of the culture-historical background for the Kahuā *ahupua‘a* and the North Kohala region. It is a comprehension of this background information that facilitates a more complete understanding of the significance of the resources that exist within the study area. A description of the current conditions of the previously recorded archaeological sites is then presented, followed by a reevaluation of site significance and proposed new treatment recommendations.

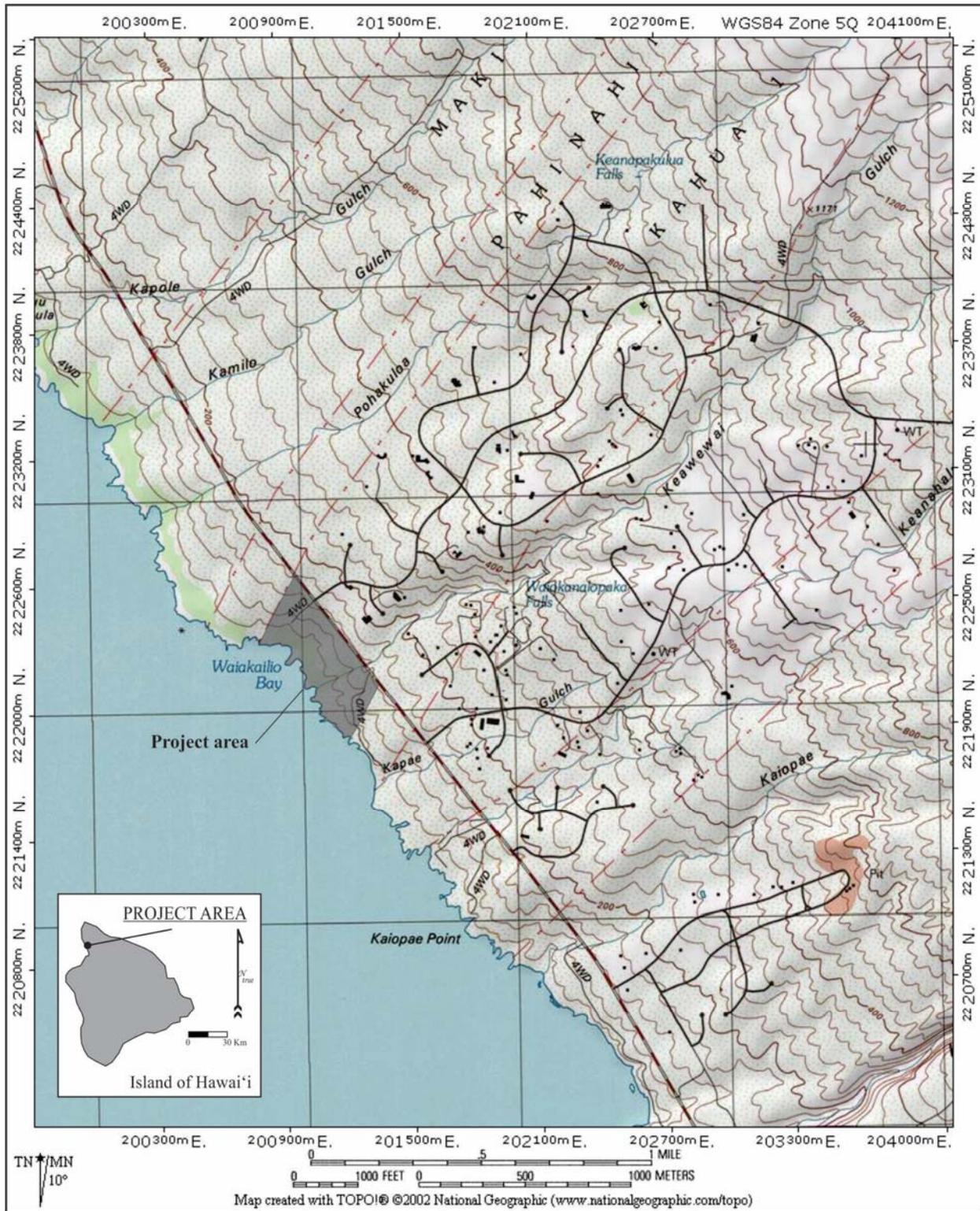


Figure 1. Project area location.



Figure 2. Tax Map Key 3-5-9-01 showing current study parcel (Parcel 008).

2. PROJECT AREA DESCRIPTION AND PROPOSED DEVELOPMENT ACTIVITIES

The project area occupies 37.8 acres along the North Kohala coast, bounded by the ocean to the west and Akoni-Pule Highway (Hwy 270) to the east (see Figure 2). The project area is bounded to the north by an undeveloped state-owned parcel and to the south by the recently developed Kohala Kai subdivision (see Figure 2). Elevation within the project area ranges from sea level to about 160 feet above sea level and the surface geology consists of basaltic lava flows from Kohala volcano dating from at least 120,000 years ago (Wolfe and Morris 1996). Soil within the study area is classified as Kawaihae very rocky very fine sandy loam. The sloping terrain is dissected in a few locations by steeply incised drainage channels (Figure 3) and the vegetation is almost exclusively low grasses and *kiawe* (Figure 4). The typical shoreline in this area is rocky (Figure 5) with a few small coral, rock, and sand beach areas (Figure 6). Waiakailio Bay (Figure 7), at the northern end of the property, is the least rocky and most sheltered area along this portion of the coast, and it offers the easiest ocean access.

The proposed development plans (Figure 8) include the establishment of a nine-lot gated subdivision. The property is currently zoned for single-family residential with minimum lots of 15,000 square feet (RS-15). Upon reviewing the project site and development options, the property owner determined that a less dense development would be more appropriate, and is proposing a change of zone to Residential Agricultural 3-acres (RA-3a), which would decrease potential density and lessen impacts to archaeological resources. Road access would be from two locations along Akoni-Pule Highway. The project would be provided with water, electrical, and telephone service from existing lines located within a utility easement above Akoni Pule Highway. The house sites would be located a minimum of 150 feet below the highway and covenants, conditions and restrictions (CC&Rs) would limit homes to a single story and require color schemes that minimize visual impacts. Landscaping would be installed along the subdivision's two internal roadways and also on the residential lots, subject to CC&Rs. The project includes public shoreline access and associated parking and will preserve a coastal buffer through the establishment of a 100-foot no development shoreline setback for all but Lot 1, which would be subject to the normal 40 foot setback.



Figure 3. Keawewai Gulch drainage.



Figure 4. Typical vegetation cover across the study parcel.



Figure 5. Rocky shoreline along the study parcel.



Figure 6. Typical rocky beach area.



Figure 7. Waiakailio Bay.

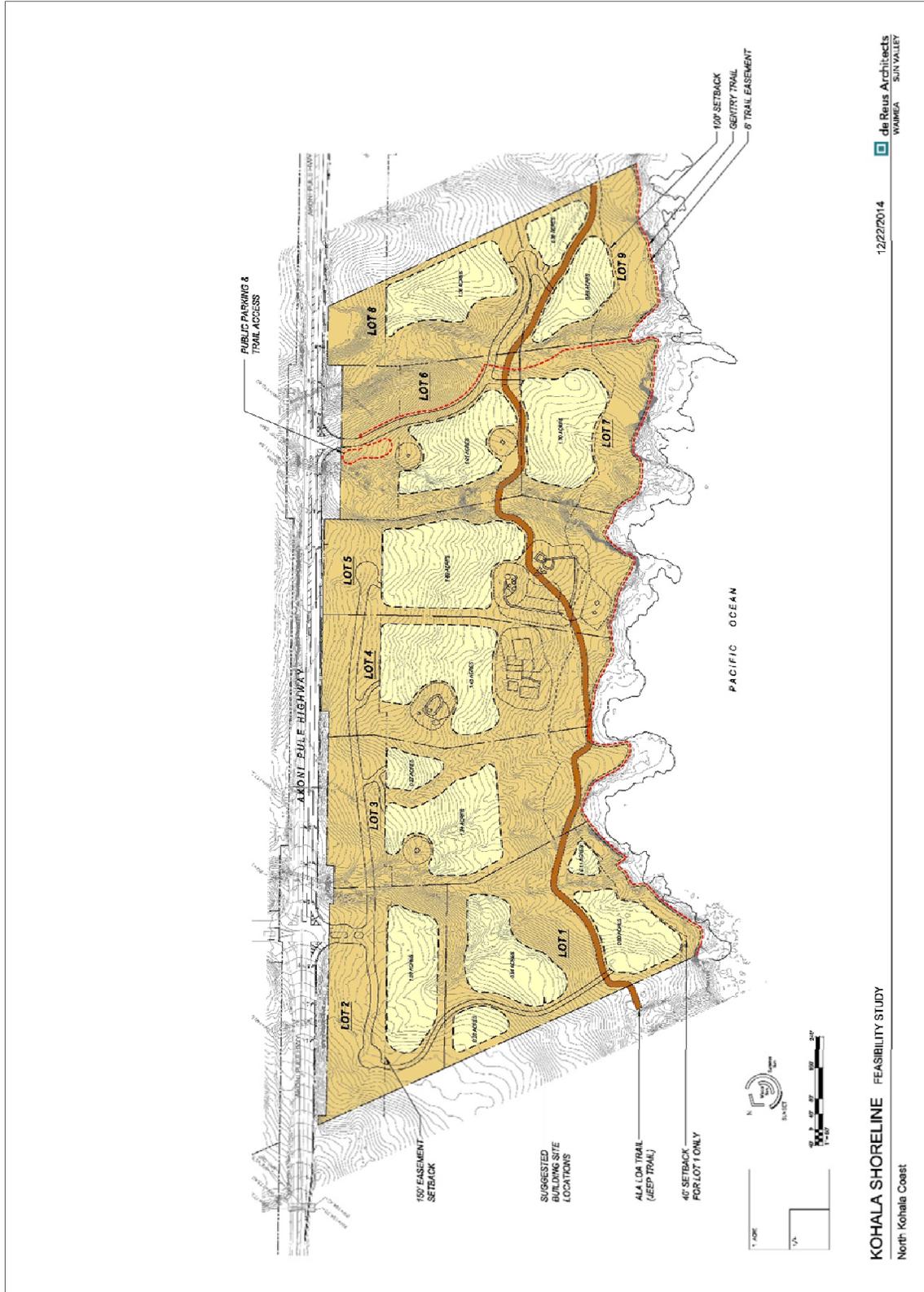


Figure 8. Proposed development plan.

3. ARCHAEOLOGICAL BACKGROUND

In 1964 Soehren surveyed the construction corridor for the Kawaihae to Mahukona Highway, which terminated roughly nine miles (14.5 kilometers) to the north of the project area. During this survey Soehren (1964) recorded two small rock cairns, a rock platform, and two open-ended enclosures with associated marine shell and coral within the *ahupua'a* of Kahuā 1 and 2. In 1968 Bonk surveyed the coastal area from Kawaihae to Kaiholena *ahupua'a*. During this survey Bonk (1968) recorded 24 stone features within Kahuā 1. The concentration of Bonk's features that were recorded on the northern side of the current project area was later designated SIHP 4156 during the 1972 Statewide Inventory as the Waiakailio Bay Complex. Starting in 1983 Paul H. Rosendahl, Ph.D., Inc (PHRI) began a series of archaeological studies that focused on the current project area and adjoining lands to the south (Allen 1985a, 1985b; Corbin 2004; Graves and Franklin 1998; Kubo and Rosendahl 2003; O'Hare and Goodfellow 1999; PHRI 2000a, 200b, 2005; Rosendahl 1994). The resultant reports include reconnaissance surveys, an inventory survey, mitigation (preservation and data recovery) plans, data recovery reports, and burial treatment plans. The inventory survey (Graves and Franklin 1998) contains a map that shows the locations of the archaeological sites that were recorded within the current project area (Figure 9), and Table 1 lists the sites and their prior approved treatments.

Table 1. Sites within the current project area and their prior approved treatments*

SIHP No.	Treatment in Inventory	Revised Treatment in Preservation Plans
2496	Data Recovery	Preservation
2498	Data Recovery/Preservation	Preservation
2499	Data Recovery/Preservation	Preservation
4000	No Further Work	No Further Work
4002	Data Recovery	Preservation
4003	Data Recovery	Preservation
4004	Burial Preservation	Burial Preservation
4005	Data Recovery/Preservation	Preservation
4010	No Further Work	No Further Work
4011	Data Recovery	Preservation
4012	Data Recovery	Preservation
4013	Burial Preservation	Burial Preservation
4015	Data Recovery Completed	Data Recovery Completed
15261	No Further Work	No Further Work
16131	Data Recovery	Preservation
16132	No Further Work	No Further Work
16133	Data Recovery	Preservation
16134	Data Recovery	Preservation
16135	Data Recovery	Preservation
16136	Further Data Collection	No Further Work
16137	Data Recovery	Preservation
16138	No Further Work	No Further Work
16139	Data Recovery	Preservation
16140	Data Recovery	Preservation
16141	Data Recovery	Preservation
16142	Data Recovery	Preservation
16143	Data Recovery	Preservation
16144	Data Recovery	Preservation
16145	Data Recovery	Preservation
16146	Data Recovery	Preservation
16147	Data Recovery	Preservation
16148	Further Data Collection	Burial Preservation
16149	Data Recovery	Preservation
16150	Data Recovery	Preservation
16151	Data Recovery	Preservation
16162	Further Data Collection	Burial Preservation
16163	Data Recovery	Preservation
16164	Data Recovery	Preservation
16167	Data Recovery	Preservation

*Derived from Graves and Franklin (1998); PHRI (2000b); PHRI (2005).

3. Archaeological Background

Within the western portion of the current study parcel, data recovery investigations at SIHP Site 4015 focused on four enclosure features (O'Hare and Goodfellow 1999). Fishing gear and grinding tools were recovered, as well as radiocarbon assays of charcoal from each of the four features. Based on the food remains, architecture, and radiocarbon results, Site 4015 could have been a habitation site associated with the collection of near-shore and offshore marine resources, possibly dating back to A.D. 1370. Judging from the presence of sub-wall deposits, an even earlier occupation could have been present at Site 4015.

Additional recent archaeological work near the project area includes an extensive data recovery investigation along the coastal portions of Kahuā 2 and Waikā *ahupua'a* (Loubser and Rechtman 2007), and a data recovery investigation of Site 16170 in coastal Waikā (Corbin 2000). The Loubser and Rechtman (2007) study was conducted at seven sites (SIHP Sites 2492, 16177, 16122, 2494, 16129, 2485, and 16154) within the state designated site complex (SIHP Site 4157) known as the Kahuā 2 Complex. This study recovered a wealth of information pertaining to resource collection, settlement distribution, feature function, and site chronology. The oldest radiocarbon date (A.D. 1270–1420) from the site complex came from a sub-wall context and is roughly contemporaneous with the early date from the nearby Waiakailio Bay Complex (O'Hare and Goodfellow 1999). Loubser and Rechtman (2007) also documented the temporal development of the Kahuā 2 village area showing where it may have started, how it subsequently expanded, and finally contracted; and demonstrated that the habitation area most likely constituted a nucleated settlement of several households with co-residential domestic groups. Discrete households were identified using a *kauhale* settlement model, and male and female activity areas were identified within each *kauhale*.

The Corbin (2000) study focused on a modified outcrop and a platform. The modified outcrop yielded volcanic glass flakes and gastropods, whereas the platform yielded volcanic glass flakes, sea urchin spine abraders, and a hearth. The hearth feature, exposed at the bottom of the platform, yielded three charcoal samples radiocarbon dated to between A.D. 1435 and 1635. The upper layers within the platform dated to after A.D. 1665. Based on the results, Corbin suggested that the platform at Site 16170 represented a temporary habitation site that was occupied to procure gastropods and possibly to manufacture urchin spine abraders.

A settlement model for leeward coastal North Kohala can be derived from the previous archaeological work referenced above. Settlement complexes are more-or-less evenly spaced along the leeward coastline of North Kohala, with a subsistence focus on marine resources, although the ostensible absence of perishable products from cultivation has most likely skewed the archaeological record. Site complexes seem to concentrate around small bays and cobble beaches where canoes could land along the otherwise cliff-lined coast. A focal point of most settlement complexes is a *halau*, or canoe shed, located above and behind the beach that affords the best opportunity for launching or landing. A canoe shed is typically long, narrow, and open on the *makai* side. Inland and on either side of the canoe shed are habitation and storage sites of various kinds. Tomonari-Tuggle (1988) notes that within site complexes it is possible to distinguish concentrations of habitation structures and associated features that could represent the areas once occupied by family units. Each family unit contained one or more living structure, an animal pen or two, outdoor working areas, and burial mounds. Typical features within a habitation area, or *kauhale*, include the following: structures with massive walls that resemble long “cupboards,” multiple unit longhouses with an opening on one end, houses with enclosing platforms, house complexes enclosed by walls, rectangular houses with open ends, a variety of C- and U-shaped structures, and burial mounds and small platforms on the periphery. According to available evidence there are few known *heiau* on the leeward North Kohala coast; only three paved structures with large rock fill at Kukuipahu fit the descriptions (Smith et al. 1973). Additional work and closer scrutiny of stone platforms on crests of rises, that are sometimes associated with walled precincts, could reveal more *heiau* along the coastal settlements, however (e.g., Soehren 1969).

The narrow band of habitation settlements along the coast are separated from a broader upland band of agricultural walls and habitations by a barren zone with relatively few archaeological sites. Within individual *ahupua'a*, trails that pass through the barren zone would have connected coastal settlements with upland fields (Apple 1965). The width of the barren zone is inversely related to the abundance of rainfall; in the wetter north near 'Upolu Point it is one kilometer wide and widens to five kilometers at Kahuā in the drier south. Surveys that have covered the uplands away from the coastline date back to the late 1960s when the University of Hawai'i field schools mapped Lapakahi *ahupua'a* north of Kaiholena *ahupua'a*, using aerial photographs and surveying instruments (Newman 1970). Vast portions of Kahuā 1 and 2 inland of the highway were surveyed by Hammatt and Borthwick (1986, 1987, 1990). During these upland surveys, that covered land up to the 3,000-foot contour above sea level, archaeologists found trail markers, scattered agricultural terraces, temporary habitation shelters, and rock walls. The remains most probably relate to the upland agricultural fields mentioned in various oral and written histories. On the basis of surveys and excavations, Rosendahl (1994) has identified the following sites in the better watered Lapakahi area: residential structures with C-

shapes or rectangular plan forms, piled stone walls or earthen embankments demarcating agricultural fields, trails, possible burial piles, water cisterns, rock shelters, and petroglyphs.

Bearing in mind that the inhabited lowland zone along the coast and the inhabited upland zone of the interior were most likely occupied by the same people at different parts of the year, detection of increased and expanded use of any one of the zones should be suggestive of overall increased population size (of course, if none of the zones show signs of decline or abandonment). Based on 54 radiocarbon assays and evidence for increasing subdivision of stone-walled field parcels in the Lapakahi uplands north of the project area, Rosendahl (1994) has suggested that the Kohala upland fields began around A.D. 1400 in the form of shifting cultivation, which intensified to a crop-rotation system with clearly delineated boundaries by A.D. 1600. Based on evidence from the entire Hawaiian Archipelago, Kirch (1985:216–217) has proposed that agricultural development and population growth occurred as three generalized phases: adjustment, expansion, and intensification. When Polynesian colonizers first landed they had to adjust to the unique demands of the less tropical Hawaiian environment. Once this adjustment along the littoral zone had been made, settled populations were able to increasingly utilize upland areas. Greater labor inputs to increase yields eventually meant that even the uplands needed to be terraced and sub-divided for crop rotation. By the time Europeans documented Hawaiian agriculture from the late eighteenth century onwards, the system was a fully fledged intensive one, with populations utilizing even seemingly marginal zones. The practice of mulching and the surprisingly rapid construction of irrigation systems enabled Hawaiian communities to cultivate seemingly marginal hinterlands (Kirch 1985:236). For example, Kamehameha I was able to feed his substantial entourage and standing army at Kawaihae by constructing irrigated fields in the Waimea uplands over a five-year period.

To summarize the archaeologically derived settlement patterns of the Kohala area, the first significant occupation of the area seems to occur around A.D. 1300 near the coast. Based on available evidence, the population appears to have been small and engaged primarily in fishing and some cultivation of crops. Over the next two centuries the uplands too were increasingly cultivated. This period experienced more regular seasonal transhumance between the coast in summer and uplands in winter. Around A.D. 1500 *ahupua'a* were clearly delineated and bound fields in the uplands also became more marked. By A.D. 1700 more-or-less permanent settlements occurred along the coast and in the uplands. The *ahupua'a* system of social organization was firmly established at this time, with defined land units extending from the ocean into the mountains. Local chiefs controlled the *ahupua'a* and these were in turn integrated at the district level. Paramount chiefs ruled over the district within a feudal-like system of taxation and redistribution. Class distinction between ruling *ali'i*, or chiefs, and *maka'āinana*, or commoners, characterized the overall political economy and ideology prior to the *Māhele* in 1848.

4. CULTURE-HISTORICAL BACKGROUND

A GENERALIZED MODEL OF HAWAIIAN PREHISTORY

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

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

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 was 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 later was a status item worn by those of high rank, indicating a trend toward greater status differentiation (Kirch 1985). Early dates from windward Kohala were reported by Cordy (2000); these sites are believed to have been utilized in the early 1200s.

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 escaped Lonopele's wrath by fleeing in a canoe. Kamakau (1991:100–102) told the following story in 1866:

Puna on Hawai'i Island was the first land reached by Pa'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, Pa'ao went on to land in Kohala, at Pu'uēpa. He built a *heiau* there called Mo'okini, a *luakini*. It is thought that Pa'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. There were seventeen generations during which Hawai'i Island was without chiefs—some eight hundred years.

There are several versions of this story that are discussed by Beckwith (1976), including the version where Mo'okini and Kaluawilinau, two *kāhuna* of Moikeha, decide to stay on at Kohala. The bones of the *kahuna* Pa'ao are said to be deposited in a burial cave in Kohala in Pu'uēpa [possibly Pu'uēpa?] (Kamakau 1964:41).

The concept of the *ahupua'a* was established during the A.D. 1400s (Kirch 1985), adding another component to a then well-stratified society. This land unit became the equivalent of a local community, with its own social,

economic, and political significance. *Ahupua'a* were ruled by *ali'i 'ai ahupua'a* or lesser chiefs; who, for the most part, had complete autonomy over this generally economically self-supporting piece of land, which was managed by a *konohiki*. *Ahupua'a* were usually wedge or pie-shaped, incorporating all of the eco-zones from the mountains to the sea and for several hundred yards beyond the shore, assuring a diverse subsistence resource base (Hommon 1986).

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-hou 1974). The *ahupua'a* was further divided into smaller sections such as the *'ili, mo'o'aina, pauku'aina, kihapai, koele, hakuone, and kuakua* (Hommon 1986, Pogue 1978). The chiefs of these land units gave their allegiance to a territorial chief or *mo'i* (king). *Heiau* building flourished during this period as religion became more complex and embedded in a sociopolitical climate of territorial competition. Monumental architecture, such as *heiau*, "played a key role as visual markers of chiefly dominance" (Kirch 1990:206).

The Proto-Historic Period (A.D. 1650–1795) is marked by both intensification and stress. Wars occurred between intra-island and inter-island polities. Sometime between A.D. 1736 and 1758, Kamehameha I was born in the *ahupua'a* of Kokoiki, North Kohala near the Mo'okini Heiau [there is some controversy about his birth year, see Kamakau 1992:66–68]. The birth event is said to have occurred on a stormy night of rain, thunder, and lightning, signified the night before by a very bright, ominous star, thought by some to be Halley's comet [this is also controversial] (Kamakau 1992). Kamehameha's ancestral homeland was in Halawa, North Kohala (Williams 1919).

This period was one of continual conquest by the reigning *ali'i*. Ke'eaumoku, son of Keawepoepoe, set up a fort at Pololu and Honokane; he was attacked there by Kalaniopu'u, so he moved to Maui. About A.D. 1759 Kalani'opu'u conquered East Maui, defeating his wife's brother, the Maui king Kamehamehanui, by using Hana's prominent Pu'u Kau'iki as his fortress. He appointed one of his Hawai'i chiefs, Puna, as governor of Hana and Kipahulu. Kahekili became king of Maui in A.D. 1766 when Kamehamehanui died following an illness. Ke'eaumoku took his widow, Namahana, a cousin of Kamehameha I, as his wife. Their daughter, Ka'ahumanu, the future favorite wife of Kamehameha I, was born in a cave at the base of Pu'u Kau'iki, Hana, Maui in A.D. 1768 (Kamakau 1992). In A.D. 1775 Kalani'opu'u and his Hana forces raided and destroyed the neighboring Kaupo District, then launched several more raids on Moloka'i, Lana'i, Kaho'olawe, and parts of West Maui. It was at the battle of Kalaeoka'ilio that Kamehameha, a favorite of Kalaniopu'u, was first recognized as a great warrior and given the name of Pai'ea (hard-shelled crab) by the Maui chiefs and warriors (Kamakau 1992). During the battles between Kalaniopu'u and Kahekili (1777–1779), Ka'ahumanu and her parents left Maui to live on the island of Hawai'i (Kamakau 1992).

HISTORY AFTER CONTACT

Captain James Cook landed in the Hawaiian Islands on January 18, 1778. Ten months later, on a return trip to Hawaiian waters, Kalaniopu'u, who was at war with Kahekili, visited Cook on board the *Resolution* off the East coast of Maui. The following January [1779], Cook and Kalaniopu'u met again in Kealakekua Bay and exchanged gifts. In February, Cook set sail; however, a severe storm off the Kohala coast damaged a mast and they had to return to Kealakekua. Cook's return occurred at an inopportune time, and this misfortune cost him his life (Kuykendall and Day 1976).

In 1779 King of the Cook expedition explored the North Kohala country and reported:

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

Around A.D. 1780 Kalaniopu'u proclaimed that his son Kiwalao would be his successor, and he gave the guardianship of the war god Ku'ka'ilimoku to Kamehameha. Kamehameha and a few other chiefs were concerned about their land claims, which Kiwalao did not seem to honor, so after usurping Kiwalao's authority with a sacrificial ritual, Kamehameha retreated to his district of Kohala. While in Kohala, Kamehameha farmed the land, growing taro and sweet potatoes (Handy and Handy 1972). After Kalani'opu'u died in A.D. 1782 civil war broke out: Kiwalao was killed. The wars between Maui and Hawai'i continued until A.D. 1795 (Kuykendall and Day 1976; Handy and Handy 1972).

4. Culture-Historical Background

In 1790 two Western ships, the *Eleanora* and *Fair American*, were trading in Hawaiian waters. As retribution for the theft of a skiff and the murder of one of the sailors, the crew of the *Eleanora* massacred more than 100 natives at Olowalu [Maui]. The *Eleanora* then sailed to Hawai'i Island, and one of its crew, John Young, went ashore, where he was detained by Kamehameha. The other vessel, the *Fair American*, was captured by the forces of Kamehameha off the Kekaha coast and its crew was killed except for one member, Isaac Davis. Kame'eiamoku, who resided in Ka'ūpulehu at the time, played a lead role in this incident. He and his followers recovered several foreign arms from the *Fair American*, including a cannon that they called "Lopaka", all of which were turned over to Kamehameha (Kamakau 1992). Kamehameha made Young and Davis his advisors. He also kept the vessel as part of his fleet. With the aid of his new advisors, new ship, and foreign arms Kamehameha conquered Maui, and by 1796 he had conquered all the island kingdoms except Kauai. It wasn't until 1810, when Kaumuali'i of Kauai gave his allegiance to Kamehameha, that the Hawaiian Islands were unified under one ruler (Kuykendall and Day 1976).

Demographic trends during this period indicate population reduction in some areas, due to war and disease, yet increases in others, with relatively little change in material culture. However, there was a continued trend toward craft and status specialization, intensification of agriculture, *ali'i* controlled aquaculture, upland residential sites, and the enhancement of traditional oral history. The Kū cult, *luakini heiau*, and the *kapu* system were at their peaks, although western influence was already altering the cultural fabric of the Islands (Kirch 1985; Kent 1983). Foreigners had introduced the concept of trade for profit, and by the time Kamehameha I had conquered O'ahu, Maui and Moloka'i, in 1795, Hawai'i saw the beginnings of a market system economy (Kent 1983). This marked the end of an era of uniquely Hawaiian culture.

Hawai'i's culture and economy continued to change drastically as capitalism and industry established a firm foothold. The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790 and turned into a viable commercial enterprise by 1805 (Oliver 1961), was flourishing by 1810. This added to the breakdown of the traditional subsistence system, as farmers and fishermen were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Kamehameha did manage to maintain some control over the trade (Kuykendall and Day 1976; Kent 1983).

Kamehameha I died on May 8, 1819 at Kamakahonu in Kailua-Kona, and once again the culture of Hawai'i was to change radically. Following the death of a prominent chief, it was customary to remove all of the regular *kapu* that maintained social order and the separation of men and women and elite and commoner. Thus, following Kamehameha's death a period of 'ai noa (free eating) was observed along with the relaxation of other traditional *kapu*. It was for the new ruler and *kahuna* to re-establish *kapu* and restore social order, but at this point in history traditional customs saw a change:

The death of Kamehameha was the first step in the ending of the tabu; the second was the modifying of the mourning ceremonies; the third, the ending of the tabu of the chief; the fourth, the ending of carrying the tabu chiefs in the arms and feeding them; the fifth, the ruling chief's decision to introduce free eating ('ainoa) after the death of Kamehameha; the sixth, the cooperation of his aunts, Ka-ahu-manu and Ka-heihei-malie; the seventh, the joint action of the chiefs in eating together at the suggestion of the ruling chief, so that free eating became an established fact and the credit of establishing the custom went to the ruling chief. This custom was not so much of an innovation as might be supposed. In old days the period of mourning at the death of a ruling chief who had been greatly beloved was a time of license. The women were allowed to enter the heiau, to eat bananas, coconuts, and pork, and to climb over the sacred places. You will find record of this in the history of Ka-ula-hea-nui-o-ka-moku, in that of Ku-ali'i, and in most of the histories of ancient rulers. Free eating followed the death of the ruling chief; after the period of mourning was over the new ruler placed the land under a new tabu following old lines. (Kamakau 1992:222)

Immediately upon the death of Kamehameha I, Liholiho (his son and to be successor) was sent away to Kawaihae to keep him safe from the impurities of Kamakahonu brought about from the death of Kamehameha. After purification ceremonies Liholiho returned to Kamakahonu:

Then Liholiho on this first night of his arrival ate some of the tabu dog meat free only to the chiefesses; he entered the *lauhala* house free only to them; whatever he desired he reached out for; everything was supplied, even those things generally to be found only in a tabu house. The people saw the men drinking rum with the women *kahu* and smoking tobacco, and thought it was to mark the ending of the tabu of a chief. The chiefs saw with satisfaction the ending of the chief's tabu and the freeing of the eating tabu. The *kahu* said to the chief, "Make eating free over the whole kingdom

from Hawaii to Oahu and let it be extended to Kauai!" and Liholiho consented. Then pork to be eaten free was taken to the country districts and given to commoners, both men and women, and free eating was introduced all over the group. Messengers were sent to Maui, Molokai, Oahu and all the way to Kauai, Ka-umu-ali'i consented to the free eating and it was accepted on Kauai. (Kamakau 1992: 225)

When Liholiho, Kamehameha II, ate the *kapu* dog meat, entered the *lauhala* house and did whatever he desired it was still during a time when he had not reinstated the eating *kapu* but others appear to have thought otherwise. Liholiho's cousin, Kekuakalani, caretaker of the war god Kū'kā'ilimoku, revolted, but by December of 1819 the revolution was quelled. With an indefinite period of free-eating and the lack of the reinstatement of other *kapu* extending from Hawai'i to Kaua'i, and the arrival of the Christian missionaries shortly thereafter, the traditional religion had been officially replaced by Christianity within a year following the death of Kamehameha I. Kamehameha II sent edicts throughout the kingdom renouncing the ancient state religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *'aumakua* worship, to continue (Oliver 1961; Kamakau 1992).

In October of 1819, seventeen Protestant missionaries set sail from Boston to Hawaii. They arrived in Kailua-Kona on March 30, 1820 to a society with a religious void to fill. Many of the *ali'i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western style and adopt their dress and religion. Soon they were rewarding their teachers with land and positions in the Hawaiian government. During this period, the sandalwood trade was wreaking havoc on the commoners, who were weakening with the heavy production, exposure, and famine just to fill the coffers of the *ali'i* who were no longer under any traditional constraints (Oliver 1961; Kuykendall and Day 1976). On a stopover in the Kohala district Ellis wrote:

About eleven at night we reached Towaihae [Kawaihae], where we were kindly received by Mr. Young. . . . Before daylight on the 22nd, we were roused by vast multitudes of people passing through the district from Waimea with sandal-wood, which had been cut in the adjacent mountains for Karaimoku, by the people of Waimea, and which the people of Kohala, as far as the north point, had been ordered to bring down to his storehouse on the beach, for the purpose of its being shipped to Oahu. There were between two and three thousand men, carrying each from one to six pieces of sandal-wood, according to their size and weight. It was generally tied on their backs by bands of ti leaves, passed over the shoulders and under the arms, and fastened across their breasts. (Kuykendall and Day 1976:42, 43; Ellis 1963:397)

The lack of control of the sandalwood trade was to soon lead to the first Hawaiian national debt as promissory notes and levies were initiated by American traders and enforced by American warships (Oliver 1961). The Hawaiian culture was well on its way towards Western assimilation as industry in Hawai'i went from the sandalwood trade, to a short-lived whaling industry, to the more lucrative, but environmentally destructive sugar industry. The windward portions of North Kohala became a center of sugarcane production, although sugarcane cultivation in Kohala had its origins in prehistory.

Pukui (1983) cites two proverbs that reference both Kohala and sugarcane. She provides an explanation and notes that Hawaiian proverbs have layers of meaning that are best left to the imagination of the reader:

He pa 'a kō kea no Kohala, e kole ai ka waha ke 'ai

A resistant white sugar cane of Kohala that injures the mouth when eaten.

Pukui explains this proverb as follows:

A person that one does not tamper with. This was the retort of Pupukeya, a Hawai'i chief, when the Maui chief Makakuikalani made fun of his small stature. It was later used in praise of the warriors of Kohala, who were known for valor (1983:95).

I 'ike 'ia no o Kohala i ka pae kō, a o ka pae kō ia kole ai ka waha.

One can recognize Kohala by her rows of sugar cane which can make the mouth raw when chewed.

Pukui interprets this proverb as follows:

When one wanted to fight a Kohala warrior, he would have to be a very good warrior to succeed. Kohala men were vigorous, brave, and strong (1983:127).

Sugarcane (*Saccharum officinarum*) was a Polynesian introduction and served a variety of uses. The *kō kea* or white cane was the most common, usually planted near Hawaiian homes for medicinal purposes, and to counteract bad tastes (Handy and Handy 1972:185). Sugarcane was a snack, condiment, famine food; fed to nursing babies, and helped to strengthen children's teeth by chewing on it (Handy and Handy 1972:187). It was used to thatch houses when *pili* grass (*Heteropogon contortus*) or *lau hala* (*Pandanus odoratissimus*) were not abundant (Malo 1951). Sugarcane was also used in relation to taro and sweet potato. Handy and Handy (1972:186) explain:

In wet-taro farming, cane was planted along the embankments separating the flooded terraces and flats. In dry-taro and sweet-potato fields on the sloping *kula* or in the lower forest zone, cane was planted as hedges along the lines of stone and rubbish thrown up between the fields. Thus it helped the planter to utilize to the maximum his soil and water, and acted as a windbreak against the gusty breezes which blow in most valley bottoms, along the coasts, and on the uplands where taro is grown.

Sugarcane was grown on all islands, and when Cook arrived he wrote of seeing sugarcane plantations. The Chinese on Lanaʻi are credited with producing sugar first, as early as 1802. However, it was not until 1835 that sugar became established commercially, replacing the waning sandalwood industry (Oliver 1961, Kuykendall and Day 1976).

Kohala became a land in transition and eventually a major force in the sugar industry with the arrival of American missionary Elias Bond (KTF 1975). In her comprehensive study of North Kohala, Tomonari-Tuggle relates this transition:

The arrival in 1841 of Elias Bond, of the Protestant American Board of Commissioners for Foreign Missions, to Kohala marked the beginning of a 22-year period of transition in the district's history. In those years a new religion, a new land tenure system, and a changing economy altered the lifestyles and world view of the indigenous population of the district. The Kohala community was in flux, attempting to find a firm footing in a changing world, in a much larger network of social, political, and economic interactions than had previously existed. (Tomonari-Tuggle 1988:I-23)

When Elias Bond directed his efforts to initiating sugar as a major agricultural industry in Kohala, he could not have foreseen the incredible success of his modest venture. His primary concern was to develop a means for the Hawaiian people of the district to compete successfully in the market economy that had evolved in Hawaii. What resulted was a vigorous, stable, and competitive industry which survived over a century of changing economic situations. For the Hawaiian people, however, the impact was not what Bond anticipated. (Tomonari-Tuggle 1988:I-39)

In 1860 Rev. Bond engaged Samuel N. Castle in founding the Kohala Sugar Company on lands owned by Bond and his neighbor Dr. James Wight. The first crop was harvested in January 1865 (KTF 1975). Kohala's transition was a reflection of what was happening elsewhere in Hawaiʻi as the sugar industry grew. The industry brought in tens of thousands of laborers from Asia, Europe, the Americas, Oceania, and Africa to work on the many plantations and mills that were being established on all major islands (Oliver 1961). This influx not only radically changed the culture, but also drastically altered agricultural lands and destroyed traditional architectural features in the process. The drier leeward portions of Kohala were not suited for cane cultivation and thus became vast pasturelands for grazing cattle.

A GENERALIZED SETTLEMENT MODEL FOR KOHALA WAHO

The following summary of settlement patterns for the leeward coast of North Kohala follows earlier regional models (Rosendahl 1972; Griffin et al. 1971; Tomonari-Tuggle 1988) and takes into account observations and information contained in traveler, missionary, and Kingdom records (Maly 2000).

Evidence for early occupation of Kohala has been collected from Kapaʻanui. Dunn and Rosendahl (1989) recovered radiocarbon samples that potentially date to as early as A.D. 460 (Site 12444). This early date may be related to the establishment of small, short-term camps to exploit seasonal, coastal resources (or more likely are the result of an anomalous radiocarbon assay; see Kirch 2011). Data recovered from Mahukona suggest initial occupation there by A.D. 1280 (Burgett and Rosendahl 1993:36). The earliest date range for permanent settlement in Kohala (A.D. 1300) was obtained from Koaiʻe, a coastal settlement where subsistence primarily derived from marine resources. According to Tomonari-Tuggle (1988:13), these resources were probably supplemented by small-scale agriculture.

The period from A.D. 1300–1500 was characterized by population growth and expanded efforts to increase upland agriculture. Rosendahl (1972) has proposed that settlement at this time was related to seasonal, recurrent occupation in which coastal sites were occupied in the summer to exploit marine resources, and upland sites were occupied during

the winter months, with a focus on agriculture. An increasing reliance on agricultural products may have caused a shift in social networks as well, according to Hommon (1976). Hommon argues that kinship links between coastal settlements disintegrated as those links within the *mauka-makai* settlements expanded to accommodate exchange of agricultural products for marine resources. This shift is believed to have resulted in the establishment of the *ahupua'a* system. The implications of this model include a shift in residential patterns from seasonal, temporary occupation, to permanent dispersed occupation of both coastal and upland areas.

This pattern continued to intensify from A.D. 1500 to Contact (A.D. 1778), and there is evidence that suggests that there were substantial changes to the political system as well. Within Kohala, the Great Wall complex at Koai'e is organized with platforms in the complex apart from contemporaneous features. Griffin et al. (1971) interpret this as symbolizing class stratification. By A.D. 1600, 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 this unification 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).

By the time of contact, numerous coastal villages and extensive dryland agricultural systems were in place in North Kohala. The *ahupua'a* system of social organization was also firmly established by this time, with defined land units extending from the mountains to the sea. The *ahupua'a* were controlled by local chiefs, and were integrated at the district level. Districts were ruled by paramount chiefs through a system of taxation and redistribution. Social stratification was defined by a class separation between the ruling *ali'i* (chiefs) at one end, and the *maka'ainana* (commoners) at the other. Kamehameha I eventually united the Island of Hawai'i, and ultimately all of the Hawaiian Islands, and freely participated in the European-introduced market economy.

The earliest detailed written descriptions of the region are contained in the Journal of William Ellis (1963), an English Missionary who traveled through the area in 1823. Two of his journal entries are of particular relevance: a visit to the villages of Owawarua [Awalua] (just south of Kukuipahu) and Hihiu (Māhukona), and an account of the coast between Towaihae [Kawaihae] and Māhukona related to him by one of his companions named Lorrin Thurston.

About three p.m. we reached Owawarua, a considerable village on the north-west coast, inhabited mostly by fisherman. Here we tried to collect a congregation, but only three women and two small children remained in the place, the rest having gone to Waimea to fetch sandalwood for Karaioimoku. From Owawarua we passed on to Hihiu, where we had an opportunity to speak to a small party of natives.

In these villages we saw numbers of canoes and many large fishing nets, which are generally made with a native kind of flax, very strong and durable . . . In taking fish out of the sea, they commonly make use of a net, of which they have many kinds, some very large, others mere hand-nets; they occasionally employ the hook and line, but never use the spear or dart which is a favourite weapon with the southern islanders.

Quantities of fish were spread out in the sun to dry, in several places, and the inhabitants of the northern shores seem better supplied with this article than those of any other part of the island. . . . Being considerably fatigued, and unable to find any fresh water in the village, we procured a canoe to take us to Towaihae, from which we were distant about 20 miles. Though we had numbered, in our journey today, 600 houses, we had not seen a thing like four hundred people, almost the whole population being employed in the mountains cutting sandalwood. It was about seven o'clock in the evening when we sailed from Hihiu, in a single canoe. (Ellis 1963:285-286)

On the 23d Mr. Thurston left Towaihae, and walked along the shore towards the north point [Upolu]. About noon he reached the small village, called Kipi [North of Kahuāli'ili'i], where he preached to the people; and as there was only one village between Kipi and the place where I had preached on Wednesday evening [Hihiu/Māhukona], he retraced his steps to Towaihae. He preached at another four villages on his return [perhaps at settlements within or adjacent to the current project area], where the congregations, though not numerous, were attentive . . . The coast was barren; the rocks volcanic; the men were all employed in fishing; and Mr. Thurston was informed that the inhabitants of the plantations, about seven miles in the interior, were far more numerous than on the shore. In the evening he reached Towaihae. (Ellis 1963:288)

As early as the 1830s, missionaries in Kohala noting that "deaths are more numerous than births; [h]ence the population is decreasing" (Doyle 1953:72) began compiling census records by *ahupua'a*. In an 1835 census, Kahuā (combined) is listed as having a resident population of 256 (Schmidt 1973:27), documenting a sizeable population.

Traditional and historical accounts indicate that the residents of the *ahupua'a* in *Kohala waho* lived both along the coast in fishing villages and in the uplands near the agricultural systems. It is interesting that within Kahuā there were 256 residents recorded in 1835, and that eleven years later in 1846 there was only one claimant for a *kuleana* in Kahuānui during the *Māhele*; the claim was not awarded having been contested by Kekūānāo'a.

Traditional land use patterns saw a rapid shift after the *Māhele* in 1848. By the mid-19th century, leeward settlement shifted to the windward side of North Kohala as the leeward, agriculturally marginal, areas were abandoned in favor of more productive and wetter sugarcane lands. In addition, native populations were decimated by disease and a depressed birth rate. According to Tomonari-Tuggle (1988:37), the remnant leeward population nucleated into a few small coastal communities and dispersed upland settlements. Settlements were no longer based on traditional subsistence patterns, largely because of the loss of access to the full range of necessary resources. At this point most communities were centered on sugar mills and became part of the plantation social hierarchy. Much of the coastal land in leeward North Kohala was used as cattle pasture. Walled complexes became the dominant residential structure for those remaining leeward settlements as families enclosed their holdings to protect them from feral cattle and to clearly define their *kuleana* boundaries.

Kahuāli'ili'i Ahupua'a

Kahuāli'ili'i Ahupua'a is one of the three southernmost *ahupua'a* of the North Kohala District (only Kahuānui Ahupua'a and Waikā Ahupua'a, along the North Kohala/South Kohala boundary, are further south; see Figure 2). During the *Māhele* of 1848 all three of these *ahupua'a* were awarded to *ali'i*. Kahuāli'ili'i was awarded to Lot Kapuāiwa (Kamehameha V) as LCAw. 7715:5, Kahuānui was awarded to Victoria Kamamalu (Lot's Sister and last Kahina-Nui of Hawai'i) as LCAw. 7713:4, and Waikā was awarded to Gina Lahilahi (daughter of John Young) as of LCAw. 8020-B:2. Pahinahina Ahupua'a, bordering Kahuāli'ili'i Ahupua'a to the north, was retained as Government Land. There were no *kuleana* awarded within Kahuāli'ili'i Ahupua'a during the *Māhele* of 1848.

By 1857 Kahuāli'ili'i had been leased by Lot Kapuāiwa to G. W. Macey, who also leased Waikā Ahupua'a from Victoria Kamamalu in 1859 (Graves and Franklin 1998). An 1859 map of Kahuāli'ili'i prepared by S. C. Wiltse (Figure 10) shows a "Road to Macy [sic] and Vida's Ranch" that extends from the coast within the current project area (labeled "Waiakailio Landing") inland towards Kahuānui and Waikā *ahupua'a*, suggesting that Macey had leased the lands for ranching purposes, and that Waiakailio Bay was the landing for the ranch. Later Boundary Commission testimony (in 1873; see below) indicates that the houses belonging to Macey and Vida were located near the Kahuānui/Waikā boundary close to the Government Road, well *mauka* of the current project area. Ownership of Kahuāli'ili'i and Waikā, which would eventually become part of Kahuā Ranch, changed hands several times during the second half of the nineteenth century. In the 1890s these lands sold (along with other lands) to John Maguire, who managed Huehue Ranch in Kona. In about 1895 Mr. Maguire sold a half interest in the Kahuā lands to James Frank Woods, who then assumed management of the property and later purchased the half interest that John Maguire still held (Henke 1929).

In 1862, to certify the boundaries of the *ahupua'a* awarded during the *Māhele*, the Kingdom of Hawai'i established the Boundary Commission. The primary informants for the boundary descriptions were elder native residents. Their testimony provides a wealth of information concerning the locations of place names and landmarks. Some of the witnesses also inform about the functions of certain areas on the landscape (e.g., resting places, residential areas, agricultural plots, fishing grounds, boundary markers). This information is very useful when interpreting archaeological features as elements of a cultural landscape. Many of the locations referenced in the boundary testimony are depicted on a map of the lands of Waikā and Kahuāli'ili'i prepared by A. B. Lobenstein in 1903, the year when the boundaries of those *ahupua'a* were officially set (Hawai'i Registered Map No. 2231; Figure 11). The 1903 map also shows the route of the *ala loa* (coastal trail) between Kawaihae and Mahukona across the current project area.

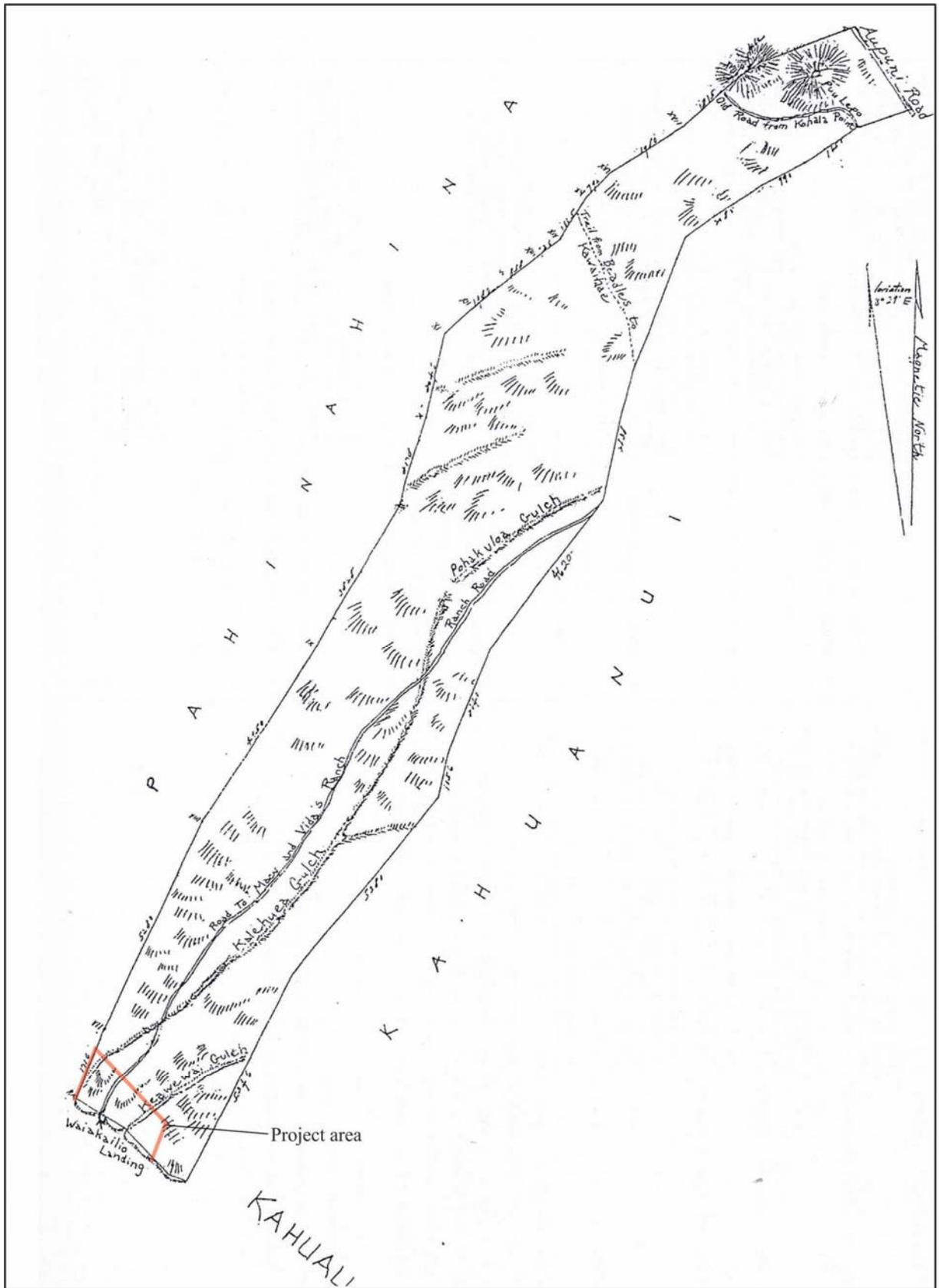


Figure 10. 1859 map of Kahuāli'i prepared by S. C. Wiltse showing the current project area.

4. Culture-Historical Background

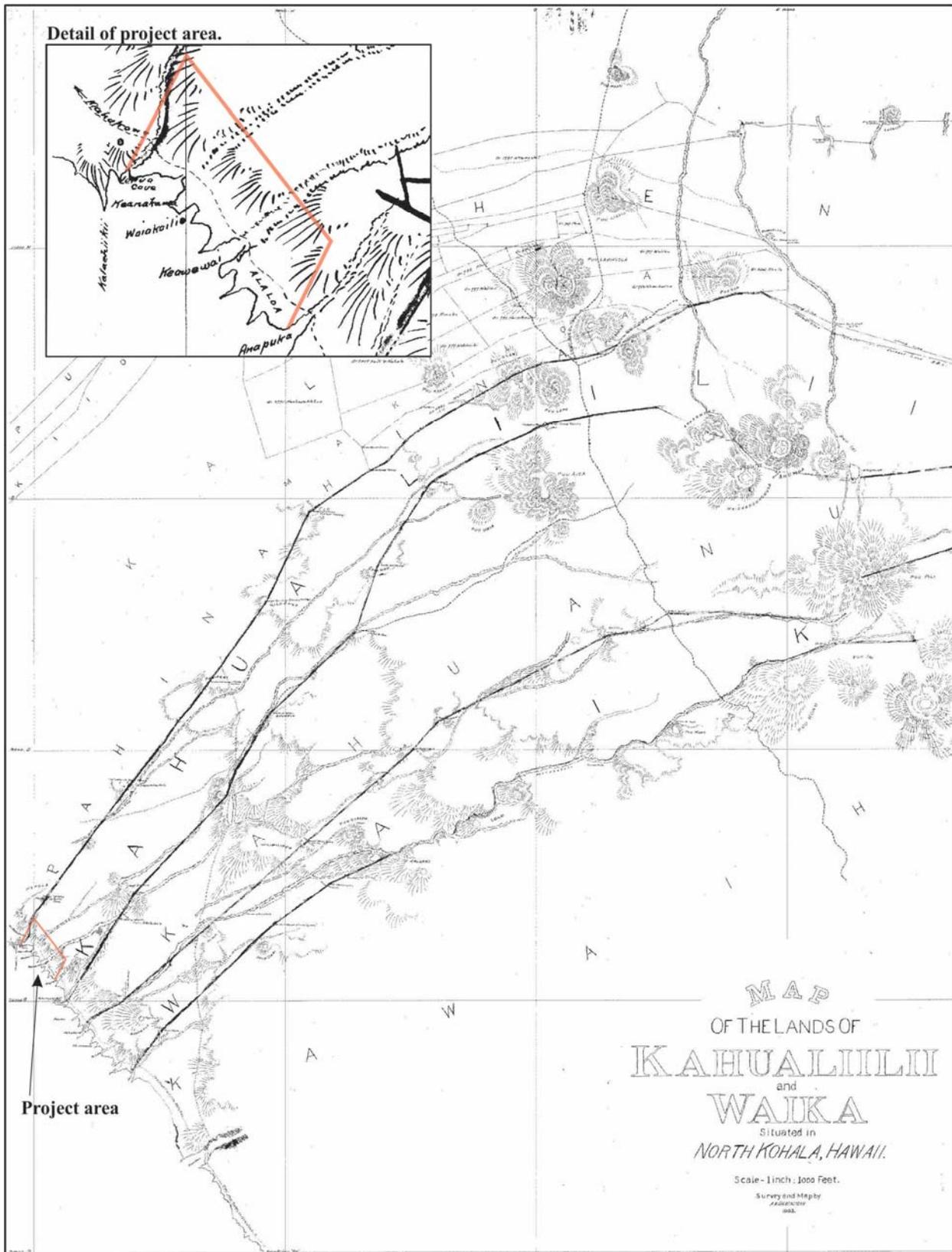


Figure 11. Hawai'i Registered Map No. 2231 (prepared by A. B. Lobenstein in 1903) showing the current project area.

Hearings for establishing the boundaries of Kahuāli‘ili‘i (also known as Kahuā 1st) began in November of 1873, roughly one year after Lot Kapuāiwa died; apparently the *ahupua‘a* became part of his father’s (M. Kekūānō‘a) estate. The boundaries were not officially set until December of 1903, by which time the land in question had been acquired by James Woods. The 1873 boundary testimony reads as follows:

Kaili, kane, sworn, I was born in Kohala at the time of the great famine, now live in Kokio; know the boundaries of Kahualiiili. Kiha, my Father and Pohina, my Uncle, showed them to me. I do not know all the boundaries between Kahuanui and Kahualiiili. Bounded on the north side at shore by the land of Pahinahina, commencing at a cave called Lehua, the boundary runs makai to a point at the sea shore called Kananakauwa; thence it runs mauka to a pile of rocks at Lehua; thence mauka to an ahu named Panipani; thence mauka to another pile of stones and thence to a place, called Kilohana where there is a pile of stones that Kahuhu and I built when Wiltse was surveying. Kilohana is an old resting place; thence mauka to Ahuaele; an ahua with a pile of stones on it; thence mauka to Pahukinikini, [page 139] a small ahua with a pile of rocks on it; thence to Puuolani hill, this is along the land of Pahinahina; that was sold to Makuaole and is now owned by Kanehaloa of Puuehuehue; thence to Lolelole, the mauka corner of land sold; thence mauka to Ahaloa, an old kauhale at the mauka corner of Pahinahina; thence along Makeloa (belonging to Kamehameha & Estate); thence the boundary runs mauka to Kalolo, a water hole in a gulch, thence across the gulch and mauka along the land of Kalala; thence mauka to Puukoa; a hill of Koa, at the mauka corner of Kanehalo’s land; thence along Kailikea, a land mauka of Puukoa (Wiltse, in surveying, cut off a corner of Kalala, and ran the line to Holeipalaoa gulch); there is a rock there on the mauka side of the gulch marked KK; thence it is bounded by Kehena to Kilohana on Honokane pali (Note See Certificate of boundaries of Kehena); Thence along Honokane pali towards Waimea, to the Waimea side of Puuwau hill, the boundary being some distance this way of the kauhale; Bounded at shore by a small gulch called Haaho, a rock marked K is at this place; thence up the gulch to an ahua; thence up to where Keawewai gulch crosses Haolo gulch; thence the boundary runs up the north side of the gulch; thence to a place called Kapakamakahonu; thence to Pohakulua, a large rock in the gulch; thence to an ahua; thence to Kawaihae Government road; thence to Puuaha; thence to Niupaa, a bullock pen, the boundary passing through the center of the pen. Thence it crosses the Government road to the wire fence some distance to the north of Upida’s [Vida’s?] old house; thence to Puumanu; thence to the south side of Ahumoa; thence on the north side of Waiakananaula, a water place; thence to Puuiki and from thence to Honokane pali.

Boundary Commission hearings for Kahuānui Ahupua‘a (also known as Kahuā 2nd), which shares a boundary with Kahuāli‘ili‘i Ahupua‘a also began in November of 1873, but the boundaries were not set until June of 1905. The petitioner and owner of the land was James W. Austin, who had acquired the land from Victoria Kamamalu and M. Kekūānō‘a in 1862 (Graves and Franklin 1998). By the time the boundaries were set in 1905 Austin had died and the lands had passed on to the Austin Estate. The 1873 boundary testimony for Kahuānui reads as follows:

Kekua, kane, sworn, I was born at the time of Aepapa and have always lived at Kahua until lately. Kahuanui is bounded on the Kona side by Waika. Commencing at the mouth of a gulch the boundary between the Ahupuaa and Kuponos begins at a landing place called Kaiopae; thence mauka along the Kuponos to Ahukuli, a pile of stones; thence mauka to Puueoka, a heiau; thence to along stone named Pohakulua; thence to Kamakaiwi, a resting place; thence to Kapio; thence to Ahumoa, the boundary running through the hills; thence to Puuiki; thence to Kanoa, where fire used to be; Thence to Kahawaikukae, to pali of Kahawaiki; thence to Kahawaiholopapa; thence to Ainamakanui at the head of Honokane Gulch.

The kuponos Kahawainui, Kukui runs up here. Waika ends at Pahoakala, a place where they used to gather mamaki. This is as far as I [page 145] know the boundaries on this side. I have heard that the land runs down to Mahiki in Hamakua. When Lyons surveyed Waika he cut across the kuponos of Kahua and included them in Waika. Know a place called Ahuanaha. The real boundary is from Oneloa to Kapai, a pile of stones by the road; thence to Kamamukaa, where the gulch is the boundary between Waika and Kahua. The boundary crosses the gulch to the Kohala side at Ahuanaha; thence it runs to Ahuakapaakea; thence mauka to Kalehua; thence up the gulch to Moalau (The pile of stones is way on the Kohala side of the gulch, but the boundary is at the gulch). Thence past Macy’s (G.W. Macy’s) old house and mauka to Hookeke; thence to kahawai Palapalai; thence mauka to the

pali of Kaloloulaula on Pili; thence to Kapohoakala; thence along to Kahaliaina, a place below Puupala, where Kawaihae joins Kahua. From Kahaliaina the boundary runs along the foot of the pali to just above Puuwau on Kahuanui. Puuwau is a hill a short distance back from Pili; thence to Hinamakanui, a cabbage garden on the brow of Honokane pali. The boundary at shore between Kahuanui and Kahualilii is a rock in the middle of the sea called Kahuapopolo. (Note: Kaauwai, kane puts the boundary a few rods on the Kohala side of this rock.)

Thence to Waiakanalopaia, a pool of water at the end of the gulch, thence to Pohakupalalaha, a wall below the road to Kawaihae, now called Kamakahonu; thence to Waikalio gulch; thence the boundary runs to a stone called Pohakulaoa; thence mauka across Pohakulaoa gulch to Puanau, a resting place; thence to Puuala; thence Kipawale, a resting place at the Government road; thence to a hill called Ahuamanu; thence to Waiakapiai; thence to Ahumoa, part of which is on Kahua and part on another land. This is all I know of the boundaries.

Frank Woods continued to ranch the Kahuā lands throughout the first half of the twentieth century. The 1913 U.S.G.S. Kawaihae quadrangle shows some of the ranch's infrastructure, including a trail labeled "Beach Trail" that leads to the coast within the current project area (Figure 12). This trail alignment appears to be similar to the road alignment (to Macy and Vida's Ranch) that is shown on the 1859 map of Kahuāli'ili'i prepared by S. C. Wiltse (see Figure 10). By the 1920s, Woods was leasing much of the area to Ronald Kamehameha o Ka Hae Hawaii von Holt and Herbert Montague Richards, Sr., who had both come to Hawai'i from O'ahu to pursue cattle ranching. By the late 1920s to early 1930s, von Holt and Richards had purchased the lands they were leasing from Woods as well as Kahuānui from the Austin heirs, thus consolidating the Kahuā *ahupua'a* with Waikā Ahupua'a into what has become known as Kahuā Ranch (Langlas 1994). A map of Kahuāli'ili'i, Kahuānui, and Waikā *ahupua'a* filed on July 15, 1931 with Land Court Application 1043 (Figure 13) shows some additional ranching infrastructure within these *ahupua'a* including a fence line that extends to the coast within the current project area and a trail, labeled "Ancient Trail", that follows the southern edge of the fence to the coast where it meets the *ala loa*. Both of the trail alignments depicted on the 1931 map are different than the alignments depicted on older maps. The *ala loa*, which is also labeled as the "Mahukona-Kawaihae Trail", is shown further inland at the southern end of the current project area than it is on the 1903 map (see Figure 11). Also, the *mauka/makai* trail is located further north than the road shown on the 1859 map (see Figure 10) and the trail shown on the 1913 U.S.G.S. map (see Figure 12), suggesting that both of these trails had been realigned by 1931. It was during the court proceedings associated with these land court applications that the pre-Jeep road Mahukona-Kawaihae Beach Trail was described as having a five foot width. The legal proceedings were conducted over a seven year period and were focused on establishing legal ownership of several adjoining parcels and roadway corridors traversing those parcels. The final ruling of the courts during these proceedings was that the Territory of Hawai'i would relinquish any claims to the Mahukona-Kawaihae Beach Trail in exchange for ownership of the Kohala to Kawaihae Road (the current Kohala Mountain Road), thus the current project area remained in the ownership of Kahuā Ranch with no encumbrances. Although no longer a public right-of-way, the coastal *ala loa* continued to serve as a non-vehicular access corridor between Mahukona and Kawaihae. The *ala loa* trail was improved for vehicular travel in the early 1940s in conjunction with the U.S. Army's efforts to provide an adequate coastal defense system during WWII. Subsequent to WWII, Kahuā Ranch maintained the roadway across their lands for ranching, transportation, and recreational uses.

According to Langlas (1994), the partners, Richards and von Holt, eventually expanded Kahuā Ranch through leases and purchases of private land to almost 30,000 acres. Orr (2003:46) describes that although Herbert, Sr. served on the board of Kahuā Ranch, Atherton Richards (Herbert's brother) was von Holt's "the real partner." In 1953 von Holt died and Herbert, Jr. (better known as Monty) returned to Hawai'i after finishing school on the mainland; gradually Monty took over as manager of the Ranch (OCA 2000). The 1956 U.S.G.S. Kawaihae quadrangle shows some of the Kahuā Ranch lands and infrastructure (Figure 14), including a fence line and "Beach Trail" extending to the coast within the current project area. A windmill (recorded as part of Site 16133) is shown adjacent to the fence line at the coast within the current project area. Both the fence line and trail are different alignments than are shown on the 1931 Land Court Application 1043 map (see Figure 12). A trail is also shown extending parallel to the coast through the project area on the 1956 map (following an alignment similar to that of the Mahukona-Kawaihae Trail shown on the 1931 map). In 1973, when construction of the current Akoni-Pule Highway was completed, most if not all of the vehicular traffic between Mahukona and Kawaihae shifting away from the coastal Jeep road to the newly constructed highway. By 1982, the coastal trail is no longer shown on the U.S.G.S. Kawaihae quadrangle. The Richards and von Holt families jointly operated Kahuā Ranch until the 1980s at which point it was legally split into two entities. The current project area was severed from the ranch and sold around this time. Today, the Richards family operates Kahuā Ranch and the von Holt family operates Ponoholo Ranch.



Figure 12. 1913 U.S.G.S. Kawaihae quadrangle showing the current project area.

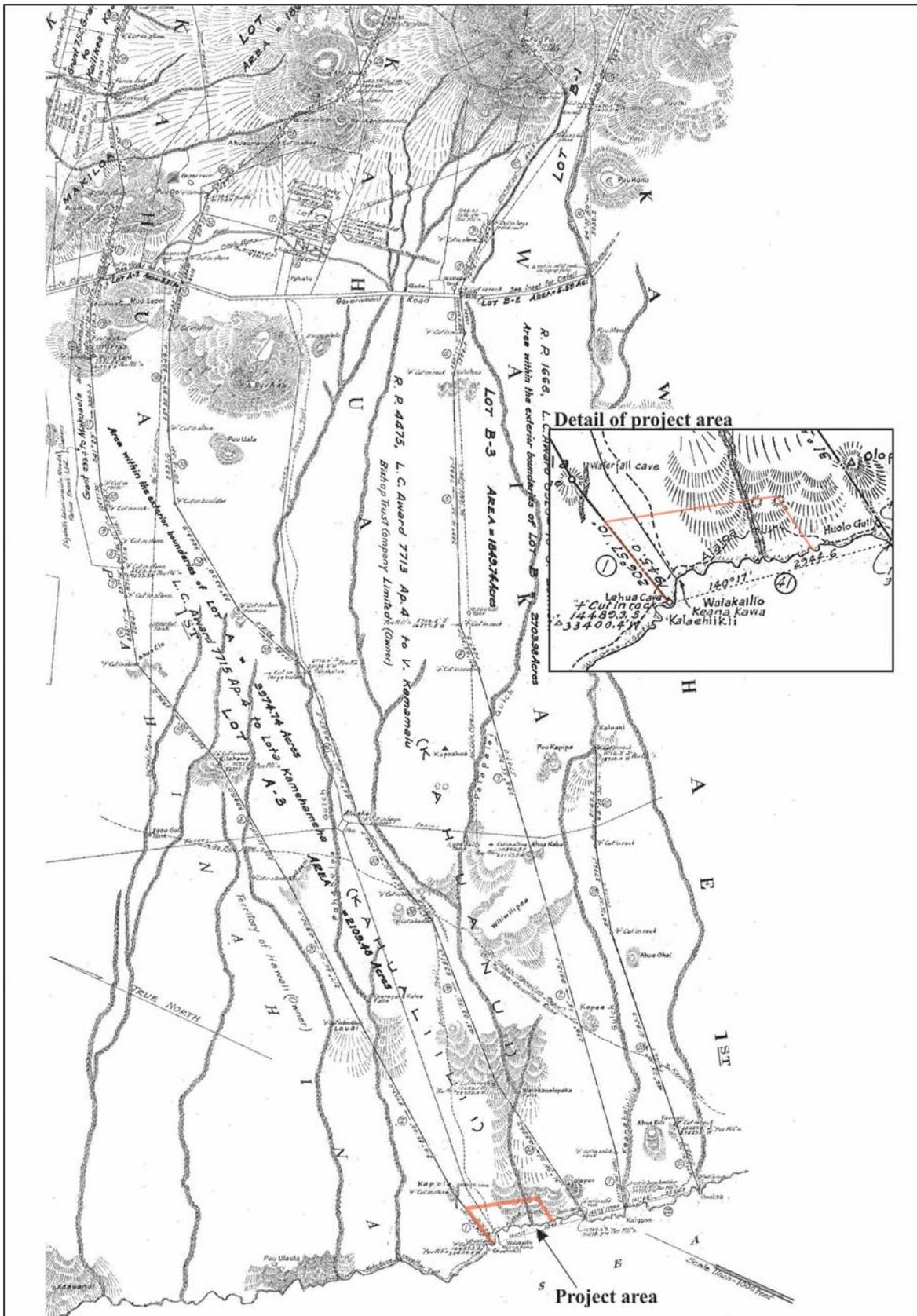


Figure 13. Portion of the 1931 Land Court Application map 1043 showing the current project area.



Figure 14. 1956 U.S.G.S. Kawaihae quadrangle showing the current project area.

5. ARCHAEOLOGICAL FIELDWORK

Intensive archaeological survey of the current project area was conducted on December 1–3, 2009 by J. David Nelson, B.A., Christopher S. Hand, B.A., Johnny R. Dudoit, B.A., and Ashton K. Dircks Ah Sam, B.A. under the direction of Robert B. Rechtman, Ph.D. Additional survey and subsurface testing at selected features was conducted on February 23 and 24, 2010 by Robert B. Rechtman, Ph.D., Matthew R. Clark, B.A., and by J. David Nelson, B.A. A search for remnants of the trails shown on the various Historic maps reviewed for this study was undertaken by Robert B. Rechtman, Ph.D., Matthew R. Clark, B.A., and Ashton K. Dircks Ah Sam, B.A. on August 22, 2013.

During the intensive pedestrian survey of the study area, the entire parcel was subject to north/south transects with fieldworkers spaced at 10-meter intervals. When archaeological resources were encountered, they were compared to existing site location maps and descriptions to determine if they had been previously recorded. If they had been recorded during the earlier studies, the sites were examined to see that the earlier site descriptions were consistent with current observations. All thirty-nine of the previously recorded sites were identified, and while the earlier plotting of site locations was not wholly accurate, in all but six cases, the site descriptions seem to be adequate. The six exceptions are that at Site 2496, Feature D was mislocated and inaccurately characterized; at Site 4013 a rock shelter feature was not recorded; at Site 15261 two additional branches of the trail alignment that are shown on Historic maps were identified; at Site 16131 a rough terrace feature was not recorded; at Site 16147 the northern extension of the site was not recorded; and at Site 16151 a marine shell scatter was not recorded. Additionally, a portion of a previously unrecognized site – Site 29271, the *ala loa* coastal trail/Jeep road, commonly labeled the “Mahukona-Kawaihae Trail” on maps produced prior to 1931 – was recorded across the project area. Of these seven total omissions from the previous inventory survey (Graves and Franklin 1998), four were deemed potentially significant enough to warrant further inventory survey investigation (Site 2496 Feature D, Site 4013 new rock shelter, Site 15261 additional trail branches, and the Site 29271 Mahukona-Kawaihae Trail section); the other three omissions are relatively minor can be easily rectified during subsequent data recovery and preservation work.

At the four sites where further documentation was deemed warranted various strategies were employed to integrate the newly collected information with the previously documented Historic properties. At Sites 2496 and 4013 the new observations had the potential to reveal previously undocumented burials. As such Feature D of Site 2496 was remapped and subject to subsurface testing, and the newly observed rock shelter (designated as Feature D) at Site 4013 was mapped and subject to subsurface testing. At Sites 15261 and 29271 the trail/road alignments were mapped across the property and photographed. Figure 15 shows the re-plotted and newly plotted site locations. The results of the further inventory work conducted at Sites 2496, 4013, 15261, and 29271 is presented below.

SIHP SITE 2496 FEATURE D

Sites 2496 and 2497 were originally recorded by Bonk (1968) as two single-feature sites four meters apart. During the PHRI inventory study (Graves and Franklin 1998), the two sites were combined and three additional features were described as comprising Site 2496 (the Site 2497 designation was dropped). As Graves and Franklin (1998:A-20) describe:

This site is on a ridge just east of Keawewai Gulch and it is bisected by the coastal jeep road. This complex consists of Feature A (enclosure), Feature B (C-shape), Feature C (terrace), Feature D (mound), and Feature E (midden deposit) [their map of the site is provided as Figures 16 and 17].

Feature D (Figure 18) was further described as “a low flat stone mound [2.3 m by 1.4 m by 0.5 m]. . . constructed of subangular pahoehoe boulders 10-20 cm in diameter . . . roughly stacked 3 courses high. The *platform* is core filled with cobbles c. 0.10 m or less and *decorated with coral.*” (Graves and Franklin 1998:A-20, *italics* added for emphasis). Despite their description, Graves and Franklin (1998) interpreted this feature to have functioned as an agricultural mound.

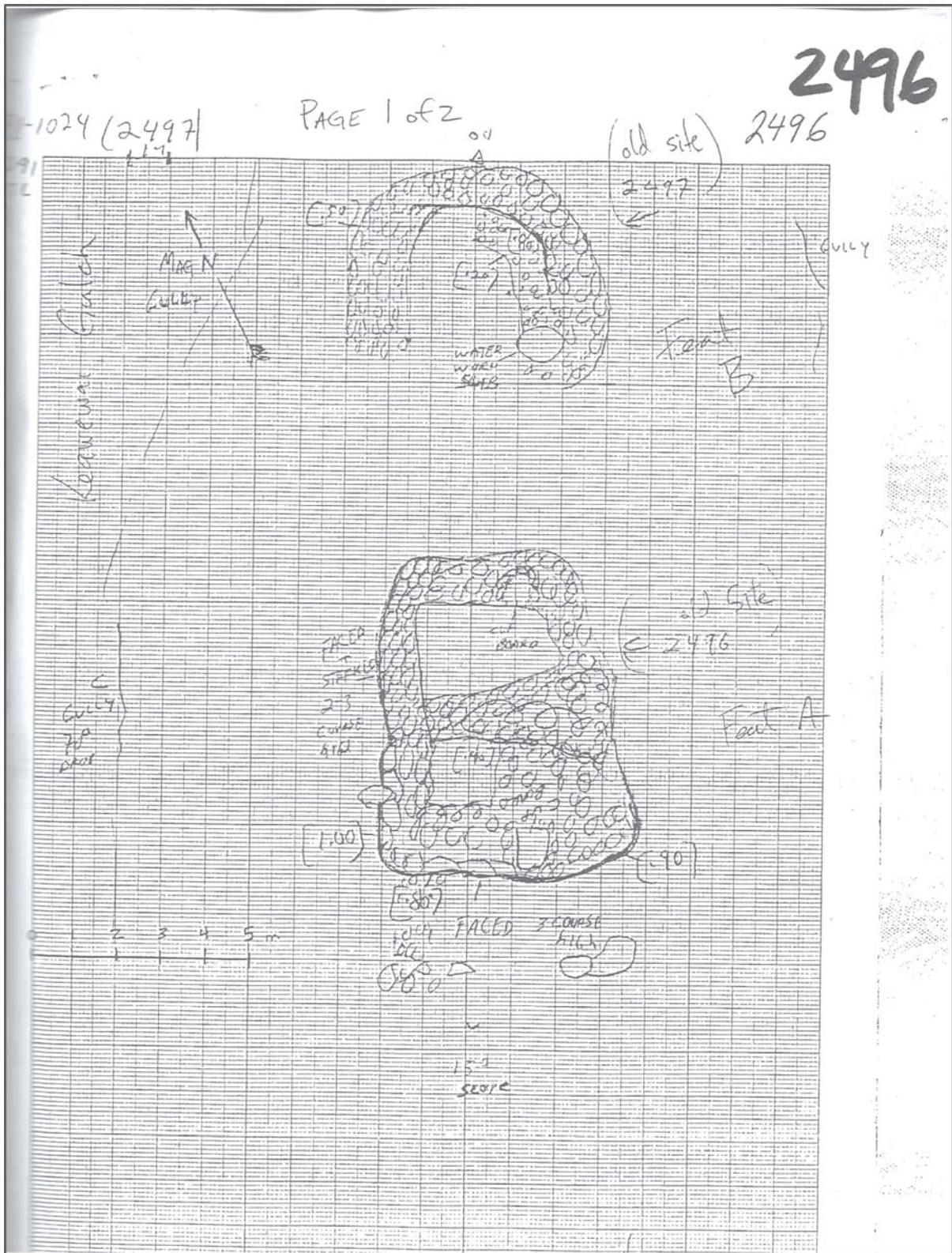


Figure 16. Graves and Franklin (1998) map of Site 2496 page 1 of 2.

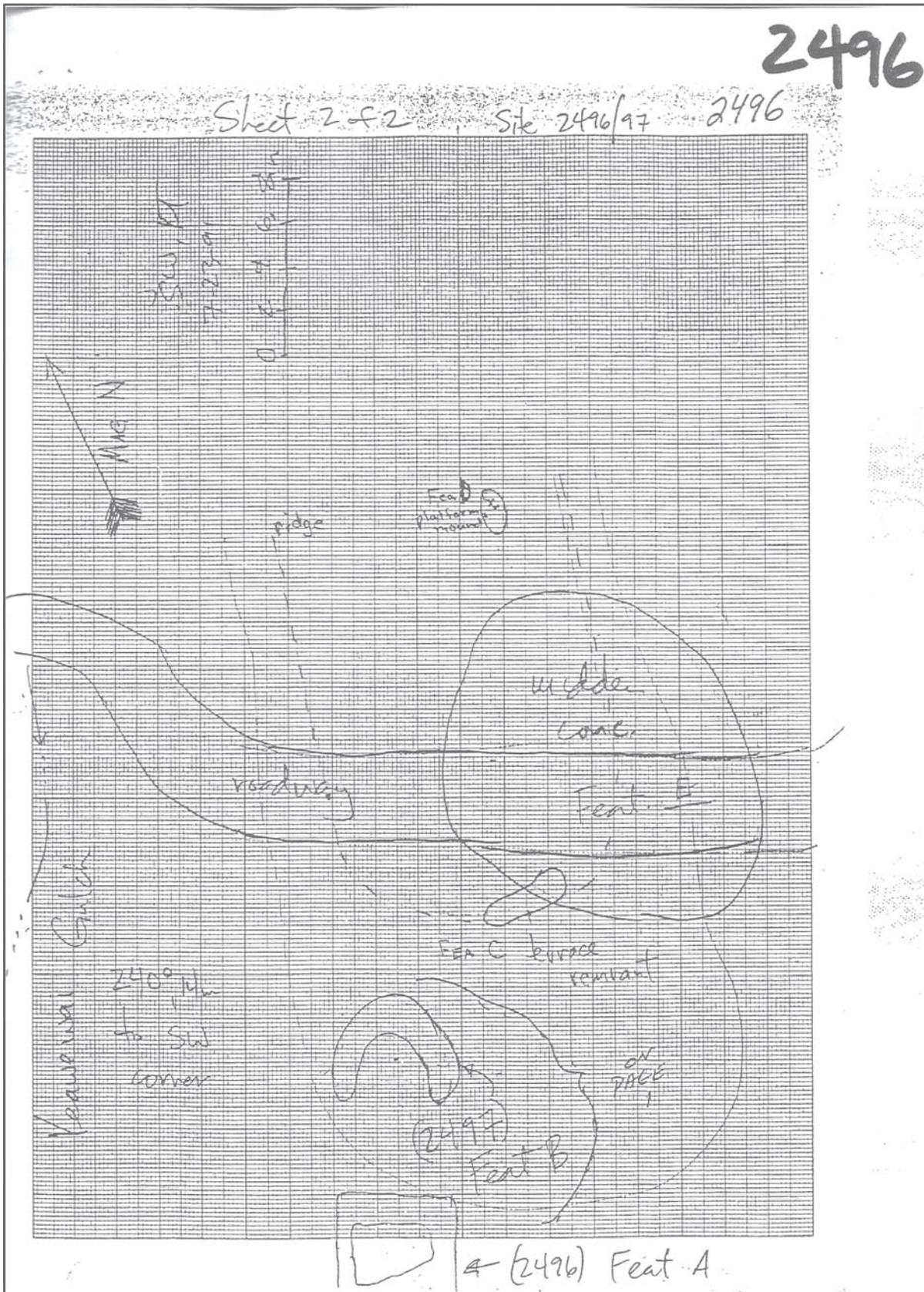


Figure 17. Graves and Franklin (1998) map of Site 2496 page 2 of 2.



Figure 18. SIHP Site 2496 Feature D, view to the northwest.

The location of Feature D as shown on Figure 17 is not accurate thus the site was remapped during the current study so as to accurately depict the relationship of Feature D to the rest of the site (Figure 19). Feature D was also individually mapped (Figure 20) and not feeling comfortable with the agricultural functional interpretation, we excavated a test trench (TU-1) bisecting the feature in a north/south direction. Upon removal of the architectural rock layer, an intrusive pit was observed in the underlying soil. Continued excavation within this pit revealed the presence of a capstone below which was the articulated human skeletal remains of one individual. Upon discovery of the remains, DLNR-SHPD was contacted, the test unit was profiled (Figure 21) and refilled, and the platform reconstructed as closely matching the original specification as possible.

As a result of the current study, SIHP Site 2496 Feature D is redescribed as a roughly rectangular platform (see Figure 11) measuring 3 meters by 2 meters with edges stacked 35 to 40 centimeters above the surrounding ground surface (see Figure 14). The platform is constructed of weathered angular basalt cobbles as large as 25 centimeters in diameter with a few waterworn cobbles and coral fragment on its surface. The platform was built over a grave pit containing the remains of a single individual. Given the absence of Historic Period material it is surmised that this feature dates to the Precontact Period.

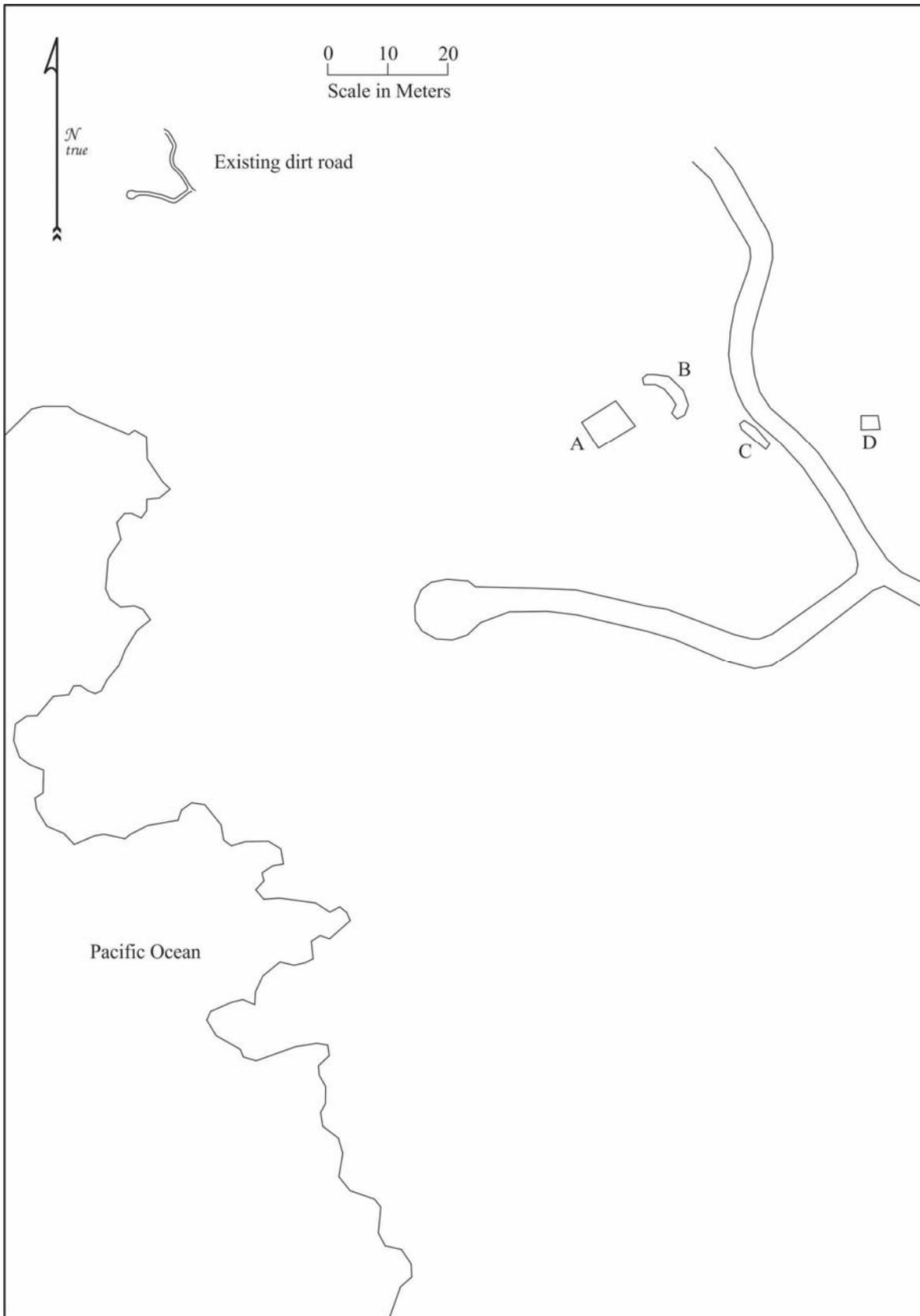


Figure 19. SIHP Site 2496 schematic plan view.

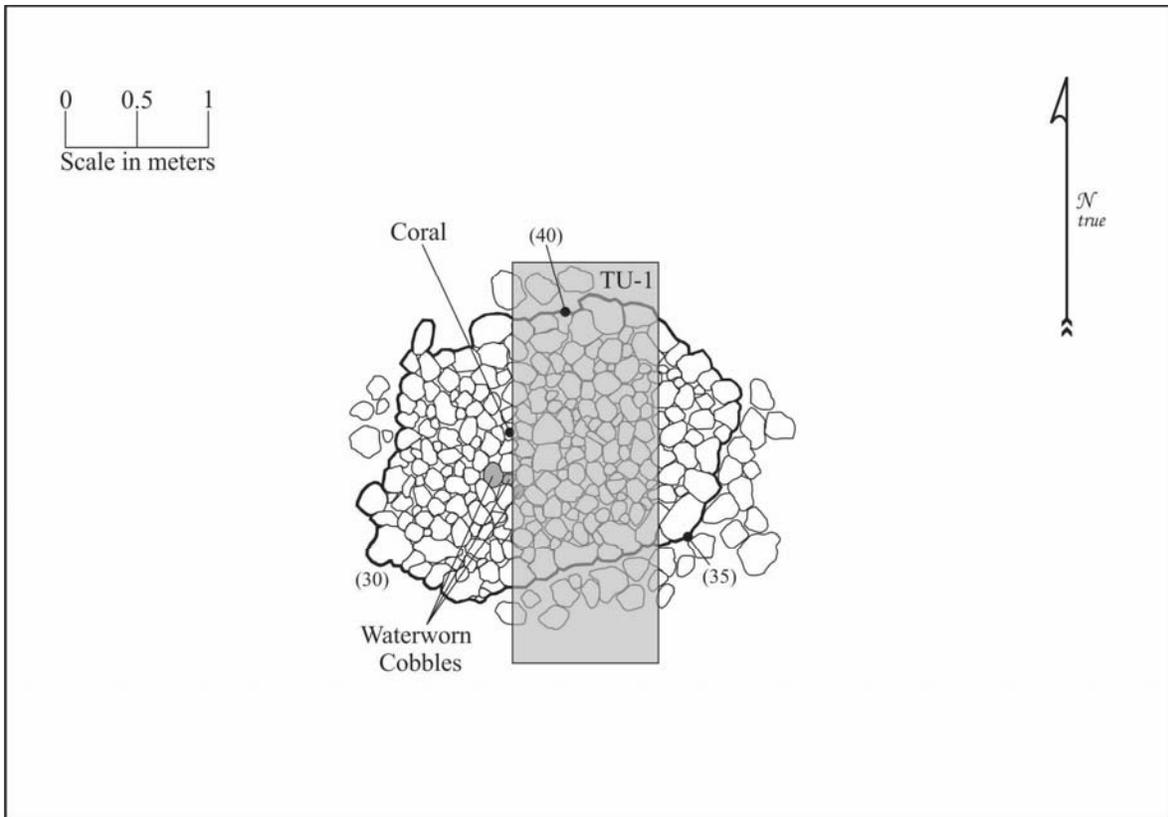


Figure 20. SIHP Site 2496 Feature D plan view.

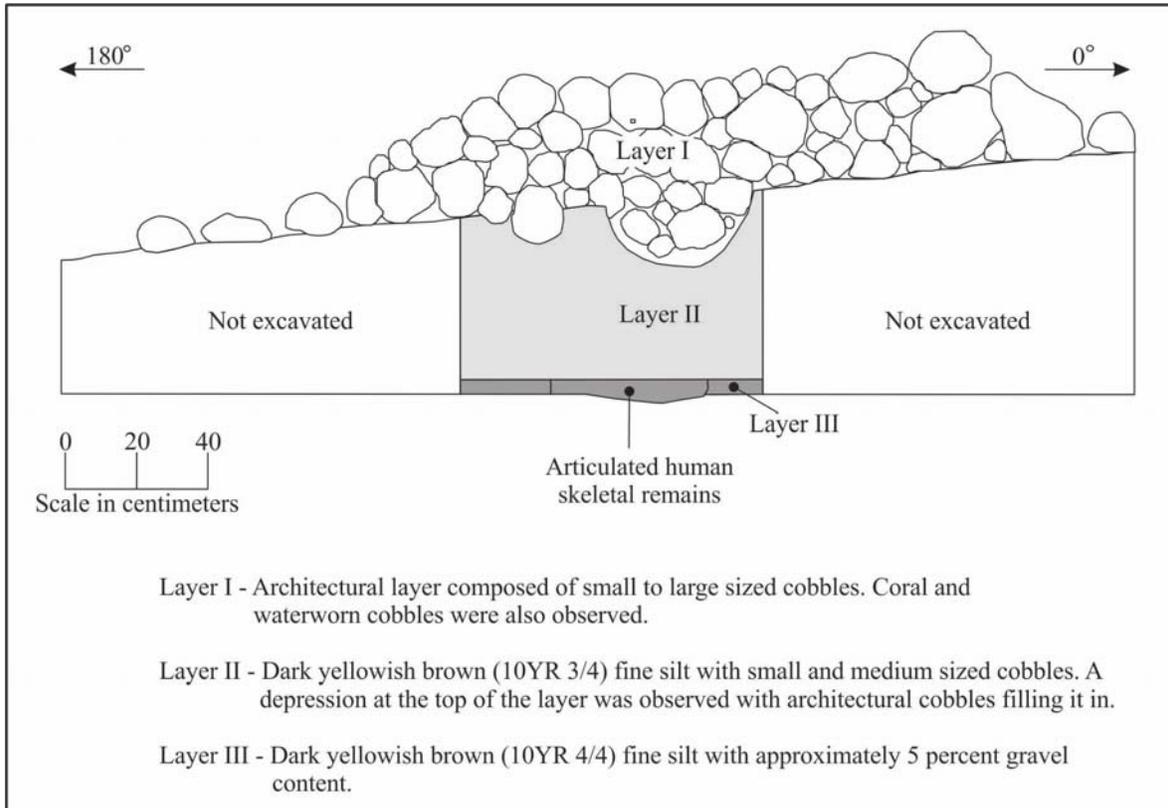


Figure 21. SIHP Site 2496 Feature D TU-1 west wall profile.

SIHP SITE 4013 FEATURE D

Site 4013 was recorded by PHRI (Graves and Franklin 1998) as a complex of three features: Feature A, a low wall and modified outcrop used as an animal corral, Feature B, a series of discontinuous walls used as an animal pen, and Feature C, a burial platform. During the current study one additional feature was identified (Feature D an overhang rock shelter) and Site 4013 was reinterpreted to be a habitation/burial complex.

The newly identified overhang rock shelter (Feature D) is located along the bedrock exposure that connects Features A and B (see Figure 15). This portion of the bedrock protrudes horizontally for about 1 meter, creating a shelter space that has been enhanced through the placement of several medium to large boulders (Figure 22). The floor of the shelter space is relatively level and free of stones. The effective useable interior space is 3 meters by 1 meter with the ceiling height reaching a maximum of 50 centimeters (Figure 23). There was no cultural material observed on the surface of the shelter, and to test the accumulated soil a 50 centimeter by 1.5 meter test unit (TU-2) was excavated at the center of the overhang. TU-2 was excavated in 10 centimeter arbitrary levels until bedrock was reached at a maximum depth of 12 centimeters below the surrounding ground surface (Figure 24). The soil encountered in TU-2 was dark yellowish brown (10YR 3/3) silt. Cultural material recovered from the 1/8 inch screening of the excavated soil included 36.6 grams of marine shell and seven pieces (0.1 gram) of fish bone (Table 2). Based on its barricaded nature and the presence of faunal remains, Feature D is considered to have functioned as either a sleeping or working area.



Figure 22. SIHP Site 4013 Feature D, view to the southeast.

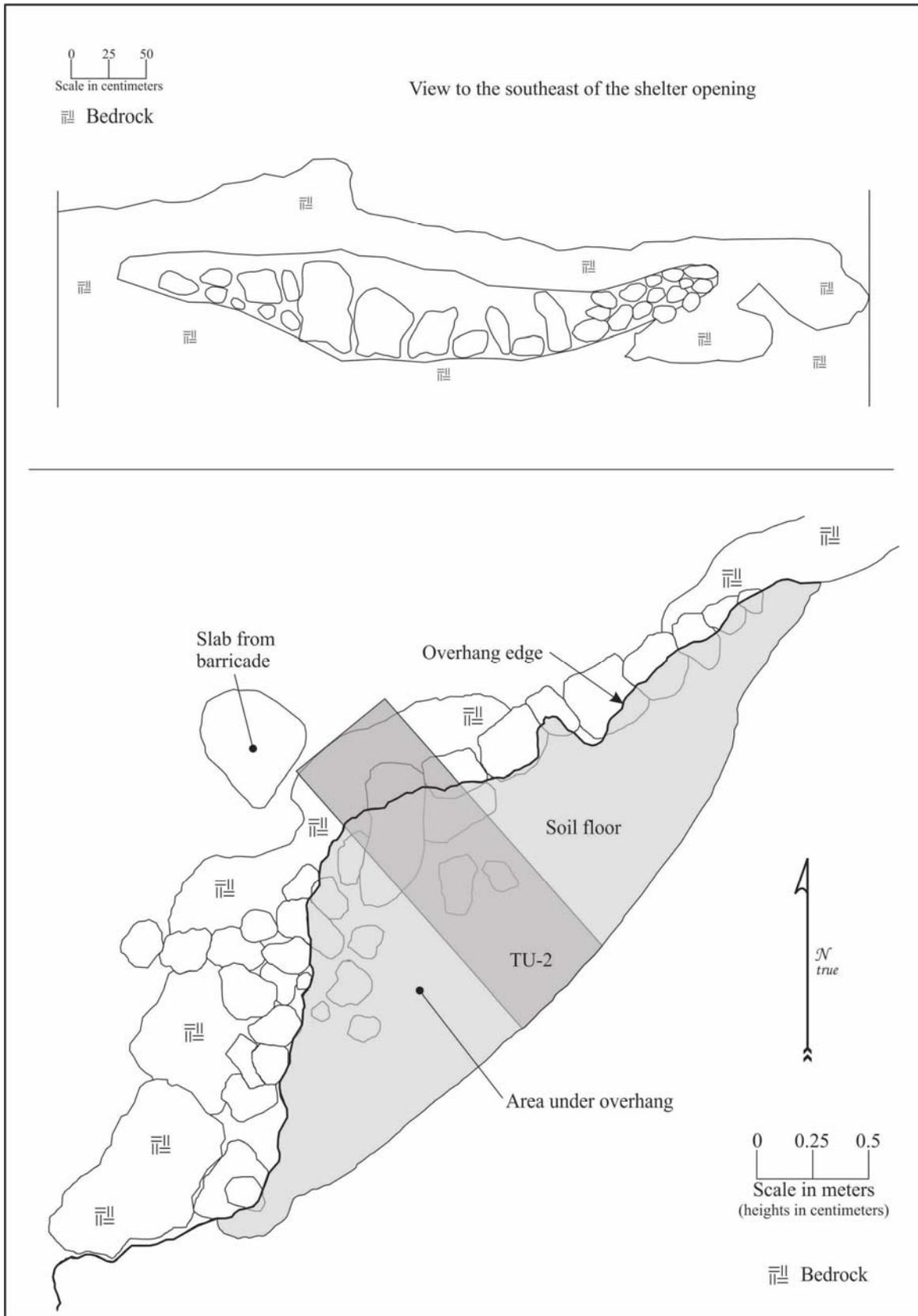


Figure 23. SIHP Site 4013 Feature D plan view and profile.

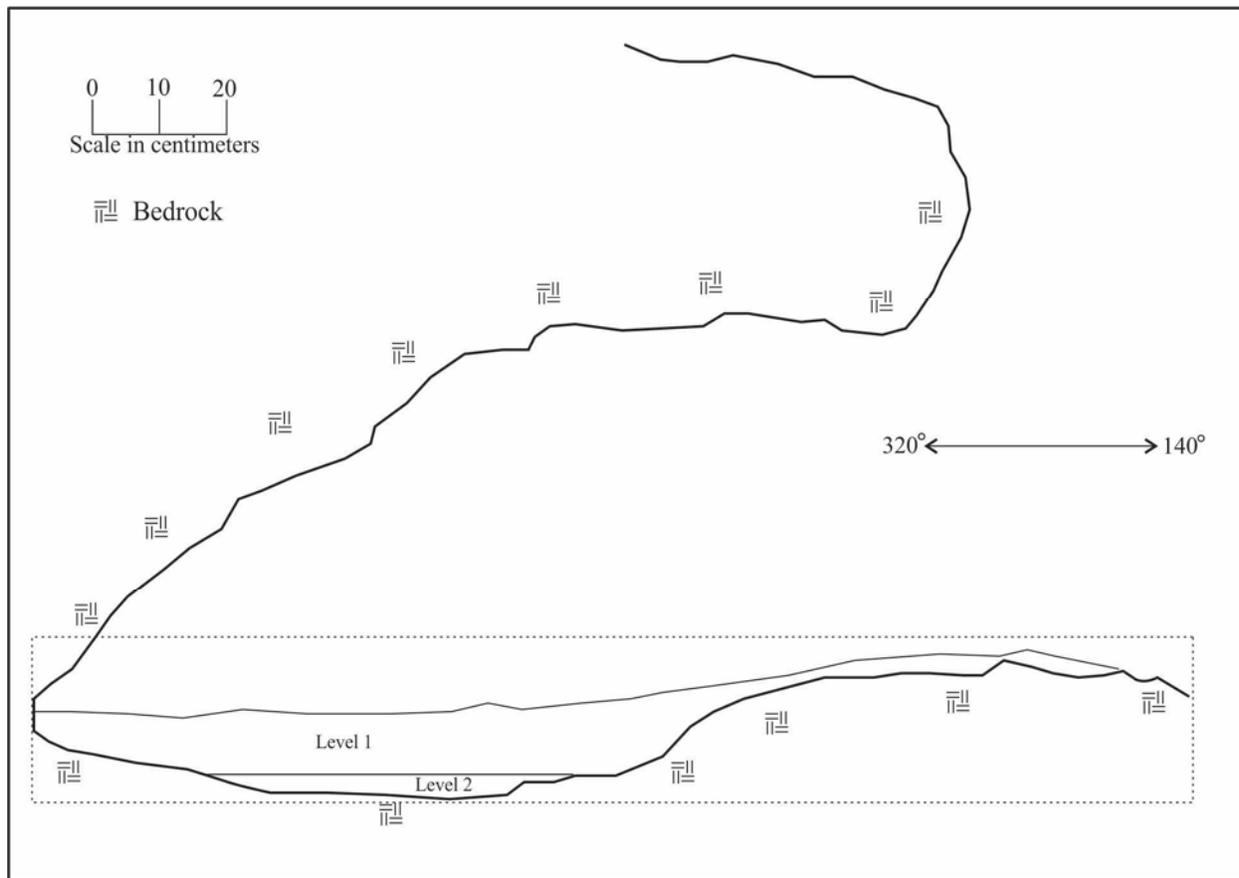


Figure 24. SIHP Site 4013 Feature D TU-1 and overhang western profile.

Table 2. Items recovered from SIHP Site 4013 Feature D TU-2.

<i>Acc. #</i>	<i>Level</i>	<i>Material</i>	<i>Type/Species</i>	<i>Count</i>	<i>MNI</i>	<i>Weight (g.)</i>
2	1	Echinoderm	Echinoidea	3	-	1.7
3	1	Marine shell	<i>Nerita</i> sp.	9	8	1.5
4	1	Marine shell	<i>Cellana</i> sp.	2	2	15.9
5	1	Marine shell	<i>Drupa</i> sp.	5	2	1.5
6	1	Marine shell	<i>Cypraea</i> sp.	16	2	14.2
7	1	Fish bone	unidentified	7	1	0.1
8	1	Reptile bone	Gekkonidae	1	1	<0.1
9	1	Rodent bone	<i>Mus</i> sp.	1	1	<0.1
10	1	Marine shell	Mitridae	1	1	0.2
11	1	Marine shell	unidentified	1	1	0.5
12	1	Nut Shell	<i>kukui</i>	4	-	2.7
13	2	Marine shell	<i>Cellana</i> sp.	2	1	0.3
14	2	Marine shell	<i>Nerita</i> sp.	2	2	0.8

SIHP SITE 15261

Site 15261 was recorded by PHRI (Graves and Franklin 1998) as a discontinuous *mauka/makai* trail segment that begins c. 10 meters south of the Akone-Pule Highway and extends seaward along the eastern side of a shallow gully for c. 150 meters (see Figure 9). The route of the trail is marked mostly by a worn path (0.52-0.68 meters wide), but it also has a short section (2.5 meters long) where small boulders line its northern edge. PHRI notes that destruction along the trail has been caused mostly by erosion, but that it has also been impacted by bulldozing. This trail segment was relocated and mapped during the current inventory survey fieldwork, as were two other additional trail segments located to the north of the first. A review of Historic cartographic resources for the general project area suggests that all three segments are likely separate branches of the same *mauka/makai* trail alignment. The trail segments may represent subsequent alignments that were created as earlier alignments were abandoned due to deterioration (from erosion) or changing land use and transportation needs during the Historic Period; or they may have seen contemporaneous use (at least by foot or horse) depending on the traveler's coastal destination or starting point. Each of the three segments of Site 15261 identified within the project area exhibits varying levels of deterioration, and each is separated from the next by an intervening gulch, making either scenario possible. Graves and Franklin (1998), in their analysis of site and feature types recorded during the original inventory survey, interpret Site 15261 (the only trail segment they identified) as the remains of an "ancient trail" shown on a 1935 Tax Map Key (the alignment depicted on that map appears the same as the "ancient trail" alignment depicted on the 1931 map submitted with Land Court Application 1043, and was likely copied directly from that older map; see Figure 13). However, an overlay of the "ancient trail" alignment from the 1931 map onto the current project area map indicates that the Site 15261 trail segment recorded by PHRI is actually located well to the south of the trail shown on that map.

Historic maps from 1859, 1913, 1931, and 1956 each show *mauka/makai* trail alignments extending across the current project area (Figure 25). The trails follow two general routes (a pre-1913 route and a post-1931 route) that are both distinct from the route of Site 15261 reported by Graves and Franklin (1998). The 1859 map of Kahuāli'ili'i prepared by S. C. Wiltse (see Figure 10) shows a Road to Macy and Vida's Ranch that extends from the coast within the current project area at Waiakailio Landing inland to roughly 1,600 feet above sea level before exiting the southern boundary of the *ahupua'a*. The 1913 U.S.G.S. Kawaihae quadrangle (see Figure 12) shows a similar *mauka/makai* trail alignment (labeled "Beach Trail") extending from the coast within the current project area to roughly 1,100 feet above sea level where it meets the Kawaihae-Puu Hue Trail near the southern *ahupua'a* boundary and the junction with the Kawaihae-Kahua Trail. As discussed above, the 1931 map submitted with Land Court Application 1043 (see Figure 13) also shows a *mauka/makai* trail (labeled "Ancient Trail") extending inland from the coast within the current project area. The *makai*-most portion of this trail is depicted to the north of the trail alignments shown on the earlier maps (adjacent to a fence line), but *mauka* of the project area (beginning at an elevation of roughly 150 feet above sea level) the trail appears to follow the same combined routes as the Beach and Kawaihae-Kahua trails that are depicted on the 1913 U.S.G.S. (see Figure 25). The 1956 U.S.G.S. Kawaihae quadrangle shows a *mauka/makai* trail alignment extending inland from the coast within the current project area (labeled "Beach Trail") that is similar to that shown on the 1931 map. *Mauka* of the project area, however, beginning at an elevation of roughly 150 feet above sea level, the trail turns to the east (eventually becomes a road) and follows a different route than shown on any of the earlier maps to the Kawaihae-Puu Hue Trail before continuing as the Kawaihae-Kahua Trail.

As shown in Figure 25, *mauka* of the current project area, the trail alignments depicted on the Historic maps (with the exception of the Beach Trail shown on the 1956 U.S.G.S. Kawaihae quadrangle) all follow similar, intertwined routes to the Kawaihae-Puu Hue Trail where they meet with the Kawaihae-Kahua Trail and continue to the Government Road. It is posited that these trails actually represent shifting alignments of the same *mauka/makai* trail route, and that the branches discovered with the current project area are functionally, if not temporally, related. For this reason the branch of Site 15261 originally recorded by PHRI (the southernmost branch; see description above) has been designated Feature A, the newly recorded branch shown on pre-1913 maps (the middle branch) has been designated Feature B, and the other newly recorded branch shown on post-1931 maps (the northern branch) has been designated Feature C. The newly recorded Features B and C are described below.

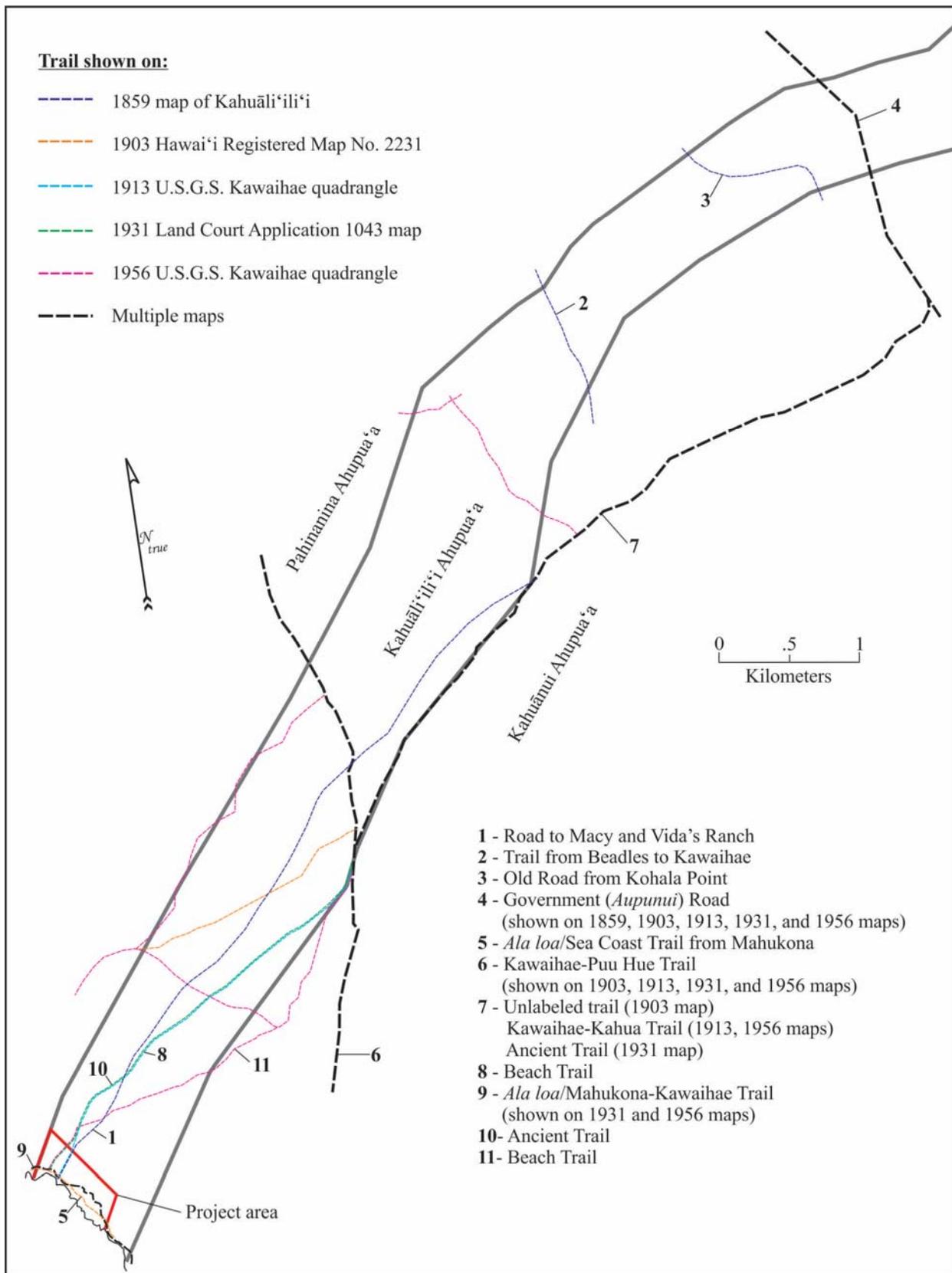


Figure 25. Trail alignments shown on Historic maps in Kahuāli‘ili‘i Ahupua‘a.

Feature B

Feature B is a trail segment that extends *mauka* from Site 16133 for roughly 50 meters (see Figure 15). The trail begins c. 20 meters south of Site 4011 at a low spot in a bedrock ledge that partially encloses the northern edge of Site 16133. Both edges of the bedrock ledge at this location, for a distance of roughly 10 meters, constricting from more than 5 meters apart at the southwestern end of the gap in the bedrock ledge to roughly 2 meters apart at the northeastern end, have been modified with short sections of stacked cobbles (Figure 26). The discontinuous stacking along the northwestern edge of the low spot is wholly dependent on the bedrock ledge for support (Figure 27), while sections of the stacking along the southeast edge are free standing and on top of the bedrock (Figure 28). The gap between the bedrock edges allows for the easiest *mauka/makai* access at Site 16133, where a well, a windmill (erected in 1931), and a cattle pen are located. Beyond the bedrock low spot Feature B seems to continue in a northeasterly direction for about 40 meters (and perhaps as far as 65 meters). A discontinuous alignment of small boulders on an eroded bedrock slope of loose cobbles and boulders faintly marks this section of Feature B (Figure 29). Beginning at a distance of roughly 65 meters from the southwestern end of Feature B, nearly the entire ground surface between the two gullies that bound the trail route and separate it from Feature A (to the south) and Feature C (to the north), up to the highway alignment, has been disturbed by bulldozing and no further traces of Site 15261 Feature B are discernable. This trail section appears match the trail alignments shown of the 1859 and 1913 maps (see Figure 25); it is labeled “Road to Macy and Vida’s Ranch” in 1859 and “Beach Trail” in 1913.



Figure 26. SIHP Site 15261 Feature B, view to the northeast.



Figure 27. SIHP Site 15261 Feature B, view to the north.



Figure 28. SIHP Site 15261 Feature B, view to the south.



Figure 29. SIHP Site 15261, view to the southwest.

Feature C

Feature C is a segment of a *mauka/makai* trail that is depicted on maps prepared in both 1931 and 1956 (see Figure 25). On the 1931 map the trail (labeled “Ancient Trail”) is shown adjacent to a fence line that extends to the coast. An overlay of that map onto the current project area map indicates that portions of the fence line are still extant on the property and that the *mauka* portion of the trail is a 4WD access road that extends southwest from a gate at the highway (Figure 30). Approximately 130 meters from the highway this *mauka/makai* road section turns into a lateral road that once crossed the gullies on either side of Feature C, but has been blocked in both directions. The trail shown at this location on the 1931 map continues in a straight line *makai* of the T-intersection to the coastal alignment of the *Ala loa*/Kawaihae-Mahukona Trail (Site 29271). On the eroded cobble and boulder slope southwest of the road intersection (Figure 31) a possible older segment of Feature C was identified. This section, which has the appearance of an old, overgrown bulldozed road, is roughly 5 meters long by 2.5 meters wide with low cobble berms along either edge (Figure 32). No further sections of Feature C were identified on the loose cobble slope.

SIHP SITE 29271

Site 29271 is a coastal trail depicted on the 1903 Hawai‘i Reg. Map 2231 (see Figure 11), the 1931 Land Court Application Map 1043 (see Figure 13), and the 1956 U.S.G.S. Kawaihae quadrangle (see Figure 14) that extended parallel to the coast between Kawaihae to the south and Mahukona to the north. On the 1903 and 1931 maps this trail is labeled as the *Ala loa* and the Mahukona-Kawaihae Trail (it is not labeled on the 1956 U.S.G.S. map, nor is it shown on more recent U.S.G.S. maps). The SIHP site designation 29271 was first assigned to this trail by Clark and Rechtman (2010). For the most part this historic property is not discernable in its original state across the current study area and beyond, as it has been superseded by a series of bulldozed Jeep roads constructed between the 1940s and 1970s. Two slightly different routes of the trail are shown on the Historic maps reviewed for this study (see Figure 25). On the 1903 map the trail alignment stays close to the shore, but on the 1931 and 1956 maps the trail turns inland near the southern boundary of the current project area where it crosses Keawewai Gulch. It is likely that the two alignments represent a shift from an earlier coastal walking trail to a later Jeep road.



Figure 30. SIHP Site 15261 Feature C, view to the northeast.



Figure 31. SIHP Site 15261 Feature C, view to the southwest.



Figure 32. SIHP Site 15261 Feature C, view to the southwest.

Graves and Franklin (1998:34) discuss, that in response to comments regarding PHRI's failure to mention the *Ala loa* or other *mauka/makai* trails identified on maps of the area in earlier drafts of their inventory survey report, PHRI had conducted a "pedestrian inspection to determine if any portion of a jeep road that crosses the coastal portion of the project area could be identified as the *ala loa* trail." The inspection included walking the length of the road to search for evidence of constructed causeways or curbing that might still be present, but none was found, and they concluded that "if the road did indeed follow the original path of the trail, all traces of it have been obliterated by long-term use and alteration (Graves and Franklin 1998:34). For the purposes of the current update inventory survey the *Ala loa*/Mahukona-Kawaihae Trail alignments from the Historic maps were overlaid on the newly prepared project area map to examine their locations relative to the existing Jeep roads on the property. The overlays indicate that the trail alignments shown on the 1931 and 1956 correspond to bulldozed Jeep road alignments across the entire property, but that the alignment depicted on the 1903 map, while it corresponds to Jeep roads for much of its length, is shown *makai* of the bulldozed Jeep road at the southern end of the project area where it crosses Keawewai Gulch. Further pedestrian inspection of the area between and the southern parcel boundary revealed two possible trail remnants, one *makai* of the Jeep road near the southern property boundary, and another *mauka* of the Jeep road near SIHP Site 4000. For descriptive purposes the Jeep road (the later alignment of the *Ala loa*) is discussed below as Feature A of Site 29271, while the remnants of the earlier pedestrian alignments are discussed as Features B and C (see Figure 15). A petroglyph found in Keawewai Gulch near where Features A and B meet is described below with Feature A.

Feature A

Feature A is the alignment of the *Ala loa*/Mahukona-Kawaihae Trail shown on the 1931 and 1956 maps (see Figure 15). This alignment (Figure 33) consists wholly of bulldozed sections of Jeep road that were likely created between the 1940s and 1970s, superseding the earlier pedestrian trail alignment. Some sections of this alignment are still accessible to 4WD vehicles (Figure 34), but others are overgrown and cannot be driven on (Figure 35). The Jeep road is generally 2.5 to 3.0 meters wide and is badly eroded in some sections. At the northern end of the property the road has been blocked by bulldozed berms at two locations to prevent vehicular access. On the *mauka* side of the road as it crosses Keawewai Gulch there is a single anthropomorphic petroglyph etched into an eroded vertical surface (Figure 36). This image measures 25 centimeters tall by 13 centimeters wide, and its appearance and nature of execution (etching) it appears to be on the more recent end of the spectrum of such traditional practices.



Figure 33. Aerial view (from Google Earth) showing the locations of SIHP Site 29271 Features A, B, and C.



Figure 34. SIHP Site 29271 Feature A, view to the northwest.



Figure 35. SIHP Site 29271 Feature A, view to the south.



Figure 36. Triangle body anthropomorphic petroglyph etched on exfoliating vertical surface along the route of Site 29271 Feature A in Keawewai Gulch.

Feature B

Feature B consists of a short, remnant section of the *Ala loa*/Mahukona-Kawaihae Trail that roughly matches its location as shown on the 1903 Hawai‘i Reg. Map 2231 (see Figure 11). This faint trail alignment extends for roughly 130 meters in a northwesterly/southeasterly direction, 25 to 50 meters inland of the coast, near the southern boundary of project area (see Figure 15). The trail is discontinuous and very rough, but is marked in a few locations by short alignments of small boulders and cobbles along one edge (Figure 37). The pathway is littered with loose cobbles, but may have been 0.5 to 0.75 meters wide when in use. A 30 meter section of the trail, 25 meters from its northwestern end, has been erased by bulldozing. The projected route of the trail, while it could not be positively identified at Keawewai Gulch, suggests that it crossed that steep sided land form at the only easily accessible location *makai* of the existing Jeep road (Feature A). A section of this trail is observable crossing a smaller gulch to the south (Figure 38) where it also crosses at the most accessible location below the Jeep road. While Feature B once continued to both the northwest and southeast of the currently recorded section, no further physical remnants of the alignment were identified.



Figure 37. SIHP Site 29271 Feature B, view to the southeast.



Figure 38. SIHP Site 29271 Feature B at unnamed gulch, view to the southwest.

Feature C

Feature C consists of a possible, short remnant section of the *ala loa* trail that seems to correspond with the location shown on a 1931 map (see Figure 15), the more *mauka* placement of the trail. This section of trail is a worn pathway that measures between 50 and 75 centimeters wide that appears to have been cleared of larger rocks, some of which line the edge of the trail. This segment of trail is traceable for roughly 50 meters curving *mauka* then *makai* as it deviates from the Jeep road portion of the site (Feature A) just to the north of Keawewai Gulch (see Figure 33). This alignment appears to skirt the Site 4000/4004 burial complex. Feature C is currently bisected by a recent dirt road that extends in a *mauka/makai* direction between the highway and the shoreline. The section of trail on the southern side of the dirt road (Figure 39) measures roughly 20 meters; and the section on the northern side extends for roughly 30 meters. Feature C seems to represent the location *ala loa* just prior to the construction of the 1940s Jeep road.



Figure 39. SIHP Site 29271 Feature C south of *mauka/makai* dirt road, view to the north.



Figure 40. SIHP Site 29271 Feature C north of *mauka/makai* dirt road, view to the southeast.

6. SIGNIFICANCE EVALUATION AND TREATMENT RECOMMENDATIONS

All forty archaeological sites that exist within the current study parcel have already been assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai'i Administrative Rules 13§13-284-6. The significance of these sites (five modified as a result of the current study) is presented below. The significance evaluation for the earlier recorded sites that have been modified should be considered as preliminary until DLNR-SHPD provides concurrence. For resources to be significant they must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

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

Table 3 below presents a summary of the significance evaluation for all forty sites followed by a discussion.

As a result of the current study the original significance evaluation (Graves and Franklin 1998) and the subsequent DLNR-SHPD determination (DOC NO.: 9805PM21) has been modified for five of the previously recorded sites. Four of these (Sites 4000, 4010, 16132, and 16138) were not considered to be significant in the original study; however, all of these sites are part of a relatively intact archaeological landscape that documents evolving land use from Precontact times to the late Historic Period. As such, all four of these sites are now considered to be significant under Criterion D for their information content. Further, Site 2496 was originally determined to be significant solely under Criterion D; however, as this site is now known to contain a burial it should also be considered significant under Criterion E.

Table 3. Summary of site significance.

<i>SIHP No.</i>	<i>Site Type</i>	<i>Temporal Association</i>	<i>Significance</i>
2496	Habitation/Burial	Precontact	D, E
2498	Habitation/Ceremonial	Precontact	C, D, E
2499	Habitation	Precontact/Historic	C, D
4000	Wall	Precontact/Historic	D
4002	Rock mound	Precontact	D
4003	Habitation	Precontact/Historic	D
4004	Burial	Precontact/Historic	D, E
4005	Habitation	Precontact/Historic	C, D
4010	Animal Enclosure	Historic	D
4011	Habitation	Precontact/Historic	D
4012	Habitation	Precontact/Historic	D
4013	Habitation/Burial	Precontact/Historic	D, E
4015	Habitation	Precontact	D
15261	Trail	Precontact/Historic	D, E
16131	Habitation	Precontact/Historic	D
16132	Wall	Historic	D
16133	Well/Reservoir	Historic	D
16134	Enclosure	Historic	D
16135	Wall	Precontact	D
16136	Habitation	Precontact	D
16137	Rock mound	Precontact	D

continued on next page

Table 3. Continued.

<i>SIHP No.</i>	<i>Site Type</i>	<i>Temporal Association</i>	<i>Significance</i>
16138	Platform and cairn	Precontact	D
16139	Habitation	Precontact	D
16140	Habitation	Precontact	D
16141	Habitation	Precontact	D
16142	Habitation	Precontact	D
16143	Habitation	Precontact	D
16144	Habitation	Precontact	D
16145	Habitation	Precontact	D
16146	Habitation	Precontact	D
16147	Habitation	Precontact	D
16148	Habitation/Burial	Precontact	D, E
16149	Habitation	Precontact	D
16150	Habitation	Precontact	D
16151	Habitation	Precontact	D
16162	Burial	Precontact	D, E
16163	Habitation	Precontact	D
16164	Habitation	Precontact	D
16167	Agricultural Terrace	Precontact/Historic	D
29271	Trail	Precontact/Historic	D, E

Given the current development proposal (a nine lot subdivision) for the study property (see Figures 8 and 10), site treatments should be reconsidered and the existing preservation and burial treatment plans revised. Table 4 shows the prior approved treatments and current proposed treatment recommendations. As can be seen in this table, the proposed treatment for several of the sites reverts back to that as was approved in the earlier inventory survey. The revised treatments were based on a very limited land use (one single-family residence) of the 37.8 acre parcel, and the current proposed treatments take into consideration the current proposed development plan. No further work continues to be the proposed treatment for two sites (Sites 16132 and 16136); both of these were substantially documented during either the original inventory survey (Graves and Franklin 1998) or the subsequent burial testing (PHRI 2005). Data recovery has already been completed for Site 4015 (O'Hare and Goodfellow 1999). Two of the sites (Sites 4010 and 16138) that were earlier approved for no further work are now recommended for data recovery prior to their destruction; and one site (Site 4000) that was approved for no further work is now recommended for preservation as it appears to be a part of the Site 4004 burial complex.

The four previously identified burial sites (Sites 4004, 4013, 16148, and 16162) shall continue to be preserved, however the burial treatment plan (PHRI 2000a) should be updated to reflect the proposed change in land use and the newly identified burial site (Site 2496 Feature D) added to the plan. As stated in the burial treatment plan:

While it is the intent of the owner to develop only the western portion of the project area, and to leave the larger eastern portion in its present undeveloped condition, it is recognized that the possibility of changes in intended property use by the current or any subsequent owner may arise in the future. Therefore, any proposed future changes in land use for the eastern portion of the property will require the owner to return to the HIBC for possible reconsideration of the adequacy of the long-term preservation measures for the burial sites as proposed in this BTP. (PHRI 2000a:15)

Data recovery is now recommended for sixteen sites (4002, 4003, 4010, 4012, 16135, 16137, 16138, 16140, 16141, 16143, 16144, 16146, 16150, 16151, 16164, 16167) plus portion of two additional sites (Sites 2496 and 4013) that also contain preserved burial features. All of these sites were previously approved for data recovery in the prior inventory survey (Graves and Franklin 1998) with the exception of Sites 4010 and 16138, which were earlier approved for no further work. It is believed that these two sites still retain information that could be recovered and aid in developing a specific chronology of the project area land use history. Pursuant to HAR 13§13-278, a plan addressing the data recovery of these eighteen sites should be prepared and submitted to DLNR-SHPD for review and approval.

Preservation is now recommended for sixteen sites (2498, 2499, 4000, 4005, 4011, 15261, 16131, 16133, 16134, 16139, 16142, 16145, 16147, 16149, 16163 and 29271) two of which (Sites 4000 and 15261) were approved for no further work as a result of the original inventory survey (Graves and Franklin 1998) and another (Site 29271) went unrecorded in the earlier study. A new preservation plan that addresses these sixteen sites should be prepared and submitted to DLNR-SHPD for review and approval in compliance with HAR 13§13-277.

Table 4. Previously approved and current proposed treatment recommendations.

<i>SIHP No.</i>	<i>Treatment in Inventory</i>	<i>Revised Treatment</i>	<i>Current Proposal</i>
2496	Data Recovery	Preservation	Data Recovery/Burial Preservation
2498	Data Recovery/Preservation	Preservation	Preservation
2499	Data Recovery/Preservation	Preservation	Preservation
4000	No Further Work	No Further Work	Preservation
4002	Data Recovery	Preservation	Data Recovery
4003	Data Recovery	Preservation	Data Recovery
4004	Burial Preservation	Burial Preservation	Burial Preservation
4005	Data Recovery/Preservation	Preservation	Preservation
4010	No Further Work	No Further Work	Data Recovery
4011	Data Recovery	Preservation	Preservation
4012	Data Recovery	Preservation	Data Recovery
4013	Burial Preservation	Burial Preservation	Data Recovery/Burial Preservation
4015	Data Recovery Completed	Data Recovery Completed	Data Recovery Completed
15261	No Further Work	No Further Work	Preservation
16131	Data Recovery	Preservation	Preservation
16132	No Further Work	No Further Work	No Further Work
16133	Data Recovery	Preservation	Preservation
16134	Data Recovery	Preservation	Preservation
16135	Data Recovery	Preservation	Data Recovery
16136	No Further Work	No Further Work	No Further Work
16137	Data Recovery	Preservation	Data Recovery
16138	No Further Work	No Further Work	Data Recovery
16139	Data Recovery	Preservation	Preservation
16140	Data Recovery	Preservation	Data Recovery
16141	Data Recovery	Preservation	Data Recovery
16142	Data Recovery	Preservation	Preservation
16143	Data Recovery	Preservation	Data Recovery
16144	Data Recovery	Preservation	Data Recovery
16145	Data Recovery	Preservation	Preservation
16146	Data Recovery	Preservation	Data Recovery
16147	Data Recovery	Preservation	Preservation
16148	Burial Preservation	Burial Preservation	Burial Preservation
16149	Data Recovery	Preservation	Preservation
16150	Data Recovery	Preservation	Data Recovery
16151	Data Recovery	Preservation	Data Recovery
16162	Burial Preservation	Burial Preservation	Burial Preservation
16163	Data Recovery	Preservation	Preservation
16164	Data Recovery	Preservation	Data Recovery
16167	Data Recovery	Preservation	Data Recovery
29271	Not documented	Not documented	Preservation

REFERENCES CITED

- Allen, M.
1985a Limited Archaeological Reconnaissance Survey Kahua Shores Coastal Parcel: Kahua 1, North Kohala, Island of Hawaii (THK:3-5-9-01:8). PHRI Report 74-031883. Prepared for Kahua Shores, Ltd.
- 1985b Limited Archaeological Reconnaissance Survey Kahua Shores Coastal Parcel: Kahua 1-2 and Waikā, North Kohala, Island of Hawaii (THK:3-5-9-01:8). PHRI Report 76-030183. Prepared for Kahua Shores, Ltd.
- Apple, R.
1965 *Hawaiian Archaeology: Trails*. B. P. Bishop Museum Press, Honolulu.
- Barrera, W.
1971 *Anaehoomalu: A Hawaiian Oasis*. Preliminary Report of Salvage Research in South Kohala, Hawaii. Pacific Anthropological Records No. 15. Department of Anthropology, B.P. Bishop Museum, Honolulu.
- Beckwith, M.
1976 *Hawaiian Mythology*. University of Hawai'i Press, Honolulu.
- Bellwood, P.
1978 *The Polynesians: Prehistory of an Island People*. Thames and Hudson, Ltd., London.
- Bonk, W.
1968 An Archaeological Survey of a Coastal Tract in North and South Kohala, Hawaii. Report Prepared for the Department of Land and Natural Resources, Division of State Parks, Hawaii.
- Burgett, B., and P. Rosendahl
1993 Summary of Archaeological Inventory Surveys, Kapaanui Agricultural Subdivision and Mahukona Property, Lands of Kapaanui, Kou, Kamano, Mahukona 1st and 2nd, Hihiu, and Kaoma, North Kohala District, Island of Hawaii. (TMK:3-5-7-02:11 and TMK:3-5-7-03:1-3,10-14,16-18). PHRI Report 743-020993. Prepared for Chalon International of Hawaii, Inc.
- Clark, M., and R. Rechtman
2010 An Archaeological Inventory survey of TMK:3-5-8-01:15 and 3-5-9-03:03 Puaiki and Ki'iokalani ahupua'a, North Kohala District, Island of Hawai'i. Rechtman Consulting Report RC-0674. Prepared for Ponoholo Ranch.
- Corbin, A.
2000 Archaeological Data Recovery at Kohala Makai-I Project Area, Land of Waikā, North Kohala District, Island of Hawaii (TMK: 5-9-01:006). PHRI Report No. 2034-080100 Prepared for Kohala Waterfront Joint Venture.
- 2004 Archaeological Mitigation Plan Kahuā Makai Project, Lands of Kahuā 2nd and Waikā, North Kohala District, Hawai'i Island (TMK:3-5-9-01:07). PHRI Report 2284-042104 Prepared for P-Ohana Makia/K-Ohana Makai.
- Doyle, E.
1953 *Makua Laiana: the Story of Lorenzo Lyons*. Compiled from manuscript journals 1832-1886. *Honolulu Star Bulletin*.

- Dunn, A., and P. Rosendahl
1989 Archaeological Inventory Survey, Kapaanui Agricultural Subdivision, Lands of Kapaanui and Kou, North Kohala District, Island of Hawaii. PHRI Report 568-100289. Prepared for Ahualoa Development, Inc.
- Ellis, W.
1963 *Journal of William Ellis: A Narrative of an 1823 Tour Through Hawai'i*. Mutual Publishing Company, Honolulu.
- Fornander, A.
1969 *An Account of the Polynesian Race: Its Origin and Migrations*. Tokyo: Charles E. Tuttle Co., Inc.
- Graves, D., and L. Franklin
1998 Archaeological Inventory Survey, Kahuā Makai/Kahuā Shores Coastal Parcels, Lands of Kahuā 1 and 2 and Waikā, North Kohala District, Island of Hawai'i (TMK: 3-5-9-01:7,8). PHRI Report 1024-033198. Prepared for Gentry Hawai'i Company.
- Griffin, P., T. Riley, P. Rosendahl, and H. Tuggle
1971 Archaeology of Halawa and Lapakahi: Windward Valley and Leeward Slope. *New Zealand Archaeological Association Newsletter* 14(3):101-112.
- Hammatt, H., and D. Borthwick
1986 Archaeological Survey and Excavations at Kohala Ranch, North Kohala, Hawaii. Cultural Services Hawaii Report Prepared for Kohala Ranch.
1987 Archaeological Reconnaissance of 1,288 Acres for a Proposed Residential Community, Kohala Ranch, North Kohala, Hawaii Island. Cultural Services Hawaii Report. Prepared for Kohala Ranch.
1990 Archaeological Reconnaissance of Gulch Areas within 1,314 Acres for a Proposed Residential Community, Kohala Ranch, North Kohala, Hawaii. Cultural Services Hawaii Report. Prepared for Department of Land and Natural Resources.
- Handy, E. S. C., and E. G. Handy
1972 *Native Planters in Old Hawaii: Their Life, Lore, and Environment*. Bernice P. Bishop Museum Bulletin 233, Bishop Museum Press, Honolulu.
- Henke, L.
1929 *A Survey of Livestock in Hawaii*. Research Publication No. 5. University of Hawaii, Honolulu.
- Hommon, R.
1976 The Formation of Primitive States in Pre-Contact Hawaii. Ph.D. Dissertation (Anthropology), University of Arizona, Tucson. University Microfilms, Inc., Ann Arbor, Michigan.
1986 Social Evolution in Ancient Hawai'i. IN Kirch, P.V. (ed.), *Island Societies: Archaeological Approaches to Evolution and Trans-formation*: 55-88. Cambridge: University Press.
- Kamakau, S.
1964 *Ka Po'e Kahiko: The People of Old*. B.P. Bishop Museum Special Publication 51. Bishop Museum Press, Honolulu.
1976 The Works of the People of Old, *Na hana a ka Po'e Kahiko*. B.P. Bishop Museum Special Publication 61. Bishop Museum Press, Honolulu.
1991 *Tales and Traditions of the People of Old*. Honolulu: Bishop Museum Press.

References Cited

- 1992 *Ruling Chiefs of Hawaii*. The Kamehameha Schools Press, Honolulu (revised edition).
- Kent, N.
1983 *Hawaii: Islands Under the Influence*. University of Hawai'i Press, Honolulu.
- Kirch, P.
1984 *The Evolution of the Polynesian Chiefdoms*. Cambridge University Press, New York.
- 1985 *Feathered Gods and Fishhooks: An Introduction to Hawaiian Archaeology and Prehistory*. University of Hawaii Press, Honolulu.
- 1990 Monumental Architecture and Power in Polynesian Chiefdoms: A Comparison of Tonga and Hawaii. *World Archaeology* 22(2).
- 2011 When did the Polynesians Settle Hawai'i? A Review of 150 Years of Scholarly Inquiry and a Tentative Answer. *Hawaiian Archaeology* Vol. 12:3-26.
- KTF (Kohala Task Force)
1975 Kohala: A Candid View. Report of the Kohala Task Force [March].
- Kubo, L., and P. Rosendahl
2003 Burial Treatment Plan Sites 50-10-05-2491 (Feature B) and 50-10-05-16130 (Features A and B) at Kohala Bay Estates, Land of Kahuā 1 and 2, North Kohala District, Island of Hawai'i (TMK:3-5-9-01:7). PHRI Report 2283-101603. Prepared for P-Ohana Makai/K-Ohana Makai, Kamuela, Hawai'i.
- Kuykendall, R., and A. Day
1976 *Hawaii: A History From Polynesian Kingdom to American Statehood*. Prentice-Hall, Inc., Englewood Cliffs.
- Langlas, C.
1994 Pu'u of Mauka Kawaihae and Kalalā Ahupua'a, District Kohala, Hawai'i Island: Report of an Investigation of the Hawaiian Cultural Significance of Candidate Sites for the Kamuela Area (Hawai'i) NEXRAD Installation. Part 1: Candidates Sites for the NEXRAD Installation: Ethnographic Background and Site Assessment. Prepared for SRI International.
- Loubser, J., and R. Rechtman
2007 Archaeological Data Recovery Investigation at SIHP Sites 2492, 16177, 16122, 2494, 16129, 2485, and 16154, within Site Complex 50-10-05-4157, TMK: 3-5-9-017:001-007, Kahuā 2 and Waikā ahupua'a, North Kohala District, Island of Hawai'i. Rechtman Consulting Report RC-0400. Prepared for Kohala Kai LLC.
- Malo, D.
1951 *Hawaiian Antiquities*. Bishop Museum Press, Honolulu.
- Maly, K.
2000 Historical Background. In Archaeological Inventory Survey of the Coastal Portion of Kaiholena Ahupua'a, North Kohala, Hawai'i pp. 23-66. by T. S. Dye and K. Maly. International Archaeological Research Institute, Inc. Report Prepared for Pohaku Kea, LCC., Honolulu.
- Newman, T.
1970 Hawaiian Fishing and Farming on the Island of Hawaii in AD 1778. Department of Land and Natural Resources, Division of State Parks, Honolulu.

- OCA
2000 *Paniolo Hall of Fame Oral History Interviews*. O‘ahu Cattlemen’s Association, Ewa Beach.
- O’Hare, C., and S. Goodfellow
1999 Archaeological Mitigation Program, Data Recovery Excavations, Site 50-10-05-4015, Kahuā Makai/Kahuā Shores Coastal Parcels, Land of Kahuā 1, North Kohala District, Island of Hawai‘i (TMK: 5-9-01:7,8). PHRI Report 1572-081799. Prepared for Gentry Hawaii, Ltd.
- Oliver, D.
1961 *The Pacific Islands*. University of Hawaii Press, Honolulu.
- Orr, M.
2003 Cultural Impact Assessment Kahua Ranch DAGS Rainbow Tower & Facilities Pu‘u Waiakanonula, Kahua Ranch, Ahupua‘a of Kahuali‘ili‘i, District of Kohala, Hawai‘i Island, Hawai‘i. Prepared for Haun & Associates.
- PHRI
2000a Burial Treatment Plan, Kohala LLC Residential Compound Project. Land of Kahua 1, North Kohala District, Island of Hawaii (TMK:3-5-9-01:8). PHRI Report 2003-041100. Prepared for Gentry-Pacific, Limited.
- 2000b Site Preservation Plan, Kohala LLC Residential Compound Project. Land of Kahua 1, North Kohala District, Island of Hawaii (TMK:3-5-9-01:8). PHRI Report 2003-080100. Prepared for Gentry-Pacific, Limited.
- 2005 Documentation on Testing of Possible Burial Features Kahuā Makai/Kahuā Shores Coastal Parcels, Lands of Kahuā 1-2 and Waikā, North Kohala District, Island of Hawai‘i. (TMK:3-5-9-01:7,8). PHRI Report 2510-141305. Prepared for P-Ohana Makai/K-Ohana Makai, Kamuela, Hawai‘i.
- Pogue, J.
1978 *Mooleo Hawaii*. Hale Paipalapala Aupuni, Honolulu (Revised Edition).
- Pukui, M.
1983 *‘Ōlelo No‘eau: Hawaiian Proverbs and Poetical Sayings*. Bernice P. Bishop Museum Special Publication 71. Bernice Bishop Museum, Honolulu.
- Rosendahl, P.
1972 Aboriginal Agriculture and Domestic Residence Patterning in Upland Lapakahi, Island of Hawaii. Ph.D. dissertation. Department of Anthropology, University of Hawaii at Manoa.
- 1994 Aboriginal Hawaiian Structural Remains and Settlement Patterns in the Upland Agricultural Zone at Lapakahi, Island of Hawaii. *Hawaiian Archaeology* 3:14-70.
- Rechtman, R.
2010 Cultural Impact Assessment for the Proposed Development of TMK: 3-5-9-01:008, Kahuā 1st Ahupua‘a, North Kohala District, Island of Hawai‘i. Rechtman Consulting Report RC-0662. Prepared for GRM Enterprises, Kamuela.
- Schilt, R., and A. Sinoto
1980 Limited Phase I Archaeological Survey of Māhukona Properties, North Kohala, Island of Hawai‘i. Bernice P. Bishop Museum Report Prepared for Belt Collins and Associates, Honolulu.
- Schmitt, R.
1973 The Missionary Censuses of Hawaii. *Pacific Anthropological Records* No. 20. Department of Anthropology, Bernice P. Bishop Museum, Honolulu.

References Cited

- Smith, J., M. Noonan, and M. Bargion
1973 Lapahaki Coastal Excavations: 1970. In *Lapahaki Hawaii: Archaeological Studies*, edited by H. D. Tuggle and P. B. Griffin, pp. 87-114. Asian and Pacific Archaeology Series No. 5. Social Science Research Institute, University of Hawai'i, Honolulu.
- Soehren, L.
1964 An Archaeological Reconnaissance of the Maukona-Kawaihae Highway, Kohala, Hawaii. Department of Anthropology, B.P. Bishop Museum, Honolulu.
1969 An Archaeological Reconnaissance of the Parker Ranch Coastal Lands, North Kohala. In *Archaeology on the Island of Hawaii* edited by R. Pearson, pp. 15-24. Asian and Pacific Archaeology Series No. 3. Social Science Research Institute, University of Hawaii, Honolulu.
- Tomonari-Tuggle, M.
1988 *North Kohala: Perception of a Changing Community*. Division of State Parks, Outdoor Recreation and Historic Sites, Department of Land and Natural Resources, State of Hawaii, Honolulu.
- Williams, J.
1919 A Little Known Engineering Work in Hawaii. IN *Thrum's Hawaiian Almanac and Annual for 1919*. Thos. G. Thrum, Honolulu.
- Wolfe, E., and J. Morris
1996 *Geological Map of the Island of Hawaii*. U.S. Department of the Interior, U.S. Geological Survey.
- Wulzen, W., J. Head, and S. Goodfellow
1995 Final Report: Archaeological Inventory Survey, Chalon International Mahukona Mauka Parcel; Lands of Kamano, Mahukona 1st and 2nd, Hihiu and Kaoma, North Kohala District, Island of Hawaii (TMK:3-5-7-02:por.36). PHRI Report 1520-080895. Prepared for Chalon International of Hawaii, Inc.

ENVIRONMENTAL ASSESSMENT

Kohala Shoreline, LLC Project

TMK: (3rd) 5-9-001:008

Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i

APPENDIX 5

Traffic Impact Analysis Report

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**TRAFFIC IMPACT ANALYSIS
FOR
KOHALA SHORELINE
PROPOSED 9-LOT SUBDIVISION
MAKAI (WEST) SIDE OF AKONI-PULE HIGHWAY
AT KOHALA RANCH ROAD
KOHALA COAST, DISTRICT OF SOUTH KOHALA, HAWAII
TMK (3) 5-9-001:008**

MARCH, 2015

**PREPARED FOR:
KOHALA SHORELINE, LLC**



THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION

B. Witcher 3/1/15

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APPENDIX A Location Map, Tax Map Key, Concept Plan and Aerial View of Intersections

APPENDIX B Level of Service– Akoni Pule Highway/Kohala Ranch Road (Computer Printout)

- Existing Conditions AM and PM Peak Traffic
- Future Conditions AM and PM Peak Traffic (includes Build-out, 5,10 and 20 year)

APPENDIX C Level of Service– Akoni Pule Highway/South Driveway (Computer Printout)

- Build-out Conditions AM and PM Peak Traffic
- Future Conditions AM and PM Peak Traffic (includes 5,10 and 20 year)

APPENDIX D Traffic Movement Diagrams– Akoni Pule Highway/Kohala Ranch Road

- Existing Conditions AM & PM Peak Traffic
- Future Conditions AM & PM Peak Traffic (includes Build-out, 5,10 and 20 year)

APPENDIX E Traffic Movement Diagrams– Akoni Pule Highway/South Driveway

- Build-out Conditions AM & PM Peak Traffic
- Future Conditions AM & PM Peak Traffic (includes 5,10 and 20 year)

TRAFFIC IMPACT ANALYSIS REPORT
KOHALA SHORELINE
PROPOSED 9 LOT SUBDIVISION
MAKAI (WEST) SIDE OF AKONI PULE HIGHWAY AT
KOHALA RANCH ROAD
KOHALA COAST, DISTRICT OF SOUTH KOHALA, HAWAII
TMK (3)5-9-001:008

I. INTRODUCTION AND PURPOSE

This will report on the traffic impacts of developing the proposed 9-lot residential subdivision located makai (west) side of Kohala Ranch Road (the “**Project**”). See Exhibit A - Kohala Shoreline concept plan. In particular, the focus will be on impacts to traffic on Akoni Pule Highway and Kohala Ranch Road. In addition, this report will also study traffic impacts at the proposed access driveway at the existing permitted access points to the Project; one across from the entrance to Kohala Ranch at Kohala Ranch Road and the other located approximately 1,300 feet south of the Kohala Ranch entrance. Due to lack of background traffic in this area, both intersections are proposed to be un-signalized. This traffic impact analysis has been prepared based upon future traffic projections for 5, 10 and 20 years in accordance with the applicable concurrency requirements of Hawaii County Zoning Code Section 25-2-46.

II. PROPOSED DEVELOPMENT

The project is located between the ocean and Akoni Pule Highway across from the Kohala Ranch project. The tax map key involved is (3) 5-9-001:008. Current planning is for one intersection at Akoni Pule Highway to be a four-way intersection at the entrance to Kohala Ranch (“**north driveway**”) and the other to be a “T” intersection, approximately 1,300 feet southerly of the Project entrance (“**south driveway**”). The north driveway entrance at Kohala Ranch Road and Kohala Ranch entrance will provide access to five lots and the southerly access, four lots.

III. STUDY AREA CONDITIONS

A. *Study Area*

The study area primarily consists of east/mauka areas of agricultural-zoned lands with farm dwellings on large agricultural-zoned parcels. The zoning in the west/makai area varies from Single-Family Residential (RS-15) to Agricultural (A-5a) at the adjoining Kohala Kai Subdivision, and Multiple-Family Residential (RM-4) at the Kohala Waterfront Subdivision. The Project is located on 36+ acres lying

between Akoni Pule Highway and the Pacific Ocean. The closest major development is Kohala Ranch to the east/mauka, with smaller developments to the south.

B. *Site Accessibility*

At this time two accesses to the Project are proposed. The north driveway will be the west/makai leg of the intersection along Akoni Pule Highway at the Kohala Ranch Road entrance. The other would be approximately 1,300 feet south. Both are on Akoni Pule Highway (State Route 279). Akoni Pule Highway is a major two-land road. Existing conditions at the Kohala Ranch Road intersection are as follows: a southbound through lane, a northbound through lane, northbound right lane, a westbound lane and a westbound right/out lane. There is a refuge pocket for the westbound left turn lane on Akoni Pule Highway. There is adequate area to make a lane for a northbound left refuge pocket, and for a southbound right deceleration lane.

C. *Land Use*

The project site is currently vacant land and is County zoned Single-Family Residential, minimum lot size 15 acres (RS-15). The land use of the surrounding area is agricultural at both the mauka Kohala Ranch and at the adjoining Kohala Kai Subdivision, and single-family residential (though zoned multiple-family residential RM) at the Kohala Waterfront Subdivision to the south. It is the intention of the developer to reduce the Project density and rezone the property from RS-15 down to Residential-Agricultural, minimum lot size 3 acres (RA-3a).

D. *Compliance with Concurrency Requirements*

Pursuant to Section 25-2-46 (Concurrency Requirements), Hawaii County Zoning Code, a traffic impact analysis report (“**TIAR**”) is required with the application for any zoning amendment which can generate fifty or more peak hour trips. Although the proposed Project will not generate this number of peak hour trips, this report was prepared in order to fully study the impacts of the proposed Project.

The TIAR shall include projections of future traffic growth for a minimum of five- and twenty-years, and include other approved or proposed developments that are expected to impact the area of the Project, with reasonable build-out assumptions. Based on the current economic conditions, we have assumed that future development within the area of the Project over the next five years will be gradual. In light of the minimal background traffic in this area, no local or area traffic mitigation measures are required. The Project will have a minimal impact on the traffic conditions in the general area.

IV. ANALYSIS OF EXISTING CONDITIONS

A. Physical Characteristics

Akoni Pule Highway is a State of Hawaii Department of Transportation owned and maintained major two-lane highway with auxiliary lanes as necessary for turning. Kohala Ranch is a gated community with a guard facility at the entrance. The speed limit is 45 mph northward and southward bound.

B. Traffic Volumes

Traffic counts were taken on February 12, 2015, at the intersection of Akoni Pule Highway and the Kohala Ranch Road entrance. The peak hours are tabulated in the following table.

TABLE 1 PEAK HOUR TRAFFIC FLOW

<i>Location</i>	<i>Peak Hour</i>	<i>Vehicles Per Hour (vph)</i>
Akoni Pule-Highway & Kohala Ranch Road	7:30 AM to 8:30 AM	266
	3:00 PM to 4:00 PM	416

The following table gives a breakdown of the peak traffic period this location.

TABLE 2 TRAFFIC COUNTS FOR PEAK HOURS

<i>Direction</i>	<i>AM Peak Hour</i>	<i>PM Peak Hour</i>
Akoni Pule Highway & Kohala Ranch Road		
WBL	29	26
WBR	2	1
NBT	60	187
NBR	29	26
SBL	0	1
SBT	146	175

WBL - Westbound Left
 NBT - Northbound Through
 SBL - Southbound Left

WBR - Westbound Right
 NBR - Northbound Right
 SBT - Southbound Through

C. *Level-of-service*

“Level-of-service” is a term which denotes any of an infinite number of combinations of traffic operating conditions that may occur on a given lane or roadway when it is subjected to various traffic volumes. Level-of-service (“**LOS**”) is a qualitative measure of the affect of a number of actions which include space, speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience.

The operating conditions of intersections controlled by stop signs can be classified by a LOS from “A” to “F”, as summarized in the table below. However, the method of determining LOS for un-signalized intersections is based upon the use of gaps in traffic on the major street by vehicles crossing or turning through that stream. Specifically, the capacity of the controlled legs of an intersection is based on two factors: (1) the distribution of gaps in the major street traffic stream and (2) driver judgment in section gaps through which to execute a desired maneuver. The criteria for LOS at an un-signalized direction is therefore based on delay of each turning movement.

<i>Level-of-service (Un-Signalized)</i>	<i>Expected Delay</i>
A	Little or no delay
B	Short traffic delays
C	Average traffic delays
D	Long traffic delays
E	Very long traffic delays
F	Extreme delays will be encountered with queuing which may cause severe congestion affecting other traffic movements in the intersection, which usually warrants improvements of the intersection

Levels of service were calculated for these intersections using data gathered on February 12, 2015. The following table shows the level-of-service for existing conditions.

TABLE 3 LEVEL-OF-SERVICE FOR EXISTING CONDITIONS, PEAK HOUR

<i>Direction</i>	<i>AM Peak</i>	<i>PM Peak</i>
Akoni Pule Highway & Kohala Ranch Road		
WBL	A	B
WBR	A	A
NBT	A	A
NBR	A	A
SBL	A	A
SBT	A	A

Based on the existing traffic counts, all controlled movements operate at level-of-service “A” or “B”. This implies good operating conditions and minimal delays.

V. PROJECTED TRAFFIC

A. Methodology

Highway capacity analysis was performed in accordance with the “*Highway Capacity Manual, Special Report 209*” (2nd Edition) of the Transportation Research Board, 1992) and the “*Highway Capacity Software from the Federal Highway Administration and McTrans*”, University of Florida, Gainesville, Florida. LOS for the various intersections were computed for the existing condition in accordance with the Highway Capacity Manual. LOS calculations and volume-capacity-ratios are tabulated herein for both AM and PM peaks for existing- and the post-development conditions. Each intersection is diagrammed in the appendix showing existing- and post-development conditions.

The trip generation methodology used in this report is based upon applications developed by the Institute of Transportation Engineers (“ITE”) and published in “*Trip Generation*”, 8th Edition, 2011. Trip generations have been developed for a variety of land uses (or facility types) which correlate trips with dwelling units, area, population, vehicle ownership and intensity of use. Each facility type has a catalog number for identification purposes. In this case, Classification 210, Single-family Detached, was used. It should be noted that to obtain conservative estimates of potential traffic, *no* adjustments are made to reflect the impact of less than full-time residents which could be the case in the study area.

B. Project Trip Generation

As stated above, the project is to be a residential and agricultural subdivision, therefore land use Classification 210, or single-family detached is used for trip generation. Since the peak hour trips for the Project generate less than 100 peak hour trips, the horizon is the opening year which is assumed to be 2017. The following table shows the trips generated.

TABLE 4 TRIP GENERATION

<i>Time</i>	<i>Number of Lots</i>	<i>Generator</i>	<i>Entering</i>		<i>Exiting</i>	
			<i>%</i>	<i>#</i>	<i>%</i>	<i>#</i>
AKONI PULE HIGHWAY & KOHALA RANCH ROAD						
AM	5	0.77	26	1	74	3
PM	5	1.02	64	3	36	2
AKONI PULE HIGHWAY & SOUTHERLY ACCESS ROAD						
AM	4	0.77	26	1	74	2
PM	4	1.02	64	3	36	1

Note that the 5-lots are accessed by the Kohala Ranch intersection and the 4-lots are accessed by the southerly access.

C. Traffic Distribution

Trip distribution was performed on the basis of direction of the existing turning movements. In this case, that is westbound left and westbound right at the Kohala Ranch Road intersection.

D. Trip Assignment

The following table shows the trip distribution and trip assignment for the 5-year, 10-year and 20-year horizons.

TABLE 5 TRIP DISTRIBUTION AND ASSIGNMENT

INTERSECTION OF AKONI PULE HIGHWAY & KOHALA RANCH ROAD										
<i>Direction</i>	<i>AM</i>					<i>PM</i>				
	<i>Existing</i>	<i>BO</i>	<i>5-Yr</i>	<i>10-Yr</i>	<i>20-Yr</i>	<i>Existing</i>	<i>BO</i>	<i>5-Yr</i>	<i>10-Yr</i>	<i>20-Yr</i>
EBL	–	0	0	0	0	–	0	0	0	0
EBT	–	0	0	0	0	–	0	0	0	0
EBR	–	3	3	3	3	–	2	2	2	2
WBL	29	29	32	36	43	26	26	29	32	39
WBT	–	0	0	0	0	–	0	0	0	0
WBR	2	2	2	2	3	1	1	1	1	1
NBL	–	1	1	1	1	–	3	3	3	3
NBT	60	60	66	73	89	187	187	206	228	278
NBR	29	29	32	36	43	26	26	29	32	39
SBL	0	0	0	1	2	1	1	1	1	1
SBT	146	146	161	178	217	175	175	193	213	260
SBR	–	0	0	0	0	–	0	0	0	0
INTERSECTION OF AKONI PULE HIGHWAY & SOUTHERLY ACCESS										
EBL	–	0	0	0	0	–	0	0	0	0
EBT	–	–	–	–	–	–	–	–	–	–
EBR	–	2	2	2	2	–	2	2	2	2
WBL	–	–	–	–	–	–	–	–	–	–
WBT	–	–	–	–	–	–	–	–	–	–
WBR	–	–	–	–	–	–	–	–	–	–
NBL	–	1	1	1	1	–	3	3	3	3
NBT	–	90	99	110	133	–	216	238	263	320
NBR	–	–	–	–	–	–	–	–	–	–
SBL	–	178	196	217	262	–	203	224	247	301
SBT	–	0	0	0	0	–	0	0	0	0
SBR	–	–	–	–	–	–	–	–	–	–

VI. TRAFFIC IMPACT ANALYSIS

Level-of-service analysis was performed for the existing and future conditions based on 5-, 10- and 20- year projections for the intersections of Akoni Pule Highway/Kohala Ranch Road and Akoni Pule Highway/the south driveway. The following table shows the results of these calculations.

TABLE 6 LEVEL-OF-SERVICE

<i>Direction</i>	<i>AM</i>					<i>PM</i>				
	<i>Existing</i>	<i>BO</i>	<i>5-Yr</i>	<i>10-Yr</i>	<i>20-Yr</i>	<i>Existing</i>	<i>BO</i>	<i>5-Yr</i>	<i>10-Yr</i>	<i>20-Yr</i>
AKONI PULE HIGHWAY & KOHALA RANCH ROAD										
EBL	–	A	A	A	A	–	A	A	A	A
EBT	–	A	A	A	A	–	A	A	A	A
EBR	–	A	A	A	A	–	A	A	A	A
WBL	A	A	B	B	B	B	B	B	B	B
WBT	–	A	B	B	B	–	B	B	B	B
WBR	A	A	A	A	A	A	A	A	A	A
NBL	–	A	A	A	A	–	A	A	A	A
NBT	–	A	A	A	A	–	A	A	A	A
NBR	–	A	A	A	A	–	A	A	A	A
SBL	A	A	A	A	A	A	A	A	A	A
SBT	–	A	A	A	A	–	A	A	A	A
SBR	–	A	A	A	A	–	A	A	A	A
Approach Delay	9.7	9.9	10.1	10.4	10.9	10.8	11.3	11.8	12.3	13.7
Approach LOS	A	A	B	B	B	B	B	B	B	B
AKONI PULE HIGHWAY & SOUTH DRIVEWAY										
EBL	–	A	A	A	A	–	A	A	A	A
EBT	–	–	–	–	–	–	–	–	–	–
EBR	–	A	A	A	A	–	A	A	A	A
WBL	–	–	–	–	–	–	–	–	–	–
WBT	–	–	–	–	–	–	–	–	–	–

<i>Direction</i>	<i>AM</i>					<i>PM</i>				
	<i>Existing</i>	<i>BO</i>	<i>5-Yr</i>	<i>10-Yr</i>	<i>20-Yr</i>	<i>Existing</i>	<i>BO</i>	<i>5-Yr</i>	<i>10-Yr</i>	<i>20-Yr</i>
WBR	–	–	–	–	–	–	–	–	–	–
NBL	–	A	A	A	A	–	A	A	A	A
NBT	–	A	A	A	A	–	A	A	A	A
NBR	–	–	–	–	–	–	–	–	–	–
SBL	–	–	–	–	–	–	–	–	–	–
SBT	–	A	A	A	A	–	A	A	A	A
SBR	–	A	A	A	A	–	A	A	A	A
Approach Delay	–	9.1	9.2	9.4	9.6	–	9.3	9.4	9.5	9.9
Approach LOS	–	A	A	A	A	–	A	A	A	A

VII. CONCLUSIONS

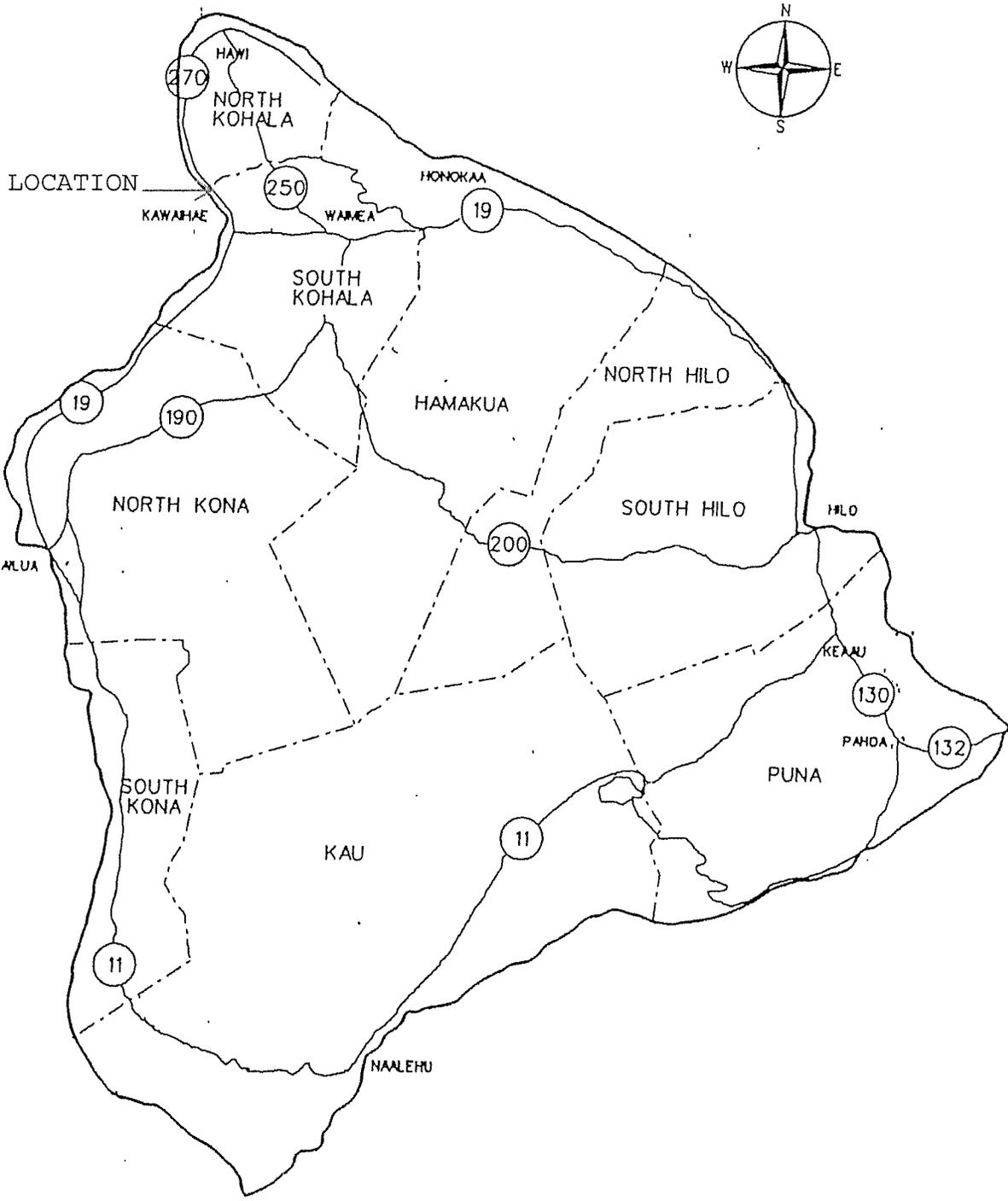
The development of the 9-lot subdivision will have little, if any, impact on the local and/or area traffic in the study area. Nine lots only generate seven trips during the AM peak hour and nine trips during the PM peak hour. Comparing this to the 2% per annum growth in traffic over twenty years, these trips only represent about 5% of the growth in traffic in the AM and 4% in the PM during peak hours.

At the Kohala Ranch Road intersection, the analysis was performed on the basis of providing a left turn pocket on Akoni Pule Highway into the Project. This can be accomplished by re-striping of the existing refuge pocket making it a northbound left turn lane. The 95% queue length for this movement computes to 0.01. Therefore, the need for storage for this movement is negligible. The same holds true for the south driveway. Without a dedicated northbound left turn lane, the level-of-service for this south driveway remains “A” throughout the twenty-year study period.

The development does not generate 50 or more trips per day. The north driveway generates four trips in the AM peak and five trips during the PM peak. The south driveway generates three trips during the AM peak and four trips during the PM peak. This is a maximum of nine trips per day; an insignificant amount of traffic in the area.

Therefore, this analysis concludes that for the study periods of 5, 10 and 20 years, all traffic movements will operate at level-of-service “A” or “B”, which show good operating conditions and minimal delays. As all movements operate at level-of-service “A” or “B”, no additional local or area traffic mitigation is required or recommended.

APPENDIX A
LOCATION MAP, TAX MAP KEY MAP
CONCEPT PLAN, AERIAL VIEW OF INTERSECTIONS



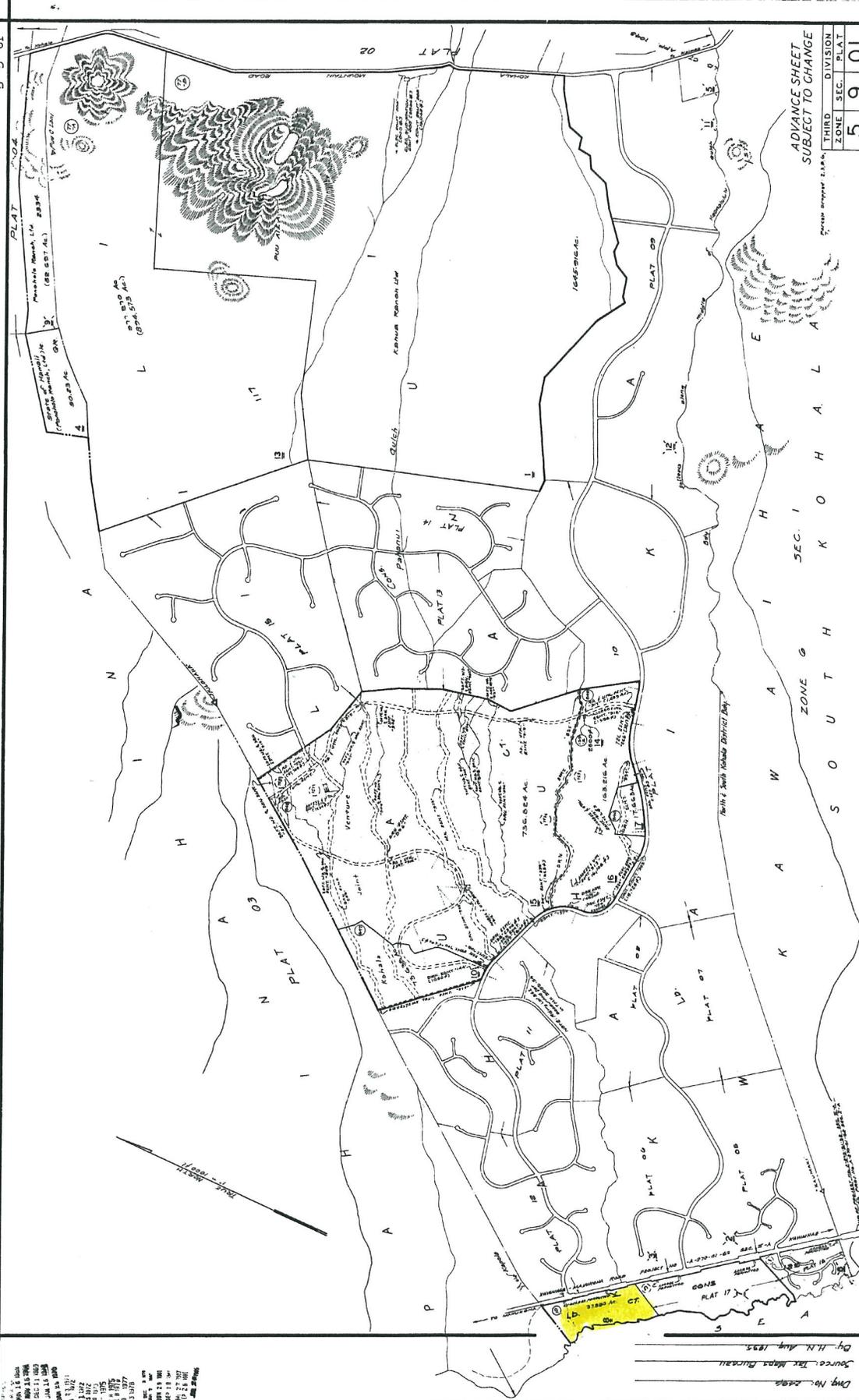
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Camp Verde, AZ 86322
(928) 554-1312

Consulting Civil Engineers
Construction Managers

LOCATION MAP

5 9 01



ADVANCE SHEET
SUBJECT TO CHANGE

THIRD DIVISION	PLAT
ZONE	SEC.
5	9
01	01

CONTAINING PARCELS
SCALE 1 in = 1000 FT.

PRINTED

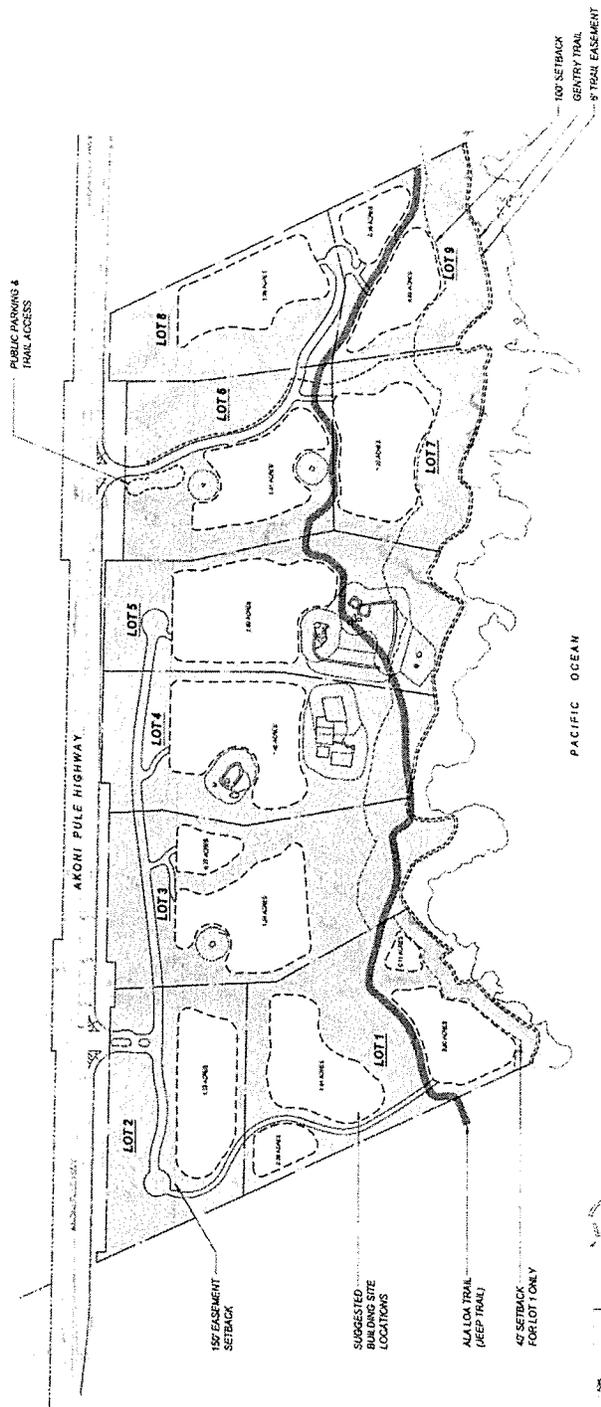
FOR OF KAUAI LILI E - MAIKA, NORTH KOHALA, HAWAII.

By: H.N. Aug. 1935

Source: Tax Maps Bureau

Comp. No. 2288

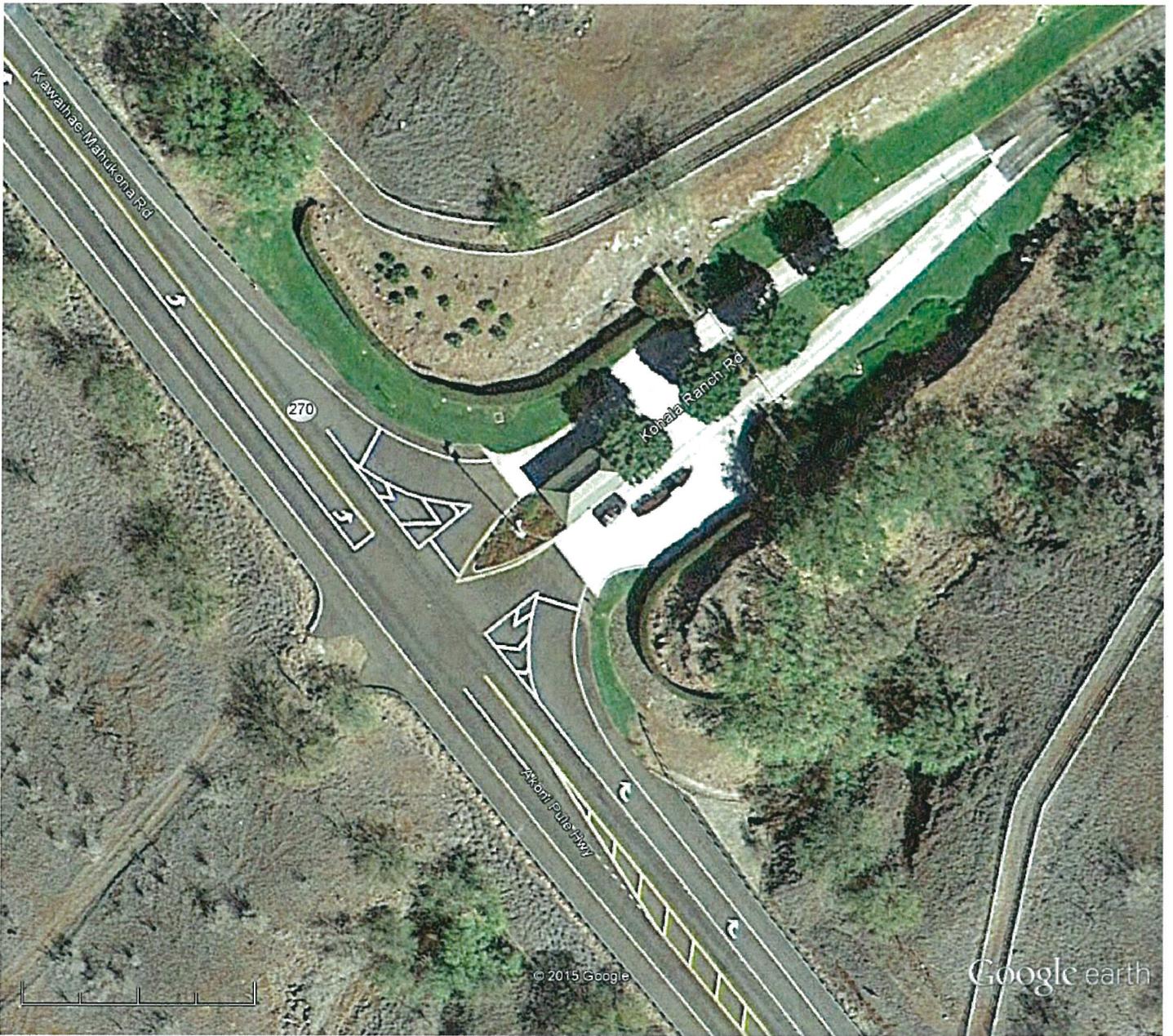
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Lot 2	1.5
Lot 3	1.8
Lot 4	2.1
Lot 5	2.4
Lot 6	2.7
Lot 7	3.0
Lot 8	3.3
Lot 9	3.6
Lot 10	3.9
Lot 11	4.2
Lot 12	4.5
Lot 13	4.8
Lot 14	5.1
Lot 15	5.4
Lot 16	5.7
Lot 17	6.0
Lot 18	6.3
Lot 19	6.6
Lot 20	6.9
Lot 21	7.2
Lot 22	7.5
Lot 23	7.8
Lot 24	8.1
Lot 25	8.4
Lot 26	8.7
Lot 27	9.0
Lot 28	9.3
Lot 29	9.6
Lot 30	9.9
Lot 31	10.2
Lot 32	10.5
Lot 33	10.8
Lot 34	11.1
Lot 35	11.4
Lot 36	11.7
Lot 37	12.0
Lot 38	12.3
Lot 39	12.6
Lot 40	12.9
Lot 41	13.2
Lot 42	13.5
Lot 43	13.8
Lot 44	14.1
Lot 45	14.4
Lot 46	14.7
Lot 47	15.0
Lot 48	15.3
Lot 49	15.6
Lot 50	15.9
Lot 51	16.2
Lot 52	16.5
Lot 53	16.8
Lot 54	17.1
Lot 55	17.4
Lot 56	17.7
Lot 57	18.0
Lot 58	18.3
Lot 59	18.6
Lot 60	18.9
Lot 61	19.2
Lot 62	19.5
Lot 63	19.8
Lot 64	20.1
Lot 65	20.4
Lot 66	20.7
Lot 67	21.0
Lot 68	21.3
Lot 69	21.6
Lot 70	21.9
Lot 71	22.2
Lot 72	22.5
Lot 73	22.8
Lot 74	23.1
Lot 75	23.4
Lot 76	23.7
Lot 77	24.0
Lot 78	24.3
Lot 79	24.6
Lot 80	24.9
Lot 81	25.2
Lot 82	25.5
Lot 83	25.8
Lot 84	26.1
Lot 85	26.4
Lot 86	26.7
Lot 87	27.0
Lot 88	27.3
Lot 89	27.6
Lot 90	27.9
Lot 91	28.2
Lot 92	28.5
Lot 93	28.8
Lot 94	29.1
Lot 95	29.4
Lot 96	29.7
Lot 97	30.0
Lot 98	30.3
Lot 99	30.6
Lot 100	30.9



KOHALA SHORELINE FEASIBILITY STUDY
North Kohala Coast

12/22/2014

de Roux Architects
VANUATU SUN VALLEY



**AKONI PULE HIGHWAY / KOHALA RANCH ROAD
KOHALA RANCH SUBDIVISION ENTRANCE INTERSECTION**



**AKONI PULE HIGHWAY / SOUTH DRIVEWAY
INTERSECTION**

APPENDIX B
LEVEL OF SERVICE
AKONI PULE HIGHWAY/KOHALA RANCH ROAD
UN-SIGNALIZED INTERSECTION
AM & PM PEAK HOURS

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2015
Analysis Time Period	AM EXISTING		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPKRAMEX
 East/West Street: KOHALA RANCH RD
 North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	60	60	29	0	146	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	60	29	0	146	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	1	1	1	0
Configuration		T	R	L	T	
Upstream Signal		0			0	
Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	1.00	1.00	1.00	29	1.00	2
Peak-Hour Factor, PHF	0	0	0	1.00	0	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	0	29	0	2
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	1	0	1
Configuration				L		R

Delay, Queue Length, and Level of Service

Approach	Northbound		Southbound		Westbound		Eastbound	
	1	4	7	8	9	10	11	12
Movement								

Lane Configuration	L	L	L	R	R
v (veh/h)	0	29		2	
C (m) (veh/h)	1519	787		1011	
v/c	0.00	0.04		0.00	
95% queue length	0.00	0.11		0.01	
Control Delay (s/veh)	7.4	9.7		8.6	
LOS	A	A		A	
Approach Delay (s/veh)	--	--	9.7		
Approach LOS	--	--	A		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2015
Analysis Time Period	PM EXISTING		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPKRPMEK
 East/West Street: KOHALA RANCH RD
 Intersection Orientation: North-South
 North/South Street: AKONI-PULE HWY
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments		Northbound		Southbound	
Major Street					
Movement		1	2	3	4
		L	T	R	L
Volume (veh/h)			187	26	1
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)		0	187	26	1
Percent Heavy Vehicles		0	--	--	0
Median Type		Undivided			
RT Channelized				0	
Lanes		0	1	1	1
Configuration			T	R	L
Upstream Signal			0		
Minor Street		Eastbound		Westbound	
Movement		7	8	9	10
		L	T	R	L
Volume (veh/h)					26
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)		0	0	0	26
Percent Heavy Vehicles		0	0	0	0
Percent Grade (%)			0		
Flared Approach			N		N
Storage			0		0
RT Channelized				0	
Lanes		0	0	0	1
Configuration					L

Delay, Queue Length, and Level of Service		Southbound		Westbound		Eastbound	
Approach							
Movement		1	4	7	8	9	10
		Northbound	Southbound	Westbound	Eastbound	Westbound	Eastbound

Lane Configuration	L	L	L	LT	R	LTR
v (veh/h)	1	0	29			3
C (m) (veh/h)	1448	1519	749		1011	906
v/c	0.00	0.00	0.04		0.00	0.00
95% queue length	0.00	0.00	0.12		0.01	0.01
Control Delay (s/veh)	7.5	7.4	10.0		8.6	9.0
LOS	A	A	A		A	A
Approach Delay (s/veh)	--	--	9.9			9.0
Approach LOS	--	--	A			A

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TWO-WAY STOP CONTROL SUMMARY									
General Information					Site Information				
Analyst	BEW	Intersection	2WAY		Agency/Co.	KOHALA SHORELINE		HDOT/PRIVATE	
Date Performed	2/17/2015	Jurisdiction			Analysis Year	2017			
Analysis Time Period	PM BUILD OUT								
Project Description KOHALA SHORELINE LLC 633-01-15 KSAPKRPMB0									
East/West Street: KOHALA RANCH RD									
North/South Street: AKONI-PULE HWY									
Intersection Orientation: North-South									
Study Period (hrs): 0.25									
Vehicle Volumes and Adjustments									
Major Street	Northbound			Southbound					
Movement	1	2	3	4	5	6			
	L	T	R	L	T	R			
Volume (veh/h)	3	187	26	1	175	0			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00			
Hourly Flow Rate, HFR (veh/h)	3	187	26	1	175	0			
Percent Heavy Vehicles	0	--	--	0	--	--			
Median Type	Undivided								
RT Channelized	0								
Lanes	1	1	1	1	1	0			
Configuration	L	T	R	L	L	TR			
Upstream Signal	0								
Minor Street	Eastbound			Westbound					
Movement	7	8	9	10	11	12			
	L	T	R	L	T	R			
Volume (veh/h)	0	0	2	26	0	1			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00			
Hourly Flow Rate, HFR (veh/h)	0	0	2	26	0	1			
Percent Heavy Vehicles	0	0	0	0	0	0			
Percent Grade (%)	0								
Flared Approach	N								
Storage	0								
RT Channelized	0								
Lanes	0	1	0	0	1	1			
Configuration	LTR			LTR					
Delay, Queue Length, and Level of Service									
Approach	Northbound	Southbound	Westbound	Eastbound					
Movement	1	4	7	8	9	10	11	12	

Lane Configuration	L	L	L	LT	R	LTR
v (veh/h)	3	1	26		1	2
C (m) (veh/h)	1414	1369	586		860	874
v/c	0.00	0.00	0.04		0.00	0.00
95% queue length	0.01	0.00	0.14		0.00	0.01
Control Delay (s/veh)	7.6	7.6	11.4		9.2	9.1
LOS	A	A	B		A	A
Approach Delay (s/veh)	--	--	11.3			9.1
Approach LOS	--	--	B			A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	2WAY
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2020
Analysis Time Period	AM 5YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPKRAM5Y
 East/West Street: KOHALA RANCH RD
 Intersection Orientation: North-South
 North/South Street: AKONI-PULE HWY
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	1	66	32	1	161	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	1	66	32	1	161	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	1	1	1	0
Configuration	L	T	R	L		TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	3	32	0	2
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	3	32	0	2
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	1
Configuration		LTR		LT		R

Delay, Queue Length, and Level of Service	Northbound		Southbound		Westbound		Eastbound	
	1	4	7	8	9	10	11	12
Approach								
Movement	1	4	7	8	9	10	11	12

Lane Configuration	L	L	L	LT	R	LTR
v (veh/h)	1	1	32		2	3
C (m) (veh/h)	1430	1508	724	1003		889
v/c	0.00	0.00	0.04	0.00	0.00	0.00
95% queue length	0.00	0.00	0.14	0.01	0.01	0.01
Control Delay (s/veh)	7.5	7.4	10.2	8.6		9.1
LOS	A	A	B	A		A
Approach Delay (s/veh)	--	--	10.1			9.1
Approach LOS	--	--	B			A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	2WAY
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2020
Analysis Time Period	PM 5YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPKRP5Y
 East/West Street: KOHALA RANCH RD
 North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	3	206	29	1	193	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	3	206	29	1	193	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	1	1	1	1	1	0
Configuration	L	T	R	L		TR
Upstream Signal						0

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	2	29	0	1
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	2	29	0	1
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	1
Configuration		LTR		LT		R

Delay, Queue Length, and Level of Service	Southbound			Eastbound		
	4	7	8	9	10	11
Approach						
Movement	1					12

Lane Configuration	L	L	L	LT	R	LTR
v (veh/h)	3	1	29		1	2
C (m) (veh/h)	1392	1344	554		840	854
v/c	0.00	0.00	0.05		0.00	0.00
95% queue length	0.01	0.00	0.17		0.00	0.01
Control Delay (s/veh)	7.6	7.7	11.9		9.3	9.2
LOS	A	A	B		A	A
Approach Delay (s/veh)	--	--	11.8			9.2
Approach LOS	--	--	B			A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	2WAY
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2025
Analysis Time Period	AM 10YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPKRAM10Y
 East/West Street: KOHALA RANCH RD
 North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound		Southbound	
	Volume	RT	Volume	RT
Movement	1	2	3	4
	L	T	R	L
Volume (veh/h)	1	73	36	178
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	1	73	36	178
Percent Heavy Vehicles	0	-	-	-
Median Type	Undivided			
RT Channelized			0	0
Lanes	1	1	1	1
Configuration	L	T	R	L
Upstream Signal		0		0

Minor Street	Eastbound		Westbound	
	Volume	RT	Volume	RT
Movement	7	8	9	10
	L	T	R	L
Volume (veh/h)	0	0	3	36
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	3	36
Percent Heavy Vehicles	0	0	0	0
Percent Grade (%)		0		0
Flared Approach		N		N
Storage		0		0
RT Channelized			0	
Lanes	0	1	0	1
Configuration		LTR		LT

Delay, Queue Length, and Level of Service											
Approach	Northbound		Southbound		Westbound		Eastbound				Level of Service
	1	4	7	8	9	10	11	12			
Movement											

Lane Configuration	L	L	L	LT	R	LTR
v (veh/h)	1	1	36			3
C (m) (veh/h)	1410	1494	697		995	870
v/c	0.00	0.00	0.05		0.00	0.00
95% queue length	0.00	0.00	0.16		0.01	0.01
Control Delay (s/veh)	7.6	7.4	10.4		8.6	9.2
LOS	A	A	B		A	A
Approach Delay (s/veh)	--	--	10.4			9.2
Approach LOS	--	--	B			A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	2WAY
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2020
Analysis Time Period	PM 10YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPKPRM10Y
 East/West Street: KOHALA RANCH RD
 North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	Movement	Volume	PHF	Movement	Volume	PHF
	1	2	1.00	3	4	1.00
	L	T	1.00	R	L	1.00
	3	228	1.00	32	1	1.00
Volume (veh/h)						
Peak-Hour Factor, PHF						
Hourly Flow Rate, HFR (veh/h)						
Percent Heavy Vehicles						
Median Type	Undivided					
RT Channelized						
Lanes	1	1	1	1	1	1
Configuration	L	T	R	L	L	TR
Upstream Signal						

Minor Street	Eastbound			Westbound		
	Movement	Volume	PHF	Movement	Volume	PHF
	7	8	1.00	9	10	1.00
	L	T	1.00	R	L	1.00
	0	0	1.00	2	32	1.00
Volume (veh/h)						
Peak-Hour Factor, PHF						
Hourly Flow Rate, HFR (veh/h)						
Percent Heavy Vehicles						
Percent Grade (%)						
Flared Approach						
Storage						
RT Channelized						
Lanes	0	1	1	0	0	1
Configuration		LTR	L		LT	R

Delay, Queue Length, and Level of Service												
Approach Movement	Northbound		Southbound		Westbound		Eastbound					
	1	4	7	8	9	10	11	12				

Lane Configuration	L	L	LT	R	LTR
v (veh/h)	3	1	32	1	2
C (m) (veh/h)	1369	1316	521	816	832
w/c	0.00	0.00	0.06	0.00	0.00
95% queue length	0.01	0.00	0.20	0.00	0.01
Control Delay (s/veh)	7.6	7.7	12.4	9.4	9.3
LOS	A	A	B	A	A
Approach Delay (s/veh)	--	--	12.3		9.3
Approach LOS	--	--	B		A

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Lane Configuration	L	L	L	LT	R	LTR
v (veh/h)	1	2	43		3	3
C (m) (veh/h)	1365	1466	640		975	828
w/c	0.00	0.00	0.07		0.00	0.00
95% queue length	0.00	0.00	0.22		0.01	0.01
Control Delay (s/veh)	7.6	7.5	11.0		8.7	9.4
LOS	A	A	B		A	A
Approach Delay (s/veh)	--	--	10.9			9.4
Approach LOS	--	--	B			A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	2WAY
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2035
Analysis Time Period	PM 20YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPKRP20Y
 East/West Street: KOHALA RANCH RD
 North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound		Southbound	
Movement	1	2	3	4
	L	T	R	L
Volume (veh/h)	3	278	39	1
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	3	278	39	1
Percent Heavy Vehicles	0	--	--	0
Median Type	Undivided			
RT Channelized			0	
Lanes	1	1	1	1
Configuration	L	T	R	L
Upstream Signal		0		0

Minor Street	Eastbound		Westbound	
Movement	7	8	9	10
	L	T	R	L
Volume (veh/h)	0	0	2	39
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	2	39
Percent Heavy Vehicles	0	0	0	0
Percent Grade (%)		0		0
Flared Approach		N		N
Storage		0		0
RT Channelized			0	
Lanes	0	1	0	0
Configuration		LTR		LT

Delay, Queue Length, and Level of Service		Southbound		Westbound		Eastbound	
Approach	Northbound	1	4	7	8	9	11
Movement							12

Lane Configuration	L	L	L	LT	R	LTR
v (veh/h)	3	1		39	1	2
C (m) (veh/h)	1316	1255		449	766	784
v/c	0.00	0.00		0.09	0.00	0.00
95% queue length	0.01	0.00		0.28	0.00	0.01
Control Delay (s/veh)	7.7	7.9		13.8	9.7	9.6
LOS	A	A		B	A	A
Approach Delay (s/veh)	--	--		13.7		9.6
Approach LOS	--	--		B		A

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APPENDIX C
LEVEL OF SERVICE
AKONI PULE HIGHWAY/SOUTH DRIVEWAY
UN-SIGNALIZED INTERSECTION
AM & PM PEAK HOURS

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2017
Analysis Time Period	AM BUILD OUT		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPSAAMBO
 East/West Street: SUOTHERLY ACCESS
 Intersection Orientation: North-South
 North/South Street: AKONI-PULE HWY
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	1	90	1.00	178	0	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	1	90	0	0	178	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	2	1.00	1.00	1.00
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	2	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR				

Delay, Queue Length, and Level of Service	Southbound			Eastbound		
	4	7	8	9	10	11
Approach						
Movement	1					12

Lane Configuration	LT							LTR
v (veh/h)	1							2
C (m) (veh/h)	1410							870
v/c	0.00							0.00
95% queue length	0.00							0.01
Control Delay (s/veh)	7.6							9.1
LOS	A							A
Approach Delay (s/veh)	--				--			9.1
Approach LOS	--				--			A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2017
Analysis Time Period	PM BUILD OUT		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPSAPMBO
 East/West Street: SOUTHERLY ACCESS
 Intersection Orientation: North-South
 North/South Street: AKONI-PULE HWY
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	3	216			203	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	3	216	0	0	203	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	1			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	1	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR				

Delay, Queue Length, and Level of Service	Southbound			Eastbound				
	1	4	7	8	9	10	11	12
Approach								
Movement								

Lane Configuration	LT							LTR
v (veh/h)	3							1
C (m) (veh/h)	1381							843
w/c	0.00							0.00
95% queue length	0.01							0.00
Control Delay (s/veh)	7.6							9.3
LOS	A							A
Approach Delay (s/veh)	--							9.3
Approach LOS	--							A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2020
Analysis Time Period	AM 5YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPSAAM5Y
 East/West Street: SOUTHERLY ACCESS
 Intersection Orientation: North-South
 North/South Street: AKONI-PULE HWY
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	1	99	1.00	196	0	1.00
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	1	99	0	0	196	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	2	1.00	1.00	1.00
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	2	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR				

Delay, Queue Length, and Level of Service	Southbound			Eastbound				
	1	4	7	8	9	10	11	12
Approach								
Movement								

Lane Configuration	LT						LTR
v (veh/h)	1						2
C (m) (veh/h)	1389						850
w/c	0.00						0.00
95% queue length	0.00						0.01
Control Delay (s/veh)	7.6						9.2
LOS	A						A
Approach Delay (s/veh)	--	--					9.2
Approach LOS	--	--					A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2020
Analysis Time Period	PM5YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPSAPM5Y
 East/West Street: SOUTHERLY ACCESS
 Intersection Orientation: North-South
 North/South Street: AKONI-PULE HWY
 Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	3	238			224	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	3	238	0	0	224	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	1			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	1	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR				

Delay, Queue Length, and Level of Service	Southbound			Eastbound				
	1	4	7	8	9	10	11	12
Approach								
Movement								

Lane Configuration	LT							LTR
v (veh/h)	3							1
C (m) (veh/h)	1357							820
v/c	0.00							0.00
95% queue length	0.01							0.00
Control Delay (s/veh)	7.7							9.4
LOS	A							A
Approach Delay (s/veh)	--					--		9.4
Approach LOS	--					--		A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2025
Analysis Time Period	AM 10YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPSAAM10Y
 East/West Street: SOUTHERLY ACCESS North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound		Southbound	
	1	2	3	4
Movement	L	T	R	L
Volume (veh/h)	1	110	1.00	217
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	1	110	0	217
Percent Heavy Vehicles	0	--	--	0
Median Type	Undivided			
RT Channelized			0	0
Lanes	0	1	0	0
Configuration	LT			
Upstream Signal		0		0
Minor Street	Eastbound		Westbound	
Movement	L	T	R	L
Volume (veh/h)	7	8	9	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	2	0
Percent Heavy Vehicles	0	0	0	0
Percent Grade (%)	0			
Flared Approach		N		N
Storage		0		0
RT Channelized			0	
Lanes	0	1	0	0
Configuration		LTR		

Delay, Queue Length, and Level of Service												
Approach	Northbound			Southbound			Westbound			Eastbound		
Movement	1	4	7	8	9	10	11	12				

Lane Configuration	LT						LTR
v (veh/h)	1						2
C (m) (veh/h)	1365						828
v/c	0.00						0.00
95% queue length	0.00						0.01
Control Delay (s/veh)	7.6						9.4
LOS	A						A
Approach Delay (s/veh)	--						9.4
Approach LOS	--						A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2025
Analysis Time Period	PM 10YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPSAPM10Y
 East/West Street: SOUTHERLY ACCESS North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	3	263			247	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	3	263	0	0	247	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	1			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	1	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR				

Delay, Queue Length, and Level of Service	Southbound			Eastbound		
	4	7	8	9	10	11
Approach						
Movement	1					12

Lane Configuration	LT							LTR
v (veh/h)	3							.1
C (m) (veh/h)	1331							797
v/c	0.00							0.00
95% queue length	0.01							0.00
Control Delay (s/veh)	7.7							9.5
LOS	A							A
Approach Delay (s/veh)	--							9.5
Approach LOS	--							A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2035
Analysis Time Period	AM 20YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPSAAM20Y
 East/West Street: SOUTHERLY ACCESS North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South Study Period (hrs): 0.25

Vehicle Volumes and Adjustments	Northbound		Southbound	
	1	2	3	4
Major Street				
Movement	L	T	R	L
Volume (veh/h)	1	133	1.00	262
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	1	133	0	262
Percent Heavy Vehicles	0	--	--	--
Median Type	Undivided			
RT Channelized			0	
Lanes	0	1	0	0
Configuration	LT			
Upstream Signal		0		0
Minor Street	Eastbound		Westbound	
Movement	L	T	R	L
Volume (veh/h)	7	8	9	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	2	0
Percent Heavy Vehicles	0	0	0	0
Percent Grade (%)	0			
Flared Approach		N		N
Storage		0		0
RT Channelized			0	
Lanes	0	1	0	0
Configuration		LTR		

Delay, Queue Length, and Level of Service	Northbound		Southbound		Westbound		Eastbound	
	1	4	7	8	9	10	11	12
Approach								
Movement								

Lane Configuration	LT							LTR
v (veh/h)	1							2
C (m) (veh/h)	1314							782
w/c	0.00							0.00
95% queue length	0.00							0.01
Control Delay (s/veh)	7.7							9.6
LOS	A							A
Approach Delay (s/veh)	--	--						9.6
Approach LOS	--	--						A

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BEW	Intersection	T
Agency/Co.	KOHALA SHORELINE	Jurisdiction	HDOT/PRIVATE
Date Performed	2/17/2015	Analysis Year	2035
Analysis Time Period	PM 20YR		

Project Description KOHALA SHORELINE LLC 633-01-15 KSAPSAPM20Y
 East/West Street: SOUTHERLY ACCESS North/South Street: AKONI-PULE HWY
 Intersection Orientation: North-South Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Northbound			Southbound		
	1	2	3	4	5	6
Movement	L	T	R	L	T	R
Volume (veh/h)	3	320			301	0
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	3	320	0	0	301	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Undivided					
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration	LT					TR
Upstream Signal		0			0	

Minor Street	Eastbound			Westbound		
	7	8	9	10	11	12
Movement	L	T	R	L	T	R
Volume (veh/h)	0	0	1			
Peak-Hour Factor, PHF	1.00	1.00	1.00	1.00	1.00	1.00
Hourly Flow Rate, HFR (veh/h)	0	0	1	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	0	0
Configuration		LTR				

Delay, Queue Length, and Level of Service	Northbound			Southbound		
	1	4	7	8	9	10
Approach						
Movement						

Lane Configuration	LT							LTR
v (veh/h)	3							1
C (m) (veh/h)	1272							743
v/c	0.00							0.00
95% queue length	0.01							0.00
Control Delay (s/veh)	7.8							9.9
LOS	A							A
Approach Delay (s/veh)	--							9.9
Approach LOS	--							A

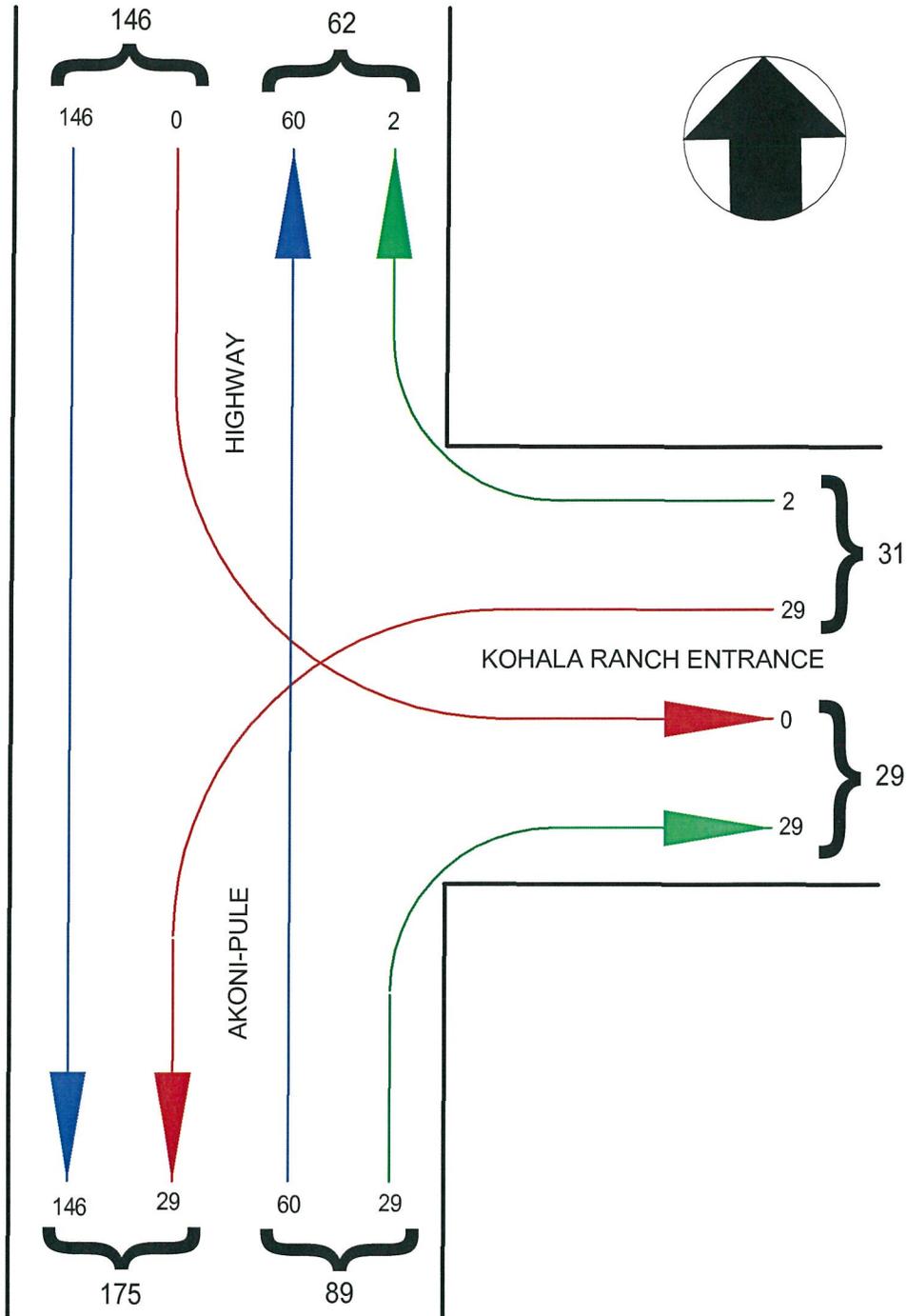
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APPENDIX D
TRAFFIC MOVEMENT DIAGRAMS
AKONI PULE HIGHWAY/KOHALA RANCH ROAD
UN-SIGNALIZED INTERSECTION
AM & PM PEAK HOURS

Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - Existing Conditions AM Peak Hour - 7:30 AM to 8:30 AM

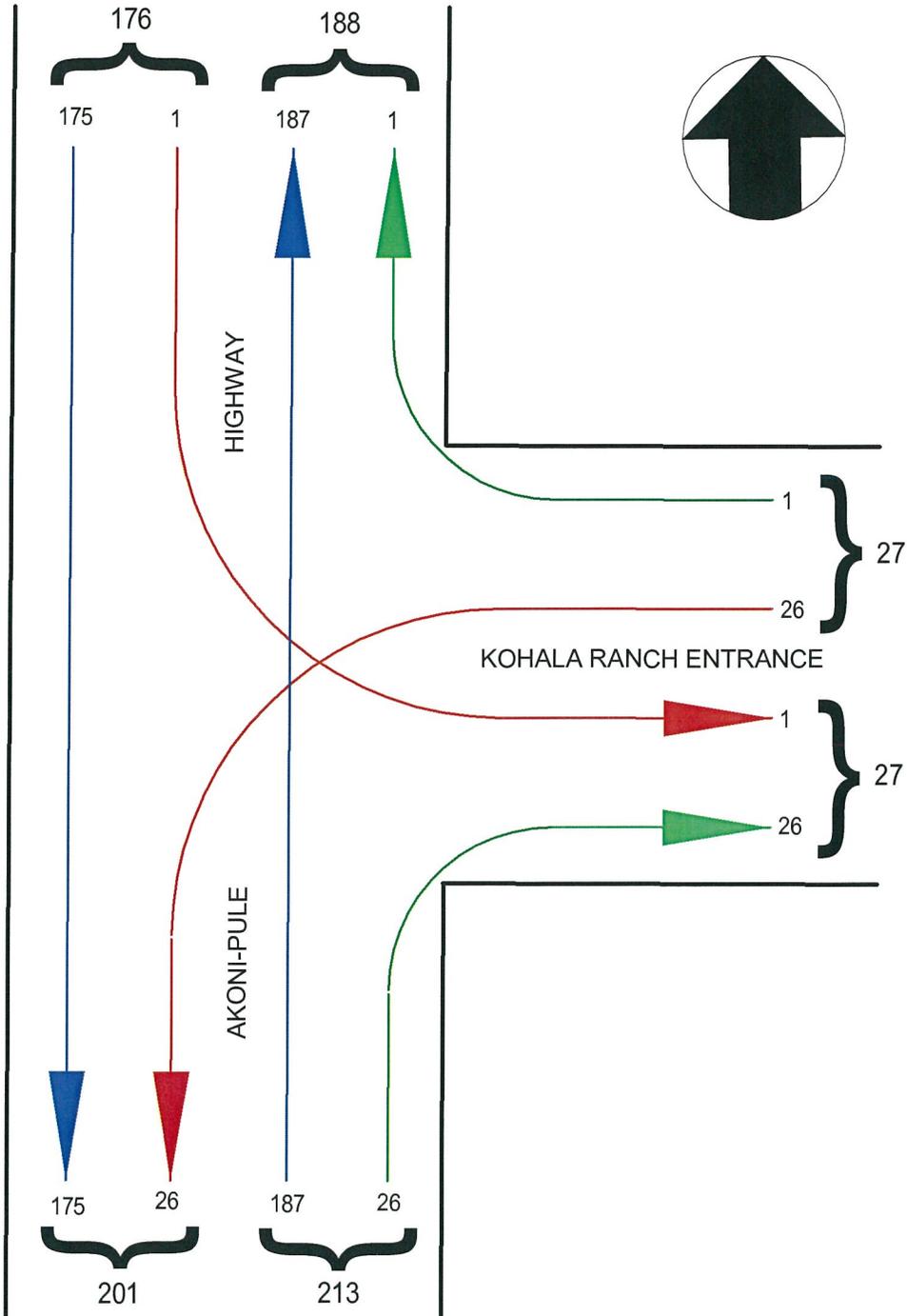


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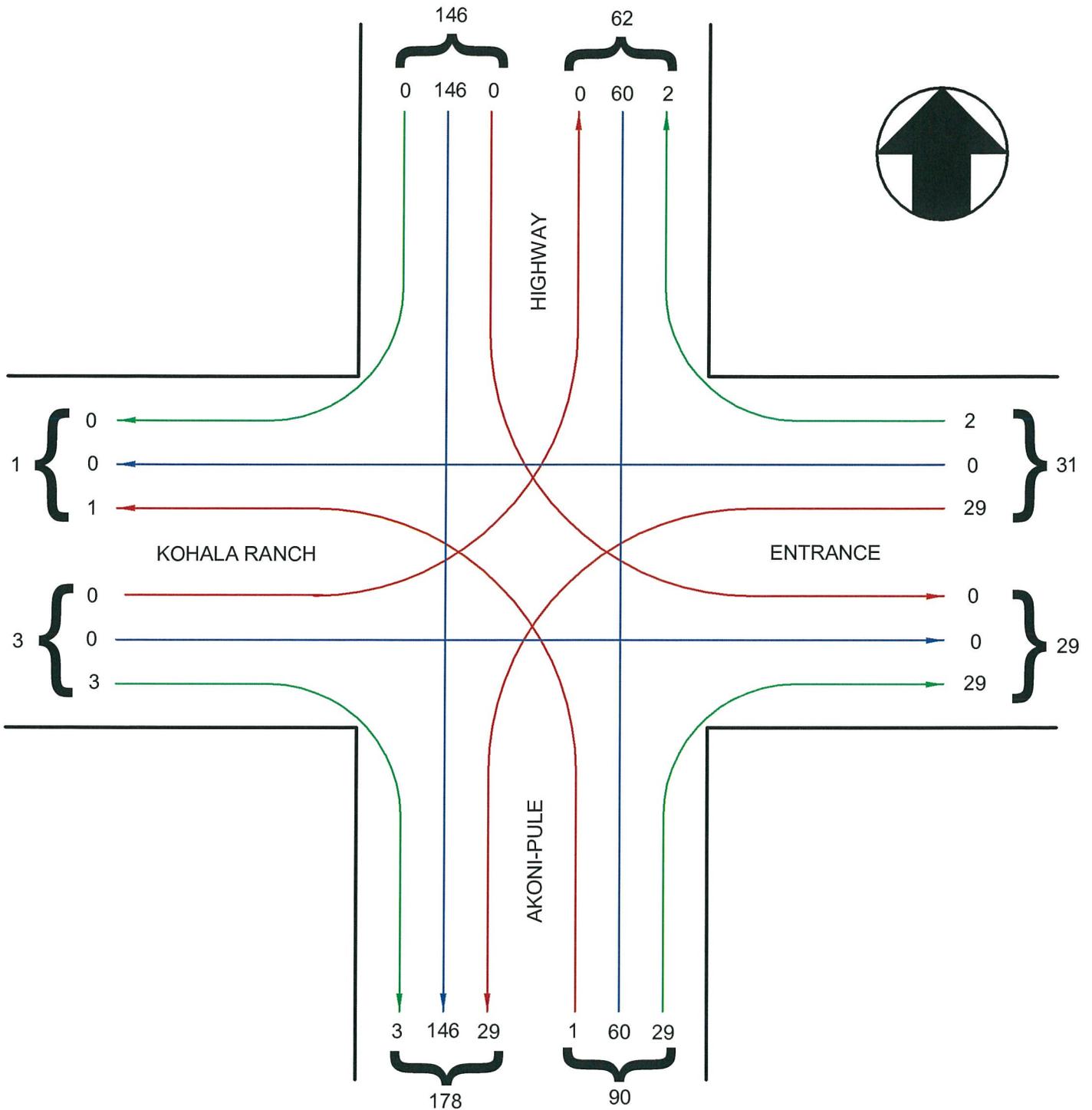
P.O. Box 4692
Camp Verde, AZ 86322
(925) 554-1312

Consulting Civil Engineers
Construction Managers

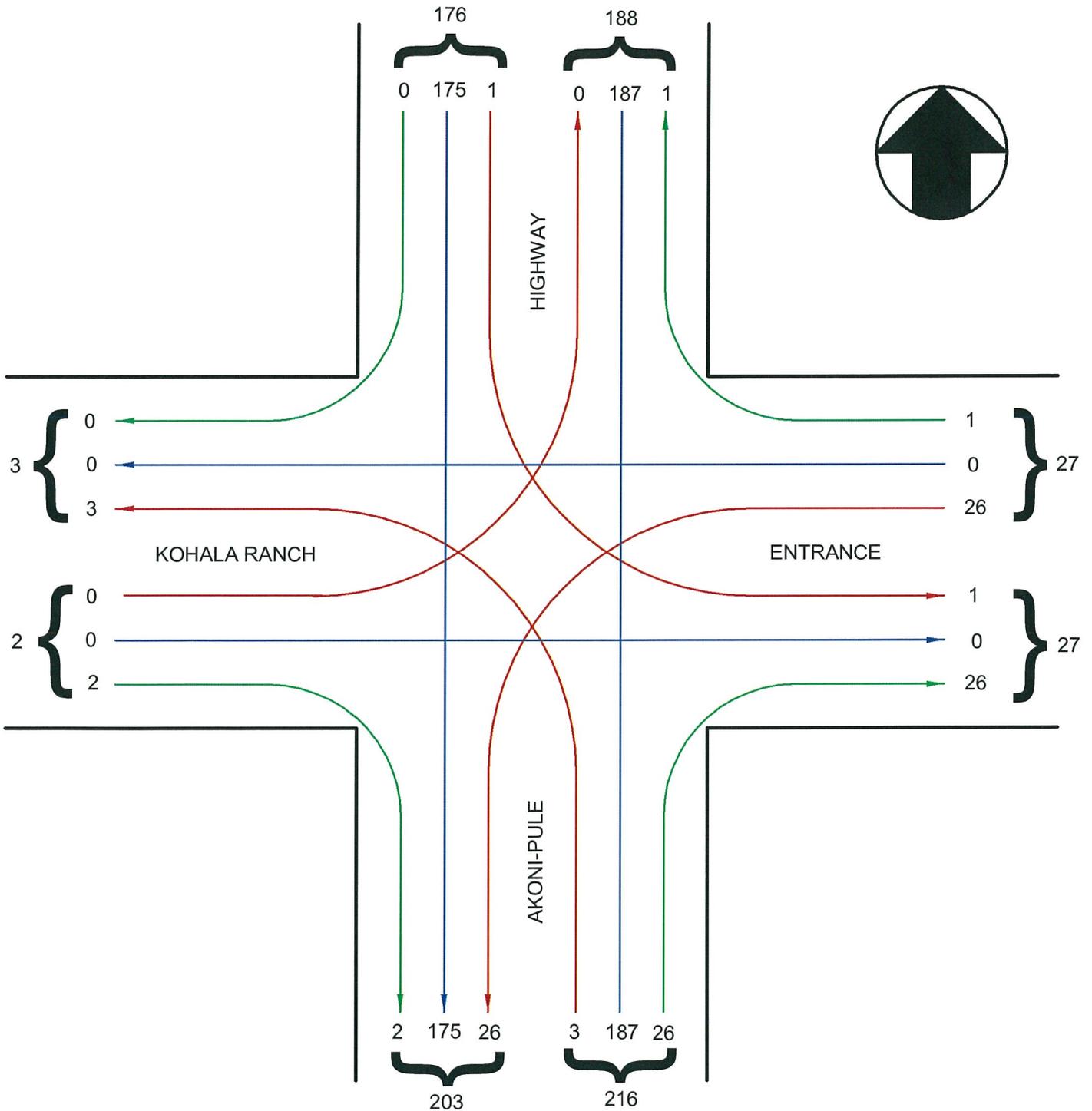
Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - Existing Conditions PM Peak Hour - 3:00 PM to 4:00 PM



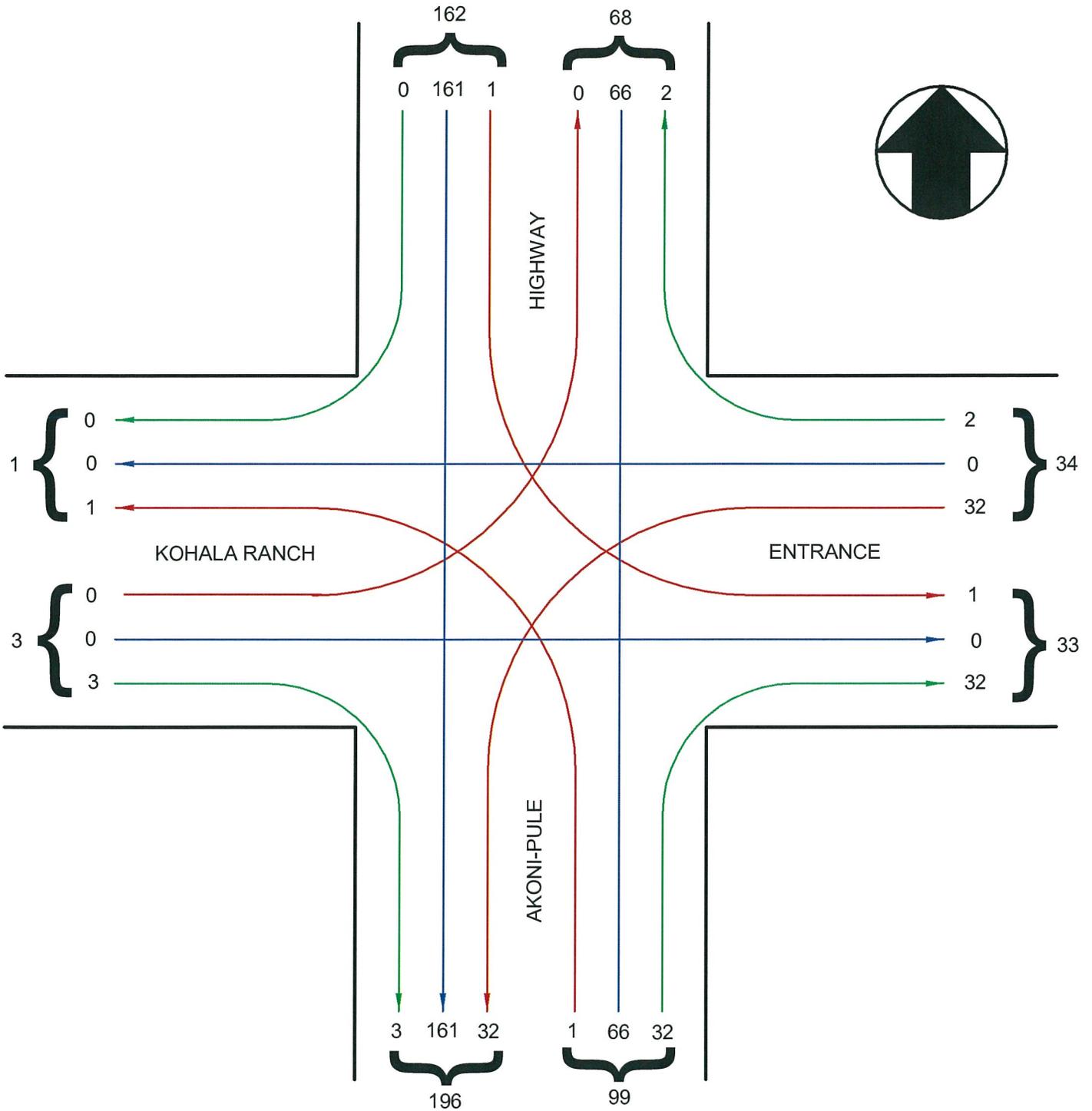
Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - Build-Out Conditions AM Peak Hour 7:30 AM to 8:30 AM



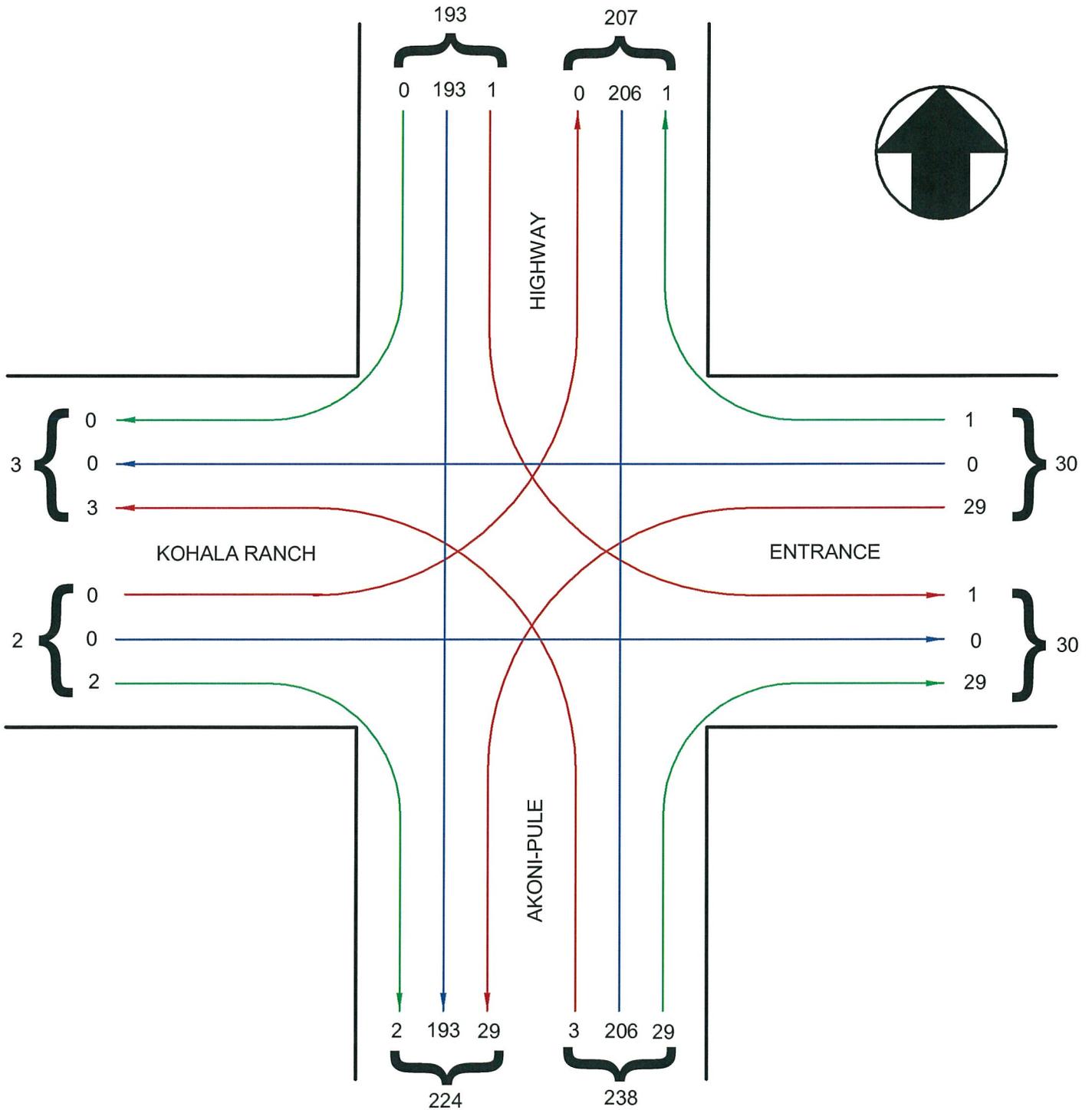
Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - Build-Out Conditions PM Peak Hour 3:00 PM to 4:00 PM



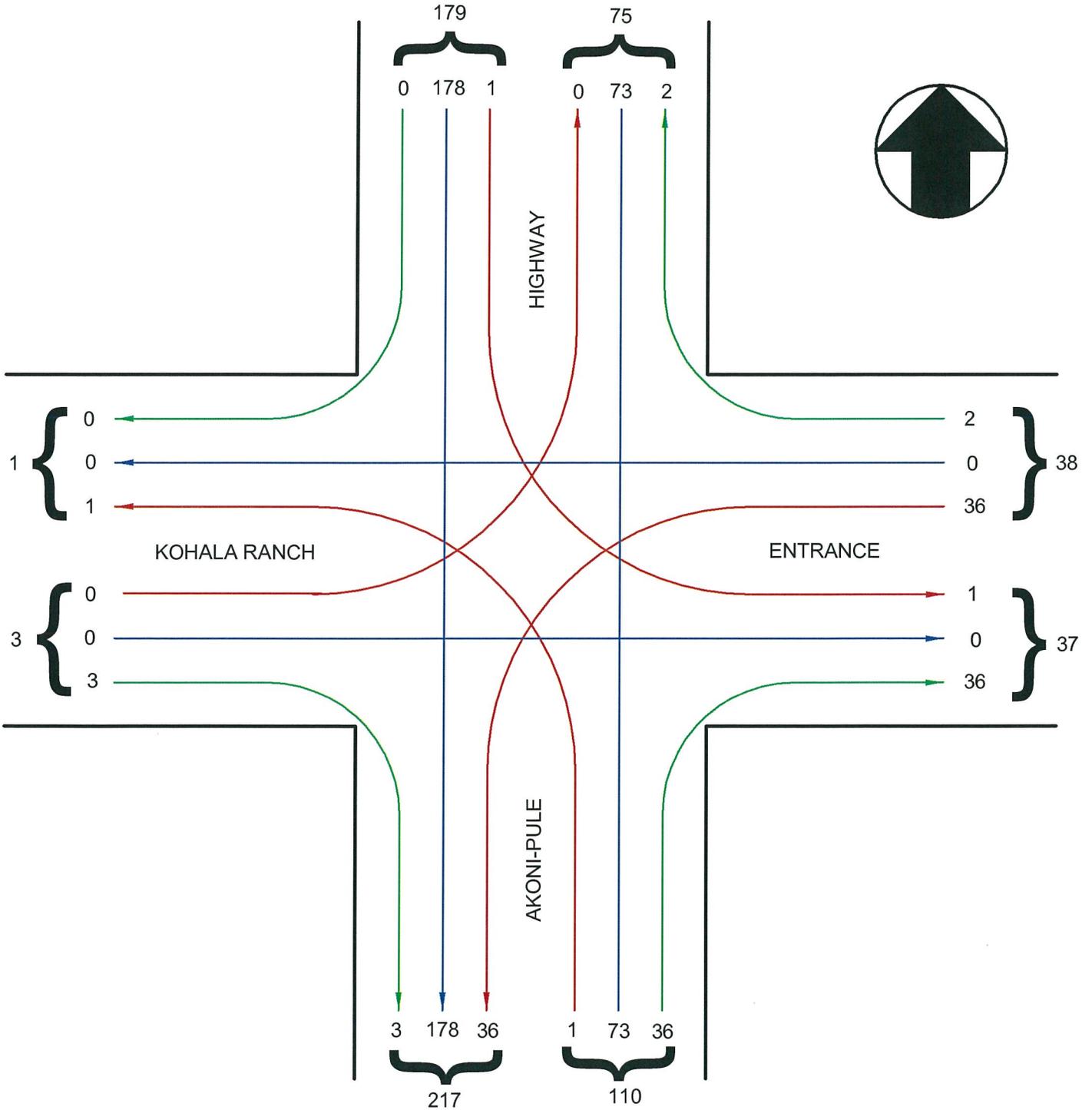
Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - 5-Year Conditions AM Peak Hour 7:30 AM to 8:30 AM



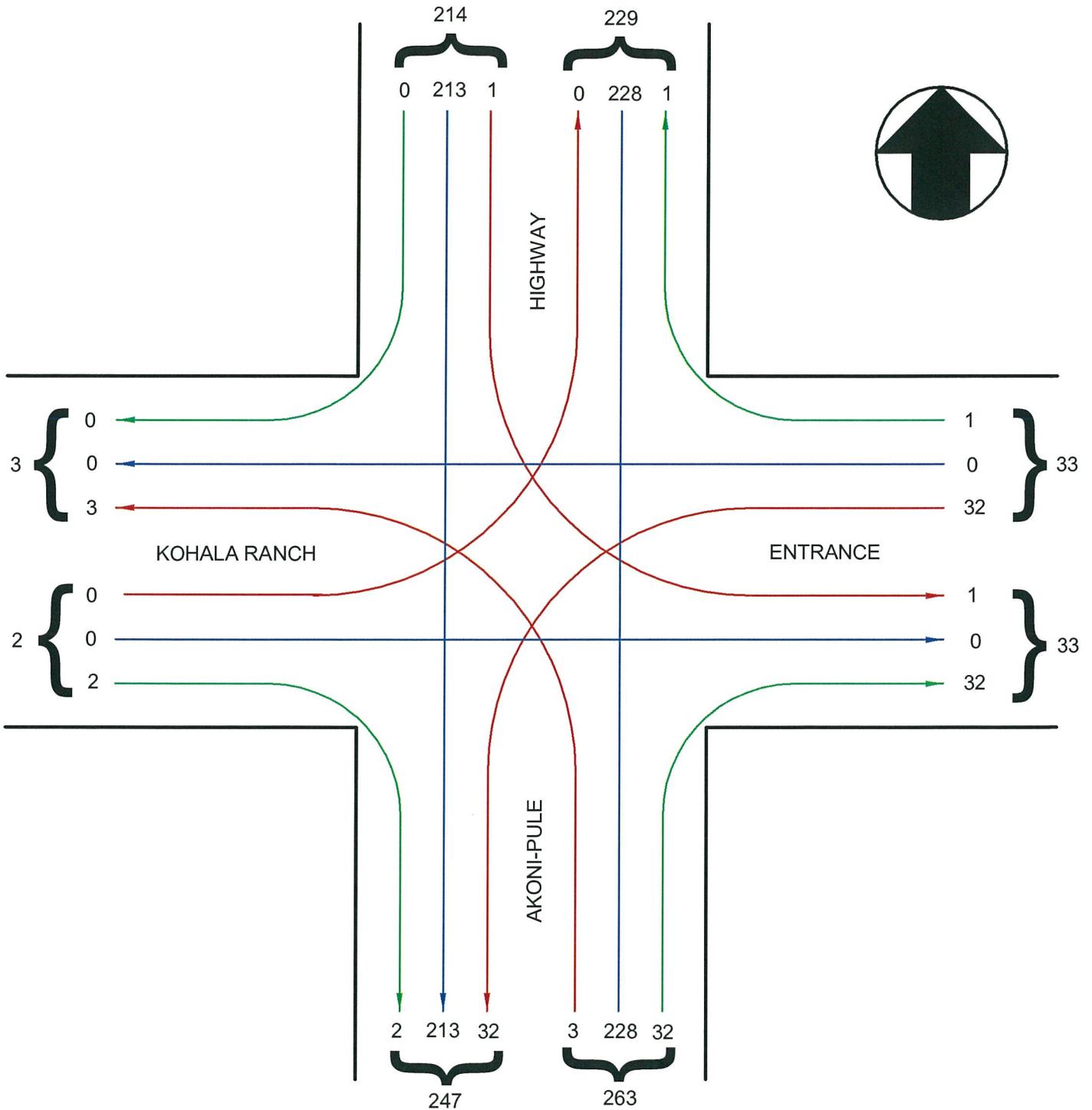
Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - 5-Year Conditions PM Peak Hour 3:00 PM to 4:00 PM



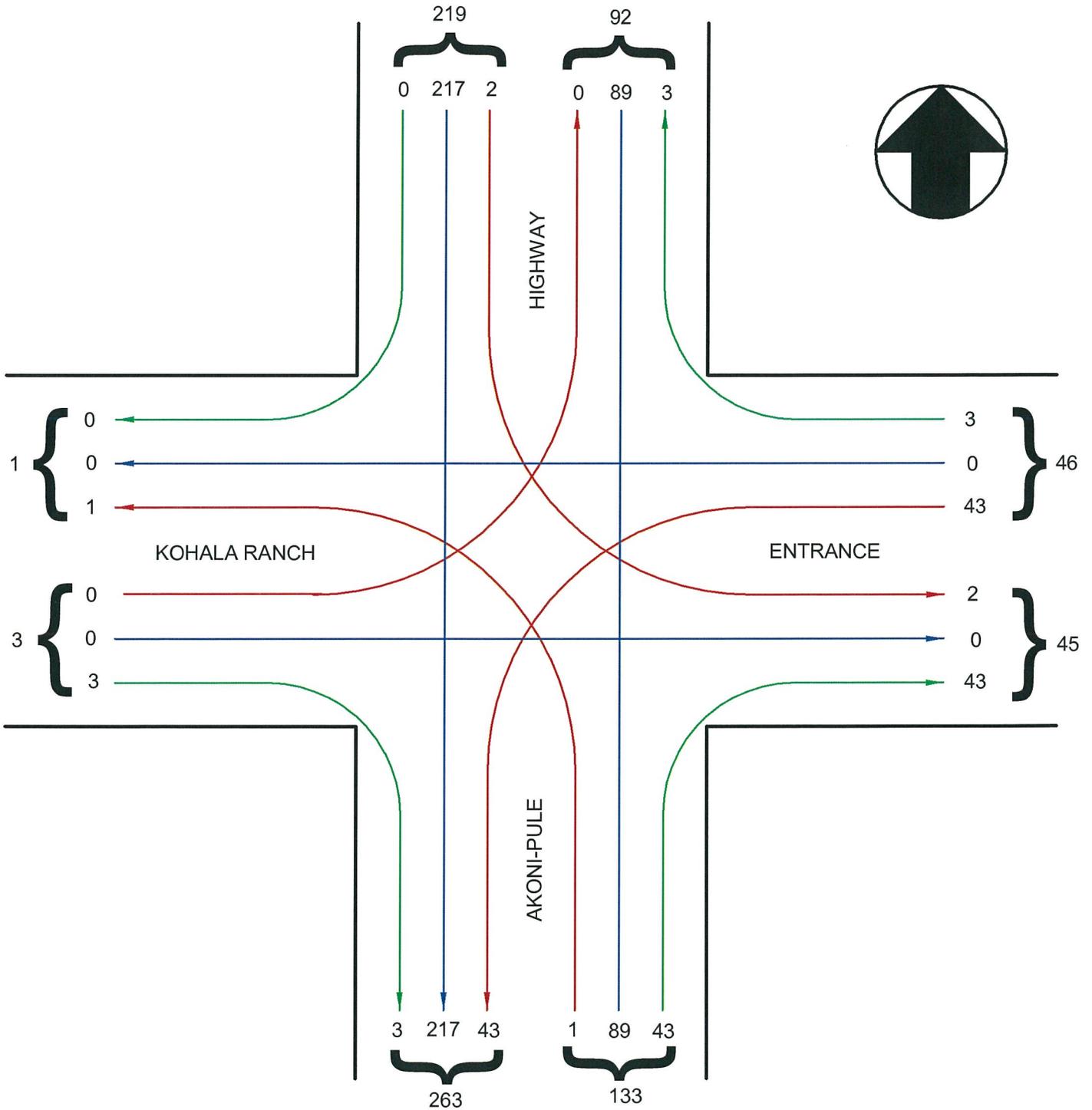
Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - 10-Year Conditions AM Peak Hour 7:30 AM to 8:30 AM



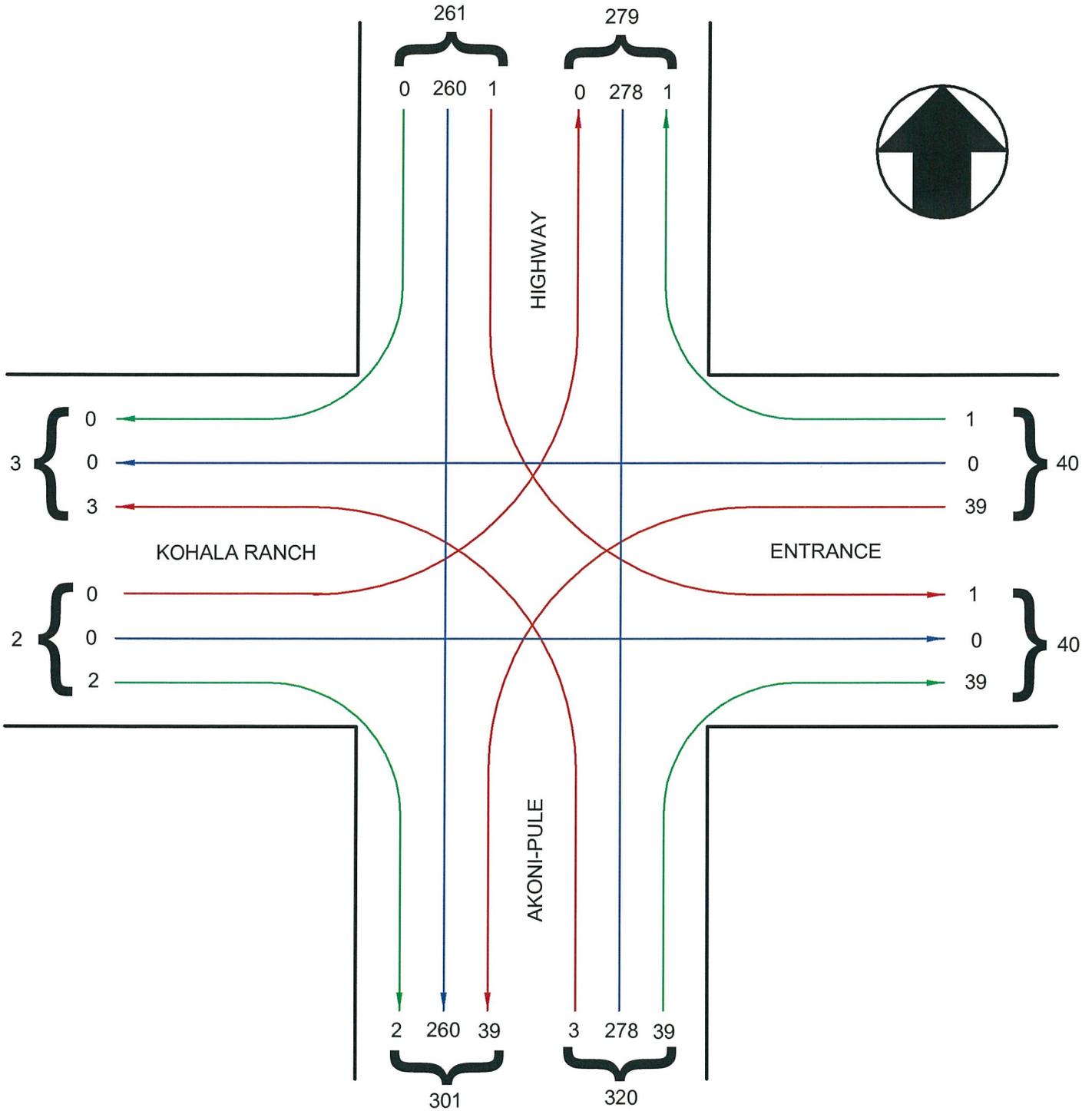
Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - 10-Year Conditions PM Peak Hour 3:00 PM to 4:00 PM



Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - 20-Year Conditions AM Peak Hour 7:30 AM to 8:30 AM

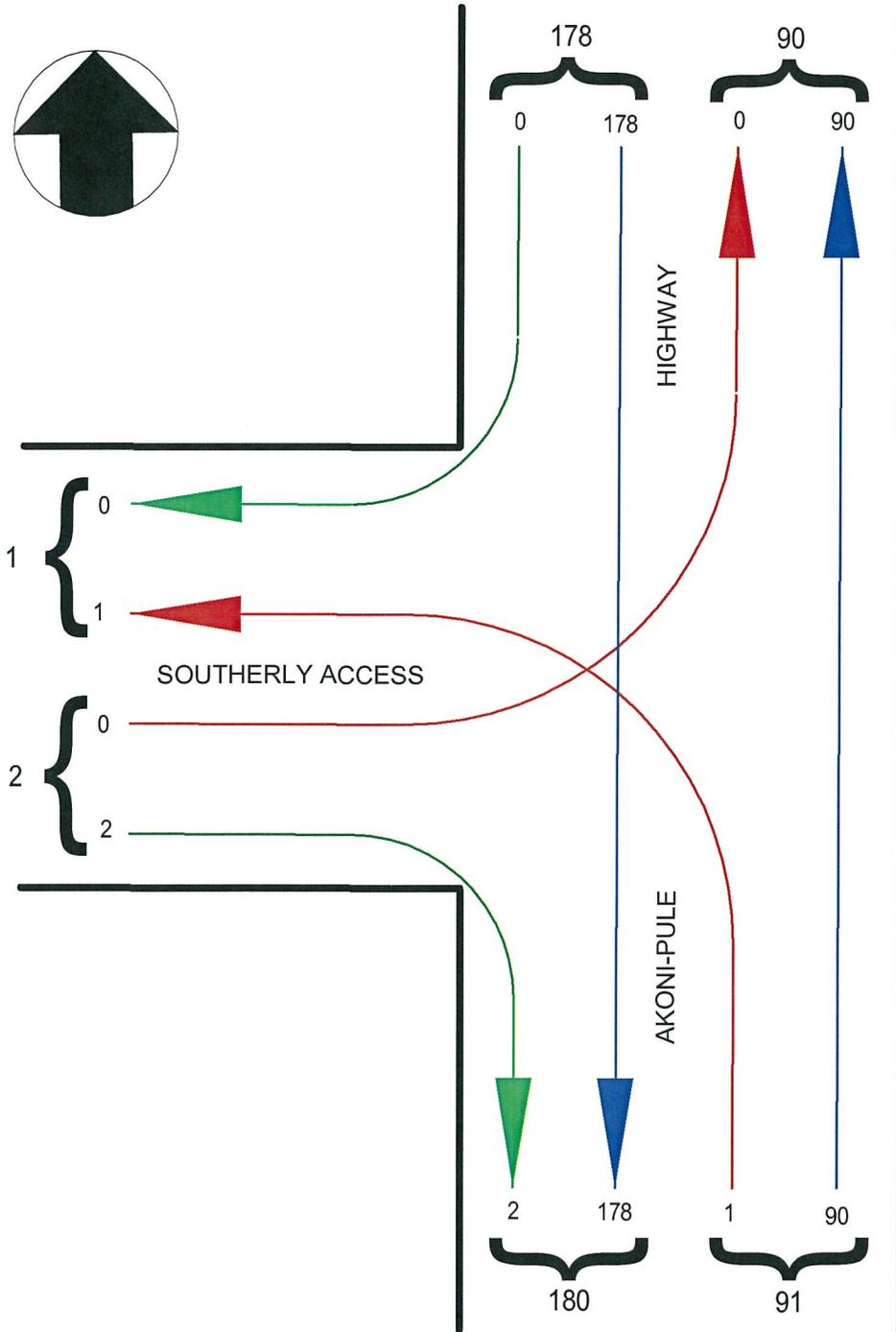


Proposed 9-Lot Subdivision Akoni-Pule Highway & Kohala Ranch Entrance Traffic Movement - 20-Year Conditions PM Peak Hour 3:00 PM to 4:00 PM



APPENDIX E
TRAFFIC MOVEMENT DIAGRAMS
AKONI PULE HIGHWAY/SOUTH DRIVEWAY
UN-SIGNALIZED INTERSECTION
AM & PM PEAK HOURS

Proposed 9-Lot Subdivision Akoni-Pule Highway & Southerly Access Traffic Movement - Build-Out Conditions AM Peak Hour - 7:30 AM to 8:30 AM

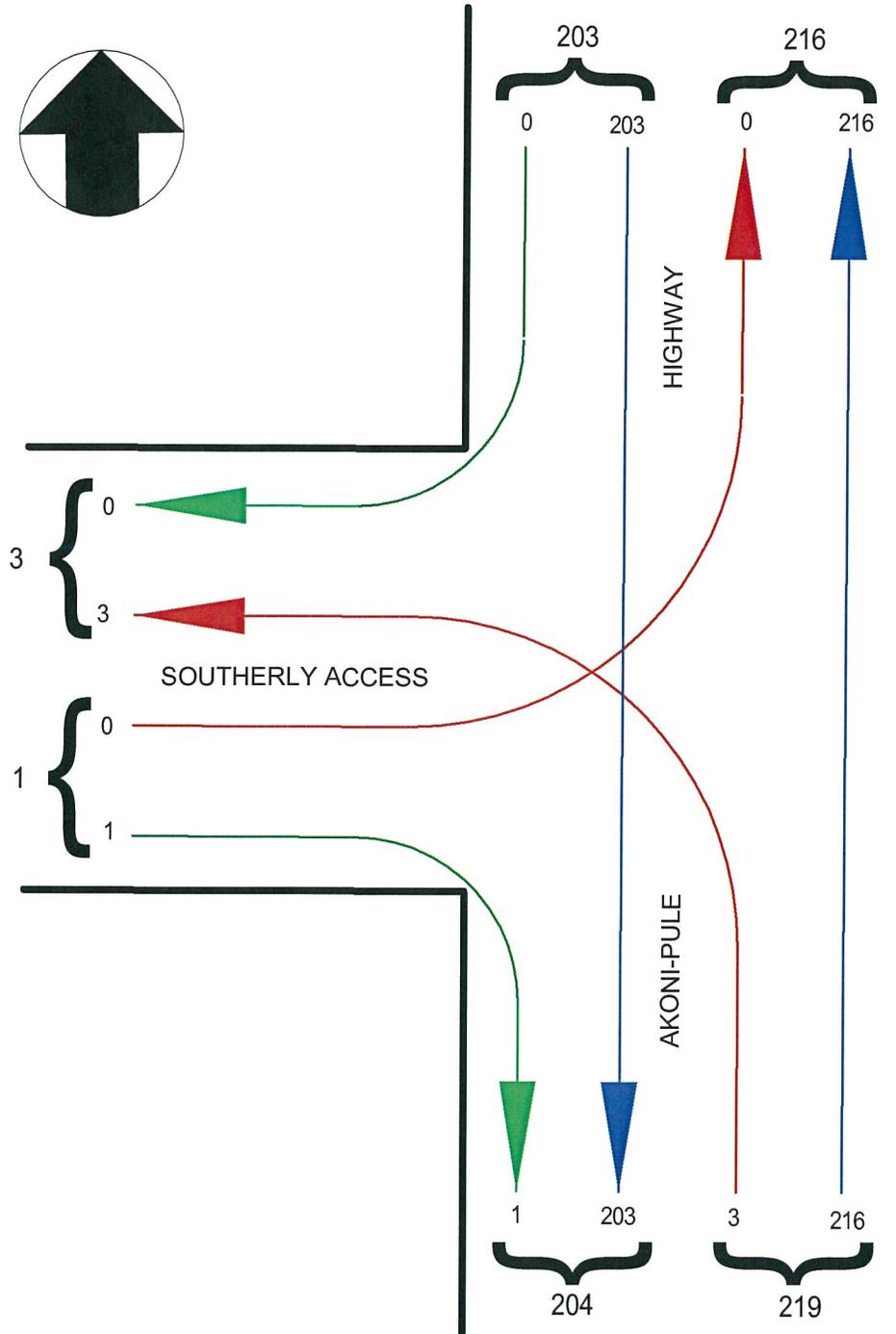


WITCHER ENGINEERING LLP

P.O. Box 4692
Camp Verde, AZ 86322
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Consulting Civil Engineers
Construction Managers

Proposed 9-Lot Subdivision Akoni-Pule Highway & Southerly Access Traffic Movement - Build-Out Conditions PM Peak Hour - 3:00 PM to 4:00 PM

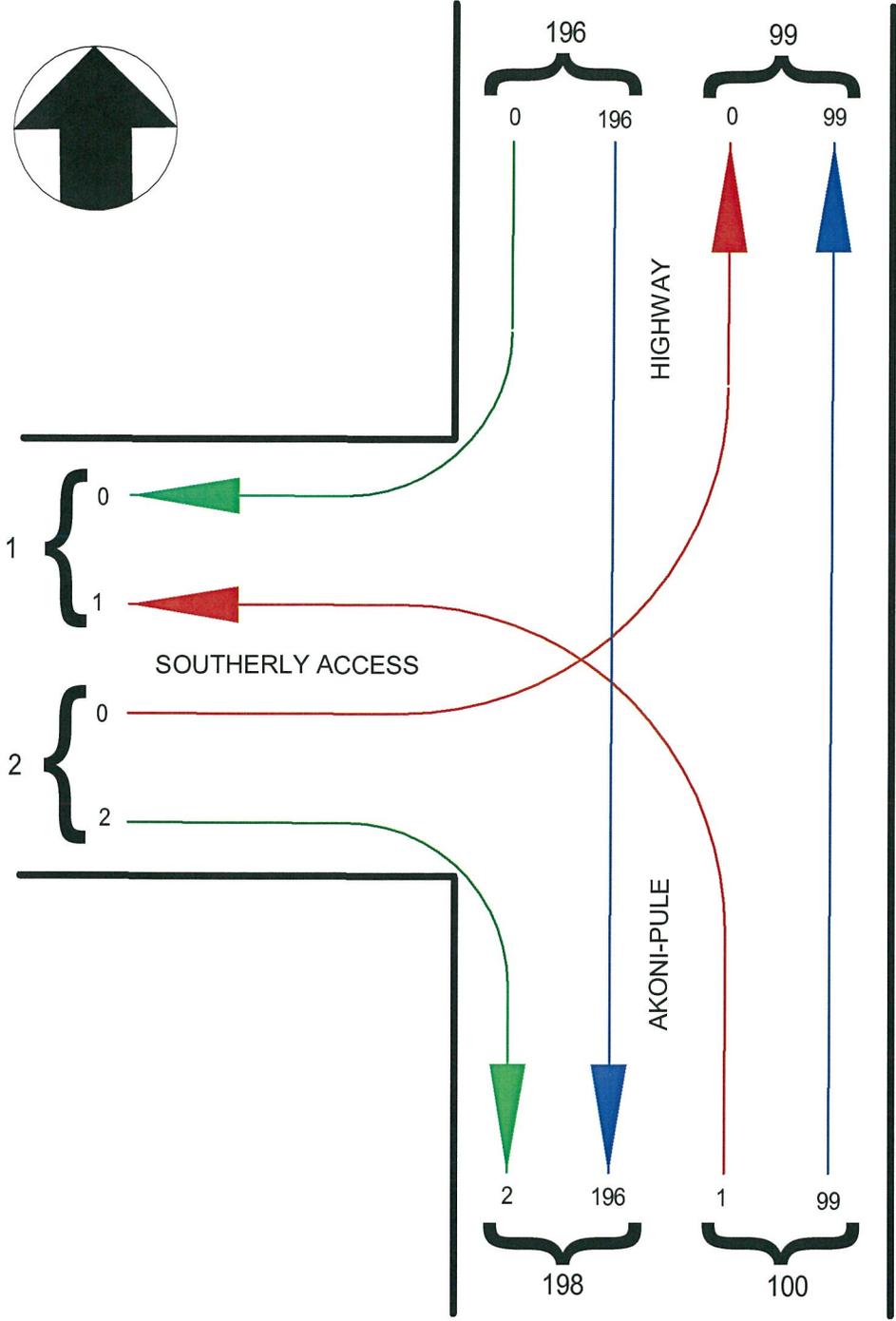


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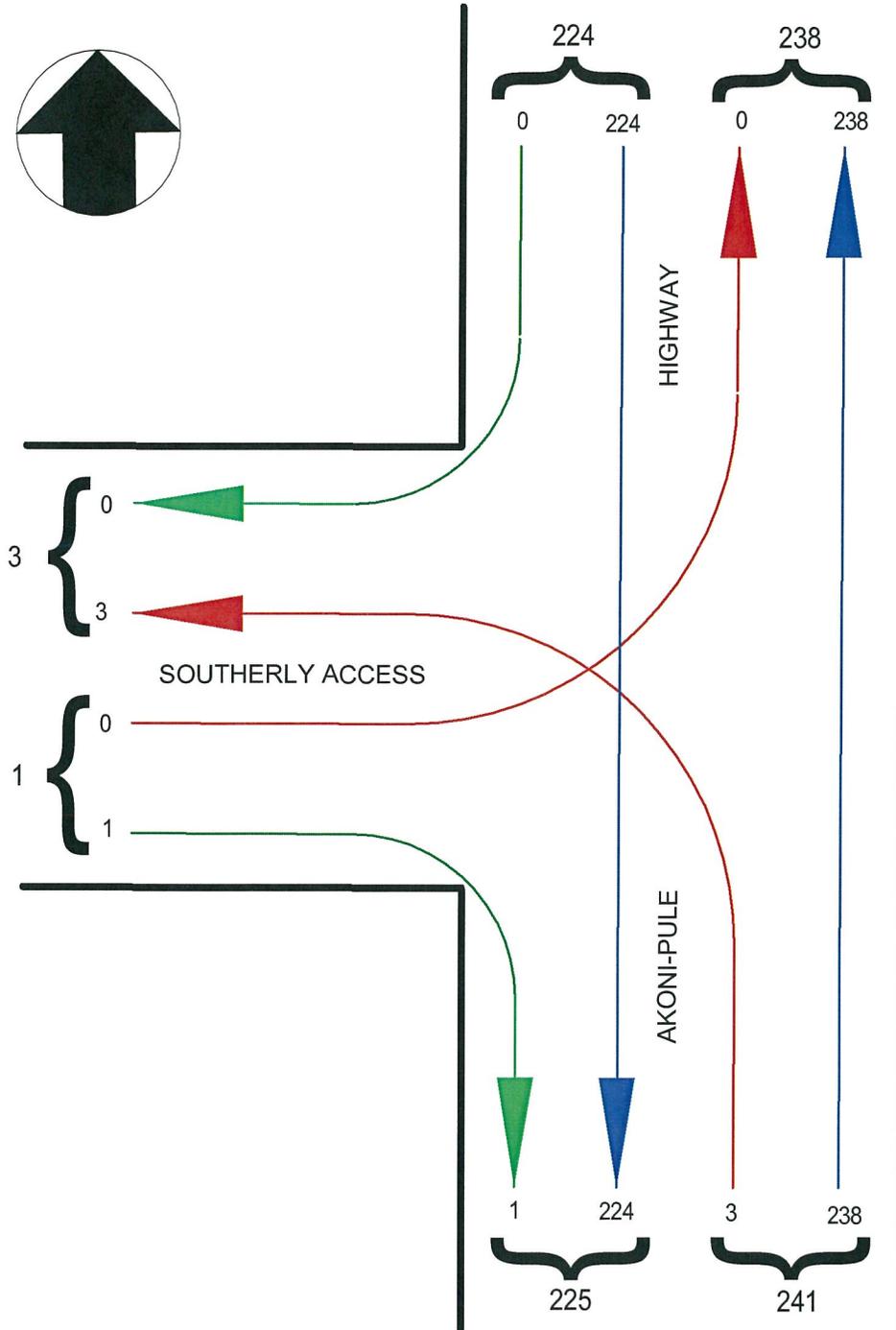


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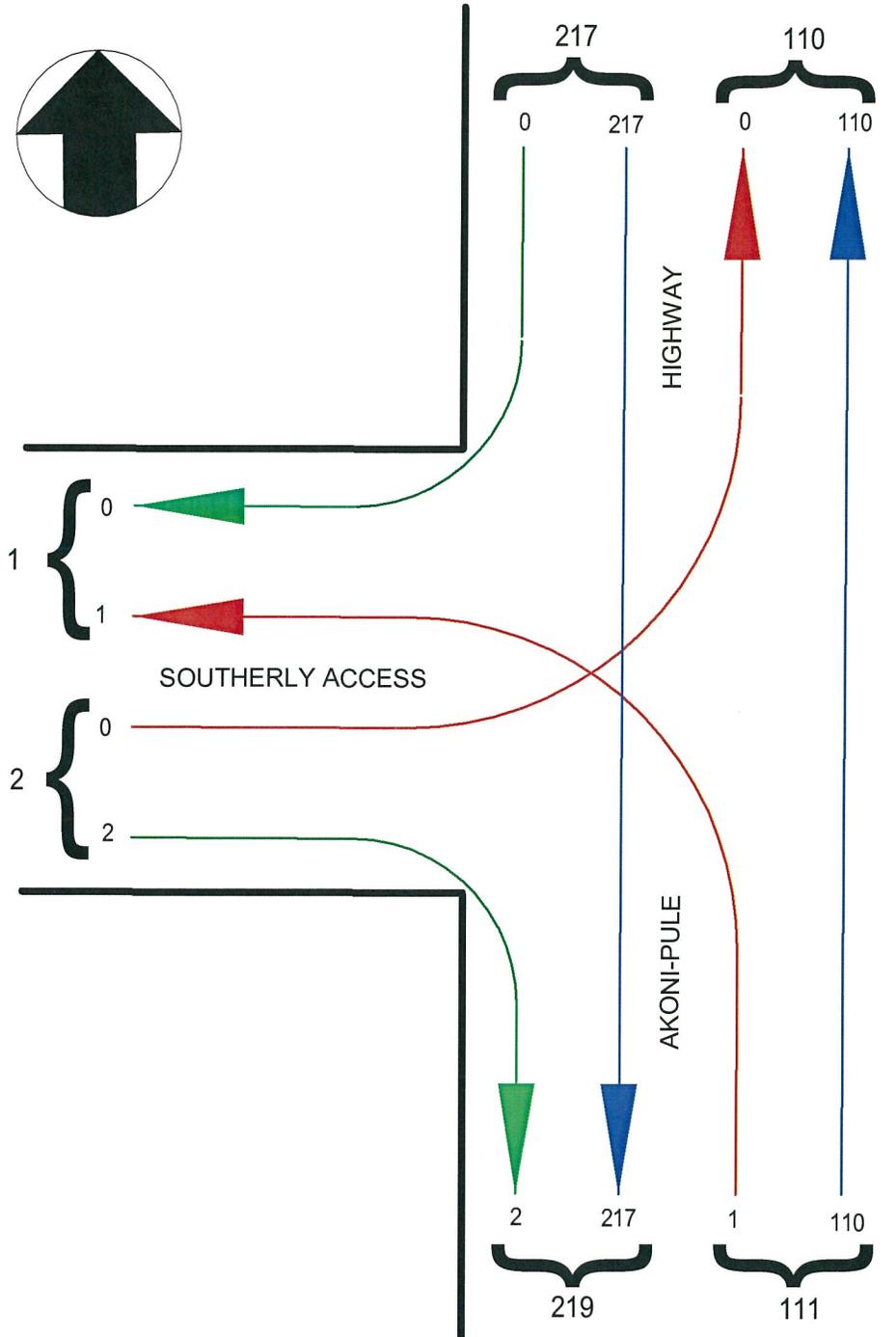


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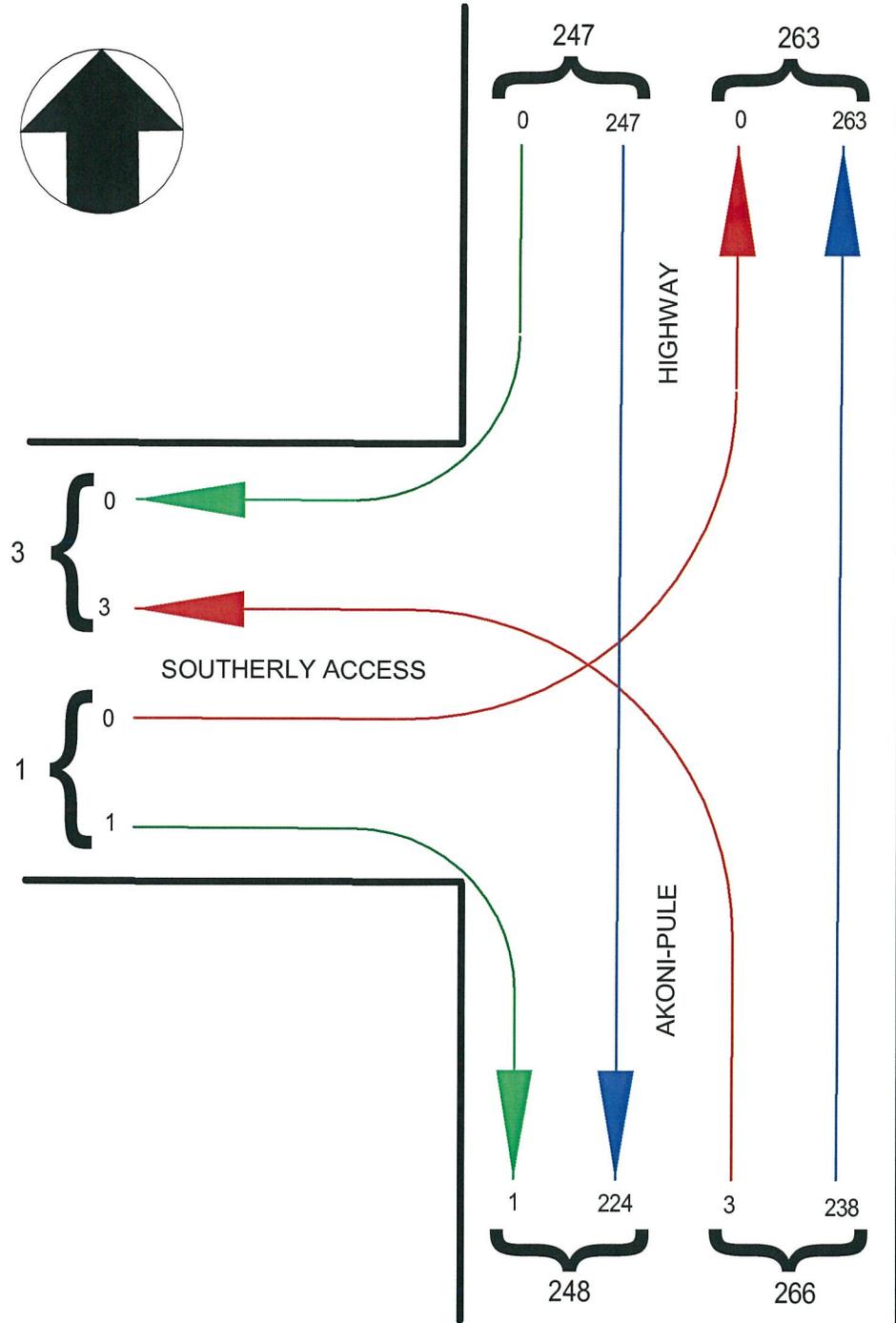


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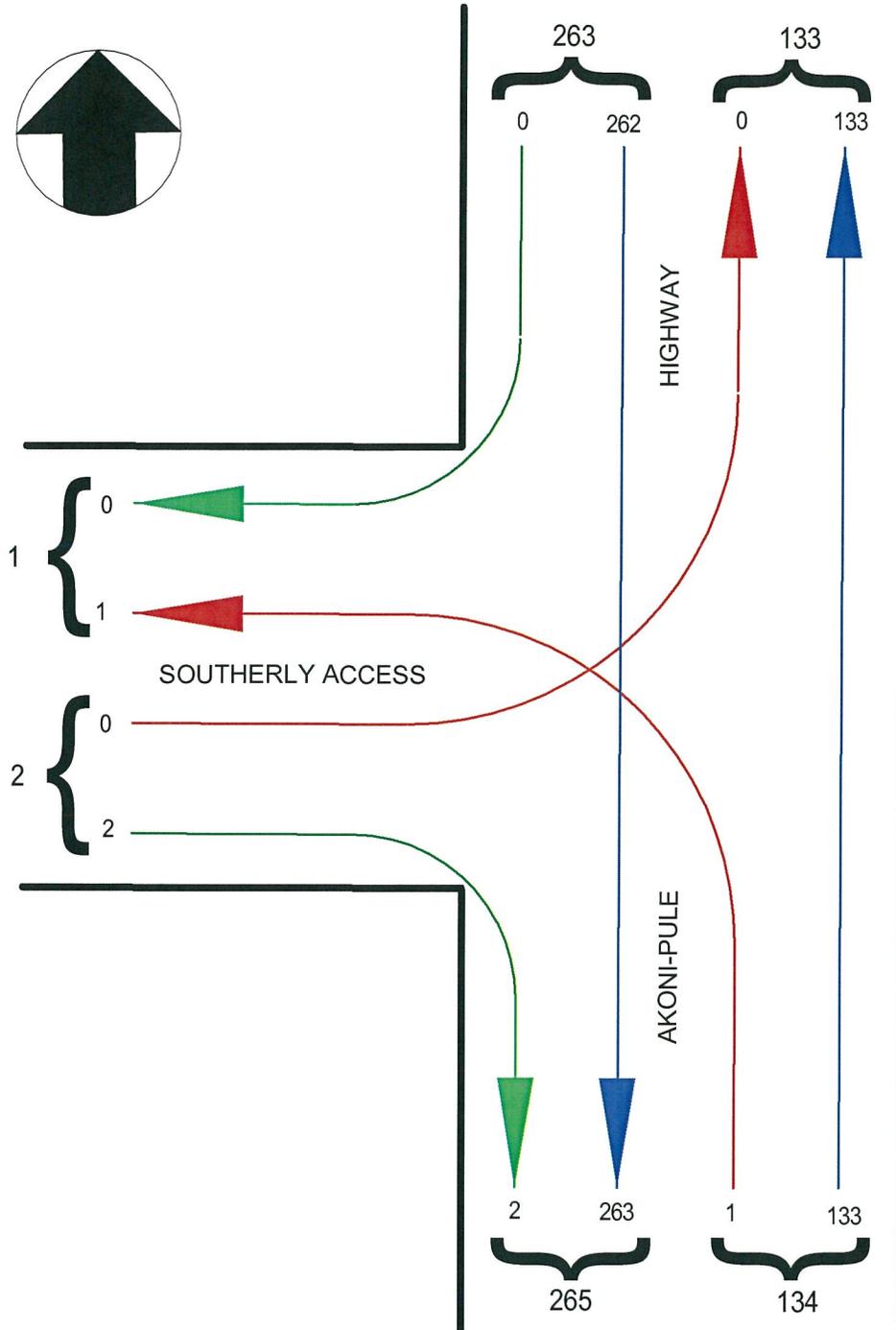


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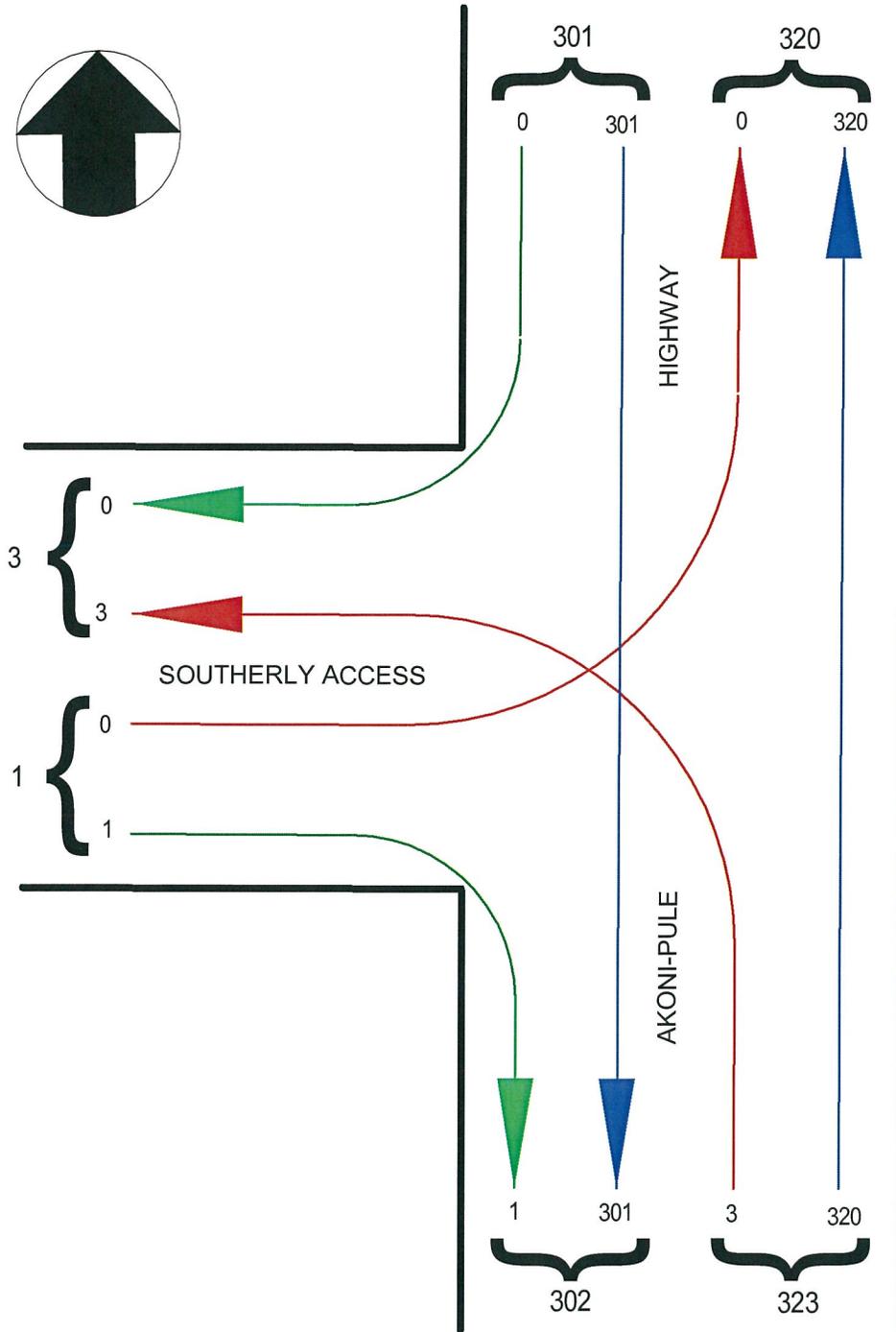


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ENVIRONMENTAL ASSESSMENT

Kohala Shoreline, LLC Project

TMK: (3rd) 5-9-001:008

Kahuāli‘ili‘i, North Kohala District, Hawai‘i Island, State of Hawai‘i

APPENDIX 6 Biological Report

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Terrestrial Flora and Fauna Survey
Kohala Shoreline LLC Property TMK: (3rd) 5-9-001:008
Kahuali‘ili‘i, North Kohala District,
Hawai‘i Island, State of Hawai‘i

By Ron Terry, Ph.D.
Geometrician Associates, LLC
Prepared for Kohala Shoreline, LLC
March 2015

Kohala Shoreline proposes to develop a 9-lot, gated subdivision on Akoni Pule Highway (State Route 270) on a 37.88-acre parcel located approximately three miles north of Kawaihae Harbor. The lots would vary in size from about three to five acres.

Field surveys of terrestrial biological resources were conducted by Ron Terry, Ph.D., at various times between February 2010 and March 2015, the combined results of which are presented below.

Vegetation and Flora

In February 2010, after a long dry period, the property was systematically walked in zigzagging transects perpendicular to the shoreline, spaced approximately 50 meters apart, with special attention to gulches, ridges, and outcrops. In addition, the entire shoreline area was walked. On follow-up visits, which were conducted to observe the property after periods of rainfall, surveys took place on the shoreline, the trails, the gulches, and selected other areas.

As is typical of the region, the property was thickly covered with alien vegetation. Virtually the entire site is dominated by a low forest of scattered *kiawe* (*Prosopis pallida*) with an understory of buffel grass (*Cenchrus ciliaris*), with relatively little cover by other plants. In gulches, runoff that creates soil moisture and collects seeds creates an environment where the flora is expanded by more species of weeds.

A total of 29 plant species were identified. Only three of them, the common roadside herb *‘uhaloa* (*Waltheria indica*), the common but cherished yellow-flowered *ilima* (*Sida fallax*), and the strand vine *pa‘ū O Hi‘iaka* (*Jacquemontia ovalifolia*), are indigenous to the Hawaiian Islands. The other 26 species are non-native. No threatened or endangered plant species (USFWS 2015) are present or would be expected to be present on the project site. All plant species observed during the survey are listed in Table 1 below.

Table 1
Plant Species on Project Site

Scientific Name	Family	Common Name	Life Form	Status*
<i>Abutilon incanum</i>	Malvaceae	Hoary abutilon	Herb	A
<i>Atriplex semibaccata</i>	Chenopodiaceae	Australian saltbush	Herb	A
<i>Boerhavia coccinea</i>	Nyctaginaceae	Boerhavia	Herb	A
<i>Cenchrus ciliaris</i>	Poaceae	Buffel grass	Grass	A
<i>Cenchrus setaceus</i>	Poaceae	Fountain grass	Grass	A
<i>Chamaesyce hirta</i>	Euphorbiaceae	Garden spurge	Shrub	A
<i>Chenopodium murale</i>	Chenopodiaceae	Goosefoot	Herb	A
<i>Cleome gynandra</i>	Capparaceae	Spider flower	Herb	A
<i>Commelina benghalensis</i>	Commelinaceae	Hairy honohono	Herb	A
<i>Cucumis dipsaceus</i>	Cucurbitaceae	Hedgehog gourd	Vine	A
<i>Desmodium sp.</i>	Fabaceae	Desmodium	Vine	A
<i>Eragrostis amabilis</i>	Poaceae	Lovegrass	Grass	A
<i>Festuca bromoides</i>	Poaceae	Brome fescue	Grass	A
<i>Ficus microcarpa</i>	Moraceae	Chinese banyan	Tree	A
<i>Jacquemontia ovalifolia</i>	Convolvulaceae	Pa'ū O Hi'iaka	Vine	I
<i>Lantana camara</i>	Verbenaceae	Lantana	Shrub	A
<i>Leonotis nepetifolia</i>	Lamiaceae	Lion's ear	Herb	A
<i>Leucaena leucocephala</i>	Fabaceae	Haole koa	Tree	A
<i>Merremia aegyptia</i>	Convolvulaceae	Hairy merremia	Vine	A
<i>Portulaca oleracea</i>	Portulacaceae	Pigweed	Herb	A
<i>Portulaca pilosa</i>	Portulacaceae	Portulaca	Herb	A
<i>Prosopis pallida</i>	Fabaceae	Kiawe	Tree	A
<i>Ricinus communis</i>	Euphorbiaceae	Castor bean	Shrub	A
<i>Sida fallax</i>	Malvaceae	'Ilima	Shrub	I
<i>Sida rhombifolia</i>	Malvaceae	Broom weed	Herb	A
<i>Spergula arvensis</i>	Caryophyllaceae	Corn spurry	Herb	A
<i>Verbesina encelioides</i>	Asteraceae	Golden crown beard	Herb	A
<i>Tribulus terrestris</i>	Zygophyllaceae	Puncture vine	Herb	A
<i>Waltheria indica</i>	Sterculiaceae	'Uhaloa	Herb	I

* A = alien; I = indigenous; botanical names follow Wagner, Herbst and Sohmer 1990.

Fauna

No mammals were seen on the site, but studies of nearby areas indicate that the mammalian fauna of this part of Kohala is composed of mainly introduced species, including possibly small Indian mongooses (*Herpestes a. auropunctatus*), feral cats (*Felis catus*) roof rats (*Rattus r. rattus*), Norway rats (*Rattus norvegicus*), European house mice (*Mus domesticus*) and possibly Polynesian rats (*Rattus exulans hawaiiensis*). None are of conservation concern and all are deleterious to native flora and fauna.

The only native Hawaiian land mammal, the Hawaiian Hoary Bat (*Lasiurus cinereus semotus*), may also be present in the area, as it is present in many areas on the island of Hawai'i. Observation took place in daylight, and therefore the lack of bat observations does not signify an actual absence of bats. Although the sparse *kiawe*-buffel grass

vegetation of the site would not be expected to represent essential habitat for this endangered species, they have been observed in *kiawe* scrub vegetation in other parts of Kona.

Almost all birds seen on the site were wide-ranging aliens such as Common Myna (*Acridotheres tristis*), Yellow-billed Cardinal (*Paroaria capitata*), Saffron Finch (*Sicalis flaveola*), Gray Francolin (*Francolinus pondicerianus*) and Zebra Dove (*Geopelia striata*). Other than the common shorebird 'Ulili or Wandering Tattler (*Heteroscelus incanus*), which was observed right on the shoreline rocks, no birds indigenous to Hawai'i were identified during the survey.

Although not detected, it is possible that small numbers of the endangered endemic Hawaiian Petrel (*Pterodroma sandwichensis*) and the threatened Newell's Shearwater (*Puffinus auricularis newelli*) over-fly the project area between the months of May and November. Hawaiian Petrels were formerly common on the Island of Hawai'i. This pelagic seabird reportedly nested in large numbers on the slopes of Mauna Loa and in the saddle area between Mauna Loa and Mauna Kea, as well as at the mid-to-high elevations of Hualālai and in the Kohala Mountains. It has within recent historic times been reduced to relict breeding colonies in a few locations. Hawaiian Petrels were first listed as an endangered species by the USFWS in 1967 and by the State of Hawai'i in 1973. Newell's Shearwaters were also once common on the Island of Hawai'i. This species breeds on Kaua'i, Hawai'i, and Moloka'i. Newell's Shearwater populations have dropped precipitously since the 1880s (Banko 1980, Day et al., 2003). This pelagic species nests high in the mountains in burrows excavated under thick vegetation, especially *uluhe* (*Dicranopteris linearis*) fern. Newell's Shearwater was listed as a threatened species by the USFWS in 1975 and by the State of Hawai'i in 1973.

Impacts and Mitigation Measures

In order to frame impacts to flora and fauna, it is important to remember that the project site is land historically used for ranching now zoned for residential use and dominated by introduced plant species. From this perspective, the development will produce almost no impacts to any species of flora and fauna other than the alien species already present. However, several mitigation measures that protect wide-ranging endangered species are recommended.

To minimize impacts to the endangered Hawaiian hoary bat, woody plants greater than 15 feet will not be removed or trimmed during the bat birthing and pup rearing season (May 15 through August 15).

If the project incorporates outdoor lighting, it may attract Hawaiian Petrels and Newell's Shearwaters, which may become disoriented by the lighting, resulting in birds being downed. To avoid the potential downing of Hawaiian Petrels and Newell's Shearwaters by their interaction with outdoor lighting, no construction or unshielded equipment maintenance lighting should be permitted after dark between the months of April and October. All permanent lighting should be shielded in conformance with Hawai'i County

Outdoor Lighting Ordinance (Hawai‘i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

REFERENCES

- Gagne, W., and L. Cuddihy. 1990. "Vegetation," pp. 45-114 in W.L. Wagner, D.R. Herbst, and S.H. Sohmer, eds., *Manual of the Flowering Plants of Hawai‘i*. 2 vols. Honolulu: University of Hawai‘i Press.
- Banko, W. E. 1980. "Population Histories – Species Accounts Seabirds: Newell’s Shearwater (‘A‘o)." Cooperative National Park Resources Studies Unit, University of Hawai‘i at Manoa, Department of Botany, Technical Report #5A.
- Day, R. H., B. Cooper, and T. C. Telfer. 2003. *Decline of Townsend’s (Newell’s Shearwaters (Puffinus auricularis newelli) on Kauai, Hawaii*. The Auk 120: 669-679.
- University of Hawai‘i at Hilo, Dept. of Geography. 1998. *Atlas of Hawai‘i*. 3rd ed. Honolulu: University of Hawai‘i Press.
- U.S. Fish and Wildlife Service (USFWS). 2015. *USFWS Threatened and Endangered Species System (TESS)*. Washington: GPO. http://ecos.fws.gov/tess_public/
- Wolfe, E.W., and J. Morris. 1996. *Geologic Map of the Island of Hawai‘i*. USGS Misc Investigations Series Map i-2524-A. Washington, D.C.: U.S. Geological Survey.