

KAMEHAMEHA SCHOOLS

Keauhou

KEAUHOU BAY MANAGEMENT PLAN
FINAL ENVIRONMENTAL IMPACT STATEMENT
VOLUME III: APPENDICES



G70

September 2025



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FINAL ENVIRONMENTAL IMPACT STATEMENT

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Cultural Impact Assessment

Cultural Impact Assessment for Kamehameha Schools' Keauhou Bay Management Plan

TMK: (3) 7-8-010 and 012 various parcels

Keauhou 1st and 2nd Ahupua'a
North Kona District
Island of Hawai'i



Historic aerial of Keauhou Bay ca. pre-1960s. ASM collection.

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TMK: (3) 7-8-010 and 012 various parcels

Keauhou 1st and 2nd Ahupua'a

North Kona District

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1. INTRODUCTION

At the request of Group 70 International, Inc. (G70), on behalf of Kamehameha Schools (KS), ASM Affiliates (ASM), has prepared this Cultural Impact Assessment (CIA) in support of the Environmental Impact Statement (EIS) being prepared in accordance with Hawai‘i Revised Statutes (HRS) Chapter 343 for the proposed Keauhou Bay Management Plan (KBMP) (referred to hereafter as the ‘proposed project’). The proposed project area includes multiple Tax Map Key (TMK) parcels, all of which are owned by KS and Kamehameha Investment Corporation, and totals approximately 29 acres in the vicinity of Keauhou Bay (Figures 1, 2, and 3). The purpose of the KBMP is to provide near (10 years) and long-term (20 years) management and land use recommendations that are consistent with KS Strategic Plan 2020 – Kūhānauna and the Draft West-Hawai‘i Regional Action Plan, while also responding to community issues within KS responsibility. The KBMP will guide and prioritize KS actions for future planning, improvement, and operation at Keauhou Bay.

This CIA, which is intended to inform an EIS conducted in compliance with HRS Chapter 343, is being prepared pursuant to Act 50 and in accordance with the Environmental Review Program (formerly known as the Office of Environmental Quality Control [OEQC]) *Guidelines for Assessing Cultural Impacts*, adopted by the Environmental Council, State of Hawai‘i, on November 19, 1997 (OEQC 1997). Act 50, which was proposed and passed as Hawai‘i State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, specifically acknowledges that State’s responsibility to protect native Hawaiian cultural practices. Act 50 further states that environmental studies “. . . should identify and address effects on Hawaii’s culture, and traditional and customary rights” and that “native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the ‘aloha spirit’ in Hawai‘i. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.”

The current report is divided into four main chapters. Chapter 1, the introduction, includes an overview of the proposed project as well as a physical description of the project area. To provide a cultural context of the project area, Chapter 2 includes cultural-historical background information specific to the project area and the broader geographical region of Keauhou 1st and 2nd, and at times the greater North Kona District. This chapter also includes a summary of prior archaeological and cultural studies that have been conducted within or in the immediate vicinity of the project area. The methods and results of the consultation process are then presented in Chapter 3. Lastly, Chapter 4 includes a discussion of potential cultural impacts as well as actions and strategies that may help to mitigate any identified impacts.

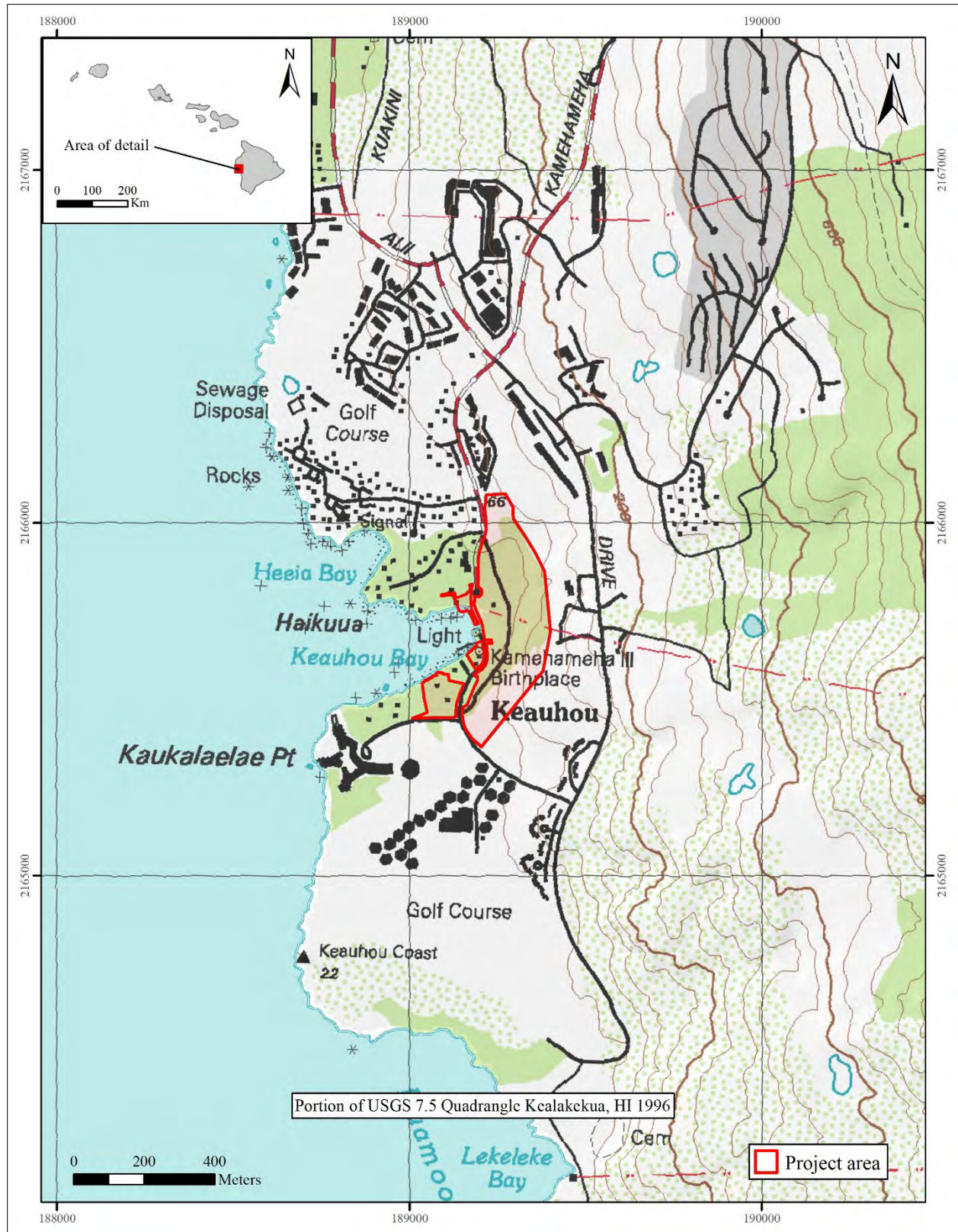


Figure 1. Project area location.



Figure 2. Tax Map Key parcels associated with the proposed project.



Figure 3. Google Earth™ satellite image showing project area location.

PROJECT AREA DESCRIPTION

The project area encompasses roughly 29 acres distributed around the historic and culturally significant Keauhou Bay and spans the *ahupuaʻa* of Keauhou 1st (located to the north) and Keauhou 2nd (located to the south), North Kona District, Island of Hawaiʻi. The project area is comprised of fourteen distinct TMK parcels, which are depicted above in Figure 2 and listed below in numerical order in Table 1.

Vehicular access into the project area is from two paved roads; Kamehameha III Road which leads to the northern part of the project area (Figure 4) and Kaleiopapa Street which leads to the south part of the project area (Figure 5). A portion of the old Kona Road extends from Kamehameha III Road and bisects the western portion of the project where it connects with Kaleiopapa Street (Figure 6).

The majority of the project area is largely undeveloped (Figure 7), however, those areas fronting Keauhou Bay are either partially or fully developed and include trailer parking, the new Keauhou boat ramp, commercial spaces, a pier, public parking, and the old Keauhou boat ramp (Figure 8). The new Keauhou Bay boat ramp is one of three State managed small boat harbors within the North Kona District, thus much of the daily activity in the vicinity of the bay involves various boating activities including commercial charter, private, or commercial fishing operations and other types of marine recreation including but not limited to kayaking, snorkeling, stand-up paddle boarding, one man and outrigger canoe paddling, swimming, and fishing (Figures 9 and 10).

The project area also includes several historically significant places located along the base of ʻAhuʻula Cliff (Figure 11), including the birth place of King Kamehameha III (Kamehameha III), marked by a commemorative plaque (Figure 12) and remnants of Hoʻokūkū Pond (Figure 13).

Table 1. Tax Map Key parcels comprising the project area.

<i>Tax Map Key Parcel</i>	<i>Ahupuaʻa</i>	<i>Acres</i>	<i>Property Class</i>
(3) 7-8-010:044	Keauhou 1 st and 2 nd	25.239	Hotel & Resort
(3) 7-8-010:049	Keauhou 2 nd	0.3132	Hotel & Resort
(3) 7-8-012:004	Keauhou 2 nd	0.25	Residential
(3) 7-8-012:007	Keauhou 2 nd	0.4	Residential
(3) 7-8-012:013	Keauhou 2 nd	0.2297	Commercial
(3) 7-8-012:014	Keauhou 2 nd	0.3295	Commercial
(3) 7-8-012:027	Keauhou 1 st	0.09	Conservation
(3) 7-8-012:048	Keauhou 1 st	0.37	Conservation
(3) 7-8-012:054	Keauhou 1 st	0.02	Residential
(3) 7-8-012:061	Keauhou 2 nd	0.071	Residential
(3) 7-8-012:065	Keauhou 2 nd	0.6	Residential
(3) 7-8-012:098	Keauhou 2 nd	1.0791	Residential
(3) 7-8-012:101	Keauhou 1 st	0.1222	Residential
(3) 7-8-012:103	Keauhou 2 nd	0.01	Residential



Figure 4. Aerial showing Kamehameha III Road leading to the northwestern portion of the project area.



Figure 5. Aerial showing Kaleiopapa Street leading to the southwestern portion of the project area.



Figure 6. Old Kona Road extending through the western portion of the project area.



Figure 7. Aerial showing the western and largely undeveloped portion of the project area.



Figure 8. Aerial showing Kaleiopapa Street leading to trailer parking, new boat ramp, commercial spaces, pier, and public parking located in the southwestern portion of the project area.



Figure 9. Marine recreation at Keauhou Bay viewed from old boat ramp on north side of existing pier, view to the west.



Figure 10. Outrigger canoes belonging to Keauhou Canoe Club, view to the northeast.



Figure 11. Aerial image of ‘Ahu‘ula Cliff, note interpretive walking path at the base of cliff.



Figure 12. Birth place of King Kauikeaouli (Kamehameha III) located along the western side of road leading to pier, view to the northeast.



Figure 13. Remnants of Ho'okūkū Pond, view to the east.

Geology and Soil

The geology underlying the project area is comprised of volcanic flows originating from both Hualālai and Mauna Loa. The northern portion of the project area, which is made up entirely of Hualālai volcanics, is mapped in Figure 14 below as Qh4 dating between 560-860 years ago and Qh dating between 11,000 and 30,000 years ago. The central section of the project area includes a small pocket of Hualālai volcanics (Qh) along the eastern edge, however, the majority is comprised of Mauna Loa volcanics shown below as Qk dating between 11,000-30,000 years ago. Along the southwestern section of the project area, the geology transitions back to Hualālai volcanics mapped below in Figure 14 as Qh2 dating between 1,500 and 3,000 years ago (Sherrod et al. 2007).

The soil types found within the project area varies and as depicted in Figure 15, Keauhou Bay serves as a converging point for the soil types found therein. The northern tip of the project area is comprised entirely of soil type 10, well-draining ‘a‘ā with 2 to 20 percent slopes. The central section of the project area is comprised of three soil types including 245, ash deposits overlaying an ‘a‘ā flow and designated as Waiaha cobbly medial silt loam with a 10 to 20 percent slopes; 243, ash deposits overlaying a *pāhoehoe* flow and described as Waiaha medial silt loam with a 10 to 20 percent slopes; and 122, a *pāhoehoe* flow identified as Punalu‘u lava flow complex with 10 to 20 percent slopes. The southwestern tip of the project area is comprised of soil type 121, another *pāhoehoe* flow described as Punalu‘u lava flow complex with 2 to 20 percent slopes (Soil Survey Staff 2020).

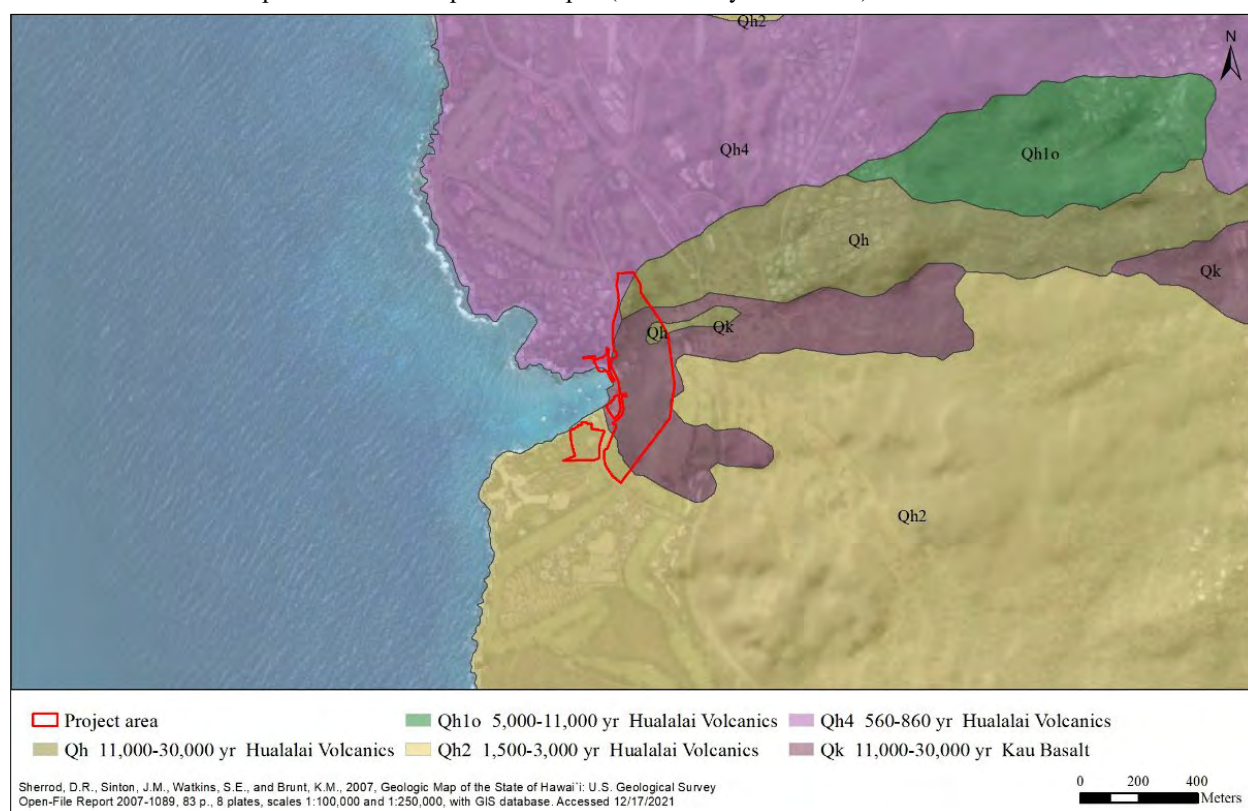


Figure 14. Geology underlying the project area.

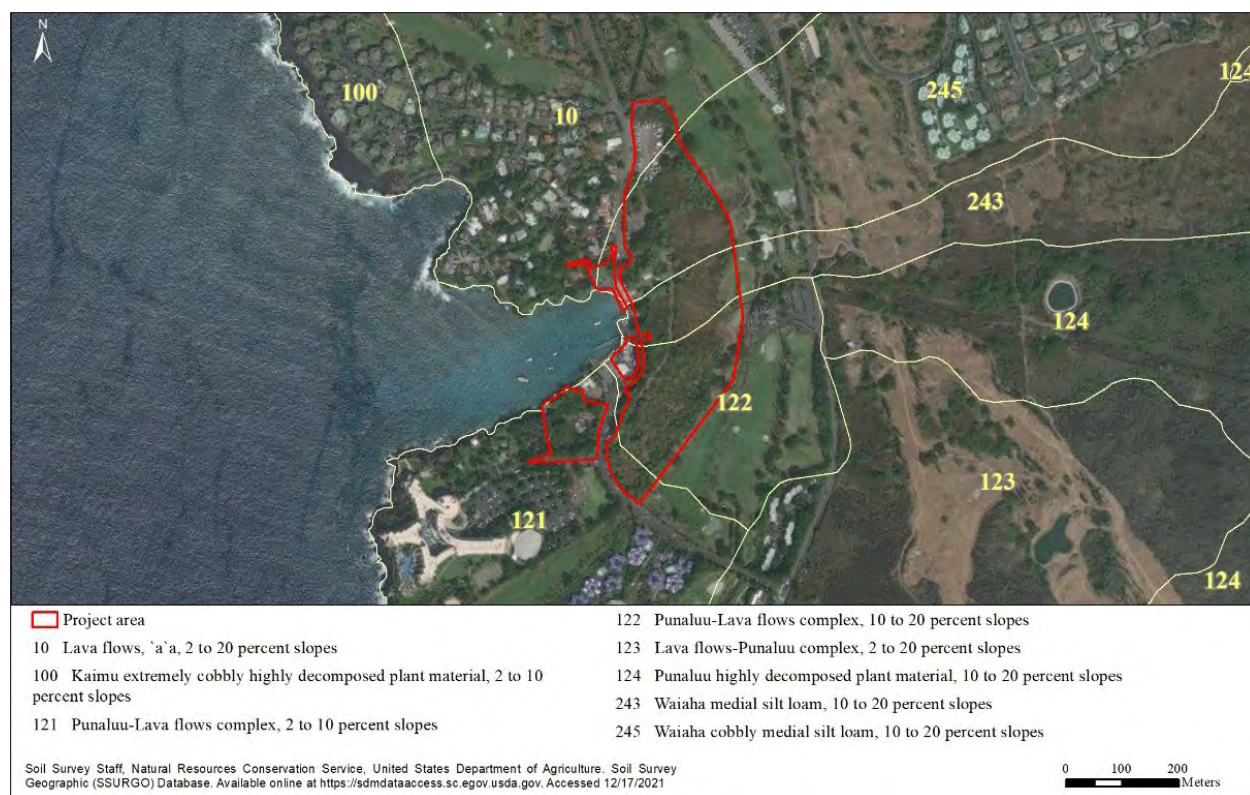


Figure 15. Soils underlying the project area.

PROPOSED PROJECT DESCRIPTION

The KBMP includes short and long-term management and land use plans to guide operations and prioritize future improvements at Keauhou Bay based upon community values and KS's Strategic Plan. The plan is also intended to facilitate cooperation and collaboration between KS, community/education partners, and stakeholders in the management of the area's natural, cultural, and commercial resources. The proposed plan includes the following five areas (Area A-E) which are depicted in the KBMP conceptual plan included below as Figure 16: A) establish a heritage management corridor; B) reposition and develop commercial bayfront areas and appropriate density resort area; C) reorient recreational and community use; D) maintain and establish new place-based cultural-educational areas, and; E) manage vehicle, boat, and pedestrian circulation and wayfinding.

The recommendations for Area A include relieving commercial and vehicular congestion away from *wahi pana*; re-establish the Old Kona Road as the main vehicle thoroughfare; repurposing the existing commercial facilities to culture/education as a way to reduce impact in the heritage corridor, and; restoring the cultural landscape and extend pedestrian-friendly walking path along 'Ahu'ula Cliff to Mo'ikeha Cave. The Area B recommendations include relocating existing commercial operations away from culturally sensitive areas; organizing existing ocean recreation commercial operators and food and beverage establishments in a new facility; creating sustainable, low rise, boutique resort on the resort-zoned upper plateau of the bay area; and explore opportunities for commercial *kīpuka* where appropriate. Area C recommendations include improving public access by establishing a *mauka-makai* corridor; expanding Ka'ili'ilinehe Beach Park as the entrance to an open space, shoreline corridor; and considering open space and walking path above 'Ahu'ula Cliff to ensure the protection of view planes and culturally significant areas. The recommendations for Area D include repurposing existing bayfront facilities to support educational programming with a community collaborator and cultivating community collaborator capacity to include bay area management and community-based economic development. The Area E recommendations include improving boat and vehicular parking on the north side of the bay; alleviating congestion by exploring opportunities with DLNR-DOBOR on potential relocation/expansion of boat trailer parking; re-establish old Kona Road to relieve vehicular congestion at bayfront heritage corridor; explore access management with Hawai'i County and DLNR to address traffic and deliveries at harbor/pier; organize active commercial/resort uses to the south side, and community/recreational use to the north side; and implement a comprehensive wayfinding and interpretive signage plan.

THE PLAN

- Includes short-term and long-term management and land use plans to guide operations and prioritize future improvements at Keauhou Bay based upon community values and Kamehameha Schools' Strategic Plan.
- The project area includes approximately 29 acres of Kamehameha Schools lands in the Keauhou Bay area.
- Facilitates cooperation and collaboration between Kamehameha Schools, community/education partners and stakeholders in the management of natural, cultural, and commercial resources.

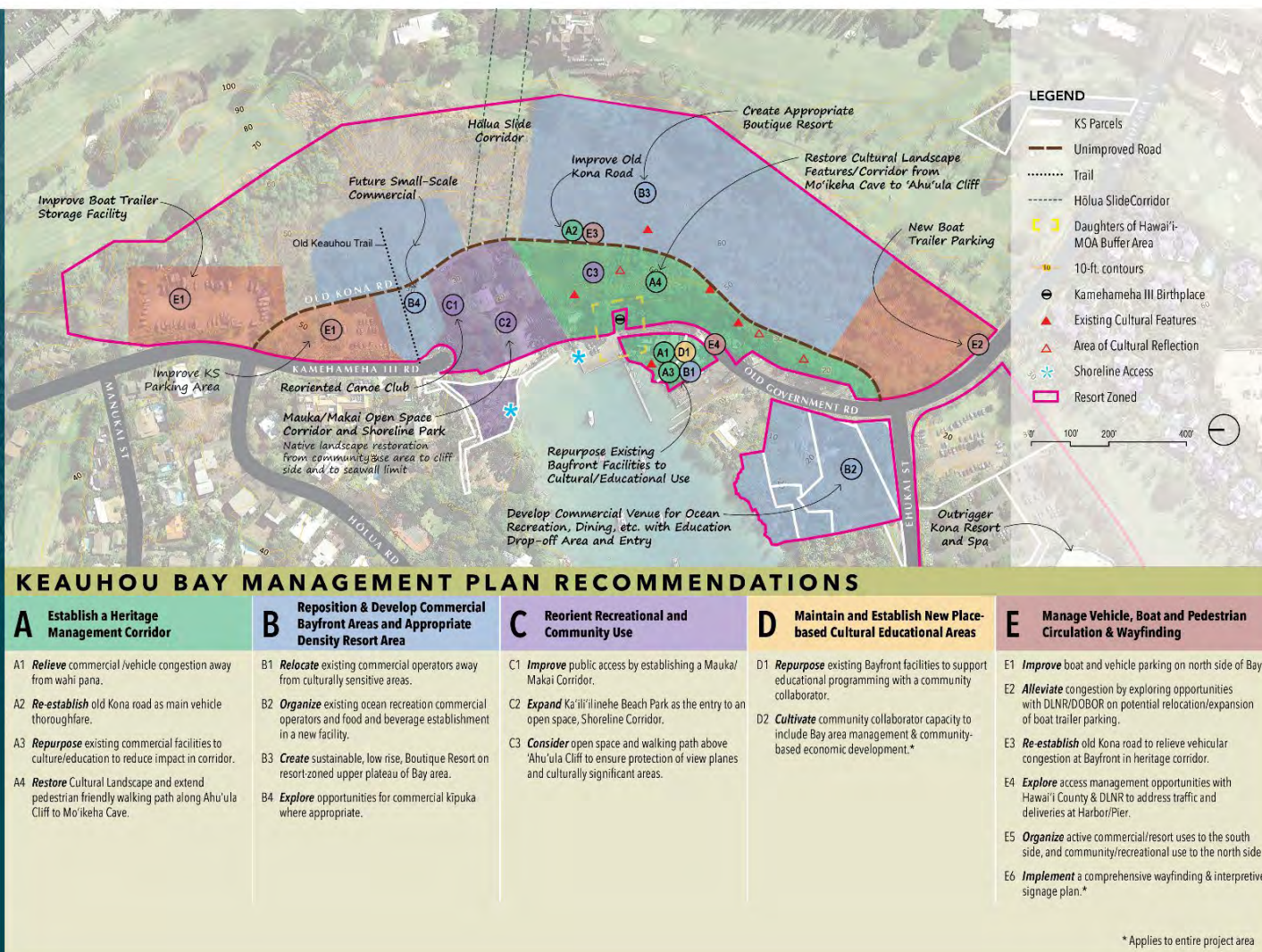


Figure 16. Keauhou Bay Management Plan conceptual plan.

2. BACKGROUND

As specified in the *Guidelines for Assessing Cultural Impacts*, “...the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment” (OEQC 1997:1). For this CIA, the *ahupua‘a* of Keauhou (inclusive of both Keauhou 1st and 2nd) is considered the ‘study area’, while the roughly 29-acre is referred to as the project area.

To generate a set of expectations regarding the nature of cultural resources that might be encountered within the current project area and to establish a context within which to assess the significance of such resources, the background section begins with a general culture-historical context. This is followed by culture-historical background information concerning the history of Keauhou. Limited background information for North Kona, the broader regional designation in which Keauhou is situated, also falls within the parameters of the OEQC CIA guidelines and ensures that a broader set of cultural practices and histories are considered. Following this background section is a discussion of relevant prior archaeological and cultural studies that have been conducted within and in the immediate vicinity of the project area.

RESEARCH METHODS

The culture-historical context and summary of previously conducted archaeological and cultural research presented below are based on research conducted by ASM Affiliates at various physical and digital repositories. Primary and secondary English language resources were found at various state agencies, including the State Historic Preservation Division, Hawai‘i State Archives, the Department of Accounting and General Services Land Survey Division, the Hawaiian Mission Houses Historic Site and Archives, the County of Hawai‘i Planning Department, Kamehameha Schools Land Information Management and Services, and at ASM’s library collection. Primary Hawaiian language resources were obtained from select ethnographic studies as well as the Office of Hawaiian Affairs’ Papakilo Database, a digital repository.

CULTURE-HISTORICAL CONTEXT

While the question of when Hawai‘i was first settled by Polynesians remains contested, scholars working in the fields of archaeology, folklore, Hawaiian studies, and linguistics have offered several theories. With advances in palynology and radiocarbon dating techniques, Kirch (2011), Athens et al. (2014), and Wilmshurst et al. (2011) have argued that Polynesians arrived in the Hawaiian Islands sometime between A.D. 1000 and A.D. 1200. This initial migration on intricately crafted *wa‘a kaulua* (double-hulled canoes) to Hawai‘i from Kahiki, the ancestral homelands of Hawaiian deities and peoples from southern Pacific islands, occurred at least from initial settlement to the 13th century. According to Fornander (1969), Hawaiians brought from their homeland certain Polynesian customs and beliefs: the major gods Kāne, Kū, Lono, and Kanaloa (who have cognates in other Pacific cultures); the *kapu* system of political and religious governance; and the concepts of *pu‘uhonua* (places of refuge), *‘aumakua* (ancestral deity), and *mana* (divine power). Archaeologist Kenneth Emory who worked in the early to mid-20th century reported that the sources of early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). However, Emory’s theory is not universally accepted, as Hawaiian scholars in the past and present have argued for a pluralistic outlook on ancestral Hawaiian origins from Kahiki (Case 2015; Fornander 1916-1917; Kamakau 1866; Kikilo 2010; Nakaa 1893; Poepoe 1906).

While stories of episodic migrations were widely published in the Hawaiian language by knowledgeable and skilled *kū‘auhau* (individuals trained in the discipline of remembering genealogies and associated ancestral stories), the cultural belief that living organisms were *hānau ‘ia* (born) out of a time of eternal darkness (*pō*) and chaos (*kahuli*) were brought and adapted by ancestral Hawaiian populations to reflect their deep connection to their environment. As an example, the *Kumulipo*, Hawai‘i’s most famed *ko‘ihonua* (a cosmogonic genealogical chant), establishes a birth-rank genealogical order for all living beings (Beckwith 1951; Liliuokalani 1978). One such genealogical relationship that remains widely accepted in Hawai‘i is the belief that *kalo* (taro) plants (in addition to all other plants, land animals, and sea creatures), are elder siblings to humans (Beckwith 1951). This concept of hierarchical creation enforces the belief that all life forms are intimately connected, evidencing the cultural transformations that occurred in the islands through intensive interaction with their local environment to form a uniquely Hawaiian culture.

In Hawai‘i’s ancient past, inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). Following the initial settlement period, communities clustered in the *ko‘olau* (windward) shores of the Hawaiian Islands where freshwater was abundant. Sheltered bays allowed for nearshore fisheries (enriched by

numerous estuaries) and deep-sea fisheries to be easily accessed (McEldowney 1979). Widespread environmental modification of the land also occurred as early Hawaiian *kanaka mahi'ai* (farmers) developed new subsistence strategies, adapting their familiar patterns and traditional tools to work efficiently in their new home (Kirch 1985; Pogue 1978). Areas with the richest natural resources became heavily populated over time, resulting in the population's expansion to the *kona* (leeward) side of the islands and to more remote areas (Cordy 2000).

Overview of Traditional Hawaiian Land Management Strategies

Adding to an already complex society was the development of traditional land stewardship systems, including the *ahupua'a*. The *ahupua'a* was the principal land division that functioned for both taxation purposes and furnished its residents with nearly all subsistence and household necessities. *Ahupua'a* are land divisions that typically include multiple ecozones from *mauka* (upland mountainous regions) to *makai* (shore and near-shore regions), assuring a diverse subsistence resource base (Hommon 1986). Although the *ahupua'a* land division typically incorporated all of the eco-zones, their size and shape varied greatly (Cannelora 1974). Noted Hawaiian historian and scholar Samuel Kamakau summarized the ecozones that could be found in a given *ahupua'a*:

Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations ('*ano*). The part directly in back and in front of the summit proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and makai of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. Makai of this region the trees are tall, and this is the *wao lipo*. Makai of the *wao lipo* is the *wao 'eiwa*, and makai of that the *wao ma 'ukele*. Makai of the *wao ma 'ukele* is the *wao akua*, and makai of there is the *wao kanaka*, the area that people cultivate. Makai of the *wao kanaka* is the '*ama'u*, fern belt, and makai of the '*ama'u* the '*apa'a*, grasslands.

A solitary group of trees is a *moku la'au* (a “stand” of trees) or an *ulu la'au*, grove. Thickets that extend to the *kuahiwi* are *ulunahale*, wild growth. An area where *koa* trees suitable for canoes (*koa wa'a*) grow is a *wao koa* and mauka of there is a *wao la'au*, timber land. These are dry forest growths from the '*apa'a* up to the *kuahiwi*. The places that are “spongy” (*naele*) are found in the *wao ma 'ukele*, the wet forest.

Makai of the '*apa'a* are the *pahe'e* [*pili* grass] and '*ilima* growths and makai of them the *kula*, open country, and the '*apoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the '*ae kai*, the water's edge.

That is the way *ka po'e kahiko* [the ancient people] named the land from mountain peak to sea. (Kamakau 1976:8-9)

The *maka'ainana* (commoners, literally the “people that attend the land”) who lived on the land had rights to gather resources for subsistence and tribute within their *ahupua'a* (Jokiel et al. 2011). As part of these rights, residents were required to supply resources and labor to *ali'i* (chiefs) of local, regional, and island chiefdoms. The *ahupua'a* became the equivalent of a local community with its own social, economic, and political significance and served as the taxable land division during the annual *Makahiki* procession (Kelly 1956). During the time of *Makahiki*, the paramount *ali'i* sent select members of his/her retinue to collect *ho'okupu* (tribute and offerings) in the form of goods from each *ahupua'a*. The *maka'ainana* brought their share of *ho'okupu* to an *ahu* (altar) that was marked with the image of a *pua'a* (pig), serving as a physical visual marker of *ahupua'a* boundaries. In most instances, these boundaries followed mountain ridges, hills, rivers, or ravines (Alexander 1890). However, Chinen (1958:1) reports that “oftentimes only a line of growth of a certain type of tree or grass marked a boundary; and sometimes only a stone determined the corner of a division.” These ephemeral markers, as well as their more permanent counterparts, were oftentimes named as evidenced in the thousands of boundary markers names that are listed in Soehren (2005).

Ahupua'a were ruled by *ali'i 'ai ahupua'a* or chiefs who controlled the *ahupua'a* resources. Generally speaking, *ali'i 'ai ahupua'a* had complete autonomy over the *ahupua'a* they oversaw (Malo 1951). *Ahupua'a* residents were not bound to the land nor were they considered property of the *ali'i*. If the living conditions under a particular *ahupua'a* chief were deemed unsuitable, the residents could move freely in pursuit of more favorable conditions (Lam 1985). This structure safeguarded the well-being of the people and the overall productivity of the land, lest the chief loses the principal support and loyalty of his or her supporters. In turn, *ahupua'a* lands were managed by an appointed *konohiki*, oftentimes a chief of lower rank, who oversaw and coordinated stewardship of an area's natural resources (Lam 1985). In some places, the *po'o lawai'a* (head fisherman) held the same responsibilities as the *konohiki* (Jokiel et al. 2011).

When necessary, the *konohiki* took the liberty of implementing *kapu* (restrictions and prohibitions) to protect the *mana* of an area's resources from environmental and spiritual depletion.

Many *ahupua'a* were divided into smaller land units termed '*ili* and '*ili kūpono* (often shortened to '*ili kū*). '*Ili* were created for the convenience of the *ahupua'a* chief and served as the basic land unit which *hoa'āina* (caretakers of particular lands) often retained for multiple generations (Jokiel et al. 2011; MacKenzie 2015). As '*ili* were typically passed down in families, so too were the *kuleana* (responsibilities, privileges) that were associated with them. The right to use and cultivate '*ili* was maintained within the '*ohana*, regardless of the succession of *ali'i* '*ai ahupua'a* (Handy et al. 1991). Malo (1951) recorded several types of '*ili*, including the '*ili pa'a* (a single intact parcel) and '*ili lele* (a discontinuous parcel dispersed across an area). Whether dispersed or wholly intact, '*ili* required a cross-section of available resources, and for the *hoa'āina*, this generally included access to agriculturally fertile lands and coastal fisheries. '*Ili kūpono* differed from other '*ili* lands because they did not fall under the jurisdiction of the *ahupua'a* chief. Rather, they were specific areas containing resources that were highly valued by the ruling paramount chiefs, such as fishponds (Handy et al. 1991).

Ali'i '*ai ahupua'a*, in turn, answered to an *ali'i* '*ai moku* (chief who claimed the abundance of the entire *moku* or district) (Malo 1951). Hawai'i Island is comprised of six *moku* (districts) that include Kona, Ka'ū, Puna, Hilo, Hāmākua, and Kohala. Although a *moku* comprises multiple *ahupua'a*, *moku* were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). While the *ahupua'a* was the most common and fundamental land division unit within the traditional Hawaiian land management structure, variances occurred, such as the existence of the *kalana*. By definition, a *kalana* is a division of land that is smaller than a *moku*. *Kalana* was sometimes used interchangeably with the term '*okana* (Lucas 1995; Pukui and Elbert 1986), but Kamakau (Kamakau 1976) equates a *kalana* to a *moku* and states that '*okana* is merely a subdistrict. Despite these contending and sometimes conflicting definitions, what is clear is that *kalana* consisted of several *ahupua'a* and '*ili* '*āina*.

This form of district subdividing was integral to Hawaiian life and the product of advanced natural resource management systems. As populations resided in an area over centuries, direct teaching and extensive observations of an area's natural cycles and resources were retained, well-understood, and passed down orally over the generations. This knowledge informed management decisions that aimed to sustainably adapt subsistence practices to meet the needs of growing populations. The *ahupua'a* system and the highly complex land management system that developed in the islands are but one example of the unique Hawaiian culture that developed in these islands.

Intensification and Development of Hawaiian Land Stewardship Practices

Hawaiian philosophies of life in relation to the environment helped to maintain both natural, spiritual, and social order. In describing the intimate relationship that exists between Hawaiians and '*āina* (land), Kepā Maly writes:

In the Hawaiian context, these values—the “sense of place”—have developed over hundreds of generations of evolving “cultural attachment” to the natural, physical, and spiritual environments. In any culturally sensitive discussion on land use in Hawai'i, one must understand that Hawaiian culture evolved in close partnership with its' natural environment. Thus, Hawaiian culture does not have a clear dividing line of where culture and nature begins.

In a traditional Hawaiian context, nature and culture are one in the same, there is no division between the two. The wealth and limitations of the land and ocean resources gave birth to, and shaped the Hawaiian world view. The '*āina* (land), *wai* (water), *kai* (ocean), and *lewa* (sky) were the foundation of life and the source of the spiritual relationship between people and their environs. (Maly 2001)

The '*ōlelo no'eau* (proverbial saying) “*hānau ka 'āina, hānau ke ali'i, hānau ke kanaka*” (born was the land, born were the chiefs, born were the commoners), conveys the belief that all things of the land, including *kanaka* (humans), are connected through kinship links that extend beyond the immediate family (Pukui 1983:57). '*Āina* or land, was perhaps most revered, as noted in the '*ōlelo no'eau* “*he ali'i ka 'āina; he kauwā ke kanaka*,” which Pukui (Pukui 1983:62) translated as “[t]he land is a chief; man is its servant.” The lifeways of early Hawaiians, which were dependent entirely from the finite natural resources of these islands, necessitated the development of sustainable resource management practices. Over time, what developed was an ecologically responsive management system that integrated the care of watersheds, natural freshwater systems, and nearshore fisheries (Jokiel et al. 2011).

Disciplined and astute observation of the natural world became one of the most fundamental stewardship tools used by the ancient Hawaiians. The vast knowledge acquired through direct observation enabled them to detect and record the subtlest of changes, distinctions, and correlations in the natural world. Examples of their keen observations are evident in the development of Hawaiian nomenclature to describe various rains, clouds, winds, stones, environments, flora, and fauna. Many of these names are geographically unique or island-specific, and have been

recorded in *oli* (chants), *mele* (songs), *pule* (prayers), *inoa* 'āina (place names), and 'ōlelo no 'eau (proverbial sayings). Other Hawaiian arts and practices such as *hula* (traditional dance), *lapa'au* (traditional healing), *lawai'a* (fishing), *mahi'ai* (farming) further aided in the practice of knowing the rhythms and cycles of the natural world.

Comprehensive systems of observing and stewarding the land were coupled by the strict adherence to practices that maintained and enhanced the *kapu* and *mana* of all things in the Hawaiian world. In Hawaiian belief, all things natural, places, and even people, especially those of high rank, possessed *mana* or “divine power” (Pukui and Elbert 1986:235; Pukui et al. 1972). *Mana* was believed to be derived from the plethora of Hawaiian gods (*kini akua*) who were embodied in elemental forces, land, natural resources, and certain material objects and persons (Crabbe et al. 2017). Buck (1993) expanded on this concept noting that *mana* was associated with “the well-being of a community, in human knowledge and skills (canoe building, harvesting) and in nature (crop fertility, weather etc.)” (c.f. Else 2004:244).

To ensure the *mana* of certain resources, places, and people, *kapu* of various kinds were implemented and strictly enforced to limit over-exploitation and defilement. Elbert and Pukui (1986:132) defined *kapu* as “taboo, prohibitions; special privilege or exemption.” Kepelino noted that *kapu* associated with *akua* (deities) applied to all social classes, while *kapu* associated with *ali'i* were applied to the people (in Beckwith 1932). As *kapu* dictated social relationships, they also provided “environmental rules and controls that were essential for a subsistence economy” (Else 2004:246). The companion to *kapu* was *noa*, translated as “freed of taboo, released from restrictions, profane, freedom” (Pukui and Elbert 1986:268). Some *kapu*, particularly those associated with maintaining social hierarchy and gender differentiation were unremitting, while those *kapu* placed on natural resources were applied and enforced according to seasonal changes. The application of *kapu* to natural resources ensured that such resources remained available for future use. When the *ali'i* or the lesser chiefs (including *konohiki* and *po'o lawai'a*) determined that a particular resource was to be made available to the people, a decree was proclaimed indicating that *kapu* had been lifted, thereby making it *noa*. Although transitioning a resource from a state of *kapu* to *noa* allowed for its use, people were expected to practice sustainable harvesting methods and pay tribute to the paramount chief and the *akua* associated with that resource. *Kapu* were strictly enforced and violators faced serious consequences including death (Jokiel et al. 2011). Violators who escaped execution sought refuge at a *pu'uhonua*, a designated place of refuge or an individual who could pardon the accused (Kamakau 1992). After completing the proper rituals, the violator was absolved of his or her crime and allowed to reintegrate back into society.

In summary, the layering and interweaving of beliefs, land stewardship practices, and the socio-political system forms the basis of the relationship shared between the Hawaiian people and the land. It is through the analysis of these dynamic elements that we develop an understanding of the complexity of place.

CULTURAL SETTING OF KEAULOU AHUPUA'A

The project area extends across the coastal section of Keaulou 1st and 2nd, both of which are *ahupua'a* in the central region of the traditional *moku* of Kona—one of six *moku* that make up Hawai'i Island. Historically, during Hawai'i's conversion to a Euro-American style of fee-simple land ownership in 1848, many of Kona's larger *ahupua'a* were subdivided into two or more independent *ahupua'a*. However, for Keaulou, Kamakau (1992) implies that its division into two *ahupua'a* had been recognized since at least 1782. The *moku* of Kona extends from the coast across the volcanically active mountain of Hualālai and continues to Moku'āweoweo, the summit caldera of Mauna Loa (Juvik and Juvik 1998). Due to its sheer size, Kona has been geographically divided into two subdistricts, Kona 'Ākau (North Kona) and Kona Hema (South Kona). Kona 'Ākau (where the project area is located), has been geographically defined as the area extending from Keahualono, an alter located at the north in Waikōloa to Pu'uohau, a large *pu'u* (hill) in Kanaeue Ahupua'a that marks the southern boundary (Pukui 1983; Soehren 2004). The *moku* of Kona contains over 100 *ahupua'a*, and approximately forty-four of these are within the fertile central region of Kona, including Keaulou 1st and 2nd. While many of the *ahupua'a* that make up the central Kona region are fairly narrow and do not extend to the mountain summits, Keaulou stands in stark contrast. It extends well into the district's interior mountainous and subalpine regions where it joins with the districts of Hāmākua, Hilo, and Ka'ū (Handy et al. 1991; Figure 17). Containing well over 100,000 acres, Keaulou 2nd is the largest *ahupua'a* in all of Kona (Cordy 1995). Keaulou, whose literal translation is “the new era or the new current” was one of several chiefly centers located along the Kona coast, thus it has a rich and well-recorded history (Pukui et al. 1974:104). Historical records often describe a close relationship between Keaulou and Kahalu'u, the lands laying to the north. Keaulou Bay was a choice settlement location and as Handy et al. (1991:287) point out, such areas typically contained a “cluster of houses where the families of fishermen lived.” Its *'ili ili* (pebble) shoreline was also a famed feature of the bay. As such the famed saying “*ka iliili nehe o Keaulou*” or “*nehe iliili o Keaulou*” translated roughly as the rustling pebbles of Keaulou was used as a term of endearment to refer to Keaulou's youth (Kahoiwai 1888; Kalawaiaopuna 1888).

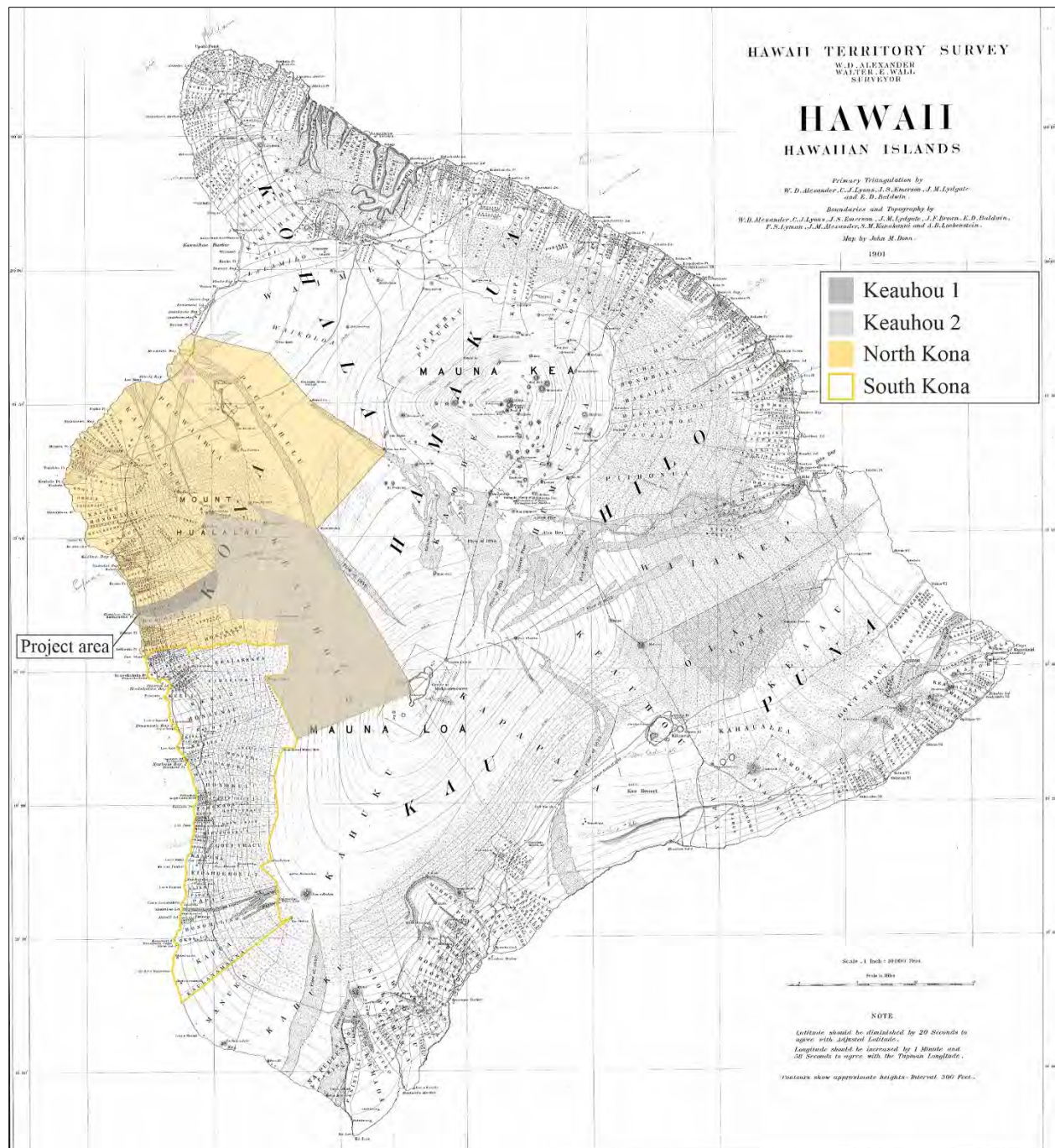


Figure 17. Hawai'i Registered Map No. 2060 by J. M. Donn (1901) showing project area in Keauhou Ahupua'a, North Kona District.

TRADITIONAL MO'OLELO FEATURING KEAUHOU

Traditional Hawaiian *mo'olelo* are key entry points to understanding the history and ideologies that have been attached to a specific place. The term *mo'olelo*, which means “succession of talk,” has many meanings, including story, tale, myth, history, tradition, literature, and legend (Pukui and Elbert 1986:254). For this study, the term *mo'olelo* is used in reference to Hawaiian narratives that are mythological or legendary in nature. In some cases, *mo'olelo* can be expansive, detailed, and are sometimes interconnected to other *mo'olelo* though certain characters or events. A review of *mo'olelo* that feature Keauhou is important because *mo'olelo* aid in tracking important social change and are nuanced with *'ike kūpuna* (ancestral knowledge) and perspectives that remain relevant to a living

culture (Kikiloi 2012). Prior to these *mo'olelo* being inscribed in textual form, which began in the early 19th century following the arrival of missionaries, such knowledge was passed down orally from one generation to the next. Keauhou is featured in multiple *mo'olelo* however, in some instances the name is mentioned in passing with little to no details about the area. For example, the name Keauhou appears in the legend of Kepaka'ili'ula recorded by (Fornander 1916-1917), in which Keauhou is the name of the wife of Kahalu'u (also the name of the *ahupua'a* situated to the north of Keauhou 1st). Similarly, in *Mo'olelo Ho'onaue Pu'uwai no Kuaiali'i* Keauhou is the name of a young female noted for her exceptional skills in surfing (Rula 1910). In writing about a great flood known as Kai-a-ka-hinalii Malo (1903) notes that there are two version of this story, one of which tells of a woman who lived in the sea at a placed called Lalohana. Regarding the location of Lalohana, Malo (1903:307) states:

There are two version of this story given by the ancients. One tradition has it that the place where the woman lived was on a reef, named *Mauna*, situated in the ocean outside of Keauhou, in Kona, and that Lono was the name of the king who reigned over the land at that time.

Malo (1903) explains that the other version states that Lalohana was in the ocean outside of Waiākea, Hilo and that Konikonika was the king at that time. Many of the accounts that feature Keauhou have been recorded by Abraham Fornander and included in his series *Fornander's Collection of Hawaiian Antiquities and Folk-lore*. The *mo'olelo* recorded by Fornander and other authors have been summarized below.

Ka'ao Ho'oniua Pu'uwai No Ka-Miki

In the legendary account titled *Ka'ao Ho'oniua Pu'uwai no Ka-Miki* as reported by Maly and Maly (2004a), the lands of Keauhou are briefly mentioned including its bay, its chief, and its '*ōhi'a* (*metrosideros polymorpha*) grove named Moku'aikaua. The legend, which is believed to have been set sometime in the 1300s, tells of the journey of two brothers, Maka'iole and Ka-Miki who challenge local '*ōlohe* (skilled fighters), priests, and chiefs. In a portion of the story, the brothers arrive at the *kahua* (contest arena) at Hōlualoa where they meet with Kahalu'u-kai-ākea, the chief of Kahalu'u and the "priest Keahiolo, for whom the *heiau* near the Kahalu'u-Keauhou 1st boundary, is named" (Maly and Maly 2004:18). After defeating Palau'eka in Hōlualoa, Ka-Miki and Maka'iole left for the compound of Kahiolo near the Kahalu'u-Keauhou 1st boundary. According to this story, Kahiolo was a high priest who secured and maintained peace on the land. He also served under the chief, Pōhaku-nui-o-Kāne, who ruled over the lands laying between Keauhou and Mā'ihī. That portion of the account telling of the battle between the two brother and Kahiolo reads thusly:

This powerful priest [Kahiolo] was jealous of the abilities of Ka-Miki and Maka'iole, and he sought to kill them. Keahiolo called the brothers to share '*awa* with him, at the same time he picked up his *pīkoi* (tripping club) which he had hidden in a mat, and prepared to attack them. (Maly and Maly 2004a:18)

Ka-Miki knew the nature of Keahiolo, and Ka-Miki used the '*olohū* (and '*ulu maika* tripping stone) called Ka'akuamā'ihī to strike at the feet of Keahiolo, and thus defeated the '*ōlohe* priest. Keahiolo apologized for his deception, but Ka-Miki told him there was no value in his repentance, as it was made in fear of his death. Ka-Miki told Keahiolo, "your god has departed from you and taken our side. And so you have seen that *Uli* is a two – fold deity, looking for that which is right, and that which is wrong; as it is said in a prayer."

"Because you have leapt first, your transgressed against your god and your god has left you. You have set aside the unwavering laws of the powerful gods and '*aumākua* which came down from ancient times, from antiquity of *Waiololī* and *Waiololā*. And so *Nana-i-ke-kihi-o-Kamalama* and *Kahuelo-i-ke-kihi-o-Kā'elo*, the descendants of *Ka-uluhe-nui-hihi-kolo-i-uka* and *Lani-nui-ku'i-a-maomao-loa* have come before you." (Maly and Maly 2004a:19)

Maka'iole pleaded with his brother to have compassion and spare Keahiolo from death. Ka-miki obliged and Keahiolo proceeded to prepare '*awa* and a feast. Keahiolo then took the brothers to Kahō'e'e, a *kahua* in Keauhou 2nd. This field was sometimes known as Ka'awale "because of the manner by which competitors and spectators were separated" (Maly and Maly 2004:19). Keahiolo took the brothers to the contest official and introduced them as his *mo'opuna* (grandchildren), which allowed them to enter the competition. It is here at Kahō'e'e that Ka-Miki challenged Haumanomano and 'Ōhi'amukumuku.

The chiefs of Keauhou offered a *lei-o-manō* (sharks tooth knife) as the vistory's trophy. The *lei-o-manō* was made by lashing sharks teeth to the wooden handle with *olonā* (*Touchardia latifolia*) cordage, and was one of the foremost and most highly coveted weapons of ancient times. *Haumanomano* thought he would win easily, and leapt onto the *kahua*, grabbing Ka-Miki. Ka-Miki

promptly threw Haumanomano out of the *kahua*. This occurred ten times, and all the local competitors were angry that Haumanomano had been so easily defeated by this stranger whom Keahiolo called his grandson.

The officials then called Kuhia, the chiefs' runner to take the *lei-o-manō* to Ka-Miki as his prize for victory over Haumanomano, and 'Ōhi'amukumuku was called as the next contestant. (Maly and Maly 2004a:19)

'Ōhi'amukumuku was an *'ōlohe* for the chief Pōhaku-nui-o-Kāne, and a *heiau* in the neighboring land of Kahalu'u was named for this *'ōlohe*. Angered by Ka-miki's victory over Haumanomano, 'Ōhi'amukumuku sought to return the prized *lei-o-manō* to the local competitors. A contest between Ka-Miki and 'Ōhi'amukumuku was arranged and the chiefs offered Lawalawa-ku'i-a-ho'i, the name of a *pīkoi* as the prize. The contest commenced and 'Ōhi'amukumuku was thrown, some five times from the arena, thus Ka-Miki triumphed over his competitor. The two defeated *'ōlohe* were angered and humiliated and agreed to kill both Ka-Miki and Maka-'iole.

Another contest was arranged, only this time, there was no prize and victory could only be had by death of the opponent. Ka-Miki and Haumanomano took to the arena. Swinging his war club Haumanomano called out to Ka-Miki, who was without his war club. Ka-Miki called to his brother to fetch his war club and in a flash, Maka-'iole returned with his brothers magical war club. Using his skill, Ka-Miki delivered a hard blow and Haumanomano was thrown out of the arena. 'Ōhi'amukumuku quickly jumped into the arena and challenged Ka-Miki in a spear fighting contest. Again, Ka-Miki struck 'Ōhi'amukumuku on his thigh with his spear and tossed him from the arena. The contest officials called for a break and the crowd surged forward to see the champion, Ka-Miki.

Ka-Miki and his crew quickly departed Keauhou and headed for the *hālau ali'i* (royal compound) in Hōnalo. Concerning other features that were within Keauhou, the story identifies La'a-hiwa-mai-Kahiki, the name of a taro plantation between Keauhou and Kaināliu. In addition to taro, this plantation contained *'awa* and many other plants.

Ka'ao No Kalaepuni and Kalaehina

In the account titled, *Ka'ao no Kalaepuni a me Kalaehina* (Legend of Kalaepuni and Kalaehina) recorded by Abraham Fornander (1918-1919), Keauhou is described as the place where Kalaepuni stationed himself while his younger brother Kalaehina brought over canoes from Kapu'a in South Kona. In this account, the two brothers were born during the reign of Keawenui-a-'Umi and during their lifetime, sought to kill the island's chiefs to become the paramount ruler of the island. As the story says, Kalaepuni killed off many of the island's chiefs but spared Keawenui-a-'Umi because of his old age. During Kalaepuni's rampage, it is said that Keawenui-a-'Umi in an attempt to evade certain death, took refuge at Ahu A 'Umi, a *heiau* located in the uplands of Keauhou 2nd that was constructed by 'Umi, the father of Keawenui-a-'Umi. The location of Ahu A 'Umi relative to the current project area is shown in Hawai'i Registered Map No. 1264 prepared by J. M. Alexander in 1885 (Figure 18).

The Legend of Namakaokapaoo

In Fornander's (1918-1919) version of the *Legend of Namakaokapaoo*, Keauhou, particularly its boundary, is noted as the place where the fierce and young Namakaokapaoo of Hō'ae'ae, 'Ewa, O'ahu, was set to challenge some boys from Keauhou in a competition of *ke'a pua* (bow and arrow). After killing several of O'ahu's district chiefs and placing his mother as ruler of that island, Namakaokapaoo sought to subjugate the chiefs of Hawai'i Island.

Departing from Hanauma Bay, as a stowaway on a canoe owned by the king of Hawai'i Island, Namakaokapaoo made his way to Keauhou, Kona where Namakaokalani, the king of Hawai'i had stopped. Namakaokapaoo escaped from the canoe unseen by the king's men and eventually came upon a group of boys engaged in *ke'a pua*. Namakaokapaoo observed the boys and their bow and arrows and began hurling insults at them. Angered by Namakaokapaoo's slights and audacity, the boys decided to challenge the young lad of O'ahu in a shooting competition. A wager was made, and the boys began to walk to the boundary of Keauhou. While en route, Namakaokapaoo was met by Namakaokaia, the son of Hawai'i Island's ruling chief. Excited by his presence, Namakaokaia praised Namakaokapaoo for his deeds on O'ahu by uttering a chant. Instead of competing against the boys in *ke'a pua*, Namakaokapaoo befriended Namakaokaia and his father and together they sought to challenge their main rival, Kū who ruled over Puna and Ka'ū. After a few days, the three traveled to Kawaihae where Kū was staying and in a sudden and swift attack, Namakaokapaoo entered Kū's home, grasped his head and snapped his neck, instantly killing the chief. After placing the father and son back into power, Namakaokapaoo returned home to O'ahu.

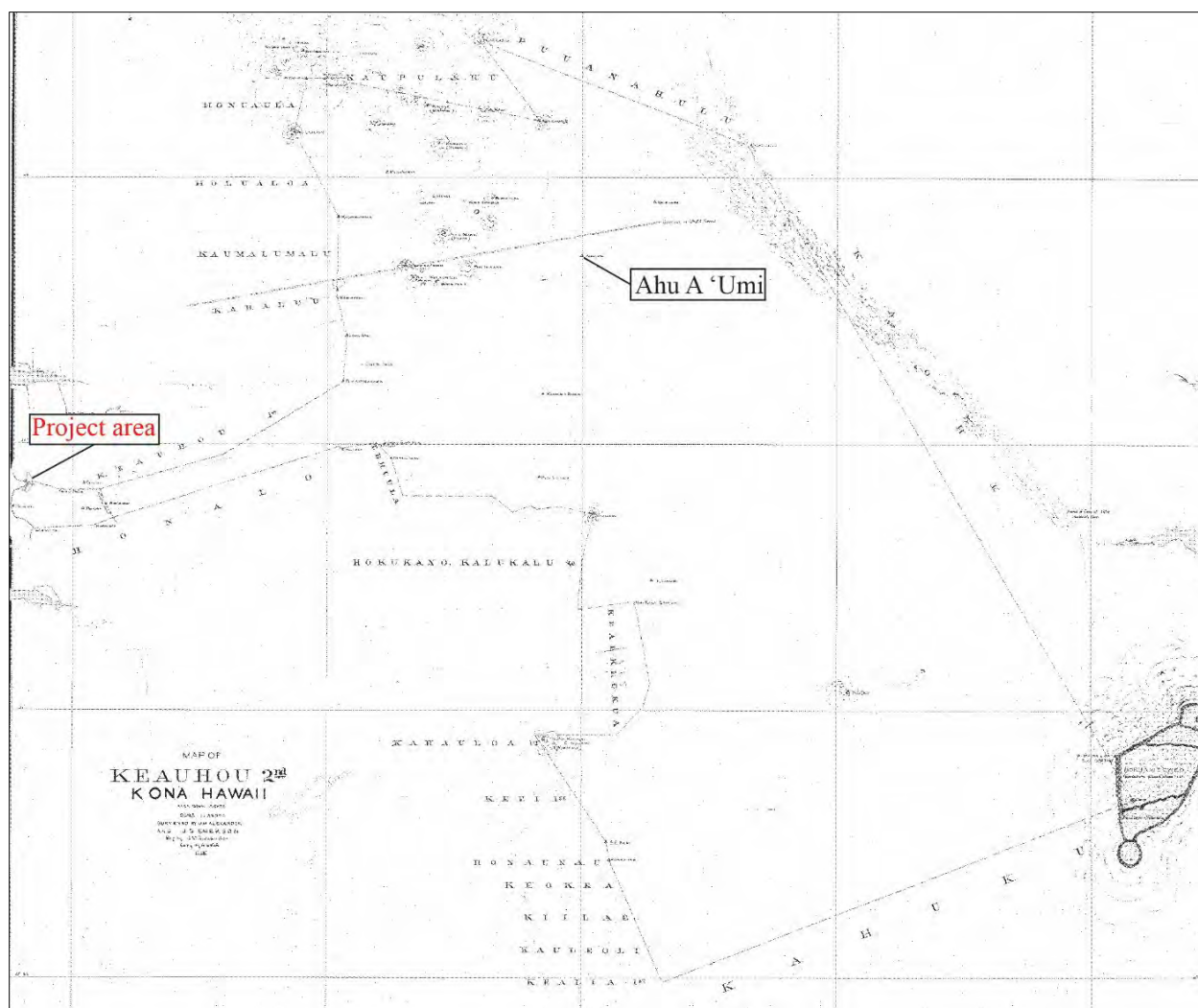


Figure 18. Hawai'i Registered Map No. 1264 by J. M. Alexander in 1885 showing project area relative to Ahu A 'Umi.

The Legend of Nihooleki

In Volume IV of Fornander's (1916-1917) *Collection of Hawaiian Antiquities and Folklore*, Keauhou is featured as the birthplace of Nihooleki, a great *aku* (bonito) fisherman and chief who traveled throughout the Hawaiian Islands. This great fisherman was known by two names, Nihooleki, which was the name of his spirit body and Keahaikiaholeha, the name that he assumed during his lifetime. After his birth, Keahaikiaholeha moved to Kuukuuu [Pu'u Ku'ua] in Pu'ukapolei in Wai'anae where he became the most renowned fisherman who knew all the fish and fishing grounds in this district. Keahaikiaholeha then moved to Waimea, Kaua'i, where he met his wife, and the pair became the chief and chiefess of Kaua'i. As part of his daily practice, Nihooleki loaded his double-hauled canoe and using Pahuhu, his great mother-of-pearl fishhook, took to the ocean depth and let down his hook until his canoe was filled with *aku*.

After his death, Keahaikiaholeha's body was brought back to Kuukuuu, Waianae where it was placed in a tomb. As custom dictated, his parents proceeded to worship his spirit which caused it to grow so strong that it was able to take the form of a living person. In his spirit form, Nihooleki returned to Kaua'i to be with his wife, however, his behavior became of great concern for he slept day and night, unable to attend to his favorite pastime and leaving his wife with no food. His wife would travel to her brothers' home to ask for some fish. Although the brothers willingly gave their sister a portion of fish, they inquired:

“Where is your husband?” The sister replied: “He is at home asleep.” “You have a queer husband. All he does is sleep at home. How is he to satisfy his wife’s hunger? Except we help you, you will not be able to live.” (Fornander 1916-1917:490)

As the conversation unfolded, Nihooleki in his spirit form overhead everything and when his wife returned home, he asked her to check if her brothers had his beloved mother-of-pearl fishhook. After several unsuccessful trips to secure her husband’s fishhook, Nihooleki told her to check near the gable end of the brother’s house where the small black *noio* bird perches. The wife returned to her brother’s house and found Pahuu, the beloved mother-of-pearl fishhook next to the black *noio*, which was the supernatural bird sister of Nihooleki. Having returned home with her husband’s prized fishhook, Nihooleki became invigorated and asked his wife to track down his large double-hauled canoe from her brothers. Having secured his fishhook and canoe, he asked his wife to secure twenty paddlers from her brothers, to which they provided. The canoe was made ready and the following morning the paddlers rose before the first crow of the chicken only to find Nihooleki missing. The paddlers waited, however, Nihooleki was at home asleep. His wife called out to awaken him from his sleep and Nihooleki gathered his belongings and made his way down to the beach. The paddlers arrived and they took to the ocean on an extended fishing trip. They fished the waters off Kaua’i with his brothers-in-law sailing alongside. When his brothers-in-law saw his well-formed body, they called him Puipuiakalawaia, making this his third name. They arrived on O’ahu then sailed for Lāna’i and back to Nihooleki’s birthland, Keauhou, Kona. While adrift off the coast at Keauhou, Nihooleki told the twenty paddlers:

“You may all go ashore here while I remain with our canoe. When you go ashore, take each of you one *aku* piece. There are twenty of you, making twenty *aku*. When you get to that shed of coconut leaves in front of that house, where women are seated, throw down the fish, but don’t look back.”

The paddlers headed the instructions of Nihooleki and returned to the double-hauled canoe where they made sail for Kaua’i to continue fishing. So productive was their fishing trip that the weight of their catch had nearly submerged the hulls of the canoe and the men only had standing room. When they returned ashore to Waimea, Nihooleki took up two *aku* and offered them to the male and female spirits. Extended fishing trips were undertaken for many days and the catch was distributed to everyone on Kaua’i. Word of Nihooleki’s great fishing expeditions quickly spread and had reached Kamapua’a, one of Nihooleki’s dear friends. Kamapua’a arrived at the home of Nihooleki and his wife and the two friends made plans to leave for Kuukuu on O’ahu. When the two men were preparing to leave Waimea, Nihooleki turned to his now pregnant wife and told her, “When you give birth to the child within you, call him by my name Keahaikiaholeha” (Fornander 1916-1917:496). As tears fell from his wife’s face, Nihooleki turned to her and said, “Here are the token by which I shall know him [the child] should he search for me, my club and my feather cape (Fornander 1916-1917:496). Kamapua’a and Nihooleki dove into the sea until they came up at the coast of Kuukuu in Wai’anae and drew near the home of his parents and sister and near the tomb where his body was laid. Nihooleki made one last request to Kamapua’a to secure his war helmet, feathered cape, a *lei palaoa* (whale tooth pendant), and a *kahili* (feathered standard). Nihooleki also requested that Kamapua’a take his sister and his wife. Kamapua’a complied with the request and Nihooleki entered his tomb and disappeared.

KEAUHOU, HE HĀLAU ALI’I

As an important *hālau ali’i* (royal compound), Keauhou’s history is deeply entwined with generations of Hawaiian royalty. Keauhou was not merely a place where various Hawaiian royalty established their residence but became a preferred locale for *ali’i wahine* (chiefess) to birth and raise their royal offspring. Because of this, the *‘ōlelo no‘eau* (poetical expression) “*Keauhou i ka ‘ihi kapu*” (Keauhou, where strict *kapu* were observed) recognizes that with the presence of Hawaiian *ali’i* came the need to observe the many *kapu* that maintained their sanctity (Pukui 1983:181). Pukui (1983:181) expounds on the meaning stating that “[t]his was the place where many of the highest chiefs resided and where Kamehameha III was born.” In an article written by historian Theodore Kelsey and Maui-born native cartographer, Henry Kekahuna, and published in the March 20, 1954, edition of the *Hawaii Tribune-Herald*, they share another saying, *‘Ena‘ena ke kapu o Keauhou*, which can be translated as the *kapu* of Keauhou burns red-hot (Kekahuna and Kelsey 1954b:4).

‘Umi and Lonoikamakahiki in Keauhou

As demonstrated in the legendary accounts presented above and by association with certain figures mentioned in these accounts, Keauhou’s history can be traced to a time when Hawaiian *akua* roamed and populated the islands. Furthermore, we know from the legendary accounts that Keauhou was significant to both Hawai’i Island *ali’i* as well as those from the outer-island chiefdoms. Another early reference to Keauhou can be traced to the *ali’i* ‘Umi-a-Līloa (‘Umi), who briefly united the various districts of Hawai’i Island under his rule during the early 1600s (Cordy 2000). Like many rulers before and after his reign, ‘Umi constructed, expanded, and rededicated many *heiau* during his rule

(Cordy 2000; Kalākau 1972). We know from Kamakau (1992:19) that after ‘Umi consolidated his kingdom, he “desired to dwell in Kona where the climate was warm.” While in Kona, Kamakau (1992:19) adds that “‘Umi did two things with his own hands, farming and fishing...farming was done on all the lands...and that much of this was done in Kona.” Concerning ‘Umi’s association with the lands of Keauhou, Ahu-a-‘Umi (previously mentioned in the Legend of Kalaepuni and Kalaehina), located in upland Keauhou (see Figure 8), is one of the most famous *heiau* constructed by ‘Umi. ‘Umi relocated his court to Ahu-a-‘Umi (sometimes spelled as Ahua-‘Umi), the remains of which can still be found today, far from the coast at an elevation of about 5,200 feet, in the plateau between Hualālai and Mauna Loa (Cordy 2000). This site contains three main parts, a central enclosure, eight *ahu* irregularly spaced around the central structure, and a smaller enclosure. Da Silva and Johnson (1982) report that after consolidation, ‘Umi undertook a census and that the priest who participated in the king’s census was responsible for calibrating and setting the dates of significant ceremonial events.

After ‘Umi’s death, his island kingdom was divided between his two sons, with Keawenui-a-‘Umi ruling over the eastern half of the island including the districts of Hilo, Puna, and a portion of Hāmākua, and Keli‘i-o-Kāloa ruling over the northern half including Kona, Kohala, and a section of Hāmākua. Keawenui-a-‘Umi eventually defeated his brother and seized control of the island (Cordy 2000; Kamakau 1992).

Other *ali‘i* associated with Keauhou include Lonoikamakahiki, whose royal residence was set up in the vicinity of Pueo Cove on the north side of the bay (Kekahuna and Kelsey 1954c). In addition to his residence at Pueo Cove, Lonoikamakahiki also had a massive royal residence (SIHP Site 50-10-37-01576) at a place known as ‘Umihale located at the coast near the Kahalu‘u-Keauhou 1st boundary. Fornander (1916-1917) reported that Lonoikamakahiki, a 17th-century chief, was the grandson of ‘Umi-a-Līloa by way of his son Keawenui-a-‘Umi who courted Kaihalawai. Kamakau (1992) related that Lonoikamakahiki ruled over the districts of Puna and Ka‘ū but while living with his wife, Kaikilani, they left Ka‘ū and settled in Kealakekua, Kona along with other Ka‘ū chiefs. The written history of Lonoikamakahiki describes him as ill-tempered and a chief that did not heed the advice of his priest or counselors (Kamakau 1992). At one point during his reign, the district chiefs of Kona, Kohala, Hilo, and Hāmākua rose in a rebellion against Lonoikamakahiki, however, with the help of the Puna chief, the rebellion was quelled and his authority as *ali‘i nui* of Hawai‘i Island was bolstered (Kamakau 1992). Also during his reign, Kamalālāwalu, a chief of Maui invaded Hawai‘i but he was defeated and sacrificed at either one of two *heiau* (‘Ōhi‘amukumuku and Ke‘ekū) in the neighboring land of Kahalu‘u (Barrera 1971; Kamakau 1992). According to Fornander (1916-1917), Lonoikamakahiki commissioned the construction of several *heiau* in the Kahalu‘u-Keauhou vicinity including Makole‘ā, Kapuanoni, and Keahiolo; the latter of which sits on the boundary of Kahalu‘u and Keauhou 1st (Stokes and Dye 1991).

Keauhou During the Reign of Kalani‘ōpu‘u

Another Ka‘ū chief known to have resided at Keauhou included Kalani‘ōpu‘u, who ruled over Hawai‘i Island in 1754 following the death of Keawe‘ōpala in the battle of Kaiomo and Mokukohekohe which took place between the lands of Ke‘ei and Hōnaunau (Kamakau 1992). Kalani‘ōpu‘u was a fierce chief, who according to Kamakau (1992:79) “...had one great fault; he loved war and display and had no regard for another’s right over land.” During his reign, he led several major war campaigns including one that began in 1759 against the chiefs of East Maui, where he managed to capture the lands of Hāna and Kipahulu. Inter-island warfare with the Maui chiefdom is one of the hallmarks of Kalani‘ōpu‘u reign and as Kamakau (1992:84) reported, between “1775 to 1779 there was continual fighting between Ka-lani-‘ōpu‘u of Hawaii and Ka-hekili [chief of Maui].” When Kalani‘ōpu‘u embarked on his war campaign to invade Maui, he (along with Kamehameha) came to Kahalu‘u periodically for ceremonial purposes. After his defeat in 1775, he retreated to Kona to build *heiau* “for his war god Ka‘ili, ‘Ōhi‘amukumuku at Kahalu‘u and Keikipu‘ipu‘i at Kailua as heiaus against sedition and for vengeance upon the chief of Maui” Kamakau (1992:180).

Kalani‘ōpu‘u’s reign is of particular importance for he was the ruling chief of Hawai‘i Island when contact was made with the first Europeans at Kealakekua Bay on January 17, 1779, thus marking the end of Hawai‘i’s Precontact period and isolation from the Western world (Kamakau 1992). Following the death of Captain James Cook on February 14, 1779, Kalani‘ōpu‘u is said to have “moved to Kainaliu near Honua‘ino and, after some months, to Keauhou where he could surf in the waves of Kahalu‘u and Holualoa, and then to Kailua.” Fornander (1969:200) makes a similar report stating that Kalani‘ōpu‘u “dwelt some time in the Kona district, about Kahalu‘u and Keauhou, diverting himself with *Hula* performances.” Fornander (1969) added that Kalani‘ōpu‘u’s court remained in Kona until a scarcity of food obliged the king to move his court to Kapa‘au, Kohala.

While in Kohala, Kalani‘ōpu‘u proclaimed that his son Kīwala‘ō would be his successor and gave the guardianship of the war god Kūkā‘ilimoku to his nephew, Kamehameha. As custom dictated, it was the duty of the newly appointed *ali‘i* to execute a land division process known as a *kālai‘āina* (lit. to carve the land), thereby dividing

and redistributing the lands of the kingdom to his closest chiefs, priests, and supporters. However, Kamehameha and a few other chiefs including Keōuakū‘ahu‘ula, (son of Kalani‘ōpu‘u and *ali‘i* of Ka‘ū) were concerned about their land claims, which Kīwala‘ō did not seem to honor (Fornander 1996; Kamakau 1992). Keōua approached Kīwala‘ō and inquired about specific lands, one of which included Keauhou:

“Are Ola‘a and Kea‘au ours?” The chief [Kīwala‘ō] answered, “They have been given away; they are not ours.” “How about Waiakea and Ponahawai?” “They have been given away; they are not ours.” “Waipi‘o and Waimea are ours?” “They are not ours; they have been given away.” Pololu and Makapala are ours? “They have been given away; they are not ours.” “The two Napu‘u and the two Honokohau are ours?” “They have been given away; they are not ours.” Kahalu‘u then, and the two Keauhou?” They have been given away; they are not ours.” “Then I am to have nothing in this division?” “You and I are left without land in this division. Our uncle has taken it. Our old lands you will have.” (Kamakau 1992:120)

Keōua returned to Ka‘ū and prepared his army for battle and his army sailed to Kona and made land fall at Ke‘ei and proceeded to cut down coconut trees at Ke‘ei, which symbolically marked the beginning of a war. After four days of skirmishes, the real battle began and Kīwala‘ō was killed in this battle known as Moku‘ōhai in July of 1782 (Kamakau 1992).

Keōpūolani Raised in Keauhou

Keauhou figures prominently in the life story of the distinguished *ali‘i wahine*, Keōpūolani who because of her high rank was known as Kamehameha I’s most sacred wife. Born at Wailuku, Maui in 1780, her father was Kīwala‘ō, the son of Kalani‘ōpu‘u and her mother was chiefess Keku‘iapoiwa Liliha. Although her father and grandfather served as *ali‘i* of Hawai‘i Island, Malo stated that she is generally identified as an *ali‘i* of Maui (Malo in Langlas and Lyon 2008). After her birth she remained on Maui until the age of nine or ten, at which time the battle at ‘Iao Valley on Maui forced her and some of her relatives to escape to Moloka‘i (Kamakau 1992). Kamakau elaborated that it was not until after the death of the chiefess Kalola (wife of Kalani‘ōpu‘u and grandmother to Keōpūolani), that Kamehameha brought the young Keōpūolani to Keauhou to be raised:

After the death of Ka-lola Kamehameha took Ke-opu-o-lani to Hawaii together with the chiefesses, Ke-ku-i-apo-iwa, Ka-lani-kua, and Ka-haku-ha‘akoi, and their households. At Keauhou in North Kona Ke-opu-o-lani was brought up under the name of Wahine-pio until she was a grown girl. With her mother she accompanied Kamehameha on his expedition to make war upon Ka-lani-ku-pule on Oahu, where in 1795 was fought the battle of Nu‘uanu. Here one of the Oahu chiefs gave her the name of Ke-opu-o-lani in place of that of Ka-lani-kau-i-ka-‘alaneo by which she had been previously called. (Kamakau 1992:260)

Kaluaikonahale Kuakini, Ke‘eumoku, and Miriam Kekāuluohi in Keauhou

Kamakau (1992) reported that Kuakini (also known as Kuaikonahale and John Adams Kuakini), who was born in the neighboring land of Kahalu‘u in 1791 and later served as governor of Hawai‘i Island between 1820-1844, was raised in Keauhou by Kamehe‘aiku (female cousin of Ke‘eumoku). At his birth, Kuakini was given the name Kaluaikonahale but when his half-brother Kuakini died, he took on his name and became known as Kaluaikonahale Kuakini. He was also known as John Adams Kuakini to foreigners. Kamakau (1992:388) stated that:

At the birth of the child [Kua-kini] there was a great hula at Kahalu‘u, and the name hula (*hula inoa*) was being danced for the birth of the new son to Na-mahana and Ke‘e-au-moku. Visitors came to bring gifts (*ho‘okupu*), and among them was Ka-mehe-‘ai-ku who had gone away and hidden in the country and slept with a man and given birth to a child. She was a cousin of Ke‘e-au-moku, and when she was discovered among the spectators at the hula Ke‘e-au-moku gave the child to her to suckle and gave with him the land of Keauhou; and Ka-mehe-‘ai-ku took the little chief [Kuakini] to Keauhou and there nourished him until he was grown.

Ke‘eumoku’s ability to hand over the lands of Keauhou to his cousin during the birth of his son, Kaluaikonahale Kuakini, hints at his power and role in the political system of this time. We know that he served as the district chief of Kona and Kohala during the reign of Alapa‘inui (*ali‘i nui* prior to Kalani‘ōpu‘u). He later sided with Kalani‘ōpu‘u during his feud with Alapa‘inui but he eventually revolved against Kalani‘ōpu‘u and fled to Maui where he stayed for some time (Tomonari-Tuggle 1985). Ke‘eumoku, was one of a handful of Kona *ali‘i* who showed unwavering support during Kamehameha I’s rise to power. When Archibald Menzies (1920), the acting surgeon and naturalist on board the *H.M.S. Discovery* landed in Keauhou in 1794, he stated, “we entered a small cove surrounded by a scattered

village belonging to Keeaumoku.” At the request of Ke‘eaumoku, Menzies stopped into Keauhou to visit Ke‘eaumoku’s son who had been injured during a spear-throwing practice and lay fatally ill.

The *ali‘i wahine* Miriam Kekāuluohi was born at Keauhou on July 27, 1794 (Kamakau 1992). Born as the only child to her mother and high chiefess Kalākua Kaheiheimalie of Maui and her father Kala‘imamahu (younger half-brother of Kamehameha I), Kekāuluohi was *lawe hānai* (adopted) by her maternal grandparents Namahana and Ke‘eaumoku “who fondled her as if she were a feather lei made from the precious *mamo* bird” (Kamakau 1992:394). To be raised by one’s grandparents was, according to Kamakau (1992:347) “regarded as a great honor” and that “this made the chiefs beloved.” Kekāuluohi went on to serve as premier of Hawai‘i from 1839-1845 and was a revered chiefess above all the others of her generation, due in part to her genealogical connection to numerous chiefly ancestral lines of Kaua‘i, O‘ahu, and Hawai‘i (Kamakau 1992). In 1809, she married Kamehameha I at ‘Apuakehau in Waikīkī and after his death in 1819, she took Kamehameha’s eldest son and heir of his father’s kingdom, ‘Iolani Liholiho (Kamehameha II) as husband. In a display of friendship, Liholiho gave Kekāuluohi to his *aikāne* (dear friend), Charles Kana‘ina. From their union and at the age of forty-two, Kekāuluohi gave birth to their son, William Charles Lunalilo who went on to serve as Hawai‘i’s sixth reigning monarch between 1873-1874.

David Malo Born in Keauhou

On February 18, 1795, Davida (David) Malo, Hawaiian intellect and historian was born at Keauhou to his mother Heone and father ‘Ao‘ao, who served in Kamehameha’s army (Alexander in Malo 1903). According to Kekahuna and Kelsey (1954c), Malo was born in the vicinity of the old school house. Raised by his grandfather under the traditional religious system, Malo was also a proficient farmer and fisher (Arista 1998). Although both of Malo’s parents were considered *maka‘āinana*, he was introduced to the life of the *ali‘i* when he joined the *aloali‘i* (court) of Kuakini, the brother of Ka‘ahumanu, Kamehameha’s favorite and politically active wife (Arista 1998; Lyon 2020). By 1823, at the invitation of Keōpūolani, Malo moved to Lahaina, Maui and became a pupil of Reverend William Richards at Lahainaluna Seminary (Alexander in Malo 1903). Because of the period in which he was born, his upbringing, and the people he associated with, Malo became a prolific writer, publishing in great detail the traditions and culture of ancient Hawai‘i, with particular attention given to *mo‘okū‘auhau* (genealogies), *mele* (songs), and *hula* (dance) (Arista 1998). Arista (1998:vi) points out that “because of his knowledge of tradition and his own intelligence, Malo became a relied upon counselor of chiefs and served them through the coming of Christianity and the transformation of the kingdom to a constitutional monarch.” Despite his knowledge of the ancient ways, his Christian education greatly influence his writings. Nonetheless, Alexander comments, he is “universally regarded as the great authority and repository of Hawaiian lore” (in Malo 1903:6)

Birth of King Kauikeaouli and Princess Nāhi‘ena‘ena

Perhaps, one of the most famed and well-recorded *ali‘i* births to have occurred at Keauhou is that King Kauikeaouli. Born as the third child of Kamehameha I and his high-ranking wife Keōpūolani, Kauikeaouli served as the third and longest-reigning monarch between 1825 and 1854. While there is no debate concerning Kauikeaouli’s birthplace, his exact birth date has been the subject of much debate amongst Hawaiian historians, which has summarized by Cummins (1973:3) thusly in the National Register of Historic Places Nomination Form for Kamehameha III’s birthsite:

David Malo believed it was in June or July of 1814. Fornander, armed with evidence from other Hawaiian sources, said it was on August 11, 1814. Stephen Reynolds, basing his information on a journal kept by a Captain Jennings who was supposedly with Kamehameha I at the time of Kauikeaouli’s birth, set the date at March 17, 1814. March 17 was the day twice proclaimed as a national holiday in honor of Kamehameha III; first in 1846, then again in 1883. Emme [Emma] Lyons Doyle, saying she had seen unpublished portions of John Young’s journal, quoted Young in the August 24, 1958 Honolulu Advertiser as follow: “Kawaihae, March, 1813. News came by bearer a few days hence of the birth of a child who will be declared kapu as an heir to this kingdom’s throne.”

Historical notes provided by Henry Kekahuna, who drew his information from Kauikeaouli’s *kahu*, Emilia Keaweamahi, gave August 11, 1813, as his actual birthdate, but it was later changed to March 17, 1814. According to *kama‘āina* and long-time members of the Daughter of Hawai‘i, Barbara Nobriga, who was interviewed as part of this study, Kauikeaouli changed his birthdate from August to March 17 to honor his admiration of Saint Patrick of Ireland.

Kamakau (1992:263) recorded the following story describing the events leading up to the birth of the royal child and mentions that Kaluaikonahele (also known as Kuakini) was residing at Keauhou at this time:

While she was carrying the child [Kau-i-ke-aouli] several of the chiefs begged to have the bringing up of the child, but she refused until her *kahu*, Ka-lua-i-konahale, known as Kua-kini, came with the same request. She bade him be at her side when the child was born lest some one else get possession of it. He was living this side of Keauhou in North Kona, and Ke-opu-o-lani lived on the opposite side. On the night of the birth the chiefs gathered about the mother.

In detailing the birth of Kauikeaouli, (Kekahuna and Kelsey 1954b:4) published the following account:

The queen-mother [Keōpūolani] had just bathed in the cold water near the southern extremity of Ke-au-hou's formerly picturesque white sand-beach, and a few steps into the sea, where slowly gushed the now mostly destroyed sea-spring of Ku-hala-lua. There in a shallow seat formed by a hollow in the top of a large rock, the mother had sat as she enjoyed her bath. Suddenly she was seized with her birth-pains. Aided by her attendants (kahus) she struggled to the near-by shore. There, grasping the trunk of a cocoanut-tree to support and sustain her, she gave birth where the commemorative tablet now stands. The place was then located in the northeast corner of the heiau of Ka-leio-papa, now entirely destroyed, by which name the king was later sometimes known.

The still little body, with navel-cord and afterbirth attached, was immediately taken to a flat place on the pahoehoe lava, just north of the one-time pool of Ho'okuku, also in the heiau, where the afterbirth ('iewe) was passed back and forth over a fire to warm it (ua 'olala 'ia i ke ahi). Just in time, through powerful prayers by the high-priest Ka-pihe-nui, and assisting priests, and with the aid of revivifying massage, the wandering spirit of the frail body was snatched back to the life of this world. When returning life's faint rooster-crow was heard ('o'o a moa) wildest joy prevailed. Most heartfelt thanks was offered to the gods. King Ka-mehameha III was spared to Island history!

Kamakau's version of the birth story offers a little more insight into the Kapihe, the prophet/high priest and the chant said to have been used to revive the stillborn:

Early in the morning the child was born but as it appeared to be stillborn Kua-kini did not want to take it. Then came Kai-iki-o-'ewa from some miles away, close to Kuamo'o, and brought with him his prophet who said, "The child will not die, he will live." This man, Ka-malo-'ihi or Ka-pihe by name, came from the Napua line of kahunas descended from Makua-kau-mana whose god was Ka-'onohi-o-ka-la... The child was well cleaned and laid upon a consecrated place and the seer (*kaula*) took a fan (*pe'ahi*), fanned the child, prayed, and sprinkled it with water, at the same time reciting a prayer...

<i>Huila ka lani i ke Akua,</i>	The heavens lighten with the god,
<i>Lapalapa ka honua i ke keiki</i>	The earth burns with the child,
<i>E ke keiki e, hooua i ka punohu lani,</i>	O son, pout down the rain that brings the rainbow,
<i>Aia i ka lani ka Haku e,</i>	There in heaven is the Lord,
<i>O ku'u 'uhane e kahe mau,</i>	Life flows through my spirit,
<i>I la 'a i kou kanawai.</i>	Dedicated to your law.
	(Kamakau 1992:263-264)

Kamakau (1992) explained that after the stillborn was restored to life, Kaikio'ewa took Kauikeaouli to 'O'oma in the Kekaha portion of North Kona where he was raised in the presence of other chiefs. Kauikeaouli spent the first five years of his life at 'O'oma and when his elder brother Liholiho had set sail for England in 1823, he assumed the affairs of the kingdom at the age of nine. Unfortunately, while on his trip Liholiho succumbed to measles and died leaving Kauikeaouli as the heir. However, because of his age, his guardians Ka'ahumanu and Kalanimoku took control of his kingdom until he came of age.

The last of Keōpūolani and Kamehameha's children to be born at Keauhou was their daughter, Nāhi'ena'ena. Born in 1815, there are but few details surrounding her birth. Unlike her brother and as custom dictated, Nāhi'ena'ena was not *hānai* rather she was raised by her biological mother (Sinclair 1976). Her time at Keauhou appears to have been brief as historical writings say that by 1823 she and her mother traveled to Maui where she came under the instruction of Maui missionaries, Charles Stewart and William Richards. (Sinclair 1976)

Accounts of Keauhou as Told by John Papa 'Ī'ī

John Papa 'Ī'ī, who was born on O'ahu in 1800 and raised under the traditional *kapu* system related a short story of Akalele, a famed paddler from Kaua'i who resided for some time in Kamehameha I's court. 'Ī'ī's story does not

describe Keauhou in any great detail, nonetheless he does make mention of the area. As the story is told, while at Kawaihae, Akalele in a single haul canoe accompanied by Kamehameha and his crew in double-haul canoes set sail for Ka'awaloa. The canoes made a stop at Kailua and the area residents brought gifts including sweet potatoes, fowls, and pigs for Kamehameha. The canoes, fully loaded with vegetables and animals, departed Kailua and upon approaching Keauhou and Kahalu'u, Akalele began to challenge the king and his men to a race. The canoes raced down the coast and upon approaching 'Awili in Ka'awaloa, Kamehameha called out to Akalele to turn his canoe into the narrow entrance and Akalele's canoe was the first to reach their destination, making him the winner of the impromptu competition (Ii 1993).

'Ī'i also tells a story of how the *ali'i wahine* Kamāmalu (wife of Kamehameha II) made a trip (ca. 1812) from Ka'ū into Kona where she and a few others stopped at Keauhou. 'Ī'i also related information about the smallpox epidemic that had arrived in Kona which was wreaking havoc on the native population:

They [Kamāmalu and Kaohe] were greeted with the news that smallpox had reached Haleili, about ten *ahupua'a* way from Papa, where death was making havoc. It was said that some people from Oahu had caused the spread of the disease...

Early Monday morning they departed and paused at Keauhou and Kahalu'u for food. They moved on comfortably until they arrived at Kailua the same day. (Ii 1993:171)

Famed Royal Pastimes-Hōlua & He'enalu

As a royal center and as demonstrated in the accounts above, Keauhou was favored by Hawaiian *ali'i* who often engaged in some of the more pleasurable activities of life including *he'enalu* (surfing), *hula*, and *he'e hōlua* (*hōlua* sledding). Detailed accounts describing celebrated surf spots and *hōlua* slides are well documented for Keauhou, in fact, some narratives tell of contest where surfers competed against *hōlua* sledders to see who could reach the coast first. As pleasurable as such activities can be, participating in any contest or sport was also very deliberate as it allowed one to further develop their skills and observe the capabilities of their opponents—skills that were also useful in the battlefield. Concerning the *hōlua* slides in Keauhou, Kamakau (1992:242-243) tells of Kāneaka:

Sledding (*he'e hōlua*) was another favorite sport, carried on sometimes over a cliffside, sometimes on the slope of a hill over a course either laid out on the ground or artificially built up, like that at Kaneaka at Keauhou in North Kona, Hawaii. This was a vigorous sport in which beginners suffered, but those who were accustomed to it guided the board with legs and arms and could keep their balance and breathe lightly as they sped faster than a racehorse or a railroad train. The runners were made of hard wood like the *koai'e*, *uhiuhi*, or *mamani*, about two and a half fathoms long and a half inch thick, tapering upward, and some four inches high. They were set in pairs six inches apart and fastened together neatly and firmly with cord of coconut fiber. In front they turned straight up and then pointed outward like the beak of a duck. The top where the person lays was woven over with fine matwork leaving space between it and the runners. The runners were made slippery with *kukui*-nut oil. The course was covered with stalks of *pili* grass stripped of the blade and laid evenly. Midday was the favorite time for the sport when the heat of the sun made the grass slippery and the sled could then attain terrific speed.

In 1915, Albert Baker published a description of the famed *hōlua* in the *Hawaiian Annual and Almanac*. Baker's commentary reads thusly:

At Keauhou, on a pretty little bay part way between the other bays, is a well-preserved papa holua, a broad, well-built, undulating toboggan-like slide, built before his reign for Kamehameha III to slide down on sleds, with his friends, over the grass-covered slide made slippery with kukui-nut oil. The slide used to pass out behind the chapel on the north arm of the bay. There the prince and his friends would take surf-boards and return by water to the head of the bay. After the prince had started the sport, others might slide as well. Originally the slide was over a mile long, about three-quarters of a mile still being in good condition. It is fifty feet wide for the entire distance, and across one hollow it is raised at ten feet. Kamehameha III was born at Keauhou, and a stone tablet was placed at the site in the summer of 1914, by the Daughters of Hawaii. (Baker 1915:82-83)

The *hōlua* slide in Keauhou was mapped and described by Henry Kekahuna on November 15, 1953 (Figure 19). According to Kekahuna's notes, the top of this *hōlua* side originated at Pu'u O Kaomilā'ō and terminated at He'eia Bay, northwest of the proposed project area. Kekahuna's notes, which are written on his map (see Figure 19) have been transcribed below for readability:

THE FAMOUS ROYAL HOLUA, OR SLIDE, AT KE-AU-HOU, N. KONA, HAWAII

This sketch represents a general view, together with measurements and details of construction of the long slide that extends far upland above the village of Ke-au-hou, over largely lava flowed country, to the top of the hill named Pu'u o Kaomi-la-'o, at a considerable elevation.

The starting-point is a narrow platform paved level, succeeded by a slightly declined crosswise platform 36 ft. long by 29 wide, and is followed by a series of steep descents that give high speed to the holua-sleds.

Great care seems to have been exercised in the building of this huge relic of the ancients. Practically the whole slide is constructed of fairly large 'a'a rocks, filled in with rocks of medium and small-sized 'a'a. The base-walls on the north and south vary in height according to the contour of the land. The width of the runway varies considerably.

In several places the floor of the holua has sunk, leaving depressions of various size, due to the collapse of the pahoe-hoe base because of age and earthquakes.

The length of the slide, measured through the middle from the present lower end, is 3,682 feet. It may have extended about 3,000 ft. farther, as it is said that in ancient days the now missing lower part extended along the point north of Ke-au-hou Bay nearly to the Protestant open chapel by beautiful He'eia Bay. On completion of their slides the chiefs would have their close attendants (kahus) transport them and their surf-boards by canoe to a point about a mile offshore and a little to the north, from where they would ride into He'eia on the great waves of the noted surf of Ka-ulu.

Unfortunately bushes and trees have gained a foothold on the slide, and will cause great damage in a short time unless something is done to properly preserve this historic monument of old Hawaii.

Kekahuna and Kelsey published an expanded version of their notes in the March 21, 1954, edition of the *Hawai'i Tribune-Herald*. Below is that portion of their notes describing the royal *hōlua* and its connection to the famed surf of Ka-ulu:

In the Ke-au-hou of old special attractions were not lacking. Chief among them, wrought by the toil of human hands, was the famed royal holua-slide, most of which still exist, and has long outlived all its merry sliders of the days that are no more. High above the village, from a short distance behind it, over rugged, lava-flowed country it extends, up to the top of the hill of Kaomi-la-'o-Press Down the Sugar-Cane Leaves (la'o lau ko). At its considerable elevation on the upland slope, somewhat below the highway, the air is cool and refreshing. To the north and to the south, set against a glorious background of sea and sky, lies outspread for our delight a fascinating panorama of lowland and shoreline.

Down the great cascading rock-waves, packed smooth with slippery long leaves and grass in days of old, sped chiefs and chiefesses in a thrilling wild ride from upland height to lowland shore. Steep and undulating, yet somewhat reminiscent of a modern highway—how prophetic of the impending, crushing impact of the advent of our own days of hurry and of worry, decreeing death to that carefree life of old!—stretches the holua, constructed of fair-sized stones of 'a'a lava, filled in with those of lesser size, and topped with small 'a'a. In its period of ancient glory, tradition has it, the slide continued beyond its present end, which is approximately 3,682 feet from the starting-point, for say about another 3,000 feet, almost to the brink of the fairly narrow northern pali of Ha'i-kaua Point, where it adjoins beautiful He'eia Bay with its splendid beach, of which sand, perchance, in that long gone time beyond our human ken, but in our own time black and pebbly.

As from the upland to sea, on their narrow, speeding sleds, the royal ones concluded their spectacular feats of skill, their devoted close attendants (kahus) accompanied by their masters down the cliff to the beach below. There the faithful servants loaded the big imposing surf-boards of their respective chiefs and chiefesses on large outrigger-canoes, graceful and swift, and bore them, together with their eager owners, to a point about a mile offshore and a mile to northward, where rolls the far-famed surf of Ka-ulu-Ka Nalu or Ka-ulu. From thence, speeding shoreward on the backs of bounding mighty white-maned chargers of ocean, a second thrilling ride awaited. Flaying with arms, and kicking, they mounted their galloping steeds, leaped to their feet on the saddles of wood, and went flying right back into He'eia Bay!

Races were arranged, at times, between riders of the rock-waved surf of the upland, and the thundering surf of the sea. Whether from upland or from sea, the first to arrive at the goal at He'eia Bay was proclaimed the victor. (Kekahuna and Kelsey 1954c:4)

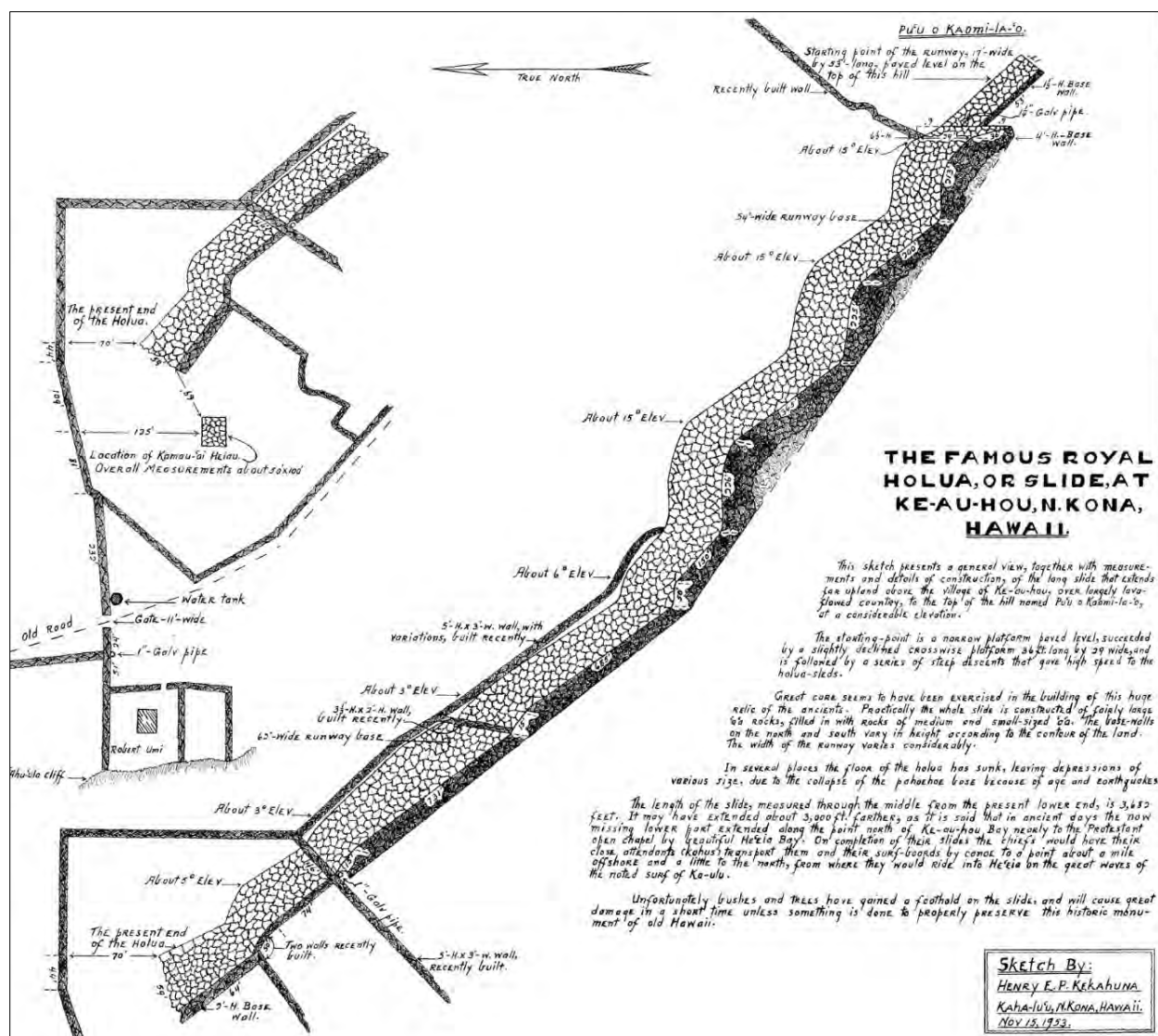


Figure 19. Kekahuna's 1953 map and description of hōlua in Keauhou.

Such a massive structure would have required a substantial labor force and the organizational capacity of a very powerful *ali'i*. Furthermore, the circumstances surrounding Kauikeaouli's birth might have well inspired the construction of this substantial feature (Soehren 1966). Baker also provided the following information in the 1916 Hawaiian Annual:

At Keauhou, on a pretty little bay part way between the other bays, is a well-preserved papa holua, a broad, well-built toboggan-like slide, built before his reign for Kamehameha III to slide down on sleds, with his friends, over the grass-covered slide made slippery with kukui-nui oil. The slide used to pass out behind the chapel on the north arm of the bay. There the prince and his friends would take surf-boards and return by water to the head of the bay. After the prince had started the sport, others might slide as well. Originally, the slide was over a mile long, about three-quarters of a mile still being in good condition. It is fifty feet wide for the entire distance, and across one hollow it is raised ten feet. Kamehameha III was born at Keauhou, and a stone tablet was placed at the site in the summer of 1914, by the Daughters of Hawaii. (Baker in Maly and Maly 2004a:28)

In an article titled 'Hawaiian Surf Riding' published in Thrums's *Hawaiian Almanac and Annual for 1896*, two noted surf sports were documented for the Keauhou area, including Kaulu and Kalapu, which were said to have been "surfs enjoyed by Kauikeaouli...and his sister the princess Nahienaena, whenever they visited" their birthplace. Concerning Ka-ulu, John Papa 'Ī'i (Ii 1993:134) wrote that "the surf of Kaulu in Keauhou is a long one, and similar to the surf of Kamoā" (near Keolonāhihi, Hōlualoa).

TRADITIONAL AGRICULTURAL PRACTICES

Kirch (1985:215) states that “Hawaiians were first and foremost cultivators of the land” and over the generations, they adapted and intensified their agricultural production to levels unseen elsewhere in greater Oceania. Evidence of their adaptive agricultural endeavors is still visible today in the Kona District. Handy and Handy (1991) in referencing an article from the Hawaiian language newspaper *Ka Hōkū O Hawai‘i* provided a general description of the vast and highly productive upland areas extending from Kailua to Keauhou during Kamehameha’s reign:

In the uplands above Kahalu‘u, Keauhou, and Kailua, was a vast plantation named Kuahewa (huge), belonging to Kamehameha I. To protect these lands, which were cultivated for his people in the section, Kamehameha established the law that anyone who took one taro or one stalk of sugar cane must plant one cutting of the same in its place. Weary of war in 1812, Kamehameha went to Kuahewa and himself worked as a farmer. “This land that Kamehameha farmed is in the upland of Kailua, in Kaopua...on Honua‘ula, on the hill called Paoloa and by the spring called Waiakauhi.” (Hoku o Hawaii, May 3, 1927 in Handy et al. 1991:524)

What Handy and Handy (1991:524) described as “Kuahewa” is likely a portion of what has been referred to by archaeologists as the Kona Field System; an agriculturally fertile region that spans multiple *ahupua‘a* across North and South Kona districts (Cordy 1995; Newman 1970; Schilt 1984). This predominately dryland agricultural complex has been understood to be a nearly continuous series of agricultural fields covering approximately 34,350 acres from Kaū Ahupua‘a in the north to Ho‘okena Ahupua‘a in the south (Figure 20), with an altitudinal range of 0-2,500 meters from the coastline to the forested slopes of Hualālai (Cordy 1995; Horrocks and Rechtman 2009). A large portion of the field system has been designated in the Hawai‘i Register of Historic Places as Site 50-10-37-6601 and determined eligible for inclusion on the National Register of Historic Places. Drawing from archaeological evidence, Tomonari-Tuggle (1985) reports that by the 14th century, agricultural fields along with scattered residential areas in Keauhou were being developed about 4,000 feet inland at the lower edge of the hypothesized prime agricultural area and expanded further upland to its maximum limit. The development and expansion of the area’s agricultural pursuits are directly related to political rule and the aggrandizement of resources and labor. Tomonari-Tuggle (1985:22) add that the extent of the field system “was limited only by the barren expanded of aa lava that segregated the Kona slopes into productive and non-productive strips.”

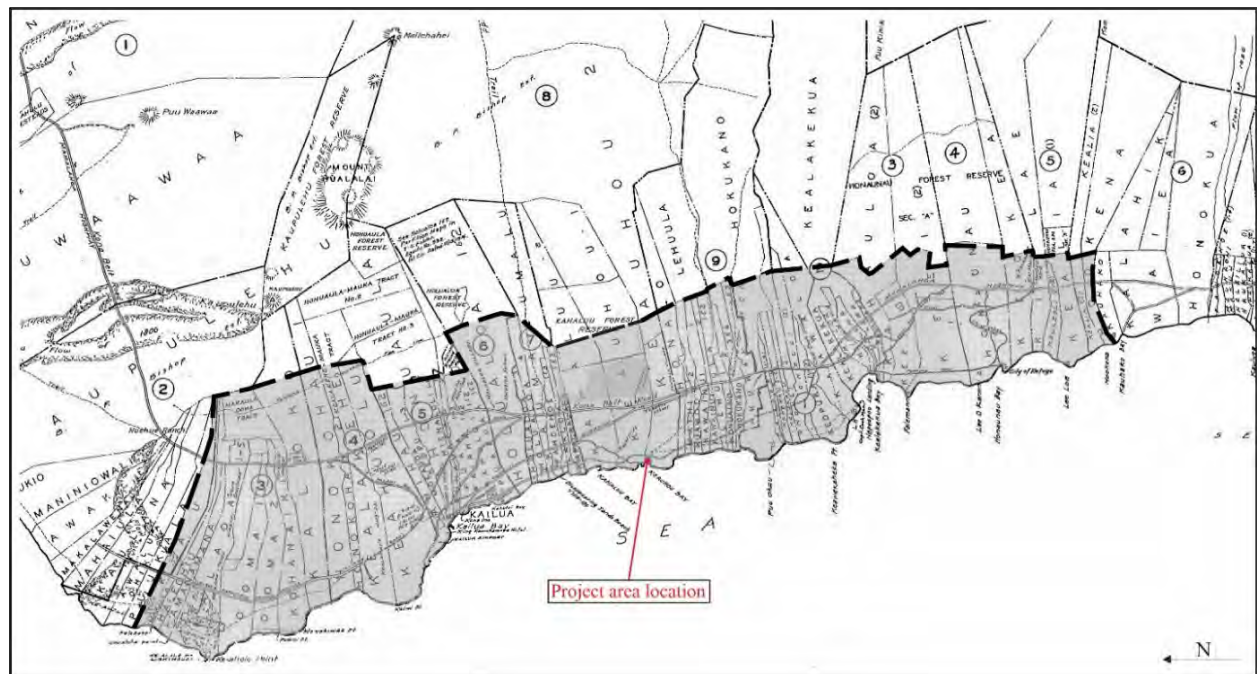


Figure 20. Extent of the Kona Field System (shaded gray) with the location of the project area.

The basic characteristics of this agricultural/residential system as presented in Newman (1970) have been confirmed and elaborated on by ethnohistorical investigations (Kelly 1983) and archaeological research (e.g., (Allen 2001; Burchard 1995; Cordy et al. 1991; Kawachi 1989; Rechtman et al. 2001; Schilt 1984; Soehren and Newman 1968). Some of the defining features of the Kona Field System is the network of long field walls that extend in a

mauka-makai direction. These walls are known by several names, all of which share a similar concept of the skeleton of the land, such as *kuaiwi* or backbone (Allen 2004). Handy and Handy provided the following description of this concept, stating:

Iwi (bone) or iwi kuamo‘o (backbone) was the term applied to the line of rocks and refuse thrown up along the side of mo‘o ‘aina, or kihapai in clearing. These iwi or iwi ‘aina demarked the boundaries of plantations and arable holdings, and hence were also called palena, or bounds. They were not mere rubbish heaps, but for example on Hawaii, served for planting sugar cane round about the field of dry taro in upland Kona, Ka‘u, and Kohala... In upland Kona they may be seen today buried in woods or occasionally bounding taro plantations still utilized. (Handy et al. 1991:51)

Situated between the *kuaiwi* were other traditional Hawaiian features, some of which were used for planting and habitation such as mounds, terraces, modified outcrops, and platforms. In describing the method of planting of sweet potato in rocky places, such as Kona, Fornander (1919-1920:164) states:

Planting in rocky places was called *makaili*. There was very little soil proper, the greater portion [of the field] being gravel, with rocks all around. There were also large holes resembling banana holes. Upon the sprouting of the potato vines gravel and stones are piled up around them, and by the time the hole was covered thick with leaves, the potatoes were large and grooved; they were ridge-formed but not very sweet; they were somewhat tasteless and insipid; not very palatable.

The Kona Field System is generally considered a dryland complex; however, water control features, such as ‘*auwai* and modified waterholes, have been documented in areas where intermittent streams were present (Allen 1984; Kawachi 1989; Rechtman et al. 2003; Schilt 1984).

Historically, the various fields that make up the Kona Field System were thought to be a cohesive unit (Newman 1974), however, recent research and interpretation suggest the field system was more dynamic with distinct agro-ecological zones (Lincoln and Ladefoged 2014). Additionally, the field system is believed to have expanded as the regional population increased and the Hawaiian socio-political system became more centralized (Horrocks and Rechtman 2009; Rechtman et al. 2001). This field system was a major source of food for the Island of Hawai‘i as evidenced by early European explorers and played a central part in Hawai‘i’s Precontact economy. Given the lack of major surface streams in this geologically young district, the Kona Field System relied primarily on rainfall, supplemented with innovative regional horticultural techniques (Lincoln and Ladefoged 2014).

Hawaiians traditionally used four terms to describe the major vegetation zones where crops were planted (Table 2). In addition to the four planting zones, Cordy (1995:5) identified a fifth, non-planting zone, the shoreline which extended “above the high-tide line extending inland 200 meters or so (600 + feet)” where most of the houses were located. These vegetation terms were used to define and segregate space within the *ahupua‘a* and later, to delineate land claim boundaries during the *Māhele*. The zones are bands of vegetation, roughly parallel to the coast, corresponding to changes in elevation, rainfall, and flora. The proposed project area, which extends from the coast and rises roughly 30 meters (100 feet) above sea level places it within the shoreline and *Kula* zone, which according to Cordy (1995) extends from sea level and rises to the 500-foot elevation with an annual average rainfall of 75-125 centimeters. Where environmental factors permitted, this zone would have supported an assortment of native cultigens but was perhaps most distinguished by plantings of ‘*uala* (*Ipomoea batatas*; sweet potato), *wauke* (*Broussonetia papyrifera*; paper mulberry); and *ipu* (gourds). While ‘*uala* was an important staple crop and although *wauke* and *ipu* were not food plants, they were valued for their utilitarian purposes. The fibrous bark of *wauke* was used to produce Hawaiian *kapa* (tapa; bark cloth), while dried *ipu* was fashioned into items like containers and *hula* implements (Abbott 1992). Of the variety of gourds that were cultivated, Keauhou was known specifically for the ‘Io variety, which (Handy et al. 1991:214) describes as a “round, light-colored “bitter-gourd” about one foot in diameter.”

Table 2. Traditional Hawaiian agricultural zones.

<i>Zone</i>	<i>Annual Rainfall (cm)</i>	<i>Elevation (ft.) limits</i>	<i>Primary Crops</i>
<i>Kula</i>	75-125	Sea level-500	‘ <i>Uala</i> , <i>wauke</i> , and <i>ipu</i>
<i>Kalu‘ulu</i>	100-140	500-1,000	‘ <i>Ulu</i> , ‘ <i>uala</i> , and <i>wauke</i>
‘ <i>Āpa‘a</i>	140-200	1,000-2,500	Dry land <i>kalo</i> , ‘ <i>uala</i> , <i>kī</i> , and <i>kō</i>
‘ <i>Ama‘u</i>	>200	2,500-4,000	<i>Mai‘a</i> (both plantain and banana)

Cordy (1995) elaborates that local lava flow patterns had a tremendous impact on the patterning of the agricultural fields. Older, ‘*a‘ā* flows typically have a more substantial soil base while younger *pāhoehoe* flows can have very little soil accumulation. As shown in the geology and soils map for the project area (see Figure 14 and 15) and articulated by Cordy (1995:10):

This effect can be seen in the ahupua'a of Keauhou. Here, four descending flows of different ages are present. At elevations of the apa'a (dryland taro/sweet potato) zone, formal walled fields are present only on the two older flows, evidently where enough soil enables this efforts of stone clearing to be useful...In the other newer flows, informal field ruins are present.

While evidence of irrigation has been discovered, the Kona Field System depended primarily on rainfall. John Papa 'Ī'i (Ii 1993) recorded that Kona was also known for the *kēwai*, a specific land breeze that is mixed with rain. Another named wind synonymous with Keauhou and the neighboring lands include *Hau* which was considered a sacred wind that did not blow beyond the lands of Kainaliu and Keauhou (Pukui 1983). Mary Kawena Pukui also documented several '*ōlelo no 'eau* (Hawaiian proverbs) for Kona that highlight the traditional practice of observing nature for signs of rain.

Aia ka wai i ka maka o ka 'ōpua.

Water is in the face of the 'ōpua clouds.

In Kona, when the 'ōpua clouds appear in the morning, it's a sign that rain is to be expected. (Pukui 1983:9)

Ao 'ōpiopio.

Young cloud.

A cloud that rises from sea level or close to the cloud banks and is as white as steam. When seen in Kona, Hawai'i, this is a sign of rain. (Pukui 1983: 27)

Māmā Kona i ka wai kau mai i ka maka o ka 'ōpua.

Kona is lightened in having water in the face of the clouds.

Kona is relieved, knowing that there will be no drought, when the clouds promise rain. (Pukui 1983:232)

Spirituality in Traditional Agricultural Practices

In addition to observing the natural elements for signs of rain, the ancient Hawaiian horticulturalists also invoked certain deities to encourage rainfall and to promote the abundance and fertility of the land. Kona is synonymous with the *akua* (god, deity) Lono, who was considered the "rain maker" and closely associated with fertility (Handy et al. 1991:333). Lono was often identified with the southern coast of Hawai'i Island, and according to Kalokuokamaile, a native of Kona, temples dedicated to Lono were established throughout Kona to invoke rain and fertility (in Handy et al. 1991). Lono was also embodied in dark rain clouds brought on by the southerly (*kona*) storms. In traditional myths, it is believed that Lono migrated from the south and landed in Kona where he introduced several food plants, such as *kalo* (taro), '*uala* (sweet potato), *uhi* (yams), *kō* (sugar cane), *mai'a* (banana) and '*awa* (kava) (Handy et al. 1991). Thrum (1907), however, offers another tradition specific to Keauhou. Concerning the customs associated with Kamau'ai, a *heiau* ascribed to the *akua* Kāne, Thrum (1907:73) notes that the first vegetables introduced into the islands were brought to this *heiau* and that:

When the canoe with its strange products reached Keauhou some of the people lifted up the vegetables and asked Kupu-a-huluena (a famous kupua who had traveled in foreign lands) their names, he gave them successively, then directed that they be offered upon the altar of Kamauai [Kamau'ai], where upon, after due ceremony, they were distributed and planted out, and have been successfully propagated from that time.

While Lono is attributed with bringing water in the rain clouds, *wai* (freshwater) is considered a *kinolau* (physical manifestation) of the *akua* Kāne, who along with his companion Kanaloa (whose dominion was over the ocean), came to Hawai'i from Kahiki (a land outside of Hawai'i). Legend has it that Kāne and Kanaloa both enjoyed consuming '*awa*, a drink prepared by mixing the crushed root of the '*awa* plant (*Piper methysticum*) with fresh water. In their travels, they stopped at various places around the Hawaiian Islands and opened new freshwater springs from which they prepared their favorite drink (Handy et al. 1991). Kalokuokamaile shared that sometimes in Kona, the farmers built temples that were dedicated to Kāne and to Kū and sometimes they prayed to certain *ki'i pōhaku* (stone images) that were sacred to these gods. It was also not uncommon for farmers to invoke these gods without the use of images or stones (in Handy et al. 1991). The '*ōlelo no 'eau* "*He huawai ola ke kanaka na Kāne*" literally translated as "[m]an is Kāne's living water gourd," highlights the relationship that Hawaiians have to freshwater, and thereby to Kāne (Pukui 1983:68). Handy et al. (1991:64) sheds light on the spiritual relationship that Native Hawaiians have to water:

Fresh water as a life-giver was not to the Hawaiians merely a physical element; it had a spiritual connotation. In prayers of thanks and invocations used in offering fruits of the land, and in prayers

chanted when planting, and in prayers for rain, the “Water of Life of Kane” is referred to over and over again. Kane—the word means “male” and “husband”—was the embodiment of male procreative energy in fresh water, flowing on or under the earth in springs, in streams and rivers, and falling as rain (and also as sunshine), which gives life to plants.

Wai was not only valued for its life-giving properties, but also its purifying properties. The continuous *mauka* to *makai* flow of *wai* provided fresh drinking water, supplied water to irrigated fields, fishponds, recharged ground water supplies, and sustained productive estuaries and fisheries by transporting nutrients from the uplands to the sea (Sproat 2009). In Keauhou Bay, Hitchcock (1909) recorded the practice of diving down in the ocean to collect freshwater from ground springs using calabashes. Because of the high degree of dependency on *wai* to furnish and satisfy life’s needs, *wai* was a public trust resource that was considered inalienable and a resource that belonged to Kāneikawaiola (Handy et al. 1991).

The significance of rituals and ceremonial observances in traditional cultivation practices (and in other facets of life) was of great importance to the well-being of the ancient people. While the tangible elements that remain on the land today point to their planting and clearing areas, these are features of the cultural landscape, and its significance is derived from its tangible and intangible elements both of which are of equal significance.

DESCRIPTIONS OF KEAUHOU DURING THE EARLY HISTORIC PERIOD

In the decades following Western contact, Hawai‘i’s interaction with the western world increased resulting in changes to the culture and the political economy. From the outset, relations between Hawaiians and the newly arrived outsiders were heavily influenced by the latter’s need for supplies to replenish their ships (Major 2001). To accommodate this newly created demand, some of the work of the *maka‘āinana* shifted from subsistence agriculture to the production of food and goods that could be traded with foreign ships (Wilkes 1845). With an aging chief Kalani‘ōpu‘u, Kamehameha I had already set in motion a plan to not only consolidate Hawai‘i Island under his rule but to expand his kingdom through intense inter-island warfare. Kamehameha I maximized his relationship with some of these foreigners, which resulted in him acquiring prized western items like ships and cannons—western imports that reshaped traditional Hawaiian warfare. Foreigners introduced the concept of trade for profit, and by the 1790s, Hawai‘i saw the beginnings of a market system economy (Kent 1983). The sandalwood (*Santalum ellipticum*) trade, established by Euro-Americans in 1790, became a viable commercial enterprise by 1805 (Oliver 1961) and was flourishing by 1810. Kamehameha, who resided on the Island of O‘ahu at this time, did manage to maintain some control over the trade (Kent 1983; Kuykendall and Day 1976). During this period, Kona served as the seat of traditional Hawaiian politics, however, historical records suggest that a large majority of the interactions with foreigners were occurring at places like Kailua or Kealahou, thus there are but few descriptions of Keauhou written by early visitors. As such, it has been hypothesized by Tomonari-Tuggle (1985:24) that during this period, “Keauhou and Kahalu‘u probably remained, in large part, characteristically Hawaiian” and likely served as a retreat for Hawaiian *ali‘i*.

Early Visitors

Acting as surgeon and naturalist on board the *H.M.S. Discovery* captained by George Vancouver, Archibald Menzies in 1794, wrote about his brief trip to Keauhou to visit the fatally injured son of chief Ke‘eaumoku (see page 24) and a foreign seaman residing at Keauhou who was engaged in the manufacturing of charcoal to supply visiting western ships. In describing the location of this seaman’s home, Menzies wrote:

This man chose a delightful situation for his dwelling, which was kept neat and clean, and from which he had a commanding prospect of the village and cove [Keauhou Bay] underneath him, of a large extent of country on both sides and of the boundless ocean before him. We dined with him on roasted pork, roasted fowls and vegetables in a very comfortable manner, as he had taught the native who attend him to cook and serve up his victuals in the English style. After dinner we entertained him with a glass of grog, to which he said he had long been a stranger. This induced us to spare him a little of our stock at parting, when he gave us an earnest commission to send him some more, and likewise some tobacco, as soon as we returned to the vessels. (Menzies 1920:150)

Menzies (1920:149) mentions the presence of an “American schooner, which the natives had captured, belonging to Mr. Medcalf” that was being housed at Keauhou. The schooner in reference is the *Fair American*, an American fur trading vessel that was seized by Kame‘eiamoku (one of Kamehameha I’s closest advisors/uncle). The *Fair American*, captained by Thomas Metcalf arrived in North Kona in 1790 with her six-man crew. The crew members became the victims of a siege disguised as trade gestures, orchestrated by Kame‘eiamoku. Isaac Davis was the only surviving crewman and he later became one of Kamehameha I’s closest foreign advisors. According to Kuykendall (1967),

Kame'eiamoku's act of vengeance was in response to an episode that had occurred just days earlier in which the chief had boarded another American fur trading vessel, the *Eleanora*, captained by Simon Metcalf (father of Thomas Metcalf) for friendly trade. Simon Metcalf's interaction with Kame'eiamoku turned sour and Metcalf proceeded to whip and humiliate the chief. The *Eleanora* left Hawai'i Island for Maui, however, because of the incident, Kame'eiamoku vowed to take his revenge on the next foreign ship to enter his waters; unbeknownst the next ship to arrive in Kame'eiamoku's territory was the ship belonging to Simon Metcalf's son, Thomas (Kuykendall 1967). A cannon (later named "Lopaka") was recovered from the *Fair American* and was kept by Kamehameha as part of his fleet (Kamakau 1992). As a result of the siege by Kame'eiamoku, Kamehameha placed a *kapu* on trading with Americans in order to keep the news of the *Fair American*'s fate from Metcalf, who was prone to violence. The *Eleanora* returned to the Kona coast (after an incident on Maui that led to Metcalf's crew massacring hundreds of native Hawaiians at Olowalu on Maui) and sent crewmember, John Young ashore to trade. Young was held captive on shore and Metcalf's attempts to drum up trade and recover his crewman was futile. Metcalf sailed for China without ever seeing Young or his son, Thomas, or the *Fair American* again (Rogers 1999). By the time Menzies (1920:149) had observed the *Fair American* at Keauhou, it appears to have been damaged as the natives of Keauhou informed him that "she made a great deal of water, which they were obliged to pump out daily, otherwise that she would sink."

Upon returning to Kailua-Kona in 1812, Kamehameha ordered men into the mountains of Kona to cut sandalwood and carry it to the coast, paying them in cloth, *tapa* material, food, and fish (Kamakau 1992). This new burden added to the breakdown of the traditional subsistence system as farmers and fishers were ordered to spend most of their time logging, resulting in food shortages and famine that led to a population decline. Once Kamehameha realized that his people were suffering, he "declared all the sandalwood the property of the government and ordered the people to devote only part of their time to its cutting and return to the cultivation of the land" (Kamakau 1992:204). In the uplands between Kailua and Keauhou, in the plantation named Kuaheha Kamehameha worked as a farmer. While in Kailua, Kamehameha resided at Kamakahonu, from where he continued to rule until his death in May of 1819. He and his high chiefs participated in foreign trade but also continued to enforce the ancient *kapu* system.

Battle of Kuamo'o, End of the 'Aikapu, and the Arrival of Missionaries

When Kamehameha I died on May 8, 1819, the changes that had been affecting Hawaiian culture since the arrival of Captain Cook in the Islands began to rapidly accelerate. Keauhou played a significant role in the events following Kamehameha's death. Upon the death of a prominent chief, it was customary to lift all of the *kapu* that maintained social order and the separation of men from women and elite from commoner. Thus, following the King'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 the ancient *kapu* and restore social order, but at this point in history, traditional customs were altered (Kamakau 1992). 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 by the death of his father. After the purification ceremonies, Liholiho returned to Kamakahonu but did not re-establish the *kapu*:

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 Kaua'i. (Kamakau 1992:225)

Kekuaokalani, caretaker of the war god Kūkā'ilimoku, was dismayed by his cousin's (Liholiho) actions. After several unsuccessful attempts to make peace with Kekuaokalani it was agreed that peace could only be sought through warfare. Liholiho's army led by Kalanimoku and others made ready to march south from Kailua. Kalanimoku "then placed the carriers of food and water and marched his men to Keauhou, where they camped." Kalanimoku sent Kaheana (also known as Moehau) to seek Kekuaokalani in a last-ditch effort to make peace. Kaheana met Kekuaokalani at Lekeleke located south of the project area (Figure 21) where the following conversation transpired:

"Where is Ka-lani-moku?" "Encamped at Keauhou." "I command you to return to Ka-lani-moku and if he attacks to seize him and await my coming." (Kamakau 1992:228)

Kalanimoku's forces fired the first shots and Kekuaokalani's men returned fire resulting in the first injuries to Kalanimoku's army including two chiefs Kaikio'ewa and Hōlualoa. The two armies advanced where they met head-to-head at the battlefield in Kuamo'o, south of the project area. The two sides armed with a mix of western and traditional weaponry fought earnestly. Kekuaokalani's army, standing in favor of restoring and maintaining the ancient *kapu* of the land was defeated in this battle, thus leaving no resistance against Liholiho's move to rule under the laws of 'ainoa (Kamakau 1992). It has been estimated that as many as 300 graves of fallen warriors can be found at the Lekeleke Burial Ground located southwest of the project area along Keauhou 2nd's southern boundary (Tomonari-Tuggle 1985). An account published by Albert Baker in the *Hawaiian Annual and Almanac* recalled the aftermath thusly:

...Keauhou, is the battlefield of Kuamoo, where Kekuaokalani, with the adherents of the old order, met the king's forces who were upholding the renunciation of idolatry and the breaking of tabu, in 1819. This place is full of interest, in that the battle taking place at the edge of the bare lava, the bodies of the slain were buried on the lava with from one to twenty in a grave, and the various huge mounds of stone show today just above the trail as plainly as when first made. The mounds are so irregularly placed that it is almost impossible to count them, but there are probably over a hundred mounds of all sizes, with from 1,500 to 2,000 bodies. A few high mounds may be over the bodies of chiefs or priests. An old man, whose grandfather had told him of the battle, showed us how the battle began by the graves at Keauhou 2, and how the rebels were pushed back across Honalo and Maihi to the last stand at Kuamoo, where Kekuaokalani and Manono, his wife, fell side by side. A few fugitives are said to have escaped by fleeing up a lava tunnel entered by a shore cave just south. (Baker 1915:82)

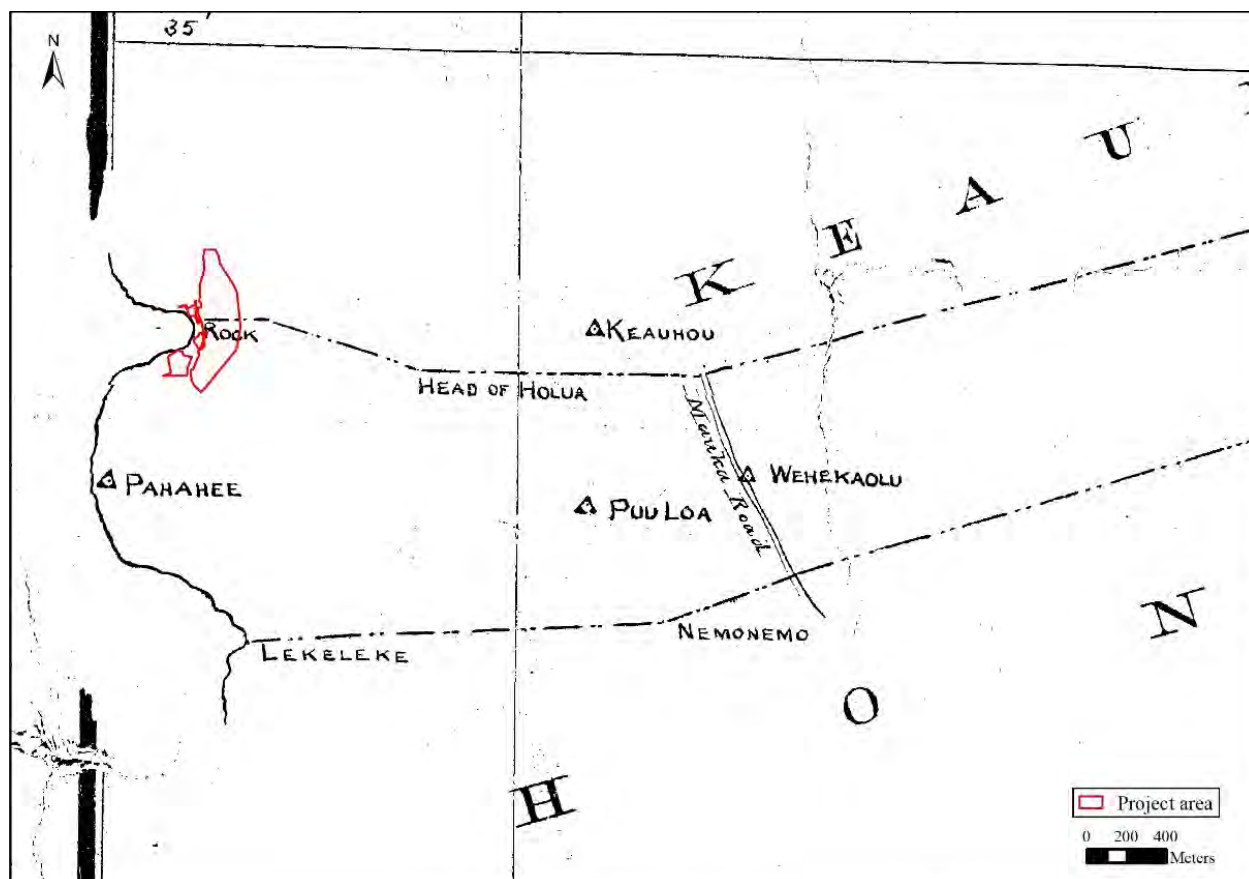


Figure 21. Portion of Hawai'i Registered Map No. 1264 by Alexander showing Lekeleke located to the south of the project area.

Ka'ahumanu, proclaimed herself *Kuhina Nui* (Premier). Not long after Kamehameha's death, Kaluaikonahale John Adams Kuakini was appointed by his sister, Ka'ahumanu, to the position of *Kia'āina* (governor) for the Island of Hawai'i. By December of 1819, Liholiho had sent edicts throughout the kingdom renouncing the ancient state

religion, ordering the destruction of the *heiau* images, and ordering that the *heiau* structures be destroyed or abandoned and left to deteriorate. He did, however, allow the personal family religion, the *'aumakua* worship, to continue (Kamakau 1992; Oliver 1961). With the end of the *kapu* system, changes in the social, spiritual, and economic patterns began to affect the lives of the common people.

By October of 1819, seventeen Protestant missionaries had set sail from Boston en route to Hawai'i. They arrived in Kailua-Kona on March 30, 1820, to a society whose long-standing *kapu* system had just been overturned. Some of the *ali'i*, who were already exposed to western material culture, welcomed the opportunity to become educated in a western-style and adopted 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 (Kuykendall and Day 1976; Oliver 1961). 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 the industry in Hawai'i went from the sandalwood trade to a short-lived whaling industry.

Following the death of Kamehameha, Liholiho shifted the center of government from Kailua to Honolulu. The introduction of several new industries in the Keauhou area resulted in a decline in coastal village settlements. The uplands of Kona saw a boom in the coffee and tobacco industries as well as more diversified agriculture, including the rearing of livestock (e.g., cattle, goats, and pigs). In 1838, Stephen D. Mackintosh (1838:2), a contributor to the newspaper *Sandwich Island Gazette and Journal of Commerce* wrote that Keauhou Bay "which affords a comfortable and safe anchorage, is resorted to by vessel for cargoes of firewood, sandal wood and other commodities of produce." The missionary presence also increased as reverends station in Kailua made periodic trips to the countryside to spread the Christian gospel.

Observations Made by Early Missionaries

In 1823, Ellis, accompanied by Joseph Goodrich and Reverends Asa Thurston and Artemas Bishop, toured the Island of Hawai'i seeking out communities in which to establish church centers and schools for the Calvinist mission. On July 18, 1823, Ellis and his missionary companions started their tour of Hawai'i heading south along the coast of the district of Kona. Of the overall environment of the district of Kona, Ellis opined that:

Kona is the most populous of the six great divisions of Hawai'i, and being situated on the leeward side, would probably have been the most fertile and beautiful part of the island had it not been overflowed by flood of lava... (Ellis 1963:174).

Ellis made the following observations of the countryside on his approach to Keauhou and the vicinity of the current project area:

We passed another large heiau, and travelled about a mile across a rugged bed of lava, which had evidently been ejected from a volcano more recently than the vast tracts of the same substance by which it was surrounded. It also appeared to have been torn to pieces, and tossed up in the most confused manner, by some violent convulsion of the earth, at the time it was in a semifluid state.

There was a kind of path formed across the most level part of it, by large smooth round stones, brought from the sea-shore, and placed about three or four feet apart. By stepping from one to another of these, we passed over the roughest piece of lava we had yet seen; and soon after five p.m. we arrived at Keauhou, a pleasant village containing one hundred and thirty-five houses, and about eight miles from Kairua [Kailua]. Messrs. Bishop and Harwood reached the same place about an hour earlier, and here we proposed to spend the night.

We had not been long in the village, when about one hundred and fifty people collected round the house in which we stopped.

After singing and prayer, Mr. Thurston preached to them. They gave good attention; and though we conversed with them a considerable time after the service was ended, they still thronged our house, and seemed unwilling to disperse. (Ellis 1963:103-104)

Ellis went on to describe the central Kona region as a populated area with extensive cultivation inland compared to the southern reaches of Kona, which supported smaller populations made up mostly of fishermen. According to Ellis, during their walk from Kailua to Keauhou they generated a population estimate based on the following observations:

We counted six hundred and ten houses, and allowed one hundred more for those who live among the plantations on the sides of the hills. Reckoning five persons to each house, which we think not far from a correct calculation, the population of the tract though which we have travelled today will be about 3550 souls (Ellis 1963:104)

In their travels between Kailua and Keauhou, Ellis' group "passed nineteen heiaus, of different dimensions" (Ellis 1963:104). Ellis also noted various smaller temples (likely fishing shrines) along the coast where fishermen made offerings to the gods of the sea. However, no specific mention of a *heiau* or shrine was made pertaining to Keauhou. Ellis (1963:364) did, however, mention Keauhou in his discussion of Hawaiian burial customs, thusly:

... Their artificial graves were either simple pits dug in the earth, or large enclosures. One of the latter, which we saw at Keauhou, was a space surrounded with high stone walls, appearing much like an ancient heiau or temple. We proposed to several natives of the village to accompany us on a visit to it, and give us an outline of its history; but they appeared startled at the thought, said it was a wahi ino, (place evil,) filled with dead bodies, and objected so strongly to our approaching it, that we deemed it inexpedient to make our intended visit.

On November 19, 1825, Reverend Artemas Bishop (1892b:18) described preaching at "Kahaluu, Keauhou, Kainaliu, and to large and attentive audiences, where the smallest number assembled could not be less perhaps than 500." By January of 1826, Bishop returned to Keauhou where he penned the following:

Gov. Adams and all the other chiefs, together with all the men of the place, left here [Kailua] this morning for Keauhou, to cut wood for a new church.

At Keauhou I found all the chiefs and their attendants assembled and waiting for my arrival. Being much exhausted after the last service, I procured a canoe to return. (Bishop 1892a:26)

Missionary Amos Starr Cooke and Chester S. Lyman both made brief visits to Keauhou. Cook's described his one-day visit to Keauhou in his journal entry dated July of 1846. That portion of Cooke's journal entry reads:

Monday 13th after breakfast we made arrangements to go to Keauhou on a double canoe, to see the place where his Hawaiian majesty was born. We stopped two miles short of it, & went that distance on foot through beautiful groves of cocoa nut trees, & on a road evidently made at great expense. After eating cocoa nuts & drinking our fill of their water, upon the stone where stood the house in which Kamehameha III was born we returned to our canoe & cutter where a dinner had been provided at the house of Laanui, whose wife was once a kahu to Kaahumanu. The girls & 4 boys with Capt. Newell & I only went. We returned in 1 ½ hours, & after supper on shore went on board -- & were soon under way for Kawaihae. (Cooke 1842-1846:406-407)

In describing the lands between Kailua and Kealakekua, Lyman wrote the following in September of 1846:

Kailua and the coast between it and Kealakekua, instead of being barren black lava as I had been led to expect, is now looking quite green with vegetation in consequence of the recent rains, from 1 to 3 inches a month having fallen for several months. (Lyman 1846 in Maly and Maly 2004a)

In a subsequent trip made in November of 1846, Lyman penned the following about his brief tour through Keauhou and the lands adjacent:

Rose and breakfasted at 5, and at 6:15 mounted Dr. A. [S. L. Andrews] donkey and started for Kealakekua along. The road for the first half of the way is very good, lying not far from the beach. About three miles from Kailua I passed the pleasant village of Holualoa, in the midst of a beautiful coconut grove... Another [3] miles brought me to the large and beautifully situated village of Kahaluu. The cocoanut groves are very dense and extensive, especially on the level point of land forming the south side of the little harbor. At 9 I reached Keauhou...about seven miles from Kailua. Here a small square or oblong bay sets in, forming a beautiful and quiet harbor for canoes.

The country along the shore is all the way rough with lava streams, and has but little soil and a scanty vegetation. The chief flower is the conspicuous white *capal*, about as large as a hollyhock, with numerous long stamens: it grows on a shrub two or three feet high.

Remains of numerous heiaus all along this coast.

At this place I turned to the left thro' an opening in the wall by the roadside, according to the directions given me by Dr. A., from which point three or four paths about equally distant diverged—and which the right one was, I was quite puzzled to know. Inquiring of a native as well as I knew how, I took the one which I thought he pointed out, and rode up a steep hill 30 or 40 rods, bringing

up at last against a high stone wall near a burying ground; unable to get further in this direction, I turned to the right over the pathless rough lava, and with some difficulty at length came upon what appeared to be the path between two low walls—guessing this to be the right one, I followed on as fast as my slow donkey would carry me, up a tedious hill for nearly a mile or perhaps more. The path is chiefly a made one in the midst of rough broken lava. This path soon brought me to the high land, covered with a good soil and an abundant vegetation, with many *kukui* and other trees. The region through which I now passed was delightful, and the view of the landscape below and of the ocean apparently rising up beyond was very beautiful. Some four or five miles beyond Keauhou I reached Mr. Hall's place where he has an extensive coffee plantation. (Lyman 1846 in Maly and Maly 2004a:26-27)

KEAUHOU DURING THE MIDDLE TO LATE 19TH CENTURY

The middle 19th century brought with it great changes, especially as it relates to the alteration of the traditional Hawaiian land tenure system. During the 1830s and 1840s, the Hawaiian Kingdom was an established center of commerce and trade in the Pacific, recognized internationally by the United States and other nations in the Pacific and Europe (Sai 2011). As Hawaiian political elites sought ways to modernize the burgeoning kingdom, and as more Westerners settled in the Hawaiian Islands, major socioeconomic and political changes took place, including the formal adoption of a Hawaiian constitution by 1840, the change in governance from an absolute monarchy to a constitutional monarchy, and the shift towards a Euro-American model of private land ownership. The change in land governance was partially informed by ex-missionaries and Euro-American businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time.

The *Māhele* 'Āina of 1848

Convinced that the feudal system of land tenure previously practiced was not compatible with a constitutional government, the reigning *Mō'ī* Kamehameha III, whose miraculous birth occurred at Keauhou, and his high-ranking chiefs decided to separate and define the ownership of all lands in the Kingdom (King n.d.). The change in land tenure was further endorsed by missionaries and Western businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. After much consideration, it was decided that three classes of people each had one-third vested rights to the lands of Hawai'i: the *Mō'ī* (King), the *ali'i* (chiefs) and *konohiki* (land agents), and the *maka'āinana* (common people or native tenants). In 1845 the legislature created the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission), first to adopt guiding principles and procedures for dividing the lands and granting land titles, and then to act as a court of record to investigate and ultimately award or reject all claims brought before them. All land claims, whether by chiefs for entire *ahupua'a* or by tenants for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1848) to be considered. This deadline was extended several times for the *ali'i* and *konohiki*, but not for commoners (Alexander 1920; Soehren 2004).

The *Mō'ī* and some 245 *ali'i* (Kuykendall 1938) spent nearly two years trying unsuccessfully to divide all the lands of Hawai'i amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.). Once the *Mō'ī* and his *ali'i* accepted the principles of the Privy Council, the *Māhele* 'Āina (Land Division) was completed in just forty days (on March 7, 1848), and the names of all of the *ahupua'a* and *'ili kūpono* (nearly independent *'ili* land division within an *ahupua'a*) of the Hawaiian Islands and the chiefs who claimed them, were recorded in the *Buke Mahele* (also known as the *Māhele* Book) (Soehren 2004). As this process unfolded the *Mō'ī*, who received roughly one-third of the lands of Hawai'i, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased by his subjects to live on. Accordingly, the day after the division when the last chief was recorded in the *Buke Mahele*, the King commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike the King, the *ali'i* and *konohiki* were required to present their claims to the Land Commission to receive their Land Commission Award (LCAw.). The chiefs who participated in the *Māhele* were also required to provide commutations of a portion of their lands to the government to receive a Royal Patent that gave them title to their remaining lands. The lands surrendered to the government by the *Mō'ī* and *ali'i* became known as "Government Land," while the lands that were personally retained by the *Mō'ī* became known as "Crown Land," and the lands received by the *ali'i* became known as "*Konohiki* Land" (Chinen 1958:vii; 1961:13). Most importantly, all lands (Crown, Government, and *Konohiki* lands) identified and claimed during the *Māhele* were "subject to the rights of the native tenants" therein (Garavoy 2005:524). Finally, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the land could be formally surveyed. This process expedited the work of the Land Commission.

Land Commission Awards

In 1848-1849, the *ahupua'a* of Keauhou was formally divided into two sections and both *ahupua'a* were awarded as Konohiki Land. Victoria Kamāmalu received Keauhou 1st as part of LCAw 7713, 'Āpana 7 while her brother, Lot Kapuāiwa (Kamehameha V) received Keauhou 2nd as part of LCAw. 7715, 'Āpana 12. Both Kamāmalu and Kamehameha V were the great-grandchildren of Ke'eaumoku and Namahana, through their daughter Kaheihimālie, a wife of Kamehameha I and her daughter Kīna'u (Tomonari-Tuggle 1985). Hammatt et al. (1981) believe that since the land of Keauhou was retained by the Kamehameha dynasty, it reflects their perceived value of the land and its resources. Maly and Maly (2004a:33) point out that it was from these *konohiki* awards that "Chiefess Bernice Pauahi Bishop inherited her rights to these lands, and by which they were incorporated into the Estate of Bernice Pauahi Bishop and Kamehameha Schools."

As the King and his *ali'i* and *konohiki* made claims to entire *ahupua'a* and the prized *'ili kūpono* lands via the *Māhele*, questions arose regarding the protection of rights for the native tenants. To resolve this matter, on August 6, 1850, the Kuleana Act (also known as the Enabling Act) was passed, clarifying the process by which native tenants could claim fee simple title to any portion of lands that they physically occupied, actively cultivated, or had improved (Garavoy 2005). The Kuleana Act also clarified access to *kuleana* parcels, which were typically landlocked, and addressed gathering rights within an *ahupua'a*. Lands awarded through the Kuleana Act were, and still are, referred to as *kuleana* awards or *kuleana* lands. The Land Commission oversaw the program and administered the *kuleana* as Land Commission Awards (LCAws.) (Chinen 1958). Native tenants wishing to make a claim to their lands were required to register in writing with the Land Commission, who assigned a number to each claim, and that number (the Native Register) was used to track the claimant through the entire land claims process. The native tenants registering their *kuleana* were then required to have at least two individuals (typically neighbors) provide testimony to confirm their claim to the land. Those testimonies given in Hawaiian became known as the Native Testimony, and those given in English became known as Foreign Testimony. Upon provision of the required information, the Land Commission rendered a decision, and if successful, the tenant was issued the LCAw which conferred a less than allodial title (Barrère 1994). Finally, to relinquish any government interest in the property, the holder of a LCAw. obtained a Royal Patent Grant from the Minister of the Interior upon payment of the commutation fee (Barrère 1994). The information recorded in the Native Register and Native and Foreign Testimony provides insight into land use and settlement patterns around the time of the *Māhele*.

Maly and Maly (2004a) estimated that as many as 100 claims were made for both Keauhou 1st and 2nd of which, sixty-nine were awarded. In Keauhou 1st, the LCAw. were clustered in three main areas; near the coast in the vicinity of He'eia Bay, between present-day Ali'i Drive and Kuakini Highway (Hawai'i Belt Road; Highway 11), and about one-mile *mauka* of present-day Kuakini Highway. In Keauhou 2nd, the LCAw. were clustered in two main areas, at the coast around Keauhou Bay and about 0.4 miles *makai* and 0.75 miles *mauka* of present-day Kuakini Highway (along the Main Government Road). This distribution pattern can be seen in a Territorial Taxation map dated July 1930 (Figure 22). Of the sixty-nine awarded claims, twenty-seven LCAw. (comprised of twenty-eight parcels) are located in the *makai* portion of the *ahupua'a* near and within the project area. The location of these LCAw. are shown below in Figure 23 and listed below in Table 3. The size of the awarded lots within the project area ranged in size from 0.16 to 6.66 acres and most of these lots were awarded between the years 1858 through 1889. Although four of the awardees listed in Table 3 only received a single parcel, the remaining awardees typically received between two and three parcels (usually at different elevations).

Based on a review of the Native Register and Native Testimony documents associated with the awarded LCAw. within the project area, it is evident that most of these lots were *pāhale* (house lots). Many of these *pāhale* were often described as being completely or partially enclosed by a rock wall that was often built by the awardee or their parents or neighbors. Many of these coastal lots are described as containing at least one *hale* (house) within which the awardees were residing. In the case of Paiki (LCAw. 10734), the house on the property was from Gov. Kuakini and Paiki was residing in that house at the time of the *Māhele*. For one of the awardees Kanehoa (LCAw. 5781), the testimony reveals that the *pāhale* at the coast contained a house, three *loulou* palm trees, five *kou* trees, *lauhala* trees, ten coconut trees that were planted on the outside of the lot, and one orange tree. Additionally, Kanehoa's second lot at the coast (LCAw. 5781:2) is described as a *pā mea kanu* (enclosed garden) bounded on the north side by the *alanui pii* (upland trail/road), an *'ili 'ili* (pebble) beach on the *makai* side and contained three coconut trees and fifteen *loulou* palm trees. The native testimonies also name different *'ili 'āina* (land sections) some of which are likely within the current project area, however, due to the way this information is presented in the testimonies, determining the exact location (and sometimes the exact spelling) cannot be done with definitive accuracy. Nonetheless, all of the *'ili 'āina* listed hereafter are within Keauhou. These include Papala 2, Papalanui, Waipio 1-4, Laulaulahuli (Laulaulahili or Laulauhili), Pakohe, Kaulukauhane 3, Haleokane 2, Kaohia, Haleope, Makakaulii, Paki, Haluapalala, Maili, and Puukaa.

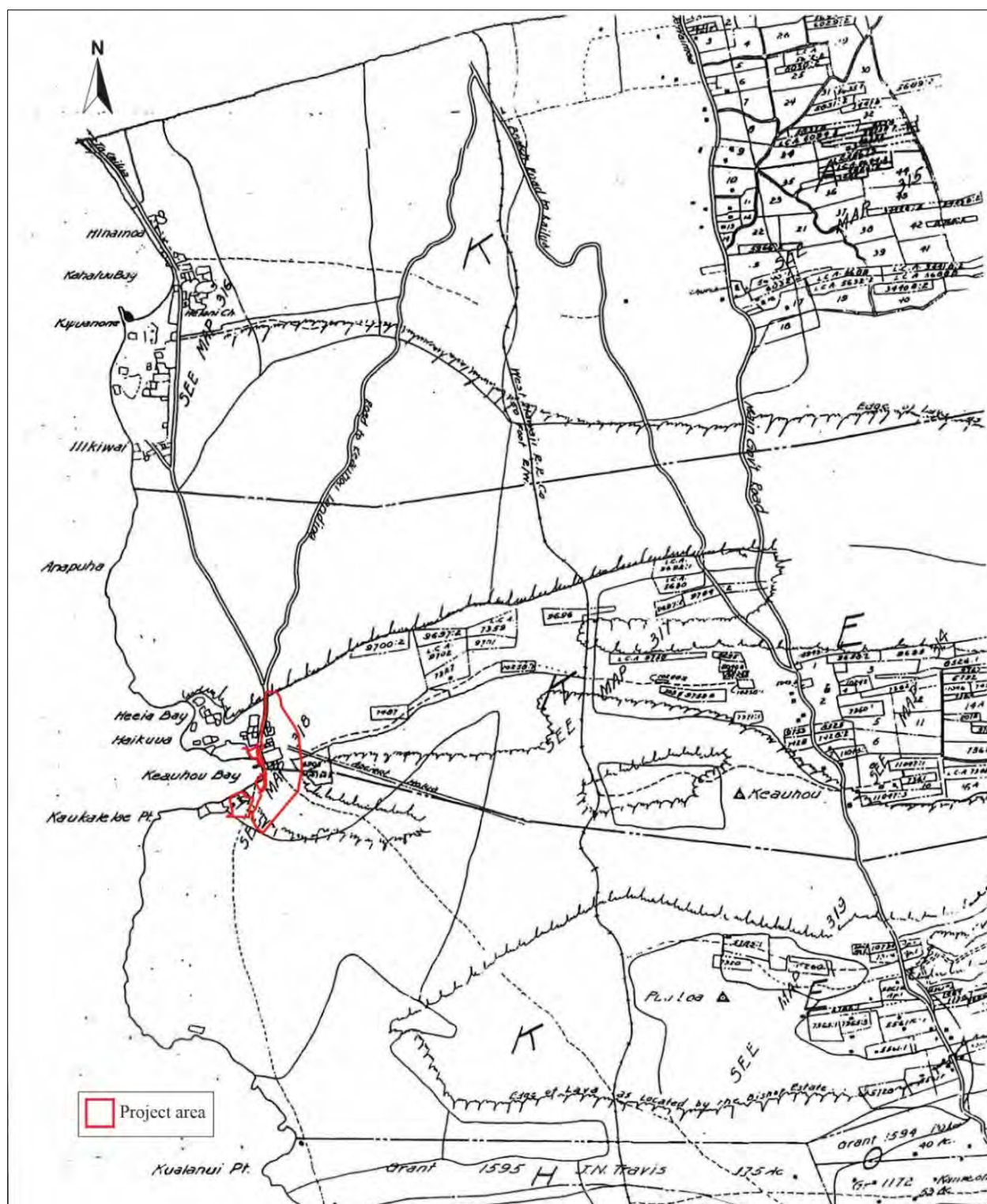


Figure 22. 1930 Territorial Taxation map showing the distribution of LCAw. in Keauhou 1st (north) and 2nd (south) (from Maly and Maly 2004a:34).

Table 3. Land Commission Awards near Keauhou Bay. (*=Konohiki award/ bolded text=LCAw. in project area)

<i>Awardee</i>	<i>LCAw.</i>	<i>Royal Patent No.</i>	<i>Year Awarded</i>	<i>Ahupua'a</i>	<i>Acres</i>	<i># of parcels awarded</i>
Aea	9695:2	4421	1859	Keauhou 1 st	1.35	1
Aoao	7738:2	7387	1879	Keauhou 1 st	2.00	2
Haluapo	11048:2	n/a	n/a	Keauhou 1st	1.30	2
Hawawa	8046 B:2	7037	n/a	Keauhou 1 st	2.69	3
Kaaiwana	7360:2	4579	1859	Keauhou 1st	2.90	2
Kaanoano	7362:2	8023	n/a	Keauhou 1st	3.11	2
Kaihe, J.H.	7428:1	4330	1859	Keauhou 1 st	2.40	1
Kaikuaana	7372:2	n/a	n/a	Keauhou 1st	1.60	2
Kailiakaale	9759	n/a	n/a	Keauhou 1 st	3.36	1
Kaluahininui	9753:2	7891	1889	Keauhou 1st	1.29	2
Kamakahia	9692:2	4420	1859	Keauhou 1 st	4.20	2
Kamāmalu, V.*	7713:7	4475	1861	Keauhou 1 st	n/a	1
Kamehameha, L.*	7715:12	7844	1887	Keauhou 2 nd	109,600.00	1
Kanehoa	5781:1 & 2	3888	1858	Keauhou 1st	6.29	3
Kapela	9698	n/a	n/a	Keauhou 1st	2.80	2
Kapela	5786:2	7032	1877	Keauhou 1 st	2.11	2
Kapuiipui	7361:2	6367	1872	Keauhou 1st	6.66	3
Keahulaaumoku	5785:2	n/a	n/a	Keauhou 2nd	4.43	2
Keohoeae	7365:2	7019	1877	Keauhou 2 nd	6.28	3
(H)Keoni	8526:2	7136	1878	Keauhou 1 st	5.0	2
Koomoa	9764:1	n/a	n/a	Keauhou 1 st	0.71	1
Kukahi	7633:2	7044	1877	Keauhou 2 nd	2.50	3
Lono	9946:2	7386	1879	Keauhou 1 st	0.16	2
Molale	11046:2	4437	n/a	Keauhou 1st	3.58	3
Nahoa	9693:1	6567	1874	Keauhou 1 st	2.59	2
Naholowaa	7319:2	n/a	n/a	Keauhou 2 nd	4.90	3
Nauki	9697:1	n/a	n/a	Keauhou 1 st	6.0	3
Paiki	5903 & 10734: 2 & 3	6842	n/a	Keauhou 2nd	5.53	3
Poopuu	11047:2	6391	1873	Keauhou 1st	5.80	3

2. Background

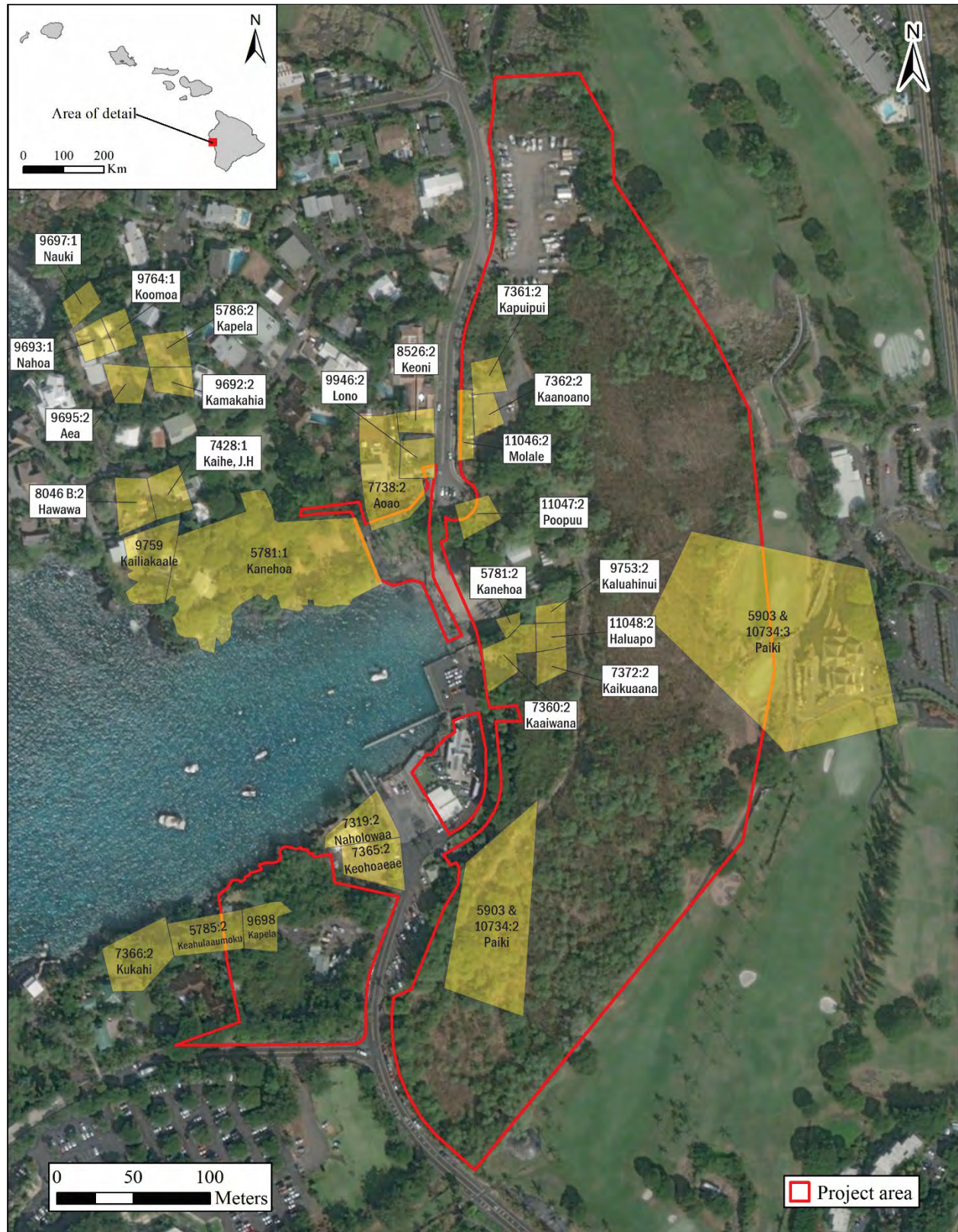


Figure 23. Location of LCAw. (excluding *Konohiki* awards) located within and in the vicinity of the project area.

Commission of Boundaries (1862-1876)

In 1862, the Commission of Boundaries (Boundary Commission) was established in the Kingdom of Hawai‘i to legally set the boundaries of all the *ahupua‘a* that had been awarded, by name only, as a part of the *Māhele*. Subsequently, in 1874, the Boundary Commission was authorized to certify the boundaries for lands brought before them. As a part of this process, the Boundary Commission gathered testimony from informants, who were typically older native residents who learned of the boundaries from their ancestors, relatives, or neighbors. The boundary information was collected primarily between 1873 and 1885 and was usually given in Hawaiian and simultaneously transcribed into English. Although hearings for most *ahupua‘a* boundaries were brought before the Boundary Commission and later surveyed by Government employed surveyors, in some instances, the boundaries were established through a combination of other methods. In some cases, *ahupua‘a* boundaries were established by conducting surveys on adjacent *ahupua‘a*. Or in cases where the entire *ahupua‘a* was divided and awarded as Land Claim Awards and or Government-issued Land Grants (both of which required formal surveys), the Boundary Commission relied on those surveys to establish the boundaries for that *ahupua‘a*. Although these small-scale surveys aided in establishing the boundaries, they lack the detailed knowledge of the land that is found in the Boundary Commission hearings.

On August 8, 1873, the Boundary Commission met at Keauhou to hear testimony for the boundaries of Keauhou 1st. The following contains excerpts of the testimony specific to the lands laying between the coast and the Government Road. Information specific to the coastal areas of Keauhou 1st has been underlined for emphasis and bracketed text has been inserted by the author to clarify spelling or translations of Hawaiian words used in the original documents:

Kakio^K sworn

I have lived on Keauhou until I am an old man and know the boundary of the land. Kahaluu bounds Keauhou on the north side. The boundary at seashore is a pali [cliff] called Paaniau and a long wall from Kawa to road. Thence mauka to Puuainako, an oioina [resting place] on old trail, said trail being made for the ohia trees, which in the time of Gov. Adams were drawn down to Kailua for a church. Said church was built some years ago

From Puuainako to Kanihinihiula, at the mauka Government road where there are two ahua pohaku [stone mounds], on the boundary; thence north side of Awapuhi in the woods. Thence to Ohiki an old cultivating grounds on the boundary...thence to Waikukulukulu, a cave with water in it...Keakaawai is a kamaaina and used to go into the mountain with his father Kuluahi.

Lono^K sworn

I was born at Keauhou at the time of Kaoku [*ka ‘ōku ‘u*] and have lived here most of my life; lived, in Kau a few years; and kamaaina of the boundaries of Keauhou as far mauka as the Government road. This boundary at the shore between Keauhou 1st and 2nd is at Kamauae [Kamau‘ai] a heiau for fishermen situated above the beach, on the hill where the house stands; thence mauka to a bread fruit tree; thence to the head of Hoolua [Holua], thence mauka to Kanakaliikapu, an ahua pohaku at the Government road, this is as far as I know the boundaries...Keauhou is bounded by the sea and the land has ancient fishing rights extending out to sea.

Kahaluu bounds Keauhou 1st on the north side. The boundary at seashore is Paaniau a large stone wall reaching from shore a short distance mauka. There is a pali at the sea shore by the same name; thence mauka to the Government road. (Boundary Commission 1874:318-320)

The following day on August 9, 1873, testimony was heard at the home of local Judge John Green Hoapili, who was born at Keauhou in 1833 (The Hawaiian Star 1896) to settle the boundaries of the neighboring land of Kahalu‘u. The following testimony, although for the adjacent lands, provides important cultural information specific to Keauhou 1st.

Papa^K sworn (very old man)

I was born at Kahaluu Kona Hawaii at the time of the Holuanui [Maly and Maly 2004:76 places this date at ca. 1814—construction of the *hōlua* at birth of Kauikeaouli], and have always lived there know the land and its boundaries. The sea bounds it makai and it has ancient fishing rights extending out to sea. Keauhou bounds Kahaluu on the southern side, at the seashore the boundary between these two places is at Ohiki, a point on the south side of Paaniau, and near to it. Thence mauka along Keauhou to Kaiōena a large heiau way above the makai road, thence to aa near kukui tree (a grove called Kuohai) the lapa [ridge] is on Keauhou the dirt on Kahaluu. Thence to Mahina o Kiiwalao

[Kīwala‘ō], a place where Kiiwalao was raised, an alii kapu [sacred chief]. Thence to Kanihinihiula two ahu pohaku at the Government road. Thence to Kalalahua, an ohia akua [‘ōhi‘a deity] in the woods. Thence mauka to Kalaeohi a kahua kauhale mahiai [agricultural village] (Boundary Commission 1874:321-322)

Kaihumua^K sworn

I was born at Kahaluu N. Kona Hawaii at the time of the building of Kiholo and have always lived there and know a part of the boundaries. Keauhou bounds Kahaluu on the south side; sea makai; and the land has fishing rights. The boundary at shore is Ohiki a pile of stones on the south side of Paaniau. Thence it runs way above the makai Government road to a large pile of stones like a heiau called Kaioena. Thence mauka to Government road; the aa on Keauhou a small portion only being on Kahaluu. Thence follows up to Kanihinihiula at the mauka Government road. Thence to Paahao a water hole in the woods, which is as far as I know the boundaries in the woods. (Boundary Commission 1874:322-323)

A few days prior to gathering testimony for Keauhou 1st, on August 4, 1873, testimony was heard to settle the boundaries of Keauhou 2nd.

Keakaokawai^K sworn

I was born a few years before the death of Kamehameha I... I moved at time of Kaua O Kekuaokalani (1820) to Lehuula...I now lived at Hokuano North Kona and am kamaaina of Kona. I used to go on the mountain with my father collecting sandalwood and catching birds, his name was Kauluahi, an old bird catcher and kamaaina now dead; Honalo bounds Keauhou 2 at sea shore on south side, a pali aa called Lekeleke is the boundary at sea shore between these lands. Thence the boundary runs mauka along land on Honalo sold to different parties on Honalo to a place called Nohomoanahoaiuku in the woods on the makai side of pali. Thence along the Government portion of Honalo to Kapapakauheana, a round water hold in the woods in the center of Honalo.... (Boundary Commission 1874:256)

I do not know the boundaries between the land of Kahaluu and Keauhou, or between the two Keauhous... (Boundary Commission 1874:259)

In a follow-up hearing held on August 5th, 1873, Kahilo, another testifier provided the following information:

Kahilo^K sworn

I was born at Keauhou at the time of the building of the first Kiholo and have always lived there in Kona, Hawaii.

Honalo bounds it on the South side, an awaawa and ilina kupapau (a crack in the rock where the natives used to put their dead) called Lekeleke is the boundary. Thence the boundary between these lands runs mauka, the kualapa on Honalo and awaawa on Keauhou to Nawawae Nuuanu at the Government road mauka. Thence follow up kualapa and awaawa to Kamomoku a pali surrounded by small trees, koa, ohia, mamani, naio &c. The tall woods are makai of this place. There is an ancient pile of stones here, at the mauka corner of Honalo... (Boundary Commission 1874:261)

My Parents and Grandparents used to go bird catching for feathers as far as Waiea...

Kamauae a cave at the seashore is the boundary between Keauhou 1 and Keauhou 2nd. Thence the boundary between these two lands runs mauka to the Poo Hoolua [hōlua], above Keauhou, thence into groves of ohia trees below the Government road to a cave called Kaekuakapua‘a. Thence to a place called Kanokeliikapu, which is on the Government road an ahu used to stand at this place but was knocked down when the road was built. Thence the boundary runs to Laaunui, a large ohia tree; said tree is in the woods about the end of where people work. (Boundary Commission 1874:262)

Keakokawai is the one who pointed out the boundaries to me when we went after mamake, and he is the only one who pointed out the boundaries through the woods to me. My parents told me some of the boundaries. My father Uluhiwa, now dead, who was an old bird catcher; showed me boundaries above the woods to Waiakapee; but did not tell me what lands joined. (Boundary Commission 1874:263)

Palea^K sworn

I was born at Kalahiki South Kona, Hawaii and have always lived there. Was born at the time of Kuewai o ka Lae. Know the land of Keauhou. Lekeleke is the boundary at the seashore between Honalo and Keauhou. My father Kanahuna (now dead) was appointed by Keauhou konohiki to watch the bird catchers on out land and other lands to see if they did not take the geese and uwau of which belonged to Keauhou and he told me the boundaries between these lands and Keauhou...

Have seen Umi's road when we were on the mountain gathering sandalwood... (Boundary Commission 1874:263)

Another hearing held the following day on August 6, 1873, included testimony from Kahulialo, whose testimony focused predominately on the *mauka* boundaries:

Kahulialo^K sworn

I was born at Honalo, North Kona, Hawaii on a place called Kealaehu and at the time of the first Kiholo. Know the land of Keauhou and part of its boundaries. Mauka in the woods and above the woods my father Kuluahi who was the kaaaina of Kona, on the mountain showed them to me...(Boundary Commission 1874:264)

Two days later on the 8th of August, the Boundary Commission met again and heard testimony from Keaka, and Kakio, the latter whom provided testimony for the boundaries of Keauhou 1st:

Keaka^W sworn

(Note same witness as on Lehuula)

Lekeleke is the boundary between Honalo and Keauhou at the seashore. From this place there is an awaawa [var. of awāwa-ravine] running mauka. I do not know the boundaries from this point to the upper edge of the woods. Have heard that there is an awaawa running through the woods, on the boundary. Kipuka Ohelo is on Hookukano [Hokukano], a good way makai of Kepulu, Kehapo^K (now dead) used to have charge of Keauhou said it came to the place we used to go after mamaki thence but there is none above. He did not tell me this was the boundary it is only my manao. I have been to Waio, but have never been told what land it is on. The kamaaina Kehiapo^K told me when I was young that Waio was on Keauhou... (Boundary Commission 1874:266)

Kakio^K sworn

I was born at Keauhou at the time Kamehameha came from Hilo to Kealakekua and from there to Honolulu at the time of Oku ['Ōku'u]. I have always lived here and know the land of Keauhou 2nd and its boundaries. I used to go after sandalwood on the mountains with Kapohakaimokumahi (now dead). He was a kamaaina in the mountain and used to go across to Hilo. Lekeleke is the boundary between Honalo and Keauhou at sea shore is kualapa. Keauhou being at the foot of the ridge on this side. Thence the boundary runs mauka along Honalo to Kukuikomo on the makai side of the Government road. Thence along the awaawa to the mauka side of the Government road place called Leiohapuu. Thence along awaawa into the woods, I do not know the boundaries. Know a place called Palahinu, a cave where people used to live. Honalo ends makai of this cave at the mauka edge of the woods. The mamani and scrub koa being on Keauhou. Have heard that Kealakekua and other lands, only run through the tall koa; have never been there.

The boundary at shore between the two Keauhous is at a place called Kamauae at the beach. Thence it runs mauka to the head of Holua (an old sliding place). Thence to the south side of Keahialoa the boundary running in a hollow. Thence to mauka of the Government road to a place called Kanaokeliikapu. Thence mauka in the woods to Kualapa Kahoopulu. This is as far as I know the boundaries in the woods...They say in the days of Keeaumoku the Akule used to belong to Keauhou 2nd and the birds to Keauhou 1st but the chief of Keauhou 2nd married a chief of Keauhou 1st and after that all the fish were given to Keauhou 1st and the birds and land mauka to Keauhou 2nd.

Mauna Loa is called the Kuaiwi of Kau. Have been told that Keauhou joins Hilo and Hamakua on Mauna Loa at the edge of the aa flow, from the summit to the mountain. The pili is on Keauhou and the aa on Kaohe, have head Kaupulehu joins Keauhou but do not know where. (Boundary Commission 1874:266-267)

Testimony resumed on the 9th of August, and Papa, a native of Kahalu‘u added to his earlier testimony. This portion of this testimony, however, was for the *mauka* portion of the *ahupua‘a* (Boundary Commission 1874). No specific cultural information concerning coastal Keauhou was provided. On August 11, 1873, the boundary commission accepted testimony from Waiau, a native of North Kona.

Waiau^K sworn

I was born at Kanauwaue North Kona Hawaii at the time Kamehameha 1st returned from Honolulu at the time of Palakee. Lived at Ka[illegible] visited about eleven years ago when I moved to Kealia South Kona. Know the land of Keauhou, used to go after birds with my father Naueue, an old bird catcher and he pointed out the boundaries to me as it was kapu [forbidden] to go after birds and not divided theirs with the konohiki. Used to go frequently not very far above here. Honalo bounds Keauhou 2nd on the south side, as you go into the lower edge of the woods. I do not know the boundaries... (Boundary Commission 1874:268-269)

By 1876, the boundaries of Keauhou 1st had been settled with D.H. Hitchcock completing the survey. In 1886, the boundaries of Keauhou 2nd had been settled and Government surveyor, J.M. Alexander completed the survey for Keauhou 2nd, which covered an area of 109,600 acres. In summary, the testimony cited above captures detailed knowledge of the not only the *ahupua‘a* boundaries, but also traditional cultural practices and resources (bird catching, *akule* fishing), settlement areas, trails, botanical resources (i.e. ‘*ōhi‘a*, *pili*, *mamane*, *koa*, ‘*iliahi*, *naio*, *mamaki*), built features (i.e. *heiau*, *hōlua*, walls) agricultural areas, *ali‘i*, water collection areas, upland habitation caves, and how resources were distributed between the residents of the two Keauhou.

Concerning the Keauhou 1st-Kahalu‘u boundary. The various testimony agrees that the coastal boundary was Paaniau, a name applied to a *pali* (cliff) as well as the large stone wall the extended *mauka* from the shore. The testimony also identified a trail along this boundary, said to have been built to haul ‘*ōhi‘a* trees to Kailua to build a church, likely Moku‘aikaua during the time of Governor Kuakini. The testifiers also identified ‘*Ōhiki*, the name of the coastal point to the south of Paaniau. Further upland near the location of the Government Road, the testifiers noted this area as the cultivating grounds, including Mahina O Kīwala‘ō, described as the place where the *ali‘i* Kīwala‘ō was raised. Kaioena, a *heiau* was also reported to be along the Keauhou 1st-Kahalu‘u boundary.

Regarding the boundary between Keauhou 1st and 2nd, the testifiers identified the coastal boundary as “Kamauae” (also spelled Kamau‘ai), the name of a cave and a *heiau* reportedly used by fishermen (Boundary 1874:267). Breadfruit was also noted along this boundary and the testifiers unanimously described the boundary extending to the *po‘o hōlua* (head of the *hōlua*). It was also noted that Keauhou had ancient fishing rights that extend out to sea.

Information concerning the Keauhou 2nd-Honalo boundary was limited, however, those that did provided testimony described its coastal boundary as Lekeleke, identified by Kahilo as both an *awaawa* [var. of *awāwa*, lit. ravine, gulch] and a ‘*ilina kupapa‘u* (burial grounds). Notes in Kahilo’s testimony say that the *awaawa* itself served as the burial ground where bodies were placed. The Keauhou 2nd-Honalo boundary is said to have followed the *awaawa* up towards the Government Road.

Information about the *mauka* resources was also described by the testifiers including Kalalahua, the name given to an ‘*ōhi‘a* deity that stands along the Keauhou 1st-Kahalu‘u boundary *mauka* of the Government Road. Kalaeohi, an agricultural village (*kahua kauhale mahi‘ai*), was also noted which was said to have stood in an area above the Government Road. One testifier described the ‘*ōhi‘a* forest extending below the Government Road and that the area of Lā‘aunui marked the *mauka* most extent of the agricultural area. One testifier noted that the geese and the ‘*uwa‘u* were birds that belonged to Keauhou. Lastly, Kakio’s testimony described how during the reign of Ke‘eaumoku, the *akule* fish belonged to Keauhou 2nd and the birds to Keauhou 1st, however, after chiefs from both lands married, all the fish went to Keauhou 1st and the birds and land *mauka* to Keauhou 2nd.

The settlement of the boundaries for these *ahupua‘a* resulted in Keauhou 1st receiving half of the bay, all of He‘eia Bay, and a fertile strip of lower agricultural lands. Whereas, Keauhou 2nd encompassed half of the bay, the more barren lower slope, and a massive interior forested area that extended to the summits of Hualālai and Mauna Loa (Tomonari-Tuggle 1985). The extent of the *ahupua‘a* boundaries are depicted in a close-up of Hawai‘i Registered Map 2060 from 1901 (Figure 24).

Ranching, Agriculture, and Other Business Endeavors

Ua ku kinikini no na hale i kukulu ia ma na kapa kahakai o Kona nei. O na hale kamaaina no Hawaii nei, oia na hale pili maoli a pela aku a kakaikahi wale hoi na wahi hale i uhi ia me na laau o ka haole, ua nui no na hale a ku ana ma kahakai a mauka no hoi...

The homes built along the shore here in Kona are numerous. The native homes are thatched with *pili* and so forth, while the wooden homes belonging to foreigners are scattered about. There are many homes standing along the shore and in the uplands. (English translation by Lokelani Brandt)

2. Background

By the 1880s, Keauhou residents were engaged in various enterprises from general store keepers, coffee planters, and goat ranchers—with the latter two ventures situated in the upper elevation of Keauhou near the Main Government Road (Bowser 1880). In 1880, George Bowser, editor of *The Hawaiian Kingdom Statistical and Commercial Directory and Tourist Guide*, wrote about the various statistics and places of interest around the Hawaiian Islands, including Keauhou Bay, which during this time, also served as a landing for passenger steamships. Bowser, who passed through the village of Hōlualoa before coming into Keauhou wrote the following:

Between two and three miles further on is the village of Holualoa, with about twenty native houses and two or three stores. It lies close to the seabeach; and here, and at intervals along the way, are groves of cocoa palm. Keauhau [Keauhou] is the next place, situated on a small inlet of the sea, and of about the same size as Holualoa. It is a romantic spot, with pretty local scenery and a fine view of Mauna-Hualalai as a background. All the way from Kailua I found the road good, with cocoanut groves every mile or so, and plenty of pineapples, which are in season all the time, from June to December (Bowser 1880:550).

An 1891 map of Keauhou Bay (Figure 25) published by the Hydrographic Office of the U.S. Navy shows the recorded depths of the bay as well as built features including a landing, houses, walls, roads, vegetation, and natural features located within roughly 100 meters inland of the shoreline. Eight houses, two of which are enclosed by walls are shown to be within the project area. Three road segments also appear in the northwestern portion of the project area. The unlabeled natural features shown in the project area include ‘Ahu‘ula cliff and Ho‘okūkū Pond at the base of the cliff.



Figure 25. U.S. Navy hydrographic map from 1891 (Hawai'i Registered Map No. 2094) showing natural and built features in the project area.

Between 1882 and 1884, Hawaiian Kingdom surveyor, Joseph S. Emerson conducted cartographic surveys of the North Kona region. He generated letters, field notebooks, and survey maps. Born on O‘ahu, J.S. Emerson (like his brother, Nathaniel Emerson, compiler of Hawaiian history) could converse in Hawaiian and had an interest in Hawaiian beliefs, traditions, and customs. As a result, his letters and field notebooks record more than coordinates for developing maps. While surveying, Emerson also sought out native residents of the lands he surveys, as guides. Thus,

while he was in the field, he often recorded place names, residences, trails, and various features of the natural-cultural landscape. Accompanying Emerson was his assistant, J. Perryman, who prepared detailed sketches of the Kona landscape during the time of their surveys. Among the lands sketched by Perryman was Keauhou, which was drawn on October 31, 1883, and includes three distinct view planes as they had observed from the Keauhou survey station (Figure 26). The uppermost portion of the page shows the view from Keauhou looking north toward Keahuolū. The middle portion of the page, which shows the view to the west overlooking the project area, illustrates a cluster of homes, walls, coconut groves, and a road extending through the project area. Lastly, the bottom portion of Perryman's sketch shows the view to the southwest of Keauhou Bay.

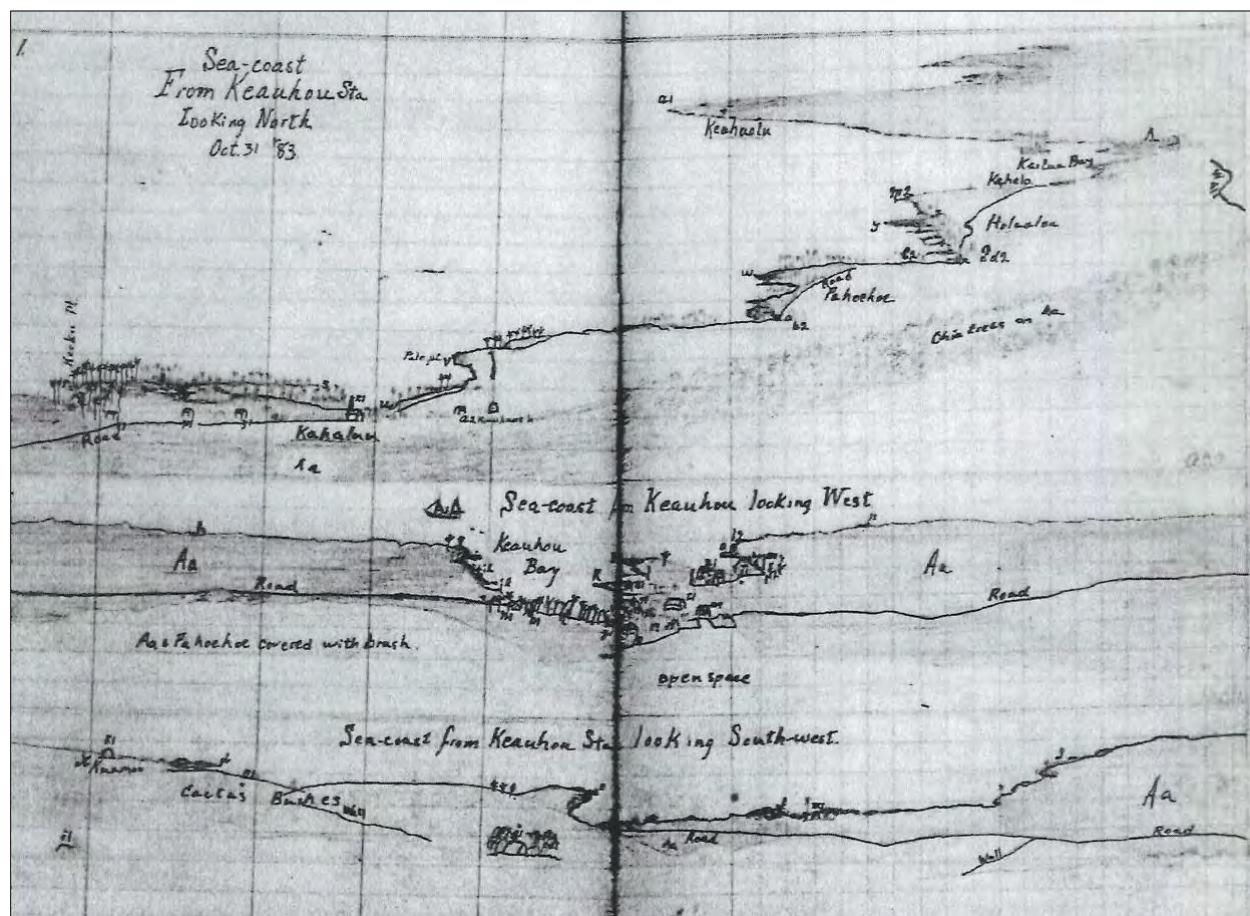


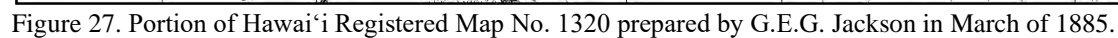
Figure 26. Perryman's 1883 sketch of the coastline from the Keauhou survey station (from Maly and Maly 2004a:95).

A more detailed look at the project area and the residences, roads, walls, and important cultural sites located therein, are recorded on sketch maps and a hydrographic map from March 1885 prepared by George Edward Gresley Jackson (Figure 27). Jackson's map shows the location of a store just inland of Keauhou Bay on the *makai* side of Pilipo's house, and a grave located in the northeastern portion of the project area on the *mauka* side of the road to Kailua. The Pilipo identified on this map is George Washington Pilipo who in 1861 became a licensed preacher and pastor. Pilipo was born in Hōlualoa around 1828, educated at Lahainaluna and took the name Pilipo (Philip) after he was baptized. He was ordained by John Paris in 1865 and replaced Asa Thurston as pastor of Moku'aikaua Church in Kailua. After six years at Moku'aikaua, Pilipo transferred to Kaumakapili Church on O'ahu but his tenure there was brief after he was accused of being involved in some financial controversy. He resigned as pastor in 1874 but maintained his involvement with the Hawaiian Evangelical Association (1863-1880s) and kingdom politics until his death in 1887. It appears that Pilipo spent the last years of his life dedicated to efforts at Keauhou (Morris and Benedetto 2019).

Notes on Gresley's map also identify the birthsite of Kamehameha III and the ruins of Kamehameha I's house, both of which are at the base of 'Ahu'ula cliff near Ho'okūkū Pond (Kekahuna and Kelsey later between 1953-1955 refute the note about Kamehameha I's house ruins explaining that this is actually Kaleiopapa Heiau; see later section titled Kelsey and Kekahuna's Survey of Keauhou Bay). Although outside of the current project area, the residence of

Hoapili is shown (on the north side of the bay and west of the project area) as well as others including Keliikoa, Makainai, Kamahalo, Kaiaki, Kapela, and Kane (see Figure 27). The Hoapili identified on this map is likely John G. Hoapili, a Kona District judge who assisted with the boundary commission hearings and who was also identified as a coffee planter in Bowser's (1880) directory. Concerning the store at Keauhou Bay, Tomonari-Tuggle (1985) reported that there was at least one predecessor to the store at Keauhou. Quoting S.D. Mackintosh, a traveler who passed through the area in the late 1830s, Tomonari-Tuggle (1985) cite:

Tomonari-Tuggle (1985) goes on to report that between 1855 and 1870, there were eleven applications made by five individuals for retail outlets in Keauhou. In comparing this number to other populated centers in Kona from this time, Tomonari-Tuggle (1985:32) concluded that Keauhou ranked second, after Kailua, thus suggesting that it may have been one of the more economically active areas along the Kona coast.



By the early 20th-century, the development of the Kona uplands as an agricultural and ranching center was in full swing. At Keauhou Bay, infrastructure including a wharf was built to accommodate inter-island cattle shipping. An article published in the *Evening Bulletin* on March 11, 1901, states that Territorial Government allocated \$800 “for widening the wharf and building a wharf shed at Keauhou, N. Kona” (Evening Bulletin 1901). The location of the wharf is shown on Hawai‘i Registered Map No. 2351 prepared by G. F. Wright in 1906 (Figure 28). Wright’s 1906 map also shows a pier and the Government Road terminating in the vicinity of the wharf where it then transitions into the natural shoreline. Although outside of the project area, Wright’s map also depicts the location of the post office within LCAw. 7053, the Keliikoa residence, and Kailiilineha (Kailiilinehe) Church and school. On the 1906 map, the

boundaries of these properties appear to be marked by stone walls. Interviews, conducted as part of this study, with *kama'āina* who grew up in Keauhou during the early 20th-century also reported on the presence of a cattle pen constructed of stone located *mauka* of the wharf (see Consultation section below). In HHF's cultural landscape study conducted for Keauhou (HHF Planners 2017), they reported that Tommy White and other ranchers shipping cattle out of Keauhou Bay constructed stacked rock corrals, water troughs, a pump house, and gates, and encouraged the growth shade trees such as monkeypod and *kiawe*, and introduced grasses to support their livestock.

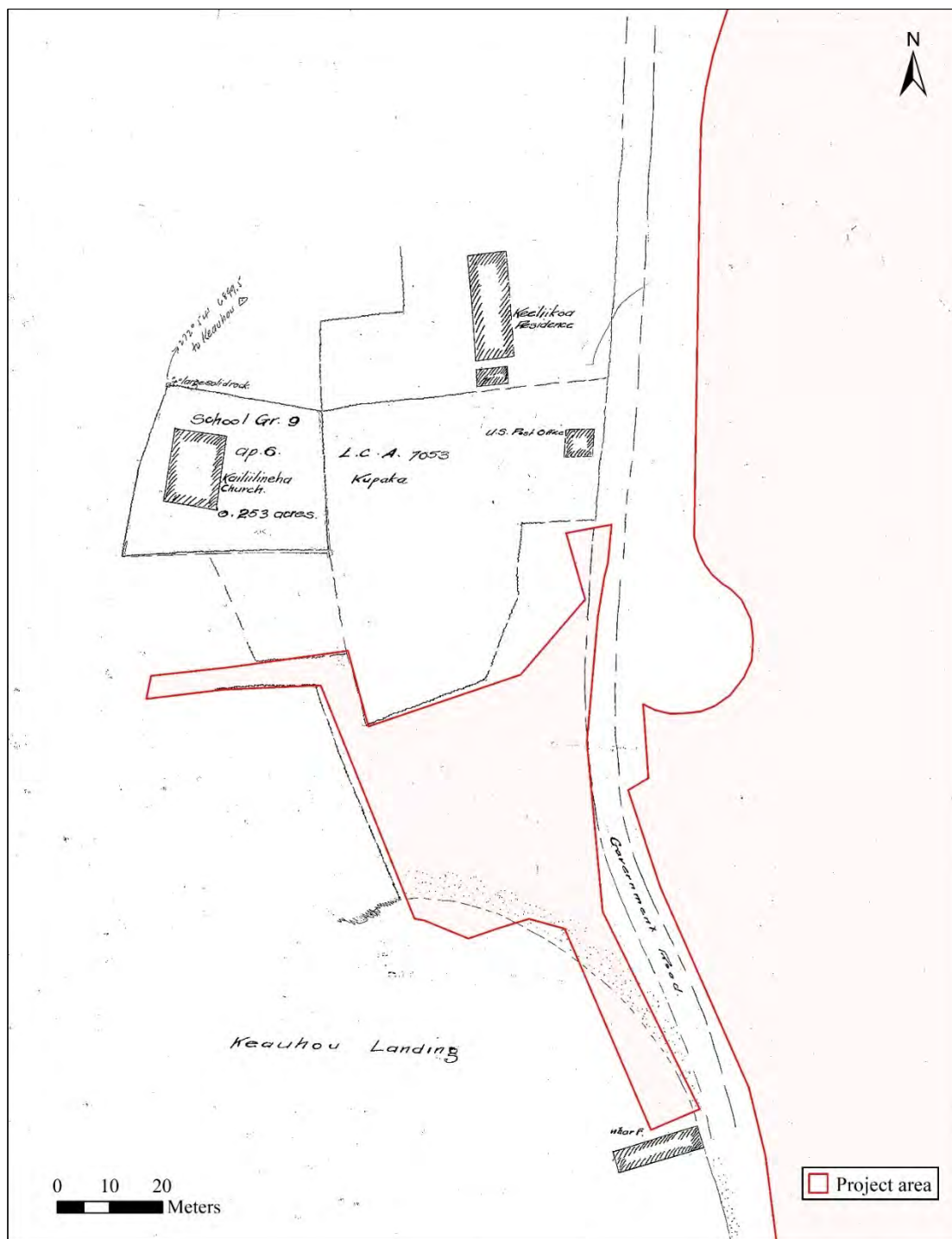


Figure 28. Portion of Hawai'i Registered Map No. 2351 prepared by G.T. Wright in 1906 showing wharf (actually a pier), Government Road, and other structures near the northern portion of the project area.

The dispersed upland and coastal communities were connected via a series of trails and roads that facilitated the movement of goods and livestock. According to Tomonari-Tuggle (1985), Keauhou was literally the end of the road from Kailua because to the south of Keauhou, the so-called road was not much more than a trail. As early as 1861, H.L. Sheldon representing a group of fifty-five residents petitioned the Minister of the Interior to build a new carriage road connecting the upper Government Road (also known as the Alanui Aupuni) to the road at the shore of Keauhou:

...We, old residents of the District of North Kona, Island of Hawaii, petition to you as follows: We have been thinking, that if a new road was to be made from Keauhou, from the Government Road *mauka* to meet with the road at the seashore, then it would be a means of helping the public, but it should be a carriage road. Therefore, we petition you...to proceed according to the law concerning same, Section 184 Civil Laws. (Interior Department, Misc. Documents #53 in Maly and Maly 2001b:82)

Within a year of their petition, the road to the coast was completed and its location is shown on a 1927 USGS map (Figure 29) as the dashed line extending in a northeasterly direction from the coastal road, through the project area where it connected with the upper Government Road. Shortly after the construction of the new carriage road, the Keauhou residents requested that trail to Kainaliu (shown in the 1927 USGS map as the dashed line extending in a southeasterly direction from the coastal road, through the project area) be closed because livestock was wreaking havoc on their *kula* planting fields. The 1927 USGS map illustrates the many paths, trails, and roads that connected the coastal and uplands areas. Within Keauhou 1st and 2nd Ahupua'a, Cordy (1989) who prepared an investigative report on the trails in the area, described two trails that cut across the *ahupua'a* in the coastal zone and six trails extending from the coast to the uplands:

Two major trails cross the ahupua'a dating to prehistoric and early historic times. These are the coastal trail and the inland trail, the latter approximating the Kona Belt Road. The inland trail is labelled [*sic*] alternatively main trail (ala nui), government main trail (alanui aupuni), and long trail (ala loa). The coastal trail is labelled main trail (ala nui). These would have been the major public routes across the ahupua'a. It appears that by the late 1800s another cross-ahupua'a trail may have been present, branching off the coastal trail south of the holua slide in Keauhou 2 and extending up to Kainaliu in the uplands. This is labeled "old carriage road" by Reinecke, "old road to Kai-na-liu" by Kekahuna, and a historic period "cart road" by archaeologists (Hammatt & Folk 1980)

Six inland-heading trails extend from the shore up to the agricultural fields...Two...are in the north identified by Reinecke. Two...are in the central and south areas...connecting to the Heeia and Keauhou bay housing areas...Two more...are identified in the uplands. (Cordy 1989:11)

These trails would have been internal ahupua'a trails in prehistoric and early historic times, used by residents of the ahupua'a to travel between their fields and the shore. (Cordy 1989:14)

In addition to requesting improvements to the road, George W. Pilipo, published an article in the Hawaiian language newspaper *Ko Hawai'i Pae 'Āina* urging a group from Helani Church, known as the Hui 'Ōpiopio 'Imi Pono Karistiano o Helani (HOIPK) to clean and improve Kauikeaouli's birthsite and to create a kind of barrier (*pā*) to to better protect this place. That portion of the article reads:

E na lala o ka Hui. Ua kukulu mai nei o Kauikeaouli i kana mau hana i Kia Hoomanao nona i ka Puuwai o ka poe Hawaii; a heaha hoi ka kakou e panai aku ai? Aole anei e hiki ia kakou ke hoohui i elua, a ekolu, a o kakou paha a pau, e hoomaemae kahi o kona hanau ia ana a me kela pohaku i waiho a make ai imua o Kapihe ke kau e hoopuni i pa kupono, i ole ai e kapulu wale ia e ka poe noonoo ole, manao au, he mea kupono kela, alaila, ua maikai a oiaio ko kaou aloha. (Ko Hawai'i Pae Aina 1885:3)

Dear hui members: Kauikeaouli's actions became a memorial within the hearts of the Hawaiian people; what will we reciprocate with? Can two, three, or all of us come together to restore the site where he was born as well as that rock he was left on as a stillborn in front of Kapihe, as well as to place an enclosure around [the site] so that it is not disturbed by thoughtless people? I believe that is a good thing, then, our aloha is good and genuine. (Translation by H. Kapuni-Reynolds, ASM Affiliates)

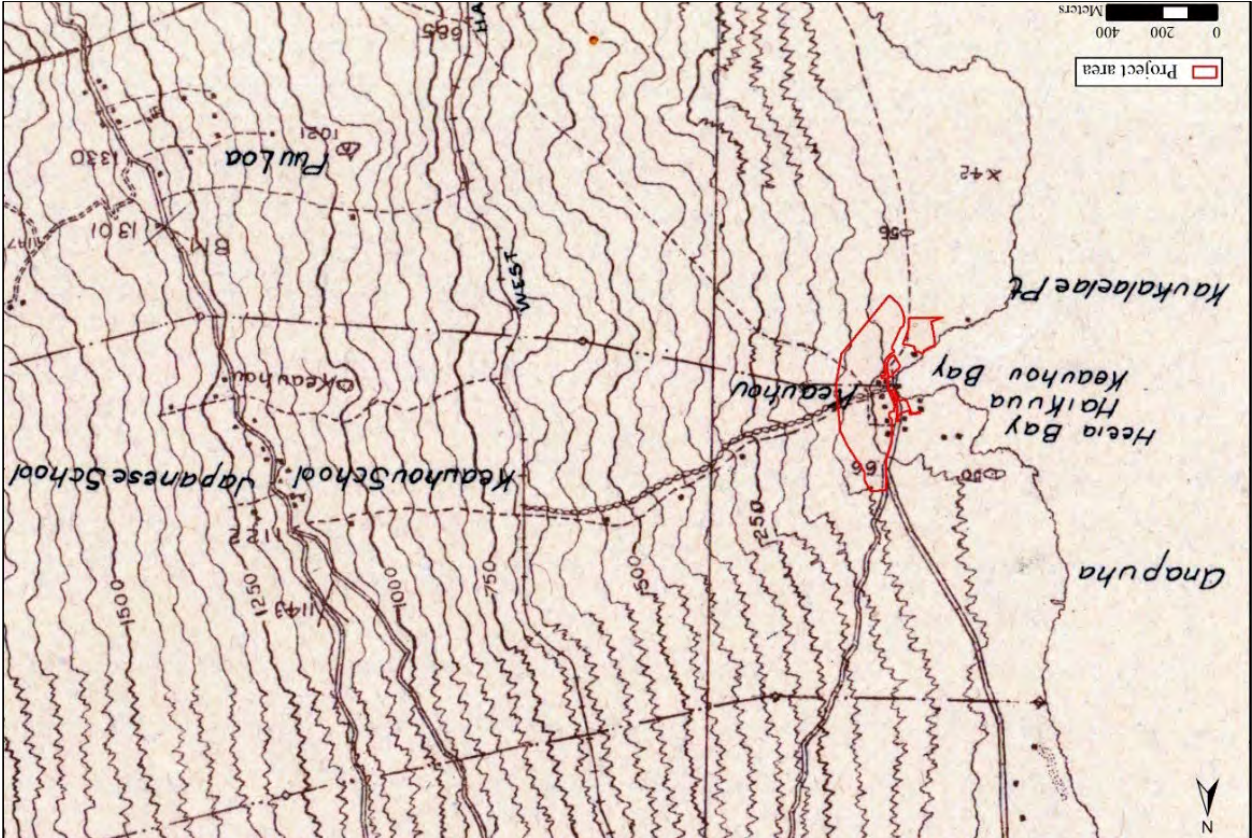


Figure 29. 1927 USGS Kaula Quadrant map showing road terminating on the north side of the project area and three trail routes within the project area.

On June 15, 1896, a tsunami generated by an 8.5 magnitude earthquake centered off the coast of Sanriku, Japan, caused major damage to the Kaula shoreline (Shepard et al. 1950). Local postmaster and legislator, Henry L. Kawewehi submitted an article to the Hawaiian language newspaper, *Ka Maka Ainana*, describing the destruction.

Portions of Kawewehi's article have been quoted below:

Mā ke kākāhiaka Poakahi nei, o ia paha ka hora 9, i hiki mai ai kekahi kai hoe nui i ike ole ia mānua ma Kaula nei, a na ia kai hoe weliweli i ulupa iho i kekahi mau hale o makou nei. O na hale i poia mai ua hana ana a kela ino, o ia ko J.N. Koomoa, C. Kakaiki, Aki (Pake), Manua, Kaula, Sam'l Kaula, Albert K. me ko Albert K. Hoapili. Ua pii mai ke aneane no e 18 kapua ke kēkie o ke kai mai ka ili honua maloo ae. O kekahi o na Waiwai o keia mau hale i poia, ua pau aku i ka lilo i ke kai a ke emi aku no hoi kei kai, waiho wale ka papaku o ka hohonu e kīhe ai ka pūkaia o ke kaula ke luu a loa ka papaku o lalo, aka, i na hana hoi a ke kai, waiho wale ana "na iwi o Hua i ka la," a he ku maoli no oe i ka weliweli ke nana aku. (Kawewehi 1896)

This past Monday morning, around 9 am, a great tidal wave, never before seen at Kaula, arrived. That fearful wave destroyed some of our homes. The homes that were destroyed by this disaster were those of J.N. Koomoa, C. Kakaiki, Aki (Chinese), Manua, Kaula, Samuel Kaula and Albert K. Hoapili. The terrifying wave rose close to 18 feet high from the surface of the earth. Some of the valuables of the destroyed homes was taken by the receding waters and deposited in the depths of the ocean where divers must dive to reach the bottom. The work of the ocean was like exposing "the bones of Hua in the sun" and it way truly dreadful to look upon. (English translation by Lokelani Brandt)

2. Background

A historic photograph of Keauhou Bay taken at the turn of the century provides a bit more detail into the character of during this period (Figure 30). This photograph, which depicts the eastern portion of the bay shows a wooden post and pier home, the residence of Mr. Tommy White, constructed on a stone platform projecting into the bay, along with several homes set back from the shoreline, a portion of the pier, and several stone walls along the shoreline (see Figure 30). Shepard et al. (1950:402) reported that on the morning of August 9, 1901 another *tsunami* consisting of “a wave about 4 feet high” impacted the Kona coast which swept away a house at Keauhou.



Figure 30. Keauhou Bay ca. 1900 (Hawai‘i State Archives PP-29-11-032).

Rancher and businessman, Tommy White leased a property (see Figure 30) along the bay as well as a large tract in the uplands of Keauhou and Kahalu‘u where he operated a cattle ranch. Tommy White and his wife Elizabeth Kahololeikini hosted many celebrations at their coastal residence. One such account written by Kawewehi tells of a birthday celebration held on June 26, 1908 at the White residence in honor of Mele Kipimana, the wife of W.H. Shipman and sister of Elizabeth Kahololeikini, Carrie Robinson, and Mrs. J.D. Paris—all of whom married prominent Hawai‘i Island ranchers. Kawewehi’s article, published in the June 26, 1908 edition of the Hawaiian language newspaper *Ka Nūpepa Kū‘oko‘a*, which describes the residence, the festivities, and includes some historical information about the birth of King Kauikeaouli, is included below along with a translation prepared by Kepā Maly in 2012 which appeared in (HHF Planners 2017)

*Mamua ae o ka manawa o ka aha-aina
ua hoomaka mua ia ke kukulu ana i
kekahi lanai nui hewahewa e na kanaka
o ka aina a i hoopili pu ia aku no ii ka
Home noho o Thos. C. White, a he mea
kanalua ole no ke olelo ae oia paha
kekahi o na lanai u‘i loa a i hana mai au
loa ia malalo o na hooponopono ana a
Mrs. Robinson ame Mrs. White, a he
laeula maoli no na hookele hana ana a
keia mau kaikamahine.*

*Ua kukulu ia keia lanai iloko o ekolu la
a hiki i kona pa’a pono ana; o kona*

Prior to the feast, there was built a very large lanai shelter by the people of the land, adjoining the residence of Thos. C. White, and it is said without a doubt that it was perhaps one of the most beautiful ever seen; it was made under the guidance of Mrs. Robinson and Mrs. White, both of these daughters were well trained in this work.

This lanai was completely built in three days; its post were ohia, and its covering was three layers of stripped coconut fronds; and upon seeing it, it

mau pou he ohia ame ka ohia i uhi pakolu ia iho hoi oluna me ka launiu i kiahahae ia; a ke nana aku me he mea la oia no oe la o ka moena pawehe o Mokuleia; a ke hoomaopopo aku no e ua ka ua nui aole e kulu...

Ua hoopiha ia ka papaaina i na ono like ole e hiki ole ai i na manamana lima ke hoomaopopo ia wai lakou e hoopa mua iho ai oiai ka io bibi momona o Kaukahoku i makana ia mai e Mrs. Robinson, a i hoolua pu ia me ka i'o puua kahi kelekele o Halekaupoku i manawalea ia mai e Mrs. White; na opihi makaiauli pili a o na Hau o Maihi, na limu lipeepee moani o Papahoaie, na limu kihe hanu ala o Kalepo a me na limu Hinakea noho papa o Paheehee...

A mamuli o ka oukou mau hana lokomaikai oluolu, a puuwai hamama, ua lilo ia he kia hoomanao poina ole iloko o ko makou mau puuwai pakahi a ma ke ano hoi a me ke kulana o ke kahua o ka lanai nolaila ke kapa ia nei ka inoa o ko kakou lanai o Keopuolani ka makuahine alii nana i haawi mai i ka mea kiekie ka Moi Kauikeaouli ka lokomaikai a i ike ia hoi o ka Moi Kamehameha III.

Malia paha e lilo ana no ke kapaia ana o keia inoa i mea e hookuihe aku ai i ka noonoo o ka mea heluhelu, nolaila e hoakaka iki aku ka mea-kakau.

Ua hanau is ka Moi Kauikeaouli ma Keauhou nei a ma kahi kokoke loa hoi i kahi ku nei keia lanai aole no paha i oi mamua o ka 20 kapuai ka mamao, a o kona hanaiia ana ma ke kahua pono no o keia lanai a ku nei; nolaila ke manao nei ka meakakau ua kohu pono loa iho la keia inoa Keopuolani a e mau aku hoi ke o ana o ia ino ia hanauna aku a ia hanauna aku; a ole ae la hoi ka inoa o ia makuahine alii i hala wale i okiloloa...(Kawewehi 1908)

looked like one of the mast of geometric designs from Mokuleia; it was known that should it rain, it would not leak.

The dining tables were filled with all manner of delicacies, one's finger could not decide which one of them to touch first. The fattened beef of Kaukahoku, given by Mrs. Robinson, together with the glistening, fat pig meat of Halekaupoku, donated by Mrs. White; the opihi makaiauli which cling to the rocks of Hau o Maihi, the sweet scented limu lipeepee of Papahoaie, the fragrant limu of Kalepo, or the Hinakea limu which is found on the reef of Paheehee...

Through your kind and open heart, let this account become an unforgettable tribute in our hearts, and let me describe the character of the lanai, which was given the name of Keopuolani, for the royal mother who have us his highness, King Kauikeouli, the benevolent, known as King Kamehameha III.

Let me explain to the multitudes, how this name came about.

King Kauikeaouli was born at Keauhou at a place very close to where the lanai was situated, perhaps not more than 20 feet away, and he was cared for at the platform where this lanai stood; therefore it was thought by the author that it was correct to give the name Keopuolani. The passing on of this name should be continued, generation to generation; that the name of the late royal mother live on as a sign forever... (translation by Maly and Maly 2012 in HHF Planners 2017:33, 37)

In 1913, Henry W. Kinney published a visitor's guide to the island of Hawai'i. In the guide, he included the following write up of Keauhou, in which he detailed the area during this time as well as highlighting the location of significant sites and practices:

KEAUHOU is the next village south of Kahaluu. It is a steamer landing and is of particular interest. It was the birthplace of Kamehameha the Third, the place of his birth being shown as a big rock immediately mauka of the big monkeypod stump about 200 feet south of the wharf. The king lived, in childhood, where the White house now stands makai of the stone mentioned. It was tabu for the people to walk on the cliff above the house in the morning, when their shadows would fall on the

house. Those who wanted to cross, had to swim. Mauka of the village is seen the most famous papa holua in the Islands, a wide road-like stretch, which was laid with grass steeped in kukui nut oil so as to allow the prince and his friends to coast down in the sleighs constructed for the purpose. At the end of the slide was a lanai, where the prince and his friends would don malos and go with their surfboards far out to sea, where the surf would carry them right to the prince's house. Here are also the remnants of the heiau Makole-a. A short distance further south stood the heiau Puu-o-Kaloa. The Hawaiians still look for a dumbbell-shaped cloud to connect it with the heiau of Keeku (See Kahaluu), which is a certain sign of rain. When it appears it is a good time to plant. In harvest time, when improvident ones would beg for food, the proverbial answer was "Where were you when the could laid its hands on Puu-o-Kaloa and Keeku?" South of Keauhou lies KUAMOO, famous as the site of the great battle where the rebel chief Kekuaokalani, who opposed the abolition of the tabu system, fought in 1819, Queen Kaahumanu's army. He was killed, after a sanguinary battle, and with him fell his heroic wife, Manono, who had fought by his side. The graves of the slain are still to be seen. (Kinney 1913:61)

Centennial Commemoration Marking the Birth of Kauikeaouli

In 1914, the Daughters of Hawai'i, an organization founded in 1903, coordinated an elaborate commemorative ceremony to mark the centennial of the birth of King Kauikeaouli. The first of the ceremonies—the unveiling of the stone tablet—was held on March 17 at Kawaiaha'o Church on O'ahu. The tablet was then transported to Keauhou for the follow-up ceremony which was held on August 15. The ceremonies were attended by Queen Lili'uokalani and other noted Hawaiians. An article published in *The Honolulu Advertiser* on March 17 described the ceremony thusly:

With ceremonies as interesting as they will be unique, the Daughters of Hawaii this afternoon, at Kawaiaha'o Church, will unveil a stone tablet, which later is to be taken to Keauhou, Kona and inset into the famous Kauikeaouli Stone, a huge saucer-shaped lava rock which marks the birthplace of Kamehameha III, born one hundred years ago today. The tablet, a tribute to the memory of "the beneficent King" will be unveiled by Her Majesty, Queen Liliuokalani, assisted by the High Chiefess Elizabeth Kekaaniau Pratt. The covering of the tablet will be the Royal Standard of Hawaii, loaned by the Queen for the purpose.

Two distinctly Hawaiian features will mark the program. One is to be the chanting of the "Life Giving Prayer," the words of which were chanted over the supposedly dead body of the newly born babe a century ago in the heiau of Keauhou by the high priest, the incantation being answered by the gods and breath coming to the body of the prince. The prayer will be recited by one of the very few living who know it as it has never been written down, and never will be, such is its sacredness in the minds of the Hawaiians. Mrs. Naha Hakuole, who will recite the words, learned them from her mother, to whom they had been imparted by her mother, all by word of mouth. The same lady will chant the koihonua of Kauikeaouli, his genealogy. (The Honolulu Advertiser 1914b:7)

Following the ceremonies held at Keauhou on August 15, *The Honolulu Advertiser* published an article detailing that day's events and included photos of the ceremony:

The ceremonies connected with the dedication of the memorial tablet to mark the birthplace of Kamehameha III were held at Keauhou, Hawaii, Saturday, August 15.

Her Majesty Queen Liliuokalani, attended by her chamberlain, Curtis P. Iaukea and Mrs. Iaukea and a delegation from the Daughters of Hawaii left Honolulu for Kona on the Mauna Loa, Friday, August 14. The ladies in attendance on the Queen included Mesdames C.S. Holloway, A. Ahrens, F.M. Swanzy, E. Henriques, M. Reis, A. Wall, Carrie Robinson, Mrs. Kekuewa, Miss Lucy K. Peabody, and many other prominent in Hawaiian society.

The Mauna Loa also conveyed the granite memorial tablet which was to be dedicated.

Met By Royal Canoes

As the Mauna Loa entered Kailua harbor Saturday morning the steamer was met by a royal double canoe manned by rowers clothed in ancient feathered cloaks and leis of scarlet and yellow. The big double canoe was accompanied by a retinue of canoes filled with warriors in ancient costume.

The stone was lowered into the double canoe and the fleet paddled down the coast to the harbor of Keauhou.

In the mean time the Queen and her party landed at Kailua and were taken in automobiles overland to Thomas C. White's residence at Keauhou where breakfast was served.

Revival of Old Days

The ceremonies attendant upon the landing of the tablet were an elaborate recrudescence of the ancient customs of the people. the stone was carried on a litter borne by twelve stalwart descendants [Figures 31 and 32] of the warrior chiefs, each clad in costume emblematic of the rank and calling of his ancestors.

A tent awning had been erected in which Liliuokalani sat [Figure 33] surrounded by her high chiefesses and her chamberlain, and from which she viewed the ceremonial.

Delegate to Congress, Jonah K. Kalaniana'ole and his party were present, and the orator of the day was Rev. Stephen Desha. A very large concourse of Hawaiians was in attendance to do homage to their Alii. The dedication ceremonies were simple, impressive and dignified. After the conclusion of the dedication a luau prepared by the Kona people was served to several thousand who had gathered to take part in the celebration.

The Queen and her party went overland to Hilo and will return to Honolulu on the Mauna Kea this week. (The Honolulu Advertiser 1914a:7)

Additional historical photos of the commemorative events at Keauhou were retrieved from the Hawaiian Mission Houses library and archives and included below as Figures 34 through 38.



Figure 31. Stone tablet being carried by attendants (The Honolulu Advertiser 1914a:7).



Figure 32. Stone tablet at Keauhou Bay (The Honolulu Advertiser 1914a:7).



Figure 33. Queen Lili'uokalani and her attendants at the White property (The Honolulu Advertiser 1914a:7).



Figure 34. Canoes carrying stone tablet arriving at Keauhou Bay, 1914 (Hawaiian Mission Houses Albert Baker Collection N-B0135a).



Figure 35. Stone tablet being carried to birthplace, 1914 (Hawaiian Mission Houses Albert Baker Collection N-B0135c).



Figure 36. Queen Lili'uokalani at the White residence (Hawaiian Mission Houses Albert Baker Collection N-B0136).



Figure 37. View of Keauhou Bay (foreground) with entrance to Kauikeaouli's birthplace (background) (Hawaiian Mission Houses Albert Baker Collection N-B0134a).



Figure 38. Entrance into Kauikeaouli's birthplace with stone tablet behind gate (Hawaiian Mission Houses Albert Baker Collection N-B0134b).

Following the commemoration ceremonies to honor the birth and birthplace of King Kauikeaouli, life at Keauhou resumed as a quiet fishing village and ranching community. By 1924, to support his ranching efforts, Tommy White constructed or reconfigured many of the stacked stone walls built along 'Ahu'ula Cliff to create small corrals for his livestock and constructed a shed and two tanks on his parcel. These changes are shown on a series of maps prepared in 1924 Bishop Estate Surveyor, G. Podmore and annotated by HHF Planners (Figure 39)(HHF Planners 2017). This map also depicts portions of 'Ahu'ula Cliff, Kamohoali'i Heiau, a Ho'okūkū Pond (labeled on the map as "pond" shaded blue), the coastal road extending from the north side of the bay towards the White residence where it transitioned into a trail, and the birth place of Kamehameha III.

Ranching persisted as an economic mainstay for many of the families in Keauhou and the greater Kona District. Cattle raised in the district were shipped to markets in Honolulu via steamship. Local ranchers retell personal accounts of driving cattle from Kainaliu along the coastal trail to Keauhou where they were held overnight in pens until the steamship arrived the following morning. Sandy Manuel (Haanio), who was interviewed as part of this study recalled how cattle were brought down from the uplands using the *mauka-makai* trail, one of which was located near their family's *makai* home.

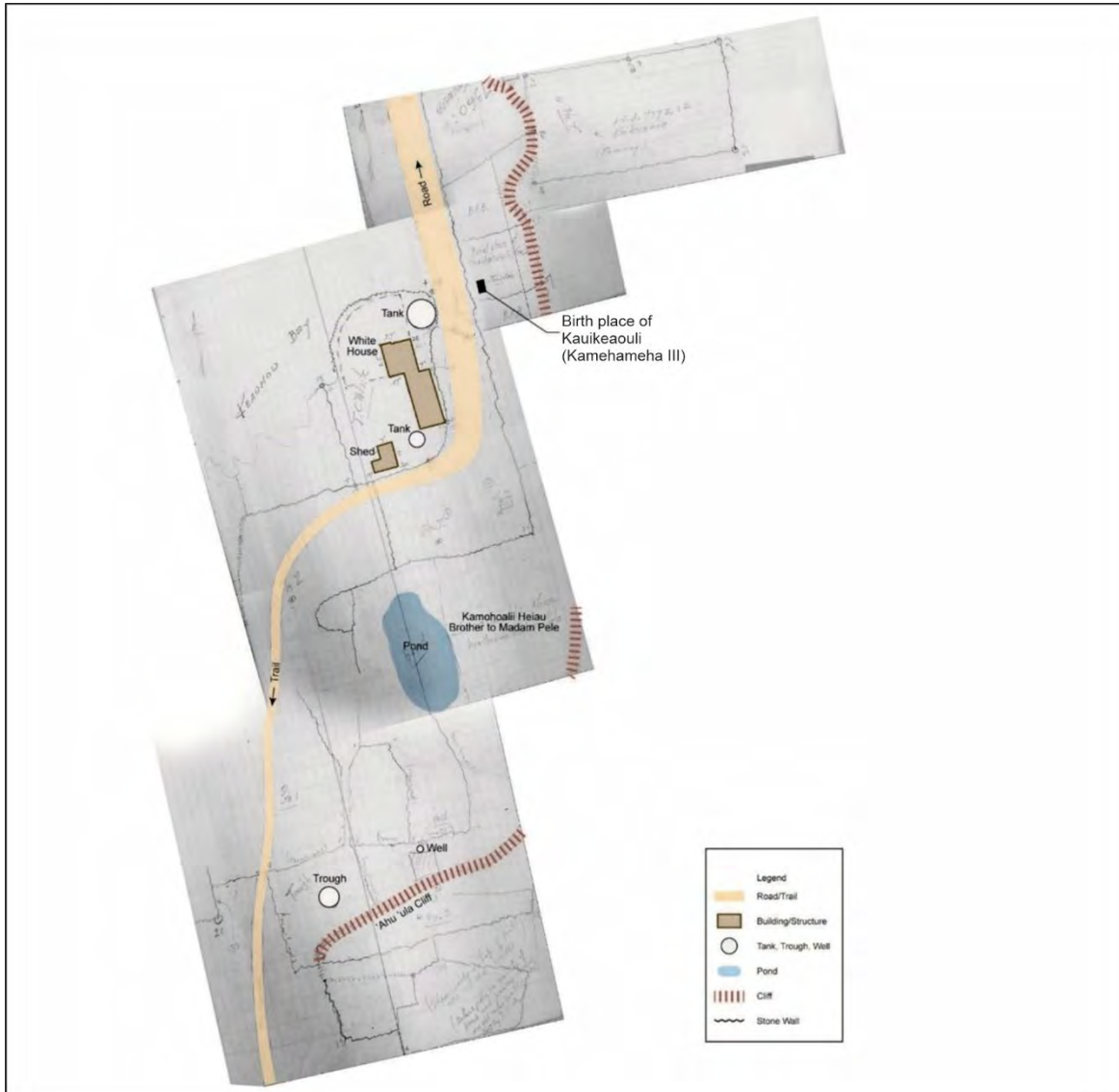


Figure 39. G. Podmore's 1924 map annotated to highlight details of the White residence and other areas along 'Ahu'ula Cliff (HHF Planners 2017:46).

An interview with Lily Haanio-Kong, who was born at her family homestead overlooking Keauhou Bay in 1927 recalled life at Keauhou during this time:

...My father, Harry Ha'ani'o was a fisherman, and we also had kuleana land at Keauhou mauka, where we grew kalo, 'uala, and all kinds of crops... My mother was Mary 'Āinako'ako'a Ha'ani'o and she was a housewife. When I was growing up, there was only about 13 or 14 families around us on Keauhou Bay—my Aunt Ida Akana-Chai; Robert Kahalio'umi (the brother of Thomas and Ben Kahulamū); Kalani Kinimaka; the Woods, Hinas, Whites, Roy Wall, and James Ko'omoa; Alikea; Henry Akā Kawewehi; Kahale Kaimihana; mother Ka'aha'āina (who lived to be 115 years old); Alice Hoapili; and the Walkers. It was a very close community. Most all of the Hawaiians were either fishermen or farmers. (Maly and Maly 2003:12)

Historical photos from 1916 (Figure 40), 1920 (Figure 41), 1935 (Figure 42), and 1937 (Figure 43) show Keauhou Bay and the project area during this period. The photos show several homes located a little inland within the project area boundaries, the coastal road, and a roughly 50-foot-long rectangular wooden pier with corrugated iron roofing projecting into the bay. A 1932 tax map (Figure 44) shows the distribution of the lots, the route of the "Kailua-Keauhou Beach Road," the "Keauhou Trail" traversing in a *mauka-makai* orientation, and a portion of a 2.15 acre cemetery within the current project area.



Figure 40. Keauhou pier, 1916 (Hawai'i State Archives PP-29-11-002).



Keauhou Cove, North Kona, Hawaii, where Kamehameha laid up the "Fair American," after its capture by Kameeiamoku. Menzies visited this place 16th January, 1794.

Figure 41. View of pier (left), White residence (right) and other structures along Keauhou Bay, ca. 1920 by W.G. Wilson (in Menzies 1920:149).

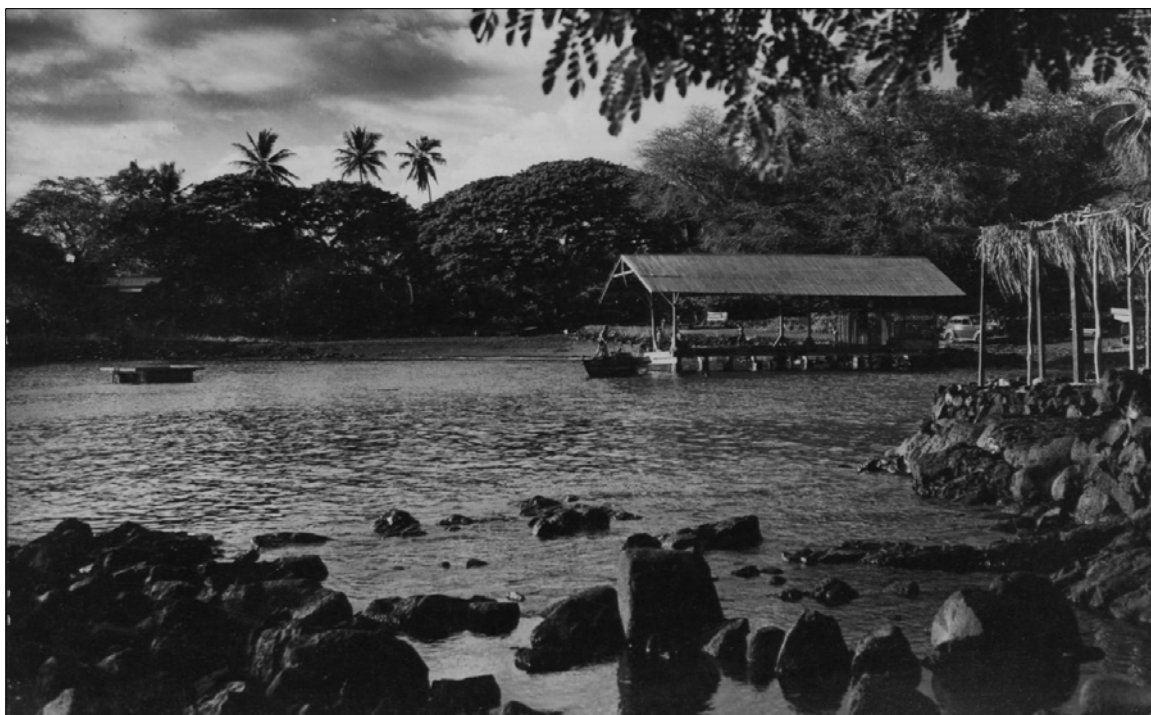


Figure 42. Keauhou Bay, pier, and corner of White residence ca. 1935 (Hawai'i State Archives PP-29-11-031).



Figure 43. Aerial image of Keauhou Bay taken July 15, 1937 (National Archives).

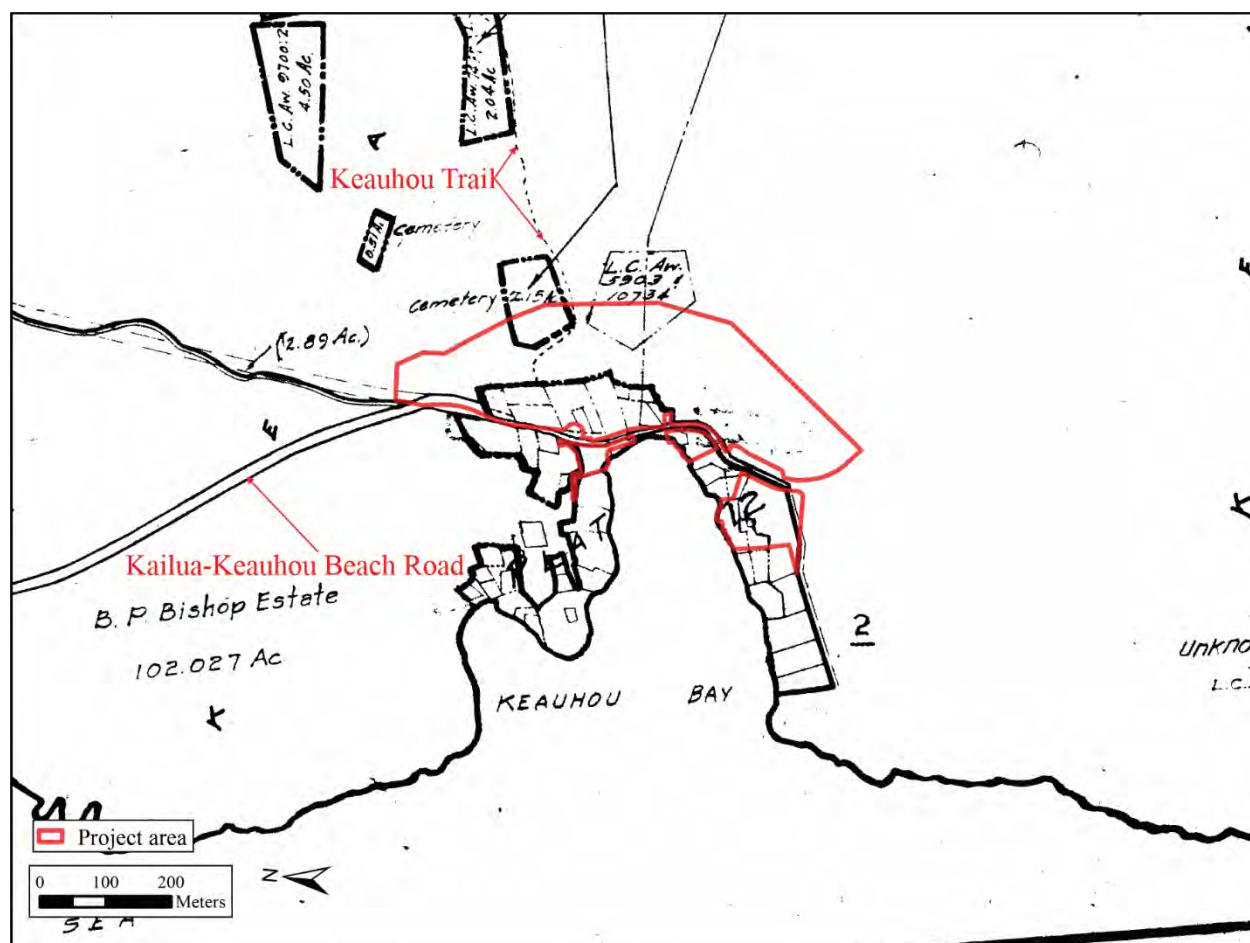


Figure 44. Portion of TMK (3) 7-8-10 showing project area in 1932.

Tourism slowly grew as a mainstay for the district's economy, especially for visitors seeking retreat from the industrially curated visitor experience. Such ideas are evident in an account written by American traveler and author, Harry A. Frank, who visited Kona during the 1930s and penned the following description:

The Kona coast has something about it that is not quite describable. It lacks that atmosphere of ball-bearing Big Business so general in the Hawaiian Islands...because the contour of Kona does not play into the hands of the big industrialists...this leaves a chance for things homegrown for the grower's own use, does not reduce Kona to a holding of a big corporation or two...so there remains a hint of the old Hawaii there. (Frank 1937 in Tomonari-Tuggle 1985:35)

Life at Keauhou was severely disrupted when on April 1, 1946, a magnitude 8.6 earthquake rocked the Aleutian Islands, sending a deadly *tsunami* racing toward the Hawaiian Islands. Although not in the wave's direct path, the sea at Keauhou "rose 13 feet" and according to one account, a single home was destroyed (Shepard et al. 1950:440). Ethnographic interviews gathered over the years with *kama'āina* reveal that the damage was, however, far more extensive. According to *kama'āina* Lily Ha'ani'o Kong (born in 1928) and Barbara Nobriga (born in 1938), the original pier (see Figures 40-42) at Keauhou was destroyed (Rechtman 2015). During the ethnographic interview with Mrs. Nobriga conducted as part of this study, she explained that their family's *makai* home at Keauhou was also destroyed. Historical photos taken four years later in February 1950, shows the pier no longer in existence (Figures 45 and 46) and the remains of the former White property (which housed Queen Lili'uokalani during the commemorative ceremonies) including the seawall and a stone staircase (Figure 47).

KEAUHOU POST TSUNAMI OF 1946

Following the 1946 tsunami, Charles Machado leased, from Bishop Estate, land a short distance inland from the destroyed pier where he had a fleet of fishing boats. The Machado's installed a dry dock with sheds, a hoist, a concrete ramp, and a marine railway, all of which are shown in historical photographs from February 1950 (see Figures 45 and

46) (Rechtman 2015). The Keauhou Road, which followed the shoreline, was improved from a low-lying compact coral road to an elevated road with a basalt rock base (see Figure 45) (HHF Planners 2017). In the following decades, more changes occurred that continued to alter the landscape of Keauhou all while ushering in an era of commercialization. According to Mrs. Nobriga (interviewed as part of this study), and Lily Haanio-Kong who was interviewed by Maly and Maly (2003), in the early 1950s, the passage into the bay was deepened when the bay was dredged using dynamite. Lily Kong reflected that:

One of the things that makes me really sad about this place today, is that they dredged the bay in the 1950s. You see how the ocean is like *kai mimiki*, like its agitated and being pulled out before a tidal wave; well it never used to be like that in here. The water was always *mālie* and clear, but when they dredged the bay, the water changed. You know that's one of the things now-a-days, they change the nature of things, they open up the bays, or make the tidal pools open out to the ocean, and its all *hāmama* (open up), just waiting for the big water. They change things and it makes problems. (Maly and Maly 2003:13)

Despite the physical changes brought about by the *tsunami*, Keauhou remained a historically meaningful location. During the early 1950s, one of the most detailed studies documenting the area's rich history and significant places was undertaken by Theodore Kelsey and Henry Kekahuna. Their work, which is detailed below, captures important changes to the project area during the 1950s, all while illuminating the historical character of this land.



Figure 45. Keauhou Bay in February 1950 showing absence of pier and the Machado dry-dock where the boat and vehicles are parked (Hawai'i State Archives PP-29-11-003).



Figure 46. Keauhou Bay shoreline in 1950 (Hawai'i State Archives PP-29-11-006).



Figure 47. View of the White property in February 1950, showing remaining seawall and stone staircase (Hawai'i State Archives PP-29-11-005).

Kelsey and Kekahuna's Survey of Keauhou Bay

Detailed knowledge of the coastal Keauhou area during the mid-20th century comes from the work of historian, Theodore Kelsey, and Maui-born cartographer, Henry Kekahuna. Together the duo undertook an extensive study to map the cultural sites in different parts of Kona and compiled historical notes based on information they obtained from elder local informants, one of which included Mrs. Naluahine Kaopua of Kahalu'u. Their work has proven invaluable to understanding the cultural-historical context of Keauhou during this time. Between 1953 and 1955, Kekahuna published several maps for the coastal section of Keauhou including one covering the shoreline of Keauhou and He'eia bays (Figure 48), one showing the sites in the vicinity of Kaleiopapa Heiau, the birth site of Kamehameha III (Figure 49), and one depicting the royal *hōlua* (see Figure 19).

Historical notes for specific sites (shown below in Figure 48 and labeled as A through N) found around Keauhou Bay have been extracted from Kekahuna's map and transcribed below. As shown in the text below, Kekahuna's notes not only describe the physical condition of some of the sites but also highlights certain cultural practices, historical figures, natural resources, and changes that had occurred prior to his visit.

- A This was once a well-terraced area where royalty viewed surf-riding contests. From about a mile offshore northwest of He'e-ia Bay, and a mile out from Pa-he'ehe'e, near the boundary of Ke-au-hou I and Kaha-lu'u, contestants rode the celebrated surf of Ka Nalu O Ka-Ulu—The Waves of Ka-Ulu—then continued on in the surf of Kala-pu, a little seaward of Ku-maha-ula Pt., right up to the now pebbly black sand beach of He'e-ia Bay.
- B Chiefs and priest, including judges of surfing contest, here assembled on a paved area 1.5 ft. h, by 30 ft. w, by 50 ft. l, extending northwards near the cliff of He'e-ia Bay.
- C Here on the top of a watch tower ('ale'o) about 30 ft. high, an umpire would have a signal-flag to start a contest between surf-riders in the surf of Ka Nalu O Ka-ulu, and holua-sled riders on the famous royal holua-slide, which then extended about 5,000 ft. from the top of Pu'u O Kaomi-la'o, a hill in the upland, to a point close to He'e-ua Bay. The first contestant to reach the bay, whether surf-rider or sled-rider, was proclaimed victor.
- D Originally, the royal holua-slide ended here near He'e-ia Bay, where a holua-idol stood. The rocks of the lower portion of the slide, about 2,000 ft. long, were unfortunately removed for various purposes subsequent to the Great Mahele (Land Division) of 1848. The upper half, over 3,000 ft. long, and about 50 ft. wide, preserved for posterity through the efforts of Mr. J. Paris, now ends about 750 ft. eastward from Ke-au-hou Bay.
- E The concrete tomb of chief Kane-hoa, a son of the noted chief Hoa-pili, close companion of Kamehameha I. Chief Kane-hoa, grandfather of the present Hoa-pili families, was a brother of chief Maka-'ina'i, who lived with his family on the land where the tomb now lies.
- F The remnant of the foundation platform of a royal residence of ancient King Lono-i-ka-makahiki. When Ka-mehameha I became king, he and his royal family occupied the sites, and the area west of it to Ha'i-ka-ua Cove. His royal canoe landing was Pueo Cove.
- G The remnant of a stone house foundation, with a solitary kukui tree near the middle of it, here marks the birthplace of the noted Hawaiian antiquarian David Malo, son of 'Ao'ao and his wife He-one. (Malo was born Feb 18, 1875, and died at Ka-lepolepo, Maui, Oct. 21, 1853)
- H Site of Ka-moho-alii Heiau, of which only a few large stones remain.
- I Site where chief Kane-hoa's residence stood.
- J Cave of Mo'i-keha (Ke ana o Mo'i-keha) in which a chief Mo'i-keha hid, with only his legs barely visible, to escape pursuers from Ka-'ū. Fortunately he was undetected, as this his life was saved.
- K A monument to the memory of King Ka-mehameha III, or Kau-i-ke-ao-uli, now in charge of the Daughters of Hawaii, here lies in an enclosure near the base of 'ahu-'ula Cliff. On this spot Queen Ke-opu-'o-lani, tabu state wife (wahine kapu) of King Ka-mehameha I, gave birth, following a bath in the cold water of the near-by sea-spring of Ku-hala-lua, to the stillborn Prince Kau-i-ke-ao-uli. Providentially he was resuscitated to become the future king. (Born Aug 11, 1813; made king in June 6, 1825; married his Queen, Ka-lama, daughter of Ka-pihe-nui, Feb 2, 1837; died in Honolulu, Dec 15, 1854.

- L At this point, now covered, which lies about 102 ft. southward from the southwest corner of the monument enclosure to the seaward edge of the present road, then 15 ft. near the former north side of the now filled Ho'okūkū Pond, on pa-hoehoe originally about 2 ft. higher than the road, the seemingly lifeless newborn Prince Kau-i-ke-ao-uli, through powerful prayers of the celebrated kahuna Ka-pihe-nui, and by passing the undetached afterbirth (ka 'iewe), over a fire to warm it (ua 'olala 'ia i ke ahi), was providentially snatched back to the land of the living, and occasion of greatest rejoicing.
- M A pit about 9 fathoms deep and 20 ft. in diameter, known as Ka-imu-ki, lies here in Ke-au-hou Bay, a little out from 'Ala-'ihi Point. Back of the point, on the land of Ka-imu-ki, where a house now stands, was born the celebrated medical kahuna Kamali'i-kane, of the class that skillfully diagnosed by feeling over the body (kahuna hāhā).
- N Feather cloaks and capes ('ahu-'ula) were here aired in the sun at the south end of 'Ahu-'ula Cliff. Hence the name of the cliff.
Wahine-maika'i Cove. Here women of old bathed for ceremonial cleansing following menstruation. Hence the name. The rocky shore, formerly fronted by a small pebbled beach, has largely broken away.

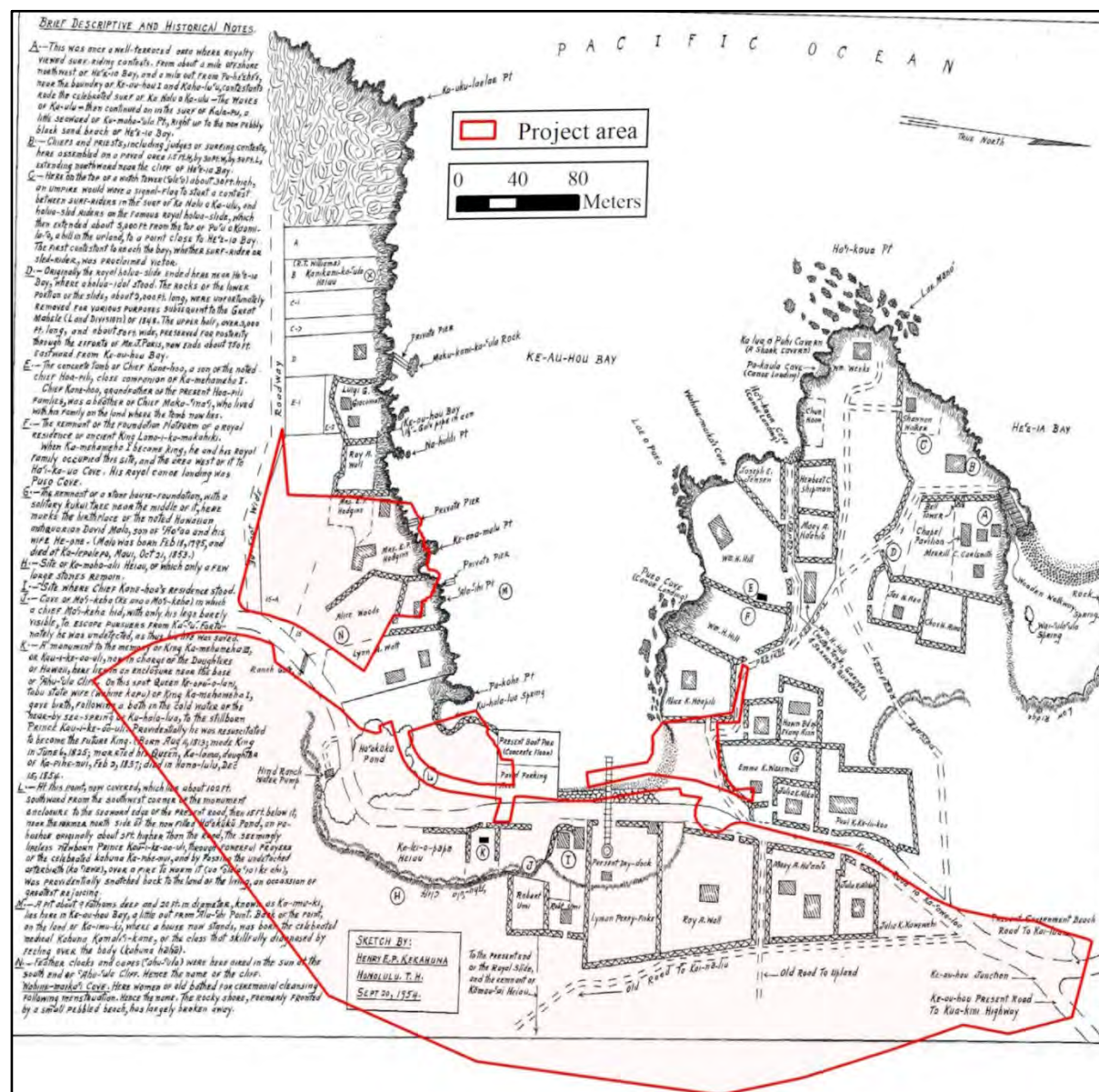


Figure 48. Kekahuna's map of Keauhou Bay dated September 20, 1954, overlaid with project area.

The historical notes included on Kekahuna's map showing the sites in the vicinity of Kaleiopapa Heiau (see Figure 49) have been transcribed below in their entirety:

BRIEF DESCRIPTION, AND HISTORICAL NOTES

The original of the sketch was made Dec 7, 1949, before great changes took place. The present sketch is made especially to indicate distance to points of interest.

- J Mo'i-keha Cave. (Ke Ana o Mo'i-keha). The entrance of this cave is 4.5 ft. high by 12ft. wide.
- K The Kau-i-ke-ao-uli Memorial Tablet. (to commemorate Prince Kau-i-ke-ao-uli, later King Kamehameha III). The monument is on a slightly elevated ground inclined towards 'Ahu-'ula Cliff. It is now in charge of the Daughters of Hawaii.
- L At this spot, filled in in 1954, the afterbirth (ko'i-ewe) of the stillborn Prince Kau-i-ke-ao-uli was passed over the fire to warm it (ua 'olala 'ia i ke ahi). By this means, and by the prayers of High Priest Ka-pihe-nui, the infant prince was restored to life, amid great thanksgiving and rejoicing.
- ⊗ Red Ochre (lepo 'alaea) in 'Ahu-'ula Cliff. Red ochre was much sought in ancient times. It was employed to color the water used in various religious ceremonies, to dye tapa, medicinally for various ailments, and for other purposes.
- Ka-lei-o-pāpā Heiau. This temple, in which Prince Kau-i-ke-ao-uli was born, and by whose name he was sometimes known, was mistakenly identified by some of the early explorers as the place of residence of King Ka-mehameha I, the Conquerer.
- Location of Ho'okūkū Pond. The land once occupied by this pond was filled in and raised about 4ft in 1953 and 1954.
- The Ancient Trail. In the old days this passed along Ke-au-hou Beach, and was part of the "King's Highway" that circuited the island.
- Ku-hala-lua Sea Spring. This royal bathing pool, in the cold water of which Ka-mehameha I's tabu queen (wahine kapu), Ke-opu-o-lani, bathed just before she was seized with her birth-pains, and gave birth to the stillborn Prince Kau-i-ke-ao-uli (later King Ka-mehameha III), was unfortunately excavated in the latter part of 1953, and the adjacent area greatly changed. Large boulders were laid semi-circularly in the sea on the northern side, from the ends of which projected short stone walls, forming an entrance about the spring, and warding off the rush of the sea.
- On the southern side, where there was black sand, a protective stone wall was built about 2ft. below the level of the pahoehoe.
- Site of Mr. Thomas C. White's Residence. The house was destroyed by the tidal wave of April 1, 1946, and its location, adjoining the present new pier, now filled in. It was here that Queen Lili'u-o-ka-lani and her retinue, and others, were entertained during the dedication ceremonies of the Kau-i-ke-ao-uli Tablet. Here, too, were held many other receptions for noted personages.

INSCRIPTION ON THE TABLET

<p>KAUIKEAOULI, KAMEHAMEHA III SON OF KAMEHAMEHA I AND KEOPUOLANI BORN MARCH 17, 1814 DIED DECEMBER 15, 1854 KA MOI LOKOMAIKAI</p>
--

Prince Kau-i-ke-ao-uli's nurse (kahu), Emilia Ke-awe-a-mahi, gave the date of his birth as August 11, 1813, which is given by both Alexander and Hitchcock. Later his birth was conventionally fixed as March 17, 1814.

BRIEF DESCRIPTIVE, AND HISTORICAL NOTES.

The original of this sketch was made Dec 7, 1949, before great changes took place. The present sketch is made especially to indicate distances to points of interest.

J—Mo'i-keha Cave (Ke'ana o Mo'i-keha). The entrance of this cave is 4.5 ft. high by 12 ft. wide. K—The Kau-i-ke-ao-uli Memorial Tablet (to commemorate Prince Kau-i-ke-ao-uli, later King Ka-mehameha III). The monument is on slightly elevated ground inclined toward 'Ahu-ula Cliff. It is now in charge of the Daughters of Hawaii.

L— At this spot, killed in 1954, the of the birth (the name) of the stillborn Prince Kau-i-ke-ao-uli was passed over the fire to warm it (ua 'olala 'ia i ke ahi). By this means, and by the prayers of High Priest Ka-pi-he-nui, the infant prince was restored to life, amid great thanksgiving and rejoicing.

Red Ochre (lepo 'aloe) in 'Ahu-ula Cliff. Red ochre was much sought in ancient times. It was employed to color the water used in various religious ceremonies, to dye tapa, medicinally for various ailments, and for other purposes.

Ka-lei-o-pāpā Heiau. This temple, in which Prince Kau-i-ke-ao-uli was born, and by whose name he was sometimes known, was mistakenly identified by some of the early explorers as the place of residence of King Ka-mehameha I, the Conqueror.

Location of Ho'okū POND. The land once occupied by this pond was filled in and raised about 4 ft. in 1953 and 1954.

The Ancient Trail. In the old days this passed along Ke-au-hou Beach, and was part of the "King's Highway" that circled the island.

Ku-halo-lua Sea Spring. This royal bathing pool, in the cold water of which Ka-mehameha I's Tabu āuēn (wahine kapu), Ke-āpu-o-lani, bathed just before she was seized with her birth-pains, and gave birth to the stillborn Prince Kau-i-ke-ao-uli (later King Ka-mehameha III), was unfortunately excavated in the latter part of 1953, and the adjacent area greatly changed.

Large boulders were laid semi-circularly in the sea on the northern side, from the ends of which projected short stone walls, forming an entrance about the spring, and warding off the rush of the sea.

On the southern side, where there was black sand, a protective stone wall was built about 2 ft. below the level of the pahoehoe.

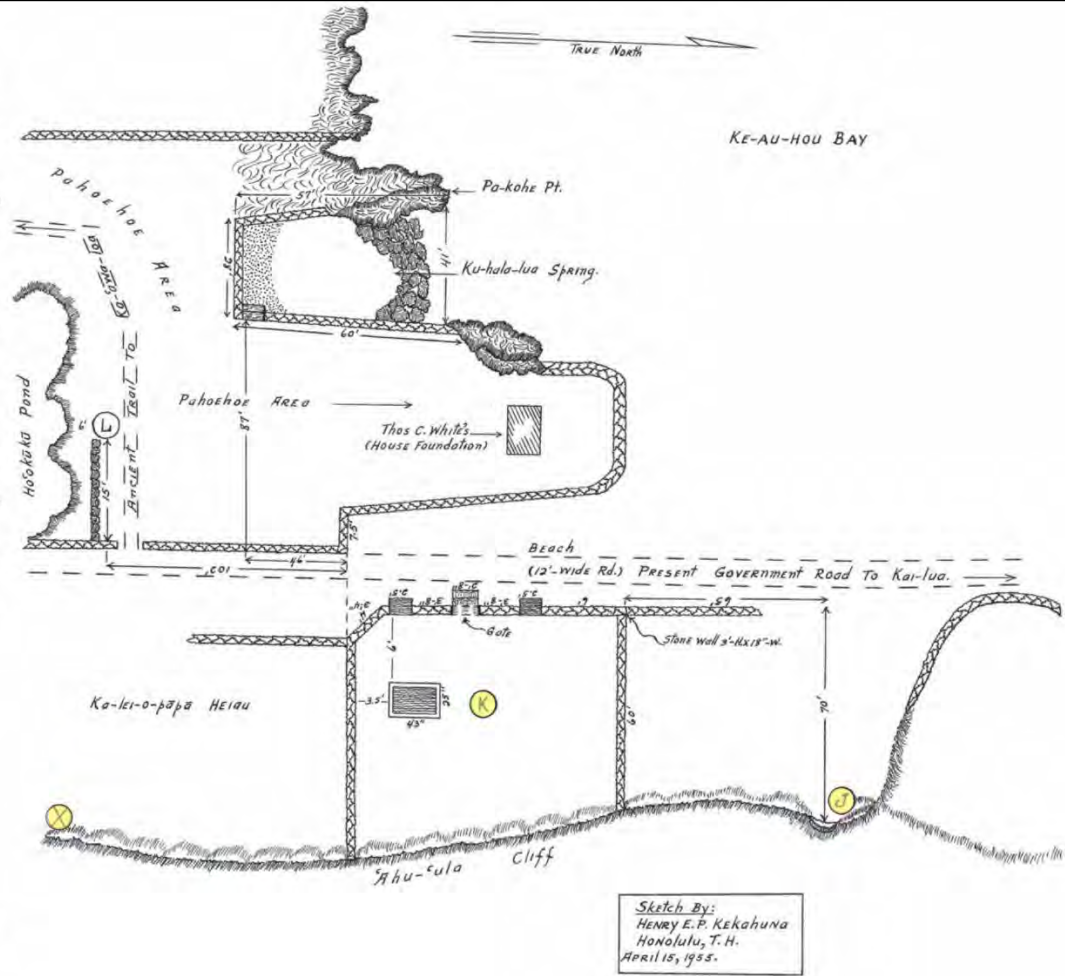
Site of Mr. Thomas C. White's Residence. The house was destroyed by the tidal wave of April 1, 1946, and its location, adjoining the present new pier, now filled in.

It was here that QUEEN Liliu-o-lani and her retinue, and others, were entertained during the dedication ceremonies of the Kau-i-ke-ao-uli Tablet. Here, too, were held many other receptions for noted personages.

INSCRIPTION ON THE TABLET

KAUIKEAOULI, KAMEHAMEHA III
SON OF KAMEHAMEHA I AND KEOPUOLANI
BORN MARCH 17, 1814
DIED DECEMBER 15, 1854
KA MOI LOKOMAIKAI

Prince Kau-i-ke-ao-uli's nurse (kahu), Emilia Ke-āne-a-Mahi, gave the date of his birth as August 16, 1813, which is given by both Alexander and Hitchcock. Later his birth was conventionally fixed as March 17, 1814.
Ke-au-hou, North Kona, Hawaii. 12-75-49.



Sketch By:
HENRY E. P. KEKAHUNA
HONOLULU, T. H.
APRIL 15, 1955.

Figure 49. Kekahuna's map showing sites in the vicinity of Kaleiopapa Heiau dated April 15, 1955.

The site identified as Mo'ikeha Cave is believed to be associated with the high chief, Mo'ikeha who in traditional lore is said to have come from Moa'ulanuiākea, Tahiti. From the account recorded by Fornander (1916-1917) after a discord with his wife Lu'ukia, Mo'ikeha left Tahiti in the company of his chiefs and attendants and set sailed for Hawai'i. The band landed first on the east side of Hawai'i Island visiting areas in Hilo and Puna before departing for the north and leeward part of the island.

Following their fields surveys, Kekahuna and Kelsey published the information that they had gathered in a series of articles that appeared in the *Hawaii Tribune-Herald* under the title, *Kamehameha In Kailua* (Kekahuna and Kelsey 1954a). The thirty-seven-part series, which was published between February 28 through April 5 of 1954 covered select areas between Kailua to Hōnaunau. That portion covering the Keauhou Bay area appeared in three separate articles published between March 20 and 22, 1954. While much of the information contained in these articles is derived from the historical notes that appear on Kekahuna's map, these articles expound upon that information and provide added detail and insight into the project area during the early 1950 and prior. Those articles relevant to Keauhou have been quoted in their entirety below:

A mile south from Kaha-lu'u, and five from Kai-lua, lies the village of Ke-au-hou, once supremely sacred, and proudest of the royal lands on the big island of Hawaii. So exceeding tabu, indeed, was Ke-au-hou, that if even so much as the shadow of a commoners fell toward it from near at hand he would be put to death for his heinous sacrilege! Therefore in the morning, when shadows fell seaward, travelers had perforce to swim across the bay from its point of Ha'i-kaua on the north to that of Ka-uku-laelae on the opposite shore, or vice versa. In the afternoon, however, when shadows fell inland, passers-by kept at a respectful distance behind the pali of 'Ahu-'ula—Feathered Cape or Cloak—that enfolded from the rear the low portion of the village between it and the curve of its splendid white-sand beach of former days.

Most tabu of all the tabu chiefesses of Ke-au-hou, in her day, was Ke-opu-o-lani, whom Kamehameha the Great made his tabu state wife (wahine kapu), and who bore to his exalted dynasty, not only two of its future kings, but also his extremely sacred daughter Nahi (Na-ahi)-'ena'ena—The Burning Hot Fires (of tabu)—(1815-1836) upon whom was bestowed her mother's seldom spoken tabu name. Thus was Ke-au-hou village, hallowed place of royal abode, celebrated for its tabu hot as fire. ('Ena'ena ke kapu o Ke-au-hou)

The tabu queen's first-born son, heir to the kingdom, was Prince Liholiho, the unfortunate Kamehameha II (1797-1824) who died in London, England, as did his consort the chiefess Ka-meha-malu, known also as Ka-mamalu, in that same fateful year of 1824. This second of the Ka-mehameha dynasty did not honor Ke-au-hou with his birth, but "Hilo Hanakahi," land of ancient King Hanakahi, with its long and beautiful sweep of crescent beach of black sand, Hilo's pride and glory, lovingly known as Ke One O Hanakahi—the sand of Kana-kahi—unexcelled charm of Hilo, now completely destroyed. Ke-au-hou later evened royal honors with Hilo, however, for it was there that Ke-opu-o-lani's second son, Prince Kau-i-ke-ao-uli, who shared his chiefly name with his ill-fated royal uncle Kiwala-'o, was fittingly born, as was later his sister Nahi-'ena'ena.

The tale of the birth of Kau-i-ke-ao-uli, born seemingly without a spark of life, but who was destined by the narrowest margin to return to this world from the spirit realm, that he might become the great Kamehameha III of history (B. 1813-D. 1854), is a fascinating story. (Kekahuna and Kelsey 1954b:4)

Other celebrities have also added luster to the name of Ke-au-hou. Best known among them is the noted antiquarian David Malo (Feb. 18, 1795-Oct. 21, 1853), author of *Hawaiian Antiquities*. His birth occurred between Ke-au-hou's present time-ravaged old stone schoolhouse, built subsequent to his birth, and the also later constructed home, still standing, of the late Honorable Henry Kawehiwehi.

Only a remnant of stone foundation is to be found of the house in which Malo was born. Standing faithful lone watch over this birth-site of a greatest shedder of light into the darkness of Hawaii's ancient past is a solitary **kukui**, or candle-butt tree, of kindred spirit and ancient lineage, whose ancestors provided light for the Hawaiians of olden times.

On the land of 'Ala-'ihi, that lies opposite a deep pit in the sea, known as Ka-imu-ki, off the bay's south shore, was born Kamali'ikane, a noted medical kahuna of King Ka-la-kaua's time who practiced in Hono-lulu, and was of the class known as kahuna-haha, who diagnosed by skillfully feeling over the body, and then administered healing herbs.

Just back of the picturesque canoe-landing cove of Pueo, first seaward on the bay's north shore, once the canoe-landing of King Ka-mehameha, and now a last of Ke-au-hou's little remaining storage space for boats and canoes to be list to the public, lies well back and close to the road the weed-overgrown remnant of King Lono-i-ka-makahiki's old-time royal residence among the elite of tabu Ke-au-hou, on the site of which Ka-mehameha lived later.

At present, amid the beauty of trees, rest in their cooling shade a little company of boats interspersed with sad reminders of Hawaiian canoes of once upon a time. Through the leafy vista one looks out across the bay. There, nodding at anchor, lies an exclusive band of small-craft. Among them is unlikely to be seen a single representative of the genuine native canoe of but half a century ago!

(Kekahuna and Kelsey 1954c:4)

It is this famed surfing-bay of He'e-ia, and not the He'e-ia of the island of O'ahu, of which a frequently heard song dedicated to King Ka-la-kaua makes mention.

In the continuance of our quest for the legendary, the traditional, the historical, we find the base of 'Ahu-'ula Cliff, a little south of its northern end, a small cave known as Ke Ana o Mo'i-keha—Mo'i-keha's Cave. Therein, in the long ago, a chief named Mo'i-keha, hotly pursued by enemies who had come from the district of Ka'u, hid therein. Though his upper body was hidden in its dark interior, his legs were visible in the dim light. Most fortunately, however, his enemies were in such great haste that they failed to observe his presence. This his life was saved!

Just beyond and below the pali of 'Ahu-'ula's southwestern end lay a flat of **pahoehoe** lava on which chiefs dried their feather capes and cloaks (**'ahu-'ula**), hence the name.

Before we resume our southern journey farther upland we shall cede a short distance till at about the middle of Ke-au-hou II we see right beside the road on the upper side a long, wide, slightly elevated tract of **pahoehoe** lava. This is the noted Pu'u o Ka-loa—Hill of Ka-loa. When it rained at this hill, relates an old story, it was the rainy season, when taro and potato crops were to be planted. Whenever a feast was held anywhere in Kona, therefore, a man's desirability as a guest might be established by inquiring: "Where were you when the rain fell on Pu'u o Ka-loa? (**'Ha'ule ka u ai Pu'u o Ka-loa 'ihe'a 'oe?**)".

If he answered that he was in another district of this island, or on another island, when the rain fell, he was welcomed as a guest. If, however, he answered that he had been in Kona, and it was known that he had failed to do his share of the work in the rainy season, he was considered a loafer, and was undeserving as a guest at a feast.

Now that we have enjoyed a brief glimpse of Pu'u o Ka-loa and the region roundabout, history dictates that we proceed upland from Ke-au-hou before continuing to the southward. (Kekahuna and Kelsey 1954d:4)

Kekahuna and Kelsey's work includes a distinctive combination of historical/cultural knowledge supplemented with information that shows changes to the Keauhou Bay area following the April 1, 1946, *tsunami*. A historical aerial taken in 1954, during the time Kekahuna and Kelsey undertook their work is shown below in Figure 50. The 1954 aerial shows but a few homes located along the fringes of the bay (some of which are within the project area boundaries), as well as alignment of the *hōlua*, which extended into the project area, and the road/trail to Kainaliu and one along the coast.

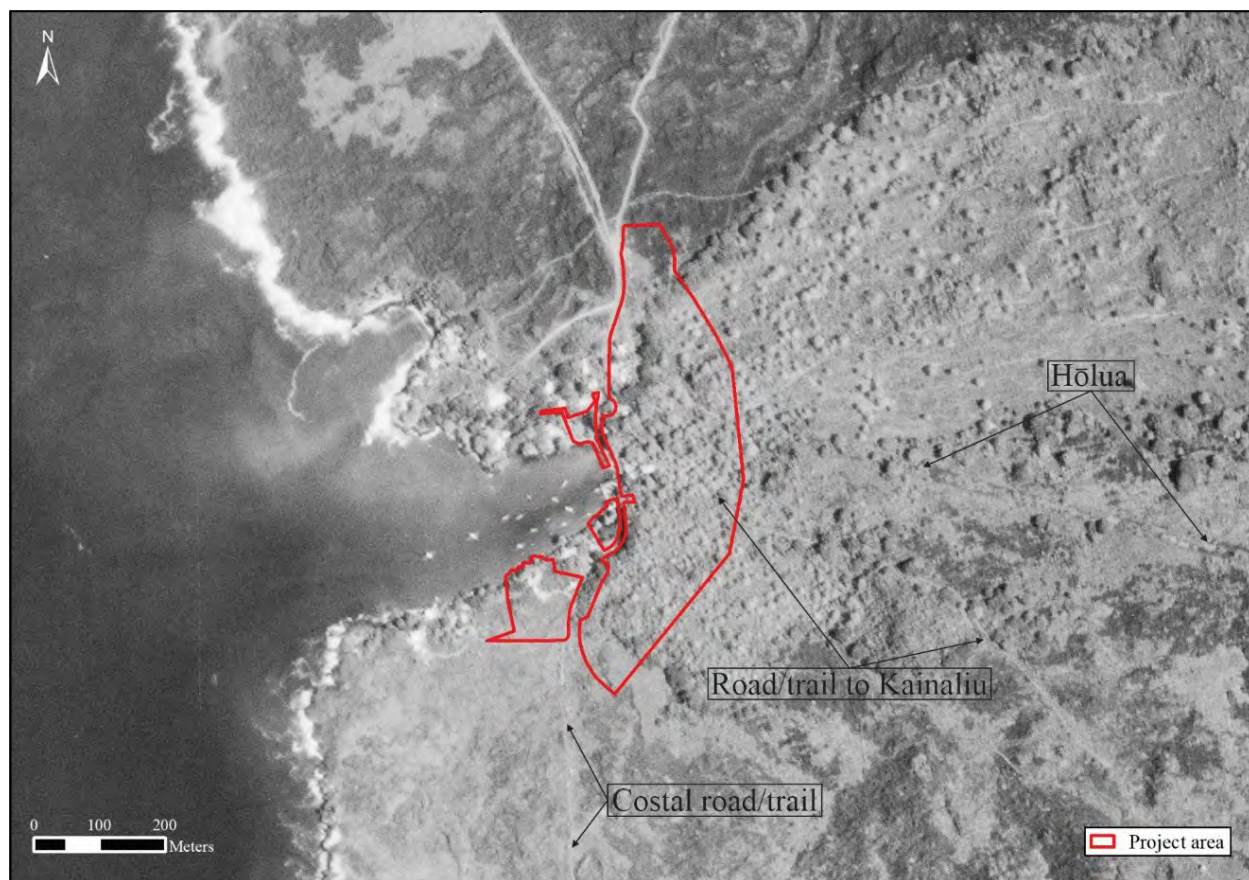


Figure 50. Historical aerial photo showing project area in 1954.

Increased Commercial Activity at Keauhou

Beginning in the 1960s, resort and tourist-related development in the Keauhou area began to alter the landscape, particularly along the coast and Ali‘i Drive including the construction of resorts and golf courses in addition to the build-out and upgrading of roadways beginning in the 1970s (Figures 51 and 52). Two tax maps, one dated 1960 (Figure 53) and one from 1980 (Figure 54) show the rapid outward expansion of development around Keauhou Bay and in the area *mauka* of the project area. Ongoing residential and resort development has taken over many of the beachfront properties in the vicinity of the current project area. The former Machado drydock area (see Figures 45 and 46) was converted for canoe storage associated with the Keauhou Canoe Club (Figure 55) (formerly Kauikeaouli Canoe Club 1980-1986). The former Charles Machado house (Figure 56), build in 1961, is now the retail and booking headquarters of the Fair Wind Cruises charter boat tour company and the former Hind house built in 1952 is the retail and booking headquarters for the Sea Quest Hawaii (Figure 57). In 1978 the Hawai‘i Department of Transportation assumed administration of the Keauhou Bay Small Boat Harbor, and within a few years thereafter, the present-day concrete boat ramp was constructed on the southern side of the bay (see Figure 57). The administration of the Keauhou Bay Small Boat Harbor was transferred again in 1992 to the Department of Land and Natural Resources (Rechtman 2015).

More recently, there has been a concerted effort on the parts of Kamehameha Schools, the Daughters of Hawai‘i, and the Hawai‘i Tourism Authority to highlight the cultural and historical significance of the Keauhou Bay area. A public walking path and the placement of interpretive signs are found in the vicinity of the Kamehameha III birthplace and other culturally important places found along the base of ‘Ahu‘ula Cliff. (Figures 58, 59, and 60) Kamehameha Schools has deeded the land where the Kamehameha III birth site monument is located to the Daughters of Hawai‘i, who not only maintain the monument (Figure 61) and host the annual celebration marking the birth of King Kauikeaouli.



Figure 51. Aerial of Keauhou Bay ca. 1960-1974 showing resort construction, golf courses, and new roads (North Hawaii Education and Research Center PP-0225).



Figure 52. Aerial image from 1974 showing increased resort development and road improvements in project area and neighboring vicinity.

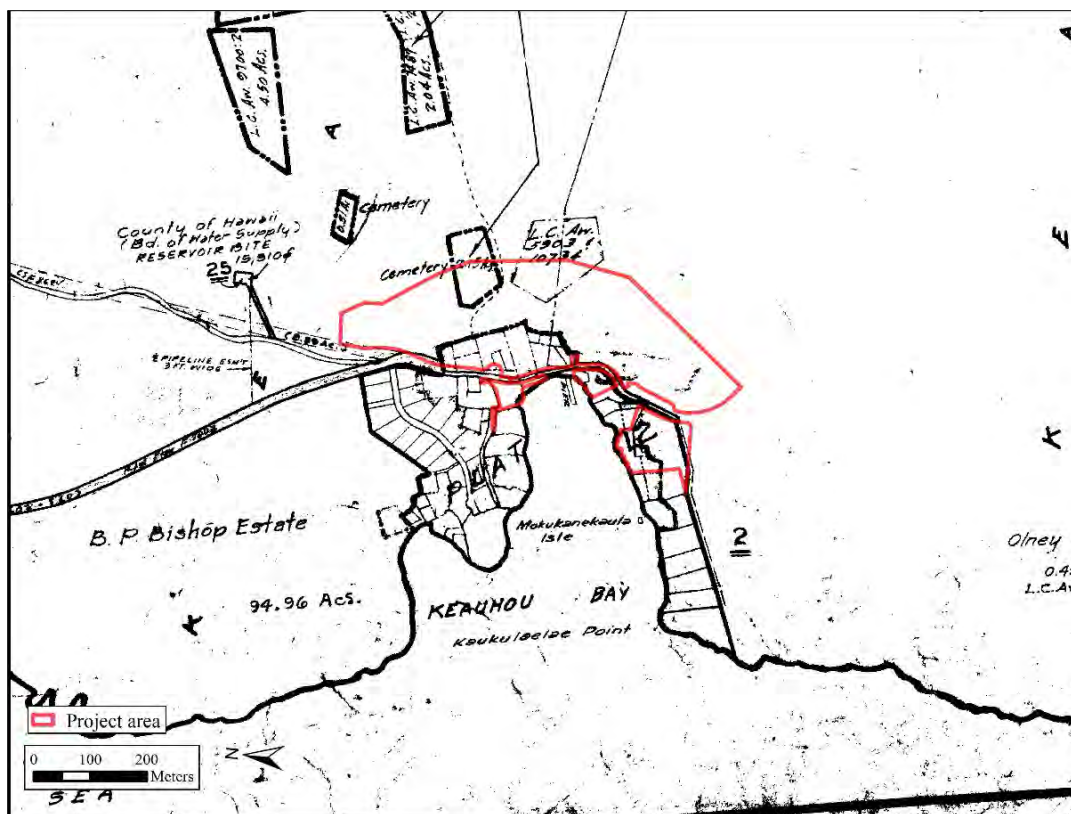


Figure 53. Portion of TMK map (3) 7-8-10 showing project area in 1960.

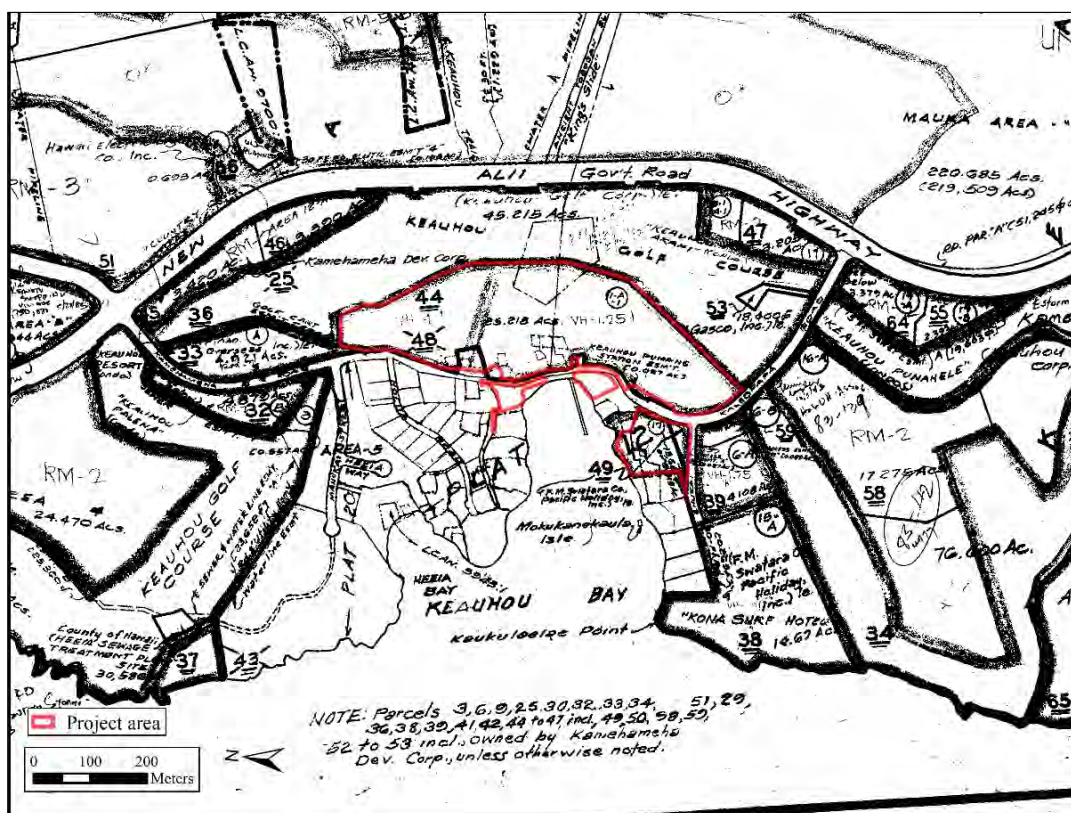


Figure 54. Portion of TMK map (3) 7-8-10 showing project area in 1980.



Figure 55. View of Keauhou Canoe Club in the location of the former Machado drydock, view to the north.



Figure 56. 1963 photograph showing the then-new wooden pier and Machado home in background (Kona Historical Society).



Figure 57. Former Machado house now the headquarters of the Fair Wind Cruises (left) and the Hind family home now the headquarters of Sea Quest Hawai'i (left).



Figure 58. Interpretive sign commemorating King Kamehameha II adjacent to interpretive pathway, view to the east.



Figure 59. Interpretive pathway located at the base of ‘Ahu‘ula Cliff, view to the south.



Figure 60. Interpretive signs located in the vicinity of Ho‘okūkū Pond, view to the east.



Figure 61. Commemorative monument marking the birthplace of King Kamehameha I, view to the northeast.

PREVIOUS ARCHAEOLOGICAL AND CULTURAL STUDIES

Since the turn of the 20th century, the Keauhou Bay area has been included in various island-wide thematic or regional surveys including those conducted by John F.G. Stokes in 1906, and John E. Reinecke in 1920. These early studies were conducted mostly under the auspices of the Bishop Museum or Bishop Estate, and the early site descriptions, oral traditions, and place name information records are currently on file at the Department of Anthropology at the Bishop Museum in Honolulu. Major resort development beginning in the 1970s spawned a surge of archaeological studies in the vicinity of Keauhou Bay carried out by the Bishop Museum as well as private archaeological consultants. These studies began to focus on individual parcels slated for development, most of which were situated along the coast. The number of studies undertaken in the Keauhou Bay area has continued to increase over the last forty years and has revealed evidence of habitation and resource acquisition as well as ceremonial and recreational use of the land. The following discussion centers on previous archaeological and cultural, and landscape studies conducted within and in close proximity to the current project area. The location of the prior studies conducted in the vicinity of the project area is shown in Figure 62 and listed chronologically in Table 4.

Table 4. List of prior studies conducted in the project area.

<i>Year</i>	<i>Author(s)</i>	<i>Type of Study</i>	<i>Study Area</i>
1906	Stokes	Survey of <i>heiau</i>	Island-wide
1929	Reinecke	Survey of sites	Kona District
1953-55	Kelsey and Kekahuna	Survey of sites	Kona District
1971	Emory et al.	Reconnaissance	Keauhou & Kahalu‘u
1979	Soehren	Reconnaissance	TMK: (3) 7-8-012:032
1979	Hammatt	Reconnaissance	Kona Surf Hotel property
1980	Hammatt	Reconnaissance	Area 1- included a portion of current project area
1983	Rosendahl et al.	Reconnaissance	Area 1- included a portion of current project area
1985	Tomonari-Tuggle	Cultural Resources Management Plan	750 acres extending <i>mauka</i> from the coast
1987	Haun	Reconnaissance and limited subsurface testing	Kona Surf Hotel property
1989	Walker and Haun	Survey and subsurface testing	Kona Surf Hotel property
1989	Rosendahl	Field inspection	TMK: (3) 7-8-012:098
1992	Rosendahl and Walker	Field inspection	TMK: (3) 7-8-012:002, 053, and 100
1996	Barrera	Inspection	TMK: (3) 7-8-012:031
2003	Tulchin et al.	Inventory survey	Kona Surf Hotel property-TMK: (3) 7-8-012:58 and (3) 7-8-010:038 and 039
2004	Mann et al.	Preservation plan	Kona Surf Hotel property-TMK: (3) 7-8-012:058
2004	Maly and Maly	Cultural synthesis	Keauhou & Kahalu‘u Ahupua‘a
2005	Jones and Hammatt	Monitoring report	Kona Surf Hotel property- TMK : (3) 7-8-010:038, 039 and 7-8-012:58-60
2005b	Haun and Henry	Inventory survey	TMK: (3) 7-8-012:098 included a portion of the current project area
2005a	Haun and Henry	Inventory survey	TMK: (3) 7-8-010:044-included a portion of current project area
2012	Haun and Henry	Impact assessment and subsurface testing	Site 24264 (Mō‘ikeha Cave) and Site 24265 (historic building) on TMK: (3) 7-8-010-044 - included a portion of current project area
2014	Haun and Henry	Preservation plan	Site 24264 (Mō‘ikeha Cave)
2015	Rechtman	Cultural impact assessment	Keauhou Bay
2017	HHF	Cultural landscape assessment	Keauhou Bay Cultural Landscape Area and Kaukulaele Cultural Landscape Area
2018	HHF	Cultural landscape assessment- final treatment plan	Keauhou Bay Cultural Landscape Area and Kaukulaele Cultural Landscape Area
2021	Haun et al.	Reconnaissance and site condition update	TMK: (3) 7-8-010:044 and 049, 7-8-012:004, 007, and 065
2022	Reeve	Supplemental inventory survey	Land Area 6- TMK: (3) 7-8-010:049, (3) 7-8-012:004, 007, 061, 065, 098, and 103
2022	Haun and Henry	Reconnaissance and site condition update	TMK: (3) 7-8-010:044 and 049, 7-8-012:044, 007, and 065

Early Archaeological Investigations (1906-1955)

In 1906, in contract with the Bishop Museum, John F. Stokes (Stokes and Dye 1991) conducted an island-wide field survey. The purpose of Stokes' survey was to document *heiau*, but he sometimes recorded *ko'a* (fishing shrines) and other miscellaneous structures. Of the approximately fifty *heiau* recorded in North Kona, five were located in Keauhou 1st and 2nd including Ka'io'ena or Keahiolo, 'Öpūkaha; Kamau'ai, Ho'okūkū or Kaopa, and Ahu A 'Umi. Of these, Stokes was able to locate and observe the remains of one of these *heiau* during his survey. The remains of Ka'io'ena (BPBM Site 50-Ha-D4-100; SIHP Site 50-10-37-04621), located on the Kahalu'u and Keauhou 1st boundary about 400 feet above sea level, consisted of a few pavements or low platforms along the edge of an 'a'ā flow. Regarding 'Öpūkaha Heiau (BPBM Site 50-Ha-D3-5; SIHP Site 50-10-37-3813), Stokes stated that the *heiau* was in Keauhou 1st "just west of the junction of the Hōlualoa and Keauhou roads" and that he had not seen the *heiau*. Of Kamau'ai Heiau (BPMB Site 50-Ha-D3-4; SIHP Site 50-10-37-3812), Stokes stated that :

This is a *heiau* mentioned by Thrum as very ancient, ascribed to Kāne himself and connected, traditionally, with the introduction and propagation of vegetables in these islands. Enquiries in the field led to a place called Kamau'ai, on the top of the cliff directly back of and overlooking the Keauhou landing. It is now a house lot, and the [then] owner said that he and his people had lived there for a long time and had never heard of a *heiau* being there. (Stokes and Dye 1991:85)

Stokes offered the following description of Ho'okūkū (Kaopa) Heiau:

Heiau of Ho'okuku or Kaopa, land of Keauhou 2, North Kona, near the boundary of Keauhou I. Keauhou wharf bears 168°, 250 feet. This place owes its interest in modern times to the tradition that the royal child (later Kamehameha III) who was stillborn here then was miraculously brought to life. There is nothing suggestive of a *heiau* in the appearance of the place. A low, rambling wall encloses a space of about 1.5 acres at the foot of a high cliff. The contour of the ground inside is similar to that outside, and within are breadfruits, *loulou*, and other trees. Also inside, however, is a large rock to which marvelous revivifying powers were attributed, and it was stated that the dead baby was placed on the stone for some days and came to life by virtue of the stone, with the aid of the priest's prayers. It is not improbable, if all were known, that this would prove to be the site of the *heiau* of Kamau'ai Heiau mentioned above. (Stokes and Dye 1991:85)

Of Ahu A 'Umi Heiau, Stokes mentioned its location within Keauhou 2nd and that he had not visited the site. Despite the limited recordation by Stokes, Cordy (2000), who provided a detailed discussion about this inland *heiau*, reported that Hiram Bingham recorded this site during his visit in 1830. Cordy (2000:208) adds that this *heiau* was:

...built on a cold, conder plain in the saddle between Hualalai and Mauna Loa at an elevation of about 5,200 feet...prior to its modification as a goat pen in the late 1800s, the *heiau* consisted of a stone-walled enclosure (20 x 20 meters) with wall up top 2.5-meters high. This is a rather small area, 440m². Four internal areas were walled off within the *heiau*. Eight very large rectangular cairns—3-4-meters high and 4-7 meters in diameter—were arranged outside of the enclosure, a feature unique to this *heiau*. Recent archaeological work has found a number of other structures scattered nearby, including platforms, enclosures, and fire hearths.

In June of 1929, John Reinecke (1930) in contract with the Bishop Museum, surveyed the coastal areas of Keauhou 1st and 2nd including a portion of the project area. Twenty-four sites (Sites 51-74) were identified. In addition to documenting *heiau* structures, Reinecke made efforts to record all site types he encountered, and worked with local informants who provided him with information about the sites he had identified. While surveying Keauhou, Reinecke relied on and corroborated information from two local informants, Robert Kahalioumi and Henry Kawewehi, whose names are mentioned throughout Reinecke's site descriptions. Regarding the general distribution of habitation areas in Keauhou, Reinecke wrote:

I found that the habitations of these two lands are distributed in three groups: the first, beginning just past the Honalo boundary, concentrated about Kahoe, and running in a thin line up the pahoe-hoe coast to the spot called Kauliloa; the second, about the present village of Keauhou; and the third, separated from the modern village by a very rough a-a flow, and conterminous with Kahalu'u.

Reinecke recorded the identified sites listed numerically by site number in Table 5, moving from south to north along the edge of Keauhou Bay. Portions of the maps associated with the current project area have been annotated and reproduced in Figures 63 and 64 below. For Sites 51-74, located in the immediate vicinity of the project area, Reinecke provided the following description and at times historical information provided by his informants:

Table 5. Sites recorded by J. Reinecke (1930:80-82) in the vicinity of the project area.

<i>Site #</i>	<i>Notes (reproduced from Reinecke (1930))</i>
51	Kaukulaelae Heiau comprised of twelve feature components. The whole platform of the heiau is so rough and dilapidated that it is hard to trace its original form and limits carefully. Apparently it was oriented roughly E. and W., with dimensions over all of about 110x40. There apparently have been later additions.
52	Platform in good condition, 26x18x2, with foundations and wall behind and makai. Probably a modern house platform.
53	A similar platform, in rougher condition. Has three layers of retaining wall makai. roughly 20 plus 4 plus 4x20-24x6.
54	Well built platform, for house or public building, about 78x30x2, with a makai section (part of main platform) 18x18x2.
55	Pen about 38x20x3 before it was broken down.
56	Platform on knoll, about 43x30x4. This site was pointed out by Mr. Kahalioumi, a fisherman, as a fishing heiau, by name Pohakukanikaula or Mokukanikaula, which is also the name of the rock off the shore. It signifies "red sounding or echoing rock."
57	Two smooth-floored pens, side by side with ruined rubble walls. Inside dimensions 36x28 and 32x22.
58	Probably <u>puoa</u> or just plan heaps on the pahoehoe: 11x8, 6x6x1 $\frac{1}{2}$, 14x13x0-2 and bearing a small heap, 7x6x1, 10x10-0-3, 21x6x0-2, and 78x76, besides one irregular and very small.
58	Modern house platform site, about 33x25.
60	Modern house platform site, about 32x23.
61	Modern house platform site, about 34x23x $\frac{1}{2}$ -6.
62	Heaps of rubble 8x9 and 5x5.
63	Heaps of rubble about 20x20, very low. There are other such heaps nearby. By this one, however, round holes have been ground into the pahoehoe slab.
64	Pointed out as Alaihi, a fishing heiau. The <u>alaihi</u> is a kind of fish meaning literally "only one who has permission," because it is dangerous to handle because of its spines. Now merely part of a house-yard.
65	A medium-sized, modern house platform, not measured.
66	Kamohoalii heiau. Utterly in ruins, nothing remaining except the foundation of the outer wall. It covered an area about 60x40 at the foot of the cliff. Stokes' notes, which I copy, are here almost entirely inaccurate: Hookuku. Keauhou 2. Built by Liholiho, near the beach, has breadfruit, loulou and other trees. Another name given is Kaopa. Near bay. Near boundary of Keauhou 1. Place where Kamehameha III was born. Called heiau, but not suggestive in appearance. A rather poorly-built rambling wall, 100 feet E. of the head of Keauhou harbor, at the foot of a cliff. the place contains a large rock, which was believed to have had marvellous vivifying powers. The tradition is to the effect that Kamehameha III was still-born, but was placed on this stone and allowed to remain some days, and through the power of the prayers, the stone put life into the babe." Hookuku, however, is the name of the pool midway of the W. side of the heiau, which now forms a small swamp. It was formerly <u>kapu</u> for the use of royalty. Kaopa is the name of the well S. of the heiau. Kauikeaouli [Kamehameha III] was born on the stone which now supports the tablet to his memory, just N. of the heiau. According to the story, which was received from Mr. Kahalioumi and the Hon. Henry Kawewehi, Kauikeaouli's mother was bathing in the bay when she felt her pangs, and staggering out of the water, she supported herself against the boulder. Kauikeaouli was stillborn. A runner was at one dispatched to fetch a noted <u>kahuna</u> , Kapihi-nui (Great Lamentation). The stories differ in this detail, Kahalioumi saying that he was at Keei and Kawewehi that he was mauka. He ordered the runner to return and notify the queen that he would soon arrive, but when the runner came back to Keauhou he was astounded to find that the <u>kahuna</u> , with his supernatural powers, had arrived before him. Kapihi-nui resuscitated Kauikeaouli by warming his body (according to Kahalioumi) reciting spells (Kawewehi). The king's name signifies "place in the black cloud," from a dream which his mother had before his birth, or from the cloud formation observed the evening before. Mr. Kahalioumi says that the front of the heiau stood ten feet in height. Mr. Kawewehi adds that the stones from it have been used for times in attempts to build up a sea wall to protect the road, but that the stones, put to such a profane use, have every time been washed down, although there have been no storms.

Table 5 continues on next page.

Table 5. continued.

<i>Site #</i>	<i>Notes (reproduced from Reinecke (1930))</i>
67	Moikeha cave. This is a famous cave. The story is that a king, flying from enemies, hid himself in the cave, standing erect and motionless with all his body above his legs hidden in a high pocket of the cave. His enemies, looking inside, did not observe his legs, and passed him by.
68	Low ground behind the Wharf. In ancient times the site of Kamaui [Kamau'ai] heiau. Kamaui signifies "to spread, or pass on, food." The legend connected with it is found in Thrum's Annual for 1908, page 72.
69	Kualalua, the brackish seepage W. of Mr. Tommy White's beach house, used for bathing.
70	The mouth of the burial cave Ke-eku-a-ka-puaa, which signifies roughly, "rooted up by the pig." This cave was used for a burial as recently as 1913, when a very poor Hawaiian was strapped between two sheets of galvanized iron roofing and thrust into the cave. Near its mouth are two double platforms, rather rough, one on the w. being 19x17 with a forecourt 16x9, and the one on the e. 26x21-16, divided into two by a low wall. Their use is puzzling.
71	An upheaved mass of pahoehoe blocks, called Puu o Kaloa. Mr. Kawewehi claims that this was sacred to the god Loa, and a heiau, but there is absolutely no trace of artificial building in the mass. According to the anecdote furnished me, spongers who came about feasts in Keauhou were asked, "Where were you when the rain fell on Puu o Kaloa?—that being the rainy season when everyone should plant his taro, sweet potatoes, etc. If the man answered, "In Honolulu, in Maui, etc." it was presumed that he would have done his share of farming had he been home, and he was allowed to sit at the feast. But if he answered, "In Kona," he was dismissed as a loafer.
72	Area in yard W. of Hoapili's house, known as Hale o Lono. Mr. Kawewehi suggests that this is not a heiau, as some claim it to be, but the site of the house of Lonoikamakahiki. This seems likely, as there are only a few large stones to suggest any kind of building—no foundations which would indicate a heiau.
73	House site on level ground, 20x16.
74	Space about 40x40, strewn with <u>iliili</u> , part of it probably once a [illegible] site.

End of Table 5.

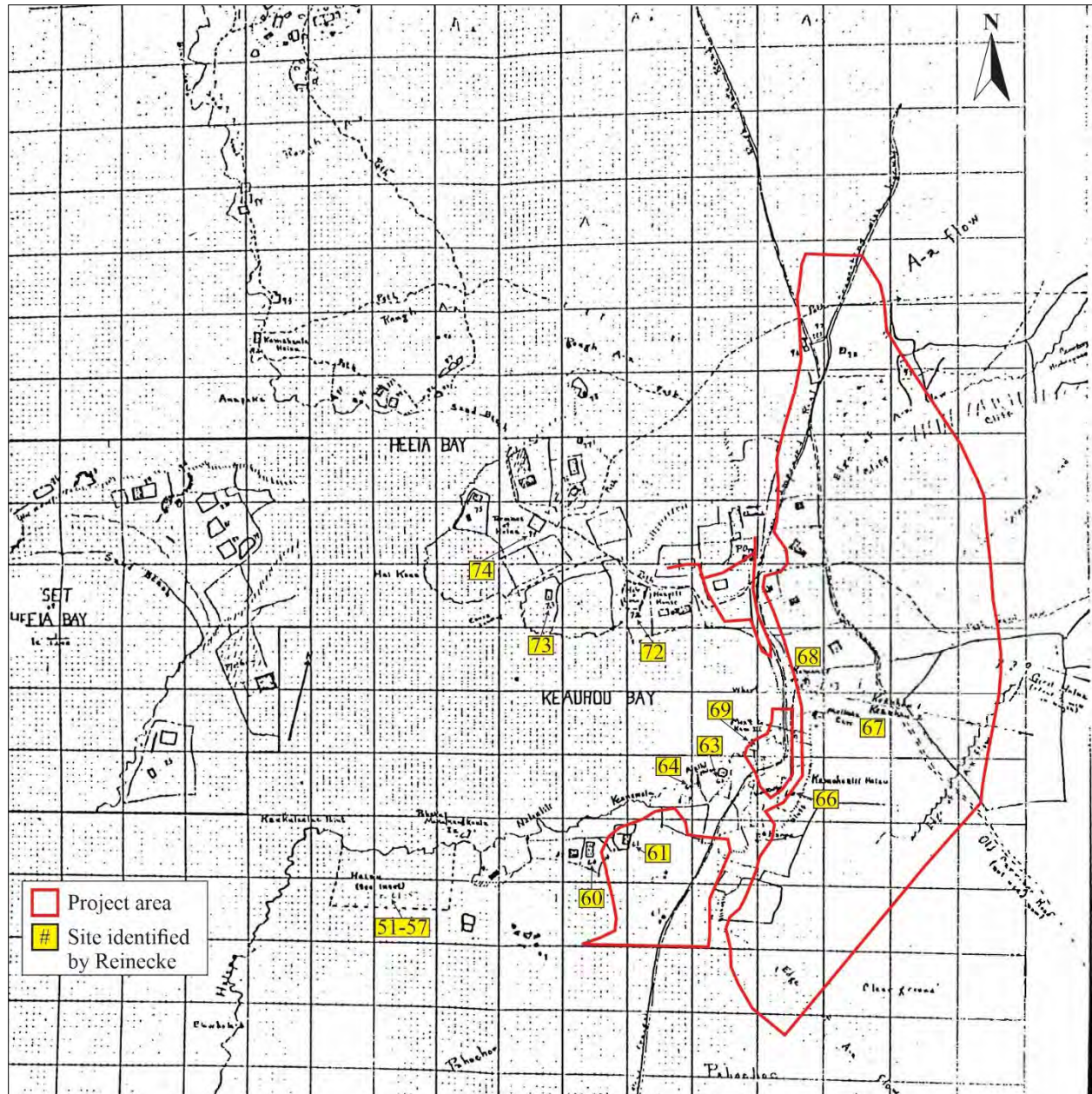


Figure 63. Portion of Reinecke's (1930:95) site map showing sites in the vicinity of the project area.

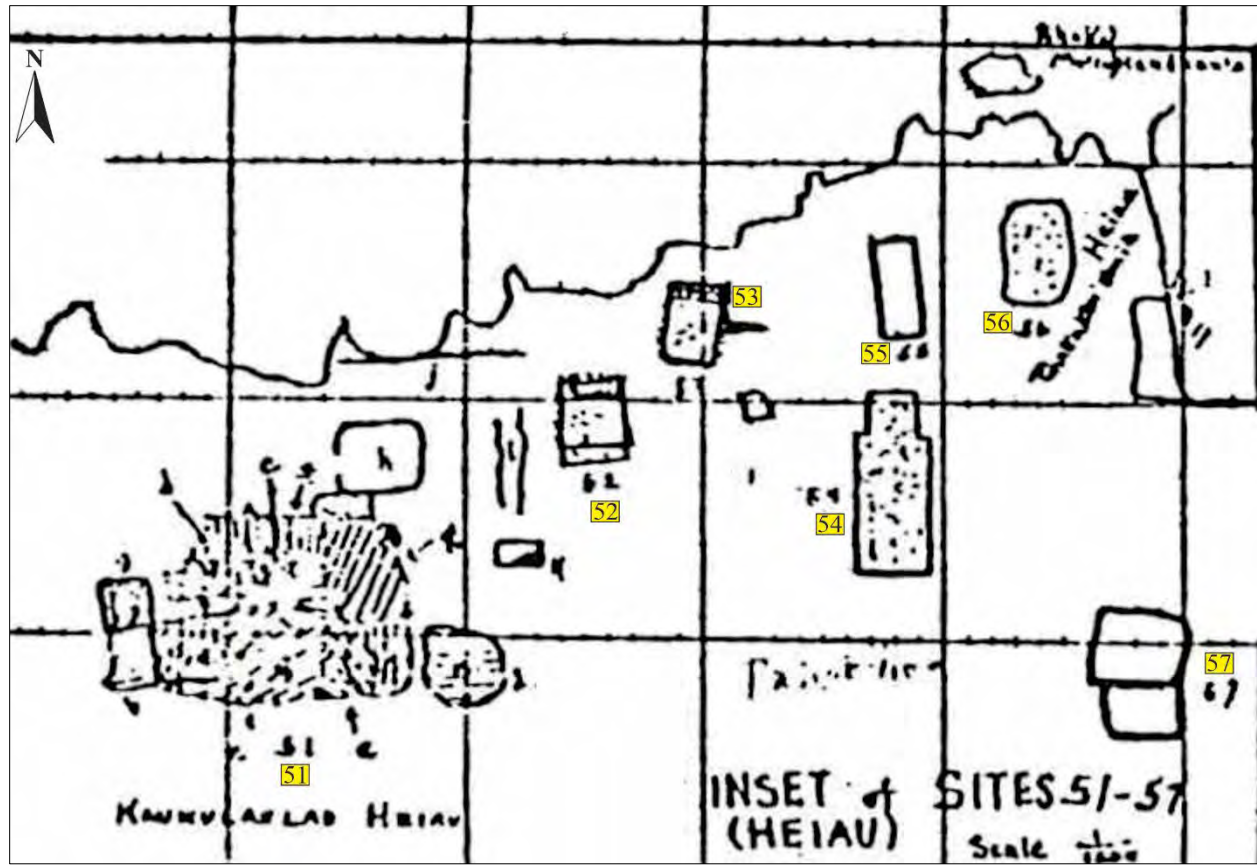


Figure 64. Portion of Reinecke's (1930:96) site map showing sites 51-57, project area not shown.

Concerning Site 51, Kaukulaelae Heiau located to the west of the project area Reinecke recorded twelve distinct feature components (labeled in Figure 64 as features a through l) and provided the following description:

- a A section paved with large stones, surrounded by walls 3' thick and 4' high. Divided into two parts, 18x5 and 18x16.
- b Remains of a platform 21' wide N. and S., width E. and W. unknown, but the ruins extend about 21'. Remains of retaining wall on S.
- c Platform 16x14x3.
- d Shelf roughly 16x16x2.
- e Main platform of various levels. From the wall about a to the east end is about 90'; width at the wall is 43', at other end about 34'. A trough 6' wide between e and d. It contains three or four little pits.
- f Platform about 12x50.
- g Platform about 30x40, merging into the debris from e.
- h Modern appearing pen 21x35, with walls 4' high and 4' thick.
- i Walls 50 and 36 feet long, which once joined and inclosed [*sic*] an area about 60x10 (may not be part of the heiau).
- j Retaining wall; platform between it and heiau proper.
- k Knoll made into rough platform about 18x12 (may not be part of the heiau).
- l Debris 25 or 30 feet each direction, about a small platform, about $6 \times 6\frac{1}{2}$

Reinecke (1930:80) reported the condition of Site 51 as follows:

The whole platform of the heiau is so rough and dilapidated that it is hard to trace its original form and limits carefully. Apparently it was oriented E. and W., with dimensions over all of about 110x40. There apparently have been later additions.

Reinecke (1930:81) also documented another *heiau* called Kamohoalii (Site 66) (see Figure 63) at the base of a cliff, which was “utterly in ruins, nothing remaining except the foundation of the outer wall”. Reinecke goes on to recount that Kamehameha III was born in the vicinity of this ruin:

Kauikeouli was born on the stone which now supports the tablet to his memory, just N. of the heiau. According to the story. . . Kauikeouli’s mother was bathing in the bay when she felt her pangs, and staggering out of the water, she supported herself against the boulder. Kauikeouli was stillborn. A runner was at once dispatched to fetch a noted kahuna, Kapihi-nui (Great Lamentation). . . He [the kahuna] ordered the runner to return and notify the queen that he would soon arrive, but when the runner came back to Keauhou he was astounded to find that the kahuna, with his supernatural powers, had arrived before him. Kapihi-nui resuscitated Kauikeouli by warming his body (according to Kanalioumi) or by breathing into his nostrils and reciting spells (Kawewehi). . .

Mr. Kahalioumi says that the front of the heiau stood ten feet in height. Mr. Kawewehi adds that the stones from it have been used four times in attempts to build up a sea wall to protect the road, but that the stones, put to such a profane use, have every time been washed down, although there have been no storms. (Reinecke 1930:81)

Another site that deserves further mention is Site 67, which is listed as Mō’ikeha Cave (see Figure 60) and described thusly:

This is a famous cave. The story is that a king, flying [fleeing] from his enemies, hid himself in the cave, standing erect and motionless with all his body above his legs hidden in a high pocket of the cave. His enemies, looking inside, did not observe his legs, and passed him by. (Reinecke 1930: 81-82)

As previously mentioned between 1953 and 1955, Kekahuna and Kelsey documented various sites and the history of Keauhou and other select areas around Kona. The sketch maps (see Figures 48 and 49) they generated based on informant accounts, contain references to various archaeological features located along the coast of Keauhou Bay. These maps provide a glimpse of where archaeological sites were known to be located as well as how Keauhou Bay appeared in the early 1950s. Many of their descriptions harken back to Reinecke’s original documentation of sites along the shores of Keauhou Bay.

Previous Archaeological and Cultural Studies Conducted Post 1970s to Present Day

In 1971, the Bishop Museum conducted a reconnaissance survey (Emory et al. 1971) of four partially developed areas (Areas 1, 7, 9, and 13B) of Bishop Estate land in the Keauhou-Kahaluu Bay region. Area 1, which included a portion of the current project area extended from the shores of Keauhou Bay inland (see Figure 62). Concerning Area 1, Emory et al. (1971:43) reported:

Area 1, largely because of extensive bulldozing, has been rendered the least important, archaeologically, of the four survey areas. The prime sites around Keauhou Bay have already been built on or cleared by bulldozers. Our search through the brush revealed few sites, all of them near the edge of the bluff immediately back of the bay. The recommendations for this area are therefore not as encompassing or as strong as for previous areas.

As a result of their study, ten sites were recorded and assigned Bishop Museum site numbers D3-35 through D3-44 within the *makai* portion of Area 1. Site types included a possible habitation enclosure (D3-35), two platforms of undetermined function (D3-36 and 39), a rock wall (D3-37), a mound that may contain a burial (D3-38), two possible house terraces (D3-40 and 41), and an open midden site that likely corresponds with a campground for fishermen (D3-44). In addition, they recorded Moikeha Cave (D3-42) and provided the following description:

Kekahuna (1954) described this natural cave as the place where Moikeha (a traditional chief who lived some 28 generations ago) hid to escape pursuers from Ka-‘u. The cave is at the base of the cliff directly back of Keauhou Bay. It is presently being used for the storage of wood and other article. (1971:45)

Site D3-43 was assigned to the location of the Birthplace of Kamehameha III (Kauikeaouli), which has been commemorated by the Daughters of Hawai‘i with an inscribed plaque set in a concrete block within a small rock enclosure (Emory et al. 1971). This site was included in Kekahuna’s 1954 and 1955 maps and was placed on the National Register of Historic Places in 1978 (Tomonari-Tuggle 1985). Emory et al. summarized their findings for Area 1 thusly:

The ten sites recorded for Area 1 are only a vestige of what must have existed formerly (before bulldozing), including the lowest surviving section of the great *holua* runway of which the upper part, above the Alii Highway, is still to be seen.

The most promising archaeological site remaining in Area 1 is the level land along the base of the vertical bluff a short distance back of the head of Keauhou Bay. (1971:46)

In 1979, Soehren conducted a reconnaissance survey (Soehren 1979) of a 0.66-acre parcel (TMK: (3) 7-8-012:032), located on the *makai* side of Kamehameha III road to the north of Keauhou Bay (see Figure 62). As a result of this study, Soehren reported that the area was mostly bulldozed but remnants of structures and midden were still observable, and he reported observing an octopus lure and a coral disc.

Also in 1979, Archaeological Research Center Hawaii, Inc. (ARCH) conducted a reconnaissance survey (Hammatt 1979) of an area along the south shore of Keauhou Bay for the Kona Surf Hotel. As a result of this study, Hammatt identified five features, two of which he interpreted as modern foundations. All five features had been originally recorded by Reinecke (1930) as part of Sites 51, 52, and 53. Hammatt recommended additional documentation and subsurface testing of Features H and I of Site 51, and Site 53. As Walker and Haun (1989:4) pointed out, "Hammatt evidently was not aware the modern foundations had been constructed above older platforms identified by Reinecke (Site 52-Feature K and Site 52)."

In October of 1980, ARCH revisited Area 1 (see Figure 62) of the Bishop Estate Lands and conducted another reconnaissance survey (Hammatt 1980). As a result of that survey, seven of the ten sites recorded by Emory et al. (1971) were identified, while sites D3-35, D3-40, and D3-44 were recorded as destroyed by road grading operations in the decade since the Bishop Museum study. Hammatt (1980) recommended that only site D3-43, the birthplace of Kamehameha warranted further study or preservation efforts.

In 1983, PHRI conducted a reconnaissance survey (Rosendahl et al. 1983) in the vicinity of the Kamehameha III Birth Site Memorial within Area 1 of Bishop Estate Lands, within the current study area (see Figure 62). Their survey was undertaken in conjunction with the preparation of a cultural resources management plan for the Keauhou Resort. As part of their study, they tried and were unable to locate the remains of Kaleiopapa Heiau atop 'Ahu'ula Cliff. Additionally, the excavation of nine test units in three separate areas at the base of 'Ahu'ula Cliff revealed that Site D3-44 (originally recorded by Emory et al. 1971) had been markedly disturbed prior to their study.

In light of a zoning change and planned residential, commercial, and recreational development for some 750 acres of land owned by Kamehameha Investment Corporation (KIC) in the area extending *mauka* from Ali'i Drive, PHRI prepared a Cultural Resource Management Plan (Tomonari-Tuggle 1985). The purpose of this plan was to "deal with archaeological and historical resources in the context of the continuing development" of the Keauhou area (Tomonari-Tuggle 1985:1). This plan has become a valuable source of information for the general Keauhou area and includes an annotated bibliography of archaeological and historical research conducted in the Keauhou area that spans over eighty years of investigations. The plan detailed inventories of sites recorded in the various development parcels that comprised Keauhou Resort. However, the two parcels (Parcels 1 and 6) located within a portion of the current project area are not featured in the plan.

In 1987, PHRI conducted a reconnaissance survey and limited subsurface testing (Haun 1987) of the entire Kona Surf Resort property (TMKs: (3) 7-8-010: 38 por. and (3) 7-8-012: 058-060) for a proposed wedding chapel site. The Kona Surf Hotel property is located along the southern coast of Keauhou Bay and includes Kaukulaelae Point (see Figure 62). As previously mentioned, this area had been surveyed by ARCH in 1979 (Hammatt 1979). As a result of the 1987 survey, PHRI relocated three of the seven sites (Sites 51-57) that Reinecke (1930) recorded on the Kona Surf Hotel property, including Features H, I, and K of Site 51 as well as Sites 52 and 53. In addition, Haun (1987) identified two previously unrecorded sites, consisting of a *papamū* and a subsurface cultural deposit with waterworn pebbles, midden, historic glass and ceramic fragments, and a coral abrader. Haun (1987) recommended that further intensive surveys and testing be conducted on the proposed wedding chapel site.

Subsequently, in 1989, PHRI (Walker and Haun 1989) conducted an intensive archaeological survey and testing at the proposed wedding chapel site located on a 2.3-acre portion of the Kona Surf Hotel grounds (TMK: (3) 7-8-012:058- 60 por.; see Figure 62). As a result of their study, five archaeological sites with seven component features were identified. Formal feature types recorded included: a previously unrecorded *papamū* and a newly identified subsurface cultural deposit (SIHP Site 5695); in addition to five previously recorded features: a platform (Site 53), two terraces (Sites 51-K and 52), a U-shaped wall (Site 51-I), and an enclosure (Site 51-H). Subsurface testing consisted of the excavation of ten test units within Reinecke's (1930) Site 51, 52, 53, and SIHP Site 5695 that were added to the three test units, which had been excavated during the earlier PHRI study of the same area (Haun 1987). As a result of their study, more than 450 portable artifacts were recovered, including 348 that were classified as

indigenous types and 110 historic. The indigenous portable artifacts were comprised primarily of volcanic glass fragments, with some coral, urchin, and scoria abraders, a few basalt flakes, modified bone, and marine shell ornaments. A partial stone *poi* pounder and the mammal bone point of a two-piece bonito lure were also recovered. Historic artifacts included fragments of metal, glass, and plastic. A large number of faunal remains (5,648 grams) comprised primarily of marine shell, followed by bone, *kukui* nut, and charcoal was also recovered. Radiocarbon testing yielded a date range of A.D. 1440-1748. Based on their findings, PHRI suggested prehistoric use of the area around Sites 53 and 5695. In particular, they suggest Site 5695 was the site of lithic manufacture, based on the volume of volcanic glass debitage present and that marine exploitation was the focus for Sites 51 and 53.

In 1989, PHRI conducted an archaeological field inspection (Rosendahl 1989) of a parcel along the south shore of Keauhou Bay (TMK: (3) 7-8-012:098; see Figure 62). As a result of that study, one site (PHRI Temporary Site 736-1) was identified, consisting of several walls that probably served as property boundaries during the Historic Period. These walls likely correspond with a series of walls oriented parallel and perpendicular to the shoreline that Hammatt (1979) mentioned as a result of his aforementioned survey of the south shore of Keauhou Bay. However, Hammatt had interpreted the walls as modern in origin (Haun and Henry 2005b).

In 1992, PHRI conducted an archaeological field inspection (Rosendahl and Walker 1992) of three parcels (TMKs: (3) 7-8-012:002, 053, and 100; see Figure 62), located along the southern shore of Keauhou Bay. No sites were identified within their study area.

In 1996, William Barrera Jr. conducted an archaeological investigation (Barrera 1996) of a parcel (TMK: (3) 7-8-012:031), located on the *mauka* side of Kamehameha III Road to the north of Keauhou Bay (see Figure 62). As a result of his study, Barrera noted that the entire parcel had been graded.

In 2003, Cultural Services Hawaii (CSH) conducted an archaeological inventory survey (Tulchin et al. 2003) of the entire Kona Surf Resort parcel (TMKs: (3) 7-8-012:58 and (3) 7-8-010:038 and 039; see Figure 62). Four previously recorded archaeological sites were relocated on the northeast side of the Kona Surf Resort property during their study. As a result, three SIHP Site designation numbers were assigned to the site numbers given by Reinecke (1930). Reinecke's field site numbers 51, 52, and 53 correspond to the currently numbered SIHP Sites 23911, 23912, and 23913. Features recorded during their study included the following: an enclosure (Site 23911 Feature A), a canoe shed (Site 23911 Feature B), two terraces (Site 23911 Features C and D), a Historic House Platform (Site 23912), a fishing shrine (Site 23913), and sub-surface cultural deposits related to a habitation (Site 5695). In this same year, CSH returned to the Kona Surf Property to conduct archaeological monitoring (Jones and Hammatt 2005) in which no new cultural remains or natural soil deposits were identified. Jones and Hammatt (2005) did, however, recommend monitoring for any significant excavations located near the freshwater swimming pool and archaeological complex.

Subsequently, in 2004, CSH prepared a preservation plan (Mann et al. 2004) for a 0.5-acre parcel (TMK: (3) 7-8-012:058) within the Kona Surf Resort property (see Figure 62). A cultural preserve was proposed for the northeast side of the Kona Surf property, where the four aforementioned archaeological sites (SIHP Sites 23911-23913, and 5695), are located. According to a local *kupuna*, Reinecke was mistaken when he called Site 51 the remains of *Kaukulaelae Heiau*, and the correct name is *Kanika'ula Heiau* (Mann et al. 2004). Interestingly, on the 1954 sketch map of Keauhou Bay (see Figure 48), Kekahuna has a site labeled "*Kanikani-ka'ula Heiau*" in the vicinity of Reinecke's Site 51, which closely resembles the name used in the preservation plan fifty years later. Preservation measures include the creation of a 50-foot buffer zone around the four sites, and stabilization of sites to provide visitors with an informative experience. The plan also proposed that all out-of-context artifacts on and off the property be reclaimed and relocated within the cultural preserve area. In addition, a burial reinterment site consisting of an above-ground burial crypt was suggested to be constructed only if burials are encountered during construction renovations of the hotel. No future archaeological research was to be allowed within the cultural preserve without the prior written approval of a research plan by SHPD.

In 2004, at the request of Kamehameha Investment Corporation (KIC), Kumu Pono Associates, LLC prepared a cultural synthesis of some 489 acres Keauhou 1st and 2nd and Kahalu'u; *mauka* of the West Hawaii Railroad Right-of-Way and *makai* of Kuakini Highway. In addition to completing a comprehensive review of published and manuscript accounts, Maly and Maly (2004a) also included excerpts from interviews conducted with elder *kama'āina* that were conducted prior to KIC's requested study specifically those originating from the Ali'i Highway Project (Maly 1996) and one that focused on the trails located between the lands of Keauhou and Kealakekua (Maly and Maly 2001a, 2001b). The names of those whose interview excerpts were included in the KIC study included Lily N. Haanio-Kong, Luciana Makuakāne-Tripp, William J.H. Paris, Julian Gouveia, Helen K. Wight-Weeks, David K. Roy Jr., Josephine H. Nāhele-Kamoku, Mitchell M. Fujisaka, and Roseline H. McComber-Smith, which was published as a Appendix A of their report (Maly and Maly 2004b). From the information provided by those who were interviewed, Maly and

Maly's (2004a) KIC study also included recommendations regarding the culturally appropriate protection and treatment of the area's cultural resources. The author of this study understands that the recommendations included in the KIC study were not developed specifically for the current project. However, reviewing and revisiting the recommendations provided by those *kūpuna*, many of whom have since passed, ensures that the recommendations provided as part of this study are aligned with the wishes of these esteemed *kūpuna*. A detailed review of those recommendations are included in Chapter 4 of this study.

In 2004, Haun & Associates conducted an archaeological inventory survey (Haun and Henry 2005b) of a 1.08-acre parcel (TMK (3) 7-8-012:098), located on the southern side of Keauhou Bay (see Figure 62). Portions of their study area had already been surveyed by Hammatt (1979) and Rosendahl (1989). Haun and Henry augmented their pedestrian survey with seven shovel tests and one trowel probe. As a result of their study, two sites were identified (SIHP Sites 24215 and 24216). Site 24215 consists of a small overhang with a wall adjacent to it. Two shovel tests excavated within Site 24215 revealed habitation debris including marine shell fragments, *kukui* nut shells, and sea urchin fragments, which suggested to them the use of the site during Precontact through early Historic times. Site 24216 is a historic complex comprised of five features, which likely corresponds with PHRI temporary Site 736-1, originally recorded by Rosendahl (1989). The features of Site 24216 included two stacked rock walls (Features A and B), a modified outcrop (Feature C), a retaining wall (Feature D), and a prepared niche (Feature E). One of the rock walls (Feature A) was interpreted as a historic livestock control feature, the crude modified outcrop (Feature C) was interpreted as a possible historic agricultural clearing mound, while the historic retaining wall (Feature D) appears to have supported a gravel and concrete roadway and concrete path. The walled-in overhang (Feature E) was interpreted as a storage feature that was used in Prehistoric and Historic times based on the cultural material recovered from five shovel tests, which included marine shell remains and waterworn basalt pebbles within and outside of the overhang, based on their review of historic maps, Haun and Henry suggest that the features of Site 24216 were likely built between 1928 and 1954 and associated with a concrete house foundation and gazebo located on an adjacent parcel, which was owned by Mrs. E.P. Hodgins ca. 1954. Both sites were assessed as significant under Criterion d based on their informational content and Haun and Henry's treatment recommendation was no further work.

In July of 2004, Haun & Associates undertook an archaeological inventory survey (Haun and Henry 2005a) of a 25-acre parcel (TMK (3) 7-8-010:044), which encompasses a portion of the current project area (see Figure 62). Their survey area corresponds with a portion of Area 1 of the Bishop Estate Lands, which has been the subject of several archaeological investigations discussed above. A total of twenty-two sites with thirty-nine features had previously been documented within their survey area. Seven of these previously recorded sites appear to have been destroyed prior to their survey. During their study, fifteen sites were recorded that including six previously recorded sites (D3-37, and D3-39 through D3-43) and nine newly identified sites, comprised of twenty-two features. The location of these sites are shown below in Figure 65. As a result, four of the sites given temporary Bishop Museum field numbers by (Emory et al. 1971) were assigned the following new SIHP Site designation numbers: Site 24256 (D3-41), Site 24262 (D3-40), Site 24264 (D3-42), and Site 24267 (D3-39); in addition to the two SIHP Site designations that had been assigned sometime in the 1980s: Site 4348 (Kamehameha III birthplace shrine, D3-43) and Site 5674 (D3-36 and D3-37). Site 24262 (D3-40), a disturbed terrace, had previously been recorded as destroyed by Hammatt (1980). Also, Site 24267 (D3-39), which was originally recorded as a platform, was reclassified by Haun and Henry as a low enclosure. The twenty-two recorded features include paved house foundations, various enclosures, walls, terraces, platforms, midden scatters, mounds, a freshwater pool, a cave, a staircase, and a road. The range of feature functions includes ranching, habitation (temporary and permanent), ceremonial, transportation, water acquisition, recreation, and possible burial, all of which conform to the documented use of the *kula* zone. Evidence of Precontact use of the study area is evidenced by the temporary habitation cave (Mō'ikeha Cave, Site 24264) and the pool designated Site 24263 that may be a remnant of Ho'okūkū Pond, which appears in legends of Keauhou as well as on Kekahuna's 1954 Map (see Figures 48 and 49). Eight test units and ten shovel tests were excavated during their study. Radiocarbon dating of a sample taken from a test excavation in a temporary habitation site within Mō'ikeha Cave (Site 24264) yielded a calibrated age range of A.D. 1000 to 1180, which makes this site "one of the earliest habitation sites along the Kona coast" (Haun and Henry 2005b:ii). The three permanent habitation sites (Sites 5674, 24261, and 24266) recorded during the study likely date to the late Historic to early Historic Period. Four of the fifteen sites assessed as significant were recommended for data recovery (Sites 5674, 24259, 24261, and 24266). Three sites were recommended for preservation (Sites 4348, 24263, and 24264).

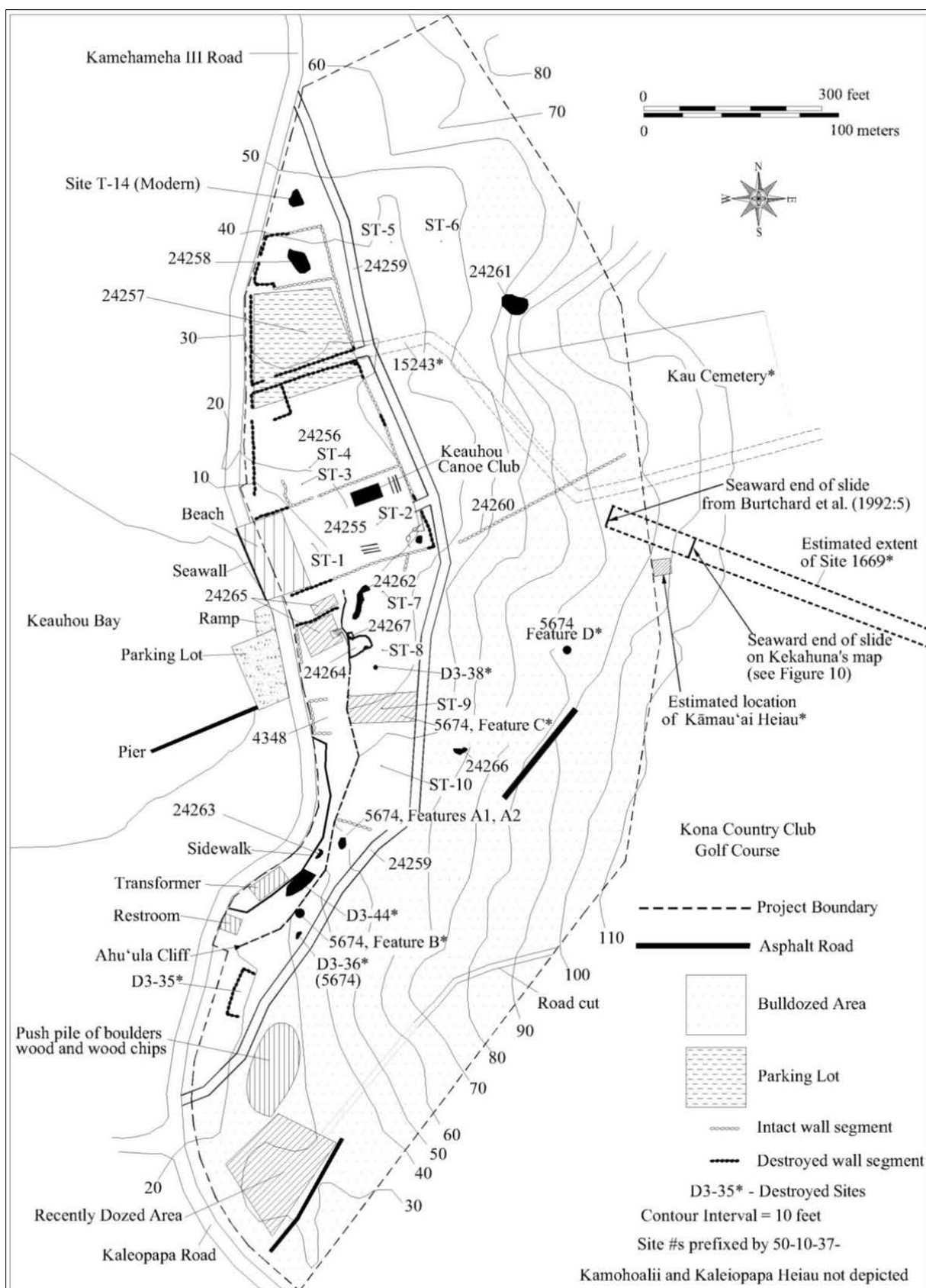


Figure 65. Haun and Henry (2005a) site location map.

In August of 2012, following the March 2011 *tsunami*, Haun & Associates returned to TMK: (3) 7-8-010:044, located in the project area (see Figure 62) to assess damages to Mō'ikeha Cave (Site 24264) and a historic building (Site 24265) (Haun and Henry 2012). Their study revealed that the *tsunami* had destroyed the modern fire pit and terrace that were recorded as features of Site 24264; scattered the stones from the features throughout the cave; exposed new cultural material including fragments of glazed ceramics and glass and a large basalt stone with a ground surface on one site, and introduced sediment, boulders, large cobbles, and a slab of asphalt into the site. It was found that the *tsunami* has caused irreparable damage to Site 24265 and subsequent efforts to rebuild the structure were unsuccessful. As part of this study, Haun and Henry (2012) excavated a 3x1-meter trench in Site 24264 and eight 50-centimeter diameter shovel tests to determine site boundaries and assess impacts from the *tsunami* and reconstruction efforts. A Precontact cultural deposit was discovered underneath Site 24265, however, it was determined that this deposit was extensively disturbed as indicated by the presence of modern debris. Haun and Henry (2012) recommended the preservation of Site 24264 and archaeological monitoring for Site 24265.

An archaeological site preservation plan (Haun and Henry 2014) was prepared by Haun & Associates in 2014 for Mō'ikeha Cave (Site 24264) (see Figure 62). The plan specified the following: avoidance and protection during any development activities that have the potential to impact the site; archaeological monitoring during any construction activities that may occur near the site; the establishment of a 10-foot buffer marked by a post and rail wooden fence which is to be installed at the front of the cave; that the buffer is recorded with the Bureau of Conveyances; prohibit public access into the cave; return the area outside of the cave to a more natural condition and install interpretive signage outside of the cave to improve public education.

ASM Affiliates prepared a CIA (Rechtman 2015) for the then proposed DLNR-Division of Boating and Ocean Recreation's Keauhou Bay mooring project (see Figure 62). Culture-historical background information specific to coastal Keauhou was compiled and interviews were conducted with various *kama'āina* families, members of the Keauhou Canoe Club, and other community members. Rechtman (2015) identified multiple significant features in the immediate vicinity of the bay including, but not limited to, the Kamehameha III birthsite, *heiau*, ponds, and identified canoe paddling and marine resource collection as significant cultural practices and resources. Recommendations to mitigate potential impacts on the identified resources were also provided including the preparation of a Hawai'i Register of Historic Places nomination to designate Keauhou Bay as a historic district and implement and develop an appropriate preservation strategy for the district; working with Keauhou Canoe Club to design a mooring layout that would meet the needs of the public and practitioners; and lastly to develop and implement monitoring and potential breeding/repopulating programs for all species that would be affected by the proposed mooring project.

In April of 2017, HHF Planners prepared a cultural landscape assessment (HHF Planners 2017) that focused on roughly 32 acres set along Keauhou Bay and included much of the current project area, which was dubbed the Keauhou Bay Cultural Landscape Area, plus an additional 3.5-acre property known as the Kaukulaelae Cultural Landscape Area located between the south side of Keauhou Bay and the Sheraton Kona Resort (see Figure 62). This assessment which was intended to supplement the Keauhou Bay Management Plan documented the history of the area and the evolution of the physical landscape as a means to inform future land use and management decisions in support of KS's goals for the area. This assessment included detailed cultural-historical background information and analysis and assessment of the historical significance of both the Keauhou Bay and Kaukulaelae Cultural Landscape Areas. A site map showing the historic features and other contributing elements of the Keauhou Bay Cultural Landscape area is provided below in Figure 66. The findings from this study led to the preparation of a comprehensive treatment plan (HHF Planners 2018) that provided specific, near-term recommendations, as well as a comprehensive vision for the cultural landscape of Keauhou Bay.

In November of 2021, as part of the current project, Haun & Associates conducted an archaeological reconnaissance and site condition update (Haun et al. 2021). Their study area included the majority of the current project area with the exception of the western section located on the north side of the bay (TMK: (3) 7-8-012:027, 048, 054, 101) and that portion near the charter boat tours (TMK: (3) 7-8-012:013 and 014). Five previously identified sites inclusive of three preservation sites (Site 4348, 24263, and 24264) and two data recovery sites (Site 24261 and 24266) were relocated and assessed, and three newly identified sites were recorded (Site 1608.1, 1608.2, and 1608.3). Haun et al.'s site map included below (Figure 67) shows the distribution of the sites. One site, Site 5674, a complex of five widely dispersed features that was recommended for data recovery, was not relocated during their survey. The three newly identified sites were interpreted as historic habitations (1608.1 and 1608.2) and a wall (1608.3) associated with ranching. These sites were found to be in poor condition and were tentatively assessed as significant under Criterion d with a likely recommended treatment of no further work. Of the three preservation sites, the Kamehameha III birthplace shrine (Site 4348) was found to be in good condition and retains its original significance assessment of Criterion b, d, and e; Ho'okūkū Pond (Site 24263) was in good condition and assessed as significant under Criterion

c, d, and e; and lastly, Mō'ikeha Cave (Site 24264) was in good condition and assessed as significant under Criterion d and e. The sites recommended for data recovery (Site 24261 and 24266), both of which were interpreted as habitation sites were found to be in fair condition and assessed as significant under Criterion d. As previously noted, the whereabouts of Site 5674, interpreted as a habitation site and was originally assessed as significant under Criterion d was not relocated during their study. Given the nature of their study, Haun et al. (2021) recommended that vegetation clearing be done prior to completing an inventory level survey of the project area; that a data recovery plan is prepared and carried out for Site 5476, 24261, and 24266; and that a preservation plan for Site 4348, 24263, and 24264 be prepared and submitted to the State Historic Preservation Division for review.

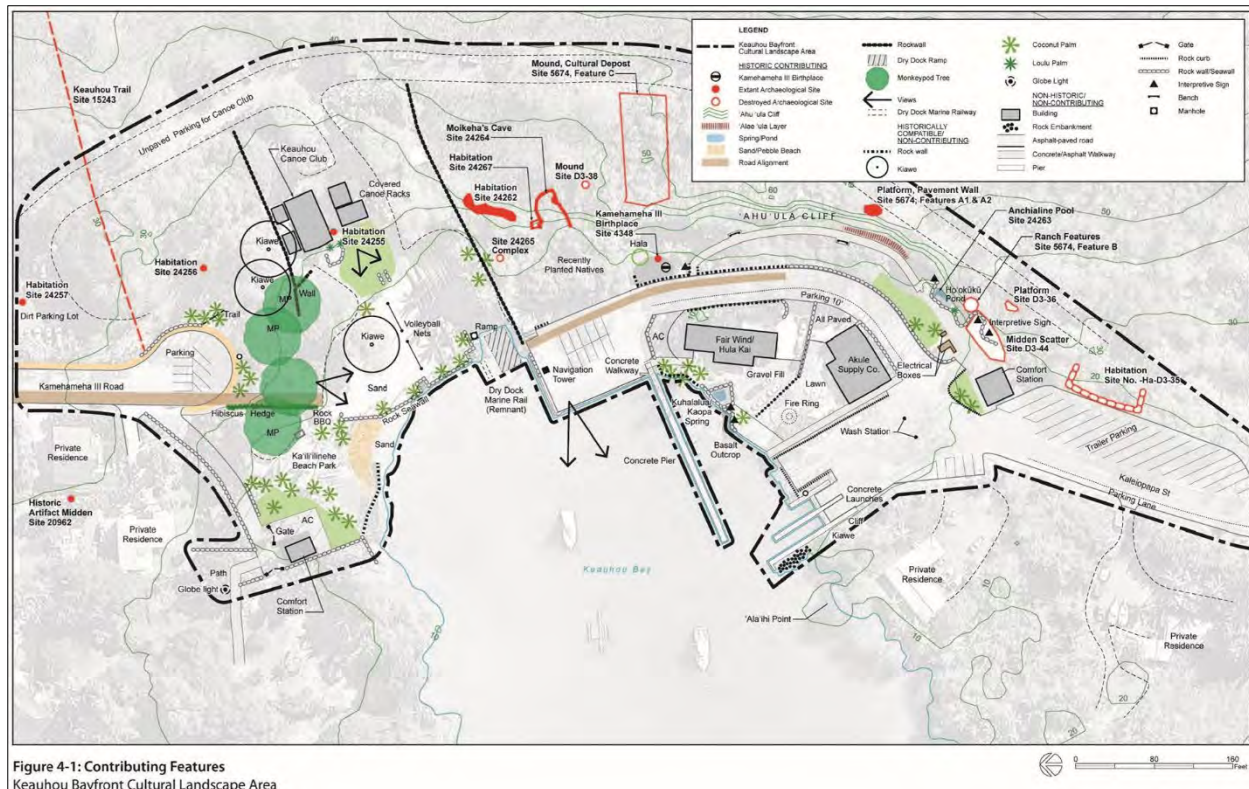


Figure 66. HHF (2017) map showing contributing features within the Keauhou Bayfront Cultural Landscape Area.

Between July and September of 2022, SWCA Environmental Consultants completed the fieldwork for a supplemental archaeological inventory survey (Reeve 2022) for Land Area 6, comprised of seven TMKs: (3) 7-8-010:049, (3) 7-8-12:004, 007, 061, 065, 098, and 103 and makes up the westernmost section of the project area (see Figure 62). A portion of their survey area was previously investigated by Haun and Henry (2005b) who documented two sites, Site 24215, a modified overhang and Site 24216, a historic habitation complex. As a result of SWCA'S fieldwork, Site 24215 was not relocated due to a dense ground cover of night blooming cereus and only four of the five features originally associated with Site 24216 was relocated. Reeve (2022) concluded that the unlocated feature was likely destroyed from recent bulldozing activities. Furthermore, Reeve (2022) found that Site 24216 forms part of a larger historic residential complex and recorded six additional sites, which they assigned temporary site numbers. The newly recorded sites include a property boundary wall (Keauhou-001), a historic cement slab foundation (Keauhou-002), baitcups (Keauhou-003), a platform and wall (Keauhou-005), another cement slab foundation likely associated with habitation or commercial activities (Keauhou0006), and another property boundary wall (Keauhou-007). Two test units were also excavated in which marine shell midden, lithic debitage, small waterworn pebbles, modern debris, historic glass, ceramic artifacts, and volcanic glass fragments were recovered. Detailed analysis and report finalization has yet to be completed.

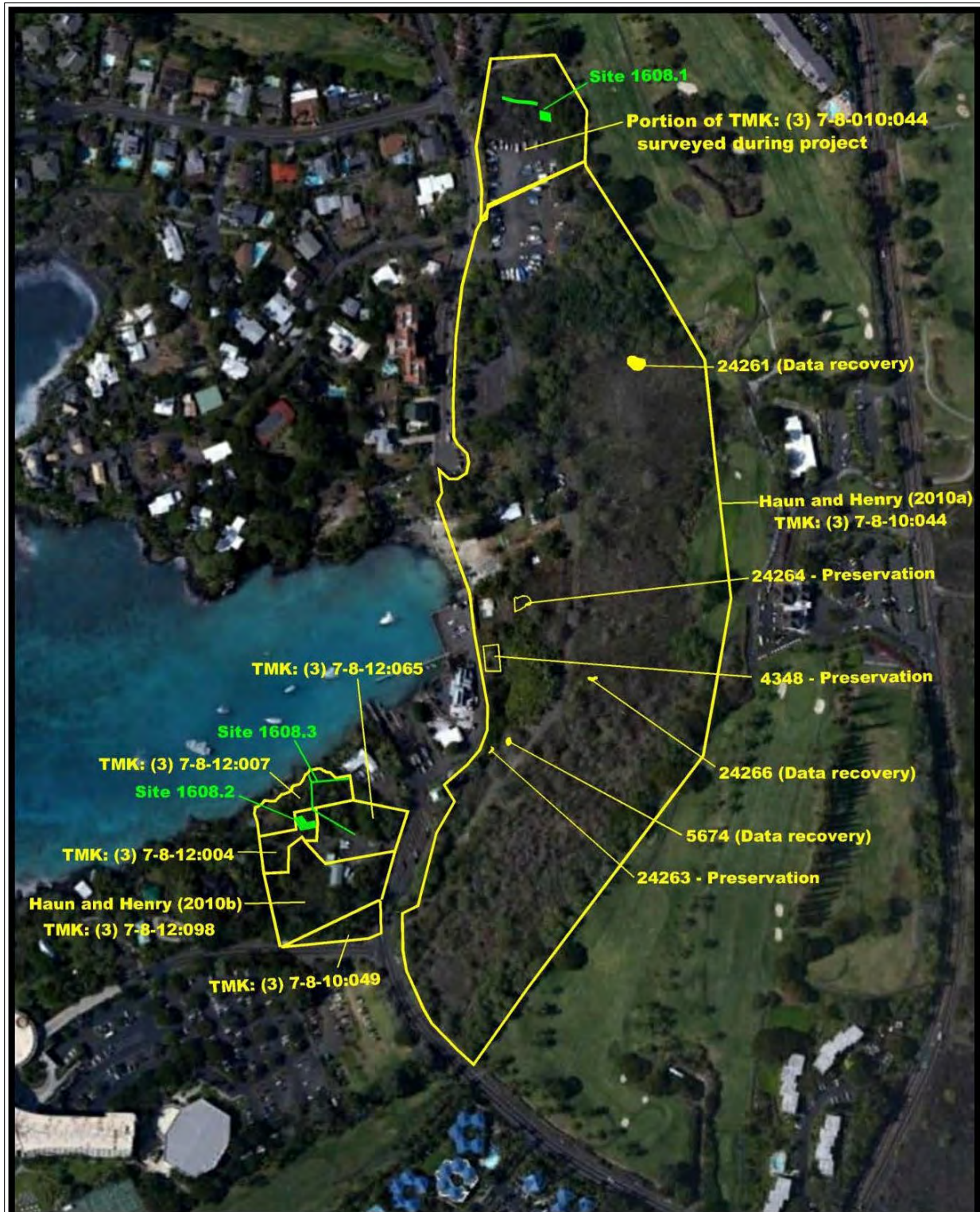


Figure 67. Haun et al. (2021:18) showing location of archaeological resources within a portion of the project area.

In a follow up to their November 2021 study and as part of the current project, between September and October 2022, Haun and Associates returned to the project area to conduct a second and more targeted archaeological reconnaissance survey (Haun et al. 2022). This survey also attempted to locate the archaeological remains of two historic trails, Site 15243 (Trail to Keauhou) and Site 24259 (Road to Kainaliu) and the Kau Cemetery. Their survey areas included a 1.35-acre section of TMK: (3) 7-8-010:044, a 0.3-acre portion of TMK: (3) 7-8-010:049, a 0.25-acre section of TMK: (3) 7-8-012:004, 0.4 acres of TMK: (3) 7-8-012:007, and a 0.6-acre section of TMK: (3) 7-8-012:065. They also conducted a site condition update of previously identified sites within two parcels (TMK: (3) 7-8-010:044 and 7-8-012:098; see Figure 62).

Their study resulted in the identification of three newly identified sites (Sites 1608.1, 1608.2, and 1608.3; all identified during the 2021 fieldwork), the relocation of three preservation sites (Sites 4348, 24263, and 24264), and two of three data recovery sites (Sites 24261 and 24266). The third data recovery site (Site 5674) was not relocated due to dense and impenetrable vegetation. The location of these sites are shown above in Haun et al. (2021) site location map (see Figure 66).

Site 1608.1 and 1608.2 were preliminarily interpreted as historic habitations with associated features and Site 1608.3 as a historic cattle wall. Haun et al. (2022:55) found these sites to be in poor condition and tentatively assessed them as significant under Criterion d and noted the “following [AIS-level] documentation these sites will likely be recommended for no further work. Site 4348 (Kauikeaouli Birth Stone), Site 24263 (Ho‘okūkū Pond), and Site 24264 (Mo‘ikeha Cave) were previously recommended for preservation by Haun and Henry (2005a). All three sites were considered significant under Criteria d, and e; Site 4348 was also considered significant under Criterion b and Site 24263 under Criterion c. Site 24261 and 24266 were recommended for data recovery by Haun and Henry (2005a), found to be in fair condition and were assessed as significant under Criterion d. Although the third data recovery site (Site 5674) was not relocated during this survey, it was assessed by Haun and Henry (2005a) as significant under Criterion d.

Concerning the Trail to Keauhou (Site 15243), no surface remains identified and Haun et al. (2022) noted that the ground surface in this area had been mechanically grubbed. Similarly, Haun et al. (2022) did not identify any remnants of Trail to Kainaliu (Site 24259). Regarding the Kau Cemetery, Haun et al. (2022:20,29) noted that “[t]he remains of the cemetery appear to be situated on a small rocky knoll, with the eastern two thirds of the cemetery having been destroyed by the construction of the adjacent golf course. A section of formed concrete, believed to have been a portion of a disturbed grave, possibly a capstone fragment, was also identified in the Kau Cemetery area. Furthermore, Haun et al. (2022) hypothesized that Site 24261, which was described as a permanent habitation structure, may actually be associated with the Kau Cemetery.

3. CONSULTATION

Gathering input from community members with genealogical ties and long-standing residency or relationships to the study area is vital to the process of assessing potential cultural impacts to resources, practices, and beliefs. It is precisely these individuals that ascribe meaning and value to traditional resources and practices. Community members often possess traditional knowledge and in-depth understanding that are unavailable elsewhere in the historical or cultural record of a place. As stated in the OEQC (1997) *Guidelines for Assessing Cultural Impacts*, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the project area. It is the present authors’ further contention that the oral interviews should also be used to augment the process of assessing the significance of any identified traditional cultural properties. Thus, it is the researcher’s responsibility to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary. This section of the report begins with a description of the level of effort undertaken to identify persons believed to have knowledge of the study area, followed by the interview methodology. This section of the report concludes with a presentation of the interview summaries that have been reviewed and approved by the consulted parties.

To identify individuals knowledgeable about traditional cultural practices and/or uses associated with the current project and study areas, three public notices were published. All notices contained (a) locational information about the project area, (b) a brief description of the proposed project, and (c) contact information. A public notice was submitted to the Office of Hawaiian Affairs (OHA) on January 13, 2022, for publication in their monthly newspaper, *Ka Wai Ola*. This notice was published in the February edition of *Ka Wai Ola* and a copy of the public notice is included in Appendix A of this report. As of the date of the current report, no responses have been received from this public notice. Two additional notices were published on January 23, 2022, in two local newspapers, the *Hawaii*

Tribune-Herald and the *West Hawaii Today*. Similarly, no responses have been received from these notices and a copy of each Affidavit of Publication and the public notices are attached to this report as Appendix A.

Additionally, ASM staff attempted to contact twelve individuals via email and/or phone (Table 6). These individuals were identified as persons who were long-time residents of the area and believed to have knowledge of past land use, history, or cultural information. Of the twelve people contacted, five agreed to participate in this study. The names of the individuals who agreed to be interviewed are Barbara Nobriga, Sandra Manuel, Noelani Campbell, Keone Kalawe, and Floyd Kahalioumi. Of the five, only four were able to review their interview summary and provided written or verbal approval for inclusion in this study.

Table 6. Persons contacted for consultation.

<i>Name</i>	<i>Affiliation</i>	<i>Date Contacted</i>	<i>Results</i>
Manu Powell	Daughters of Hawai'i	February 4, 2022	Referred ASM staff to Babara Nobriga.
Barbara Nobriga	Daughters of Hawai'i	-	Did not respond to approve interview summary.
Lily Lyons	Haanio Descendant	February 4, 2022	No response
Mahealani Pai	Kamehameha Schools	February 4, 2022	Referred ASM staff to Floyd Kahalioumi
Sandra Manuel	Haanio descendant	February 9, 2022	See summary below.
Olivia Pasciuta	Haanio descendant	February 10, 2022	Declined to participate in CIA but would like to participate in a community meeting.
Office of Hawaiian Affairs		March 1, 2022	No response.
Noelani Campbell	Keauhou Canoe Club	March 1, 2022	See summary below
Kalaniola Hamm		March 1, 2022	No response
Keone Kalawe	<i>Hōlua</i> expert	March 1, 2022	See summary below
Lionel Machado	Former resident of Keauhou	March 8, 2022	No response
Floyd Kahalioumi	Resident of Keauhou	March 30, 2022	See summary below

INTERVIEW METHODOLOGY

Prior to the interview, ASM staff provided written information about the nature and location of the proposed project and informed the potential interviewees about the current study, and how the information provided during the interview would be processed and utilized in this study. The potential interviewees were informed that the interviews were completely voluntary and that they would be allowed to review their interview summary prior to inclusion in this report. With their consent, ASM staff then asked questions about their background, their knowledge of past land use, and the history of the project area, as well as their knowledge of any past or ongoing cultural practices. The informants were also invited to share their thoughts on the proposed development and offer mitigative solutions. Two interviews were conducted via Zoom and the remaining three interviews were conducted in person at Keauhou Bay. Below are the interview summaries that have been reviewed and approved by the consulted parties.

SANDRA MANUEL

An in-person interview was conducted on February 17, 2022, with Mrs. Sandra Manuel (Figure 68) by ASM staff, Lokelani Brandt, on the shores of Ka'ili'ilinehe at Keauhou. Born in Honolulu, O'ahu to her mother Shirlen and father Samuel Haanio, Mrs. Manuel's family relocated from O'ahu to Keauhou when she was four years old. When asked why her family relocated, she shared, it was to help her aging paternal grandmother, Mary Ahlo Haanio (also known as "Tūtū Mary" or aunty Mary) a widow, whose *makai* home was located on the north side of Keauhou Bay. Through *tūtū* Harry Haanio, the family acquired their *kuleana* lands. She shared that Tūtū Mary was well-respected in the community.

In clarifying her genealogical connection to Keauhou, she noted that her mother was from O'ahu and her father and his



Figure 68. Sandra Manuel standing near her grandfather's fish lookout stone.

family were from Keauhou. Growing up in a bilingual home, Mrs. Manuel recalled how her father and Tūtū Mary spoke only ‘Ōlelo Kanaka to each other but would converse with others in the English language. She related while growing up, learning, and speaking Hawaiian was prohibited, but listening to her father and Tūtū Mary conversing enable her understanding. Thus, although she does not consider herself fluent in ‘Ōlelo Kanaka, she is adept at hearing and understanding the language and interjects words or phrases when speaking to her *mo‘opuna* (grandchildren).

In reflecting on her childhood, Mrs. Manuel stated that although life was hard, she had quite a fulfilling childhood. She recalled how everyday living was guided by their responsibilities and not distractions. She and her siblings were involved in helping the family with any task that needed to be done at their home or Tūtū Mary’s home. It was only when these tasks were completed were they permitted to go out and play. She recalled that whether at their *mauka* or *makai* house, the same rules applied.

Mrs. Manuel explained that traditionally, the families from Keauhou typically had two homes, one located *mauka* which was used mainly for farming and raising livestock, and another *makai* where fishing was the primary activity. In addition to fishing, Mrs. Manuel reported that preparing fish in its different forms, whether raw or dried was also a common practice at the coast. Collectively, she emphasized that this type of lifestyle was completely self-sustaining and “that’s just the way it was.” Ensuring the family had enough resources to sustain themselves, Mrs. Manuel opined, required the family to plan and do things daily, whether gardening, fishing, raising livestock, or hunting.

Concerning their *mauka* home, Mrs. Manuel shared that this home is about two miles inland from their *makai* home and was the home her father was born in. She recalled how her father and “tūtū man,” Harry Haanio used to farm crops such as *kalo*, sweet potato, ‘ulu, and banana in the uplands. Mrs. Manuel explained that in addition to their *mauka* house lot, her father and tūtū man cultivated food crops in an area further upland of their home called Ko‘olua‘ōhi‘a. When the crops were harvested, she described how her father would come down to the coast on his mule to share food with the ‘ohana *makai* and in exchange, they would get fish. She pointed out that it was through this *mauka-makai* system of exchange that their ‘ohana obtained everything they needed to survive. When asked how often these *mauka-makai* trips were made, she stated it was out of necessity or during times of harvest. Mrs. Manuel highlighted the fact that from the ocean, they procured a diversity of fish and marine resources that were prepared in many ways, salted and dried, raw, fried, and in soups. Concerning the types of fish they ate from Keauhou Bay, she identified the following *manini*, ‘ū‘ū, ‘upāpalu, ‘uhu, ‘ōpelu, *akule*, *pākukui*, *he‘e*, and many others. She added that the fishermen were so knowledgeable about the bay that they knew where to find certain species of fish. She detailed how her father would travel to the point near the present-day Sheraton Hotel to gather *pākukui* and *manini*. In the bay, they would gather *wana*, *hā‘uke‘uke*, and *limu*. In observing the condition of the bay today, Mrs. Manuel stated that she remembered the water being crystal clear but today it is so *pilau*, cloudy, and depleted of *wana*, *hā‘uke‘uke*, and *limu*, which were plentiful when she was a child. She shared a story of how her Tūtū Mary taught her not to gather the *limu* ‘aki‘aki because that was food for the *honu*.

When asked about what she remembers most about Keauhou Bay as a child, Mrs. Manuel, described it as a thriving fishing village and likened it to the fishing village at Miloli‘i. She recalled how the bay was filled with canoes and when the canoes returned to shore after fishing, the interior of the canoes was filled with fish. She remembered the homes being old and seeing screened boxes used to dry fish laid out and ‘ōpelu nets hanging in the yard. In reminiscing on the drive down from their *mauka* home, she recalled the old winding road to the coast where she would peek at the ocean with much excitement. Once at the coast, they arrived at tūtū Mary’s house, however, before going into the ocean, she and her brother would grab a *nī‘au* (made from coconut leaf rib) broom to go rake the mango leaves into a pile. She described, the impending excitement as the chore of raking leaves was done and her father permitted them to swim. She playfully recalled the sound of the ‘ili‘ili pebbles rustling under her bare feet as she scurried from Tūtū Mary’s yard to the shore.

In recollecting some of the visitors that came to Tūtū Mary’s house, Mrs. Manuel recalled ‘Iolani Luahine, a renowned *hula* master. She remembered how ‘Iolani Luahine would offer a chant before going into Tūtū Mary’s house. She opined that having witnessed these events, she knew that her Tūtū was well-respected in the community as even elder folks acknowledged her. She felt that her Tūtū was put in that specific area during her time to help guide others in the community. She expressed a sense of honor for the knowledge that her Tūtū has passed down whether to their family or others in the community. She lamented that her family’s success is a result of the works of her Tūtū Harry and Tūtū Mary that this was their living legacy.

Mrs. Manuel went on to share some information about specific places near her Tūtū’s *makai* home that were used for certain cultural practices. In pointing to two large boulders located on the *makai* side of the turnaround at the end of Kamehameha III Road, she describes how her Tūtū Harry, would stand or sit on these boulders to observe the school of *halalū* coming into the bay. Once he made his observation, he would signal to the canoe paddlers at the

shore where to set the nets. She clarified that during those times, there were no trees in this area, so the visibility of the bay was much greater. Also, despite not having cell phones, she playfully shared how once the canoes came ashore, people would drive down to the bay with their small bags hoping to take home some of the catch. When asked about the type of vegetation that was common near the bay, she recalled *kiawe*, *‘ōhai*, and *opiuma* but noted that *kiawe* was very useful because it was used as firewood. When asked about how her family traveled between their *mauka* and *makai* homes, she said they used the road, but the family also had a trail that ran behind their *makai* home and extended inland to their *mauka* house and to Ko‘olua‘ōhi‘a. She stated that she walked that trail twice with her father but as she got older, she found the trail arduous and “was more easy to go through the royal slide then cut to the train tracks, catch that, then walk straight up to the house...whoa cut the time in half.” She noted that it took about 45 minutes to go upland using the family trail and this was one of the reasons they used mules and donkeys to go up and down the hill. Additionally, she related that the cowboys also used their family trail when driving *pipi* (cattle) down to the coast. Mrs. Manuel also shared that on the northern peninsular of the bay is a tomb. She exclaimed that they were forbidden to go there but shared that she was told that the tomb was the burial place of an English officer. She related that they had some family burials a little inland, but the burials were relocated when they started to develop that area. Another place they were forbidden to go was near the north side of where the Keauhou Canoe Club stands. Mrs. Manuel described a large blue rock outcrop in this area and when there were heavy rains in the uplands, the water would flow underground into the bay and bubble up creating ring-like formations in the ocean, but without any sediment.

In describing her Tūtū Mary’s *makai* home, Mrs. Manuel explained that there were two homes on this property with the original home being the former post office. She shared that Ka‘ili‘ilinehe originally extended from where the restroom facility is (on the north side of the bay) to where the stone platform is near Sea Quest Hawai‘i. She clarified that the stone wall that fronts the Keauhou Canoe Club was not there when she was a child.

Recalling some of Tūtū Mary’s fishing practices, Mrs. Manuel informed how her Tūtū would come down from her home every night to fish from the old pier. She clarified that the old pier was about half the size of the existing pier. Her Tūtū would go to a specific spot on the pier to catch *moano*. She would gather about 2-3 *moano* then return home with enough for her to eat.

In sharing how her Tūtū Mary generated income, Mrs. Manuel shared that Tūtū used to go down and see some of the local fishermen, one of which included Mr. Sawada. Mr. Sawada would catch fish like *ahi* or *‘ōpelu* and Tūtū Mary would, depending on the catch, purchase one or two *ka‘au* (a Hawaiian measurement unit that refers to 40) of fish which she took home, dried then sold. Cleaning and preparing the fresh fish to be dried was another important step in which Mrs. Manuel described participating in. She shared that water was used when scaling the fish but when gutting and filleting the fish, no water was used. She added that Tūtū Mary would remove the gills of the fish and rub it on the fillet, salt it, then lay the fish out to dry. She shared that fishing using nets was another common practice at Keauhou, however, this type of fishing has since been banned, which has extinguished this practice at the bay. For the preparation of raw fish, Mrs. Manuel spoke about how they gathered *kukui* (candlenut) nuts to make *inamona* (relish consisting typically of roasted *kukui* nut and sea salt). She exclaimed that there were certain trees they gathered from because some trees produced oilier nuts. She recalled some of these trees being on the north side of the bay and near their house. After gathering the nut, they would *pūlehu* until a cracking sound was heard, after which, they removed the toasted kernel. When asked if people planted other food crops around the bay, Mrs. Manuel stated that Tūtū Mary did attempt to plant vegetables like string beans, however, she clarified that growing food was difficult at the coast because of the heat, inadequate soil, and lack of water. Rather, all planting was done in the uplands where there was good soil and sufficient rain to water the crops which were mostly grown by her late Uncle Harry and Auntie Louisa Haanio.

In speaking about other *kuleana* that Tūtū Mary had at Keauhou, Mrs. Manuel recalled that her Tūtū served as the caretaker of “Kaukeoli”, Kauikeaouli birthplace for many years. She added that her Tūtū was a member of the Daughters of Hawai‘i and the Ka‘ahumanu Society and that as children, they had to go to the birthplace and clean and care for this area. In describing how the birth site looked when she was young, she shared “was all *‘ili‘ili* inside and behind the huge rock but now today they put some type of plaque on top.” When asked if her Tūtū had shared any stories with her about the birthplace, Mrs. Manuel conveyed that “all I know that they came in the canoes one early morning, rushing in, and they had to take her [Keōpūolani] in and behind the boulder where she went *hānau* (give birth) with her ladies in waiting.”

Mrs. Manuel described how Ka‘ili‘ilinehe was the “hub” of Keauhou, where the community congregated to fish. Even when the sea was rough, the community gathered at the shore to talk and share stories. She added that although it was an ethnically mixed community “no one knew the difference, we were one family.” In relating some of her family uses of Ka‘ili‘ilinehe, Mrs. Manuel shared that this was their playground. Furthermore, Mrs. Manuel related that Ka‘ili‘ilinehe is where the fishermen would park their canoes. She detailed how the fishermen would park their

canoes further back from the shoreline to protect them from the ocean. Additionally, she recalled an old dry dock located in the vicinity of the present-day Fair Winds Cruises.

When asked about what happened to their family's *makai* home, Mrs. Manuel explained that there was a land swap negotiated by Bishop Estate and her Tutu Mary, Uncle Harry, and her dad Samuel.

Another activity that occurred near the bay was ranching. Mrs. Manuel described how the area laying above the bay to the upper road where their *mauka* home is located was all ranch lands. She added that some of the prominent ranch families included the Walls, Hinds, and Paris. She recalled how Uncle Bobby Hind would drive his cattle down the hill to Keauhou Bay where the cattle were then loaded onto waiting ships. In pointing to the specific areas at the bay used during the cattle drives, Mrs. Manuel identified the old boat ramp located on the north side of the existing pier/parking area. She also recalled an old cattle pen located near the present-day sand volleyball court. She commented how although some of the *paniolo* were *haole*, they were fluent in the Hawaiian language.

Concerning changes to the bay, Mrs. Manuel shared that as commercial activity increased at the bay, she noticed a decline in the water quality. She believes that pollution from large commercial boating has adversely impacted the water quality and the overall health of the marine life in the bay. In the early 1960s there were fewer boats in the bay and commented that "if you can imagine, the whole bay was all open. It was yours to go swimming, diving, spear fish, 'upena kū, make wana, you name it...it was our playground, our refrigerator, our everything." She expressed the importance of cleaning up the bay and ensuring the activities on land don't negatively impact the ocean. She shared that today, the marine resources that were once abundant are no longer abundant which speaks to the declining health of the bay.

Mrs. Manuel expressed her support for the cultural and educational components of the proposed development and felt that this should be the focus. She added that "there is so much here that gave to so many families back in the day, it gave them sustainability, it was their way of life, this was how they fed their families." She wants the cultural resources preserved so the next generation of *keiki* and *kamali'i* may be able to enjoy and experience the healing benefits of Ka'ili'ilinehe, just as she and the previous generations have. She would like to see the plans include improvements to the bay so there is more organization for the different user groups and ensure the *keiki* have a safe place to enjoy the water. She noted that there are a lot of recreational activities in the bay and making sure the *keiki* have a place safe from canoes, kayaks, and boats is crucial. Mrs. Manuel opined that there are many *malihini* that come into the bay that are not *ma'a* (accustomed) nor do they show concern for the safety of others. She emphasized that her ability to enjoy and experience Ka'ili'ilinehe was because her *tūtū*'s generation and those before cared for the area. She believes that if the focus of the proposed project is on culture and education, the vibrancy and fecundity of the bay can be restored. Mrs. Manuel opined that education is a critical component of this development because educating people about what to do is essential to restoring the bay. It's their *kuleana*. Furthermore, she felt that restoring the bay is beneficial to marine life and the Kanaka because the ocean is more than a place to recreate, it is a place of health and healing. She added "when we go into the water it does something for our souls and our body...it gives us that sense of being, of well-being, of continuing who we are because we went 'au'au...That is what *tūtū* always said, you go 'au'au first before you can really go swim."

In sharing her thoughts on the commercial aspect of the proposed project, Mrs. Manuel stated that she "hopes there are people *akamai* enough to know that once, this was a thriving community and because of this, it is what it is today." Furthermore, she added that the reason we have Keauhou is because of the generations of *kūpuna* that diligently cared for this area. She highlighted the importance of understanding the history and the *kuleana* that comes with caring for this place. She encouraged the leadership at KS to be the example and step into the role of taking care of this area. She understands the complexity of balancing economic activities, which funds many of KS's educational programs, and stewarding the area, and noted that it takes money and resources to care for an area. She would like KS to hold true to how Ka'ili'ilinehe once was and if they can assume this *kuleana* she would feel ok with the proposed development. She underscored the importance of inclusion and spoke about how *kūpuna* did not only think of themselves when making decisions. She lamented on the fact that *kūpuna* did not adhere strongly to the concept of private property and being selfish with what you had, rather they included and shared with anyone who sustained themselves on this land.

She would like to ensure that the *kūpuna* from the area are kept involved with this project as it moves forward and felt that their guidance would ensure the legacy of the people lives on. Mrs. Manuel noted that "I am just one of the *kupuna* from this area and there are many more that have contributed to the history of this area." She believes *kūpuna* involvement can help guide the project in culturally appropriate ways.

A major concern for Mrs. Manuel regarding the proposed project is the impacts to the bay caused by stormwater runoff. She related how within the past years, there have been major stormwater runoffs that brought down a lot of

sediment into the bay. She added that when these types of storms occur, they destroy important marine habitats and force marine life to flee the bay. She stressed that if there is going to be development, the developers must understand that there is a well-established history of stormwater runoff into the bay. She would like to ensure the developer conducts the proper studies and plans accordingly to prevent such catastrophes from occurring. She would also like to ensure her Tūtū man's lookout stone is preserved in place.

In reflecting on her childhood years spent at Keauhou Bay, Mrs. Manuel stated "I am so glad I grew up in that time because I saw, and I witnessed, and I learned and I know how it was. I am adamant with my *mo'opuna* to take care, *mālama* and give back because the land will give back to you." She commented that when she comes down to the bay today, it makes her sad to see the condition of the area. She said, "back in the day you didn't see rubbish, why? Because everybody took responsibility." She expressed "there is so much change in the world and as much as we can *mālama* and keep what we have." She reflected that she feels lucky having been born during that time; being able to see the relationship between her father and Tūtū Mary and seeing how everyday tasks were driven by their culture and sustainability. This environment, she believes has shaped her into the person she is today, and that the old way of living is something she holds dear and has passed on to her children and grandchildren.

NOELANI CAMPBELL

A Zoom video conference interview was conducted by ASM staff, Lokelani Brandt on March 9, 2022, with Mrs. Noelani Campbell. Born on the island of O'ahu in 1959, Mrs. Campbell attended Aiea Elementary School and High School and has been a lifelong *hula* dancer. After high school, she obtained her undergraduate degree from Chaminade University then pursued her Master of Business Administration (MBA), both of which were funded by financial aid provided by Kamehameha Schools. Mrs. Campbell explained that when she was given the opportunity to attend university with the financial support of Kamehameha School, she was encouraged to "please try and return, in-kind, your education to the Hawaiian people." Mrs. Campbell currently serves as the designated cultural liaison for Keauhou Canoe Club and is also a resident of Keauhou Ahupua'a.

After receiving her MBA, Mrs. Campbell married "a *haole* boy" and in 1981 and for economic reasons, she and her husband decided to relocate to the mainland and where they raised their family. She shared that while living on the mainland, she tried to maintain her cultural connection, however, with the demands of work, raising a family, and living in a culturally different place, she had to adjust. She summarized this by stating, "I was a local girl when I left, and I wasn't a local girl when I came back." She reflected that after living on the mainland for some thirty years, she questioned "what kind of Hawaiian would I be?" She recalled telling her husband that after they retire, her goal was to return home to Hawai'i. Mrs. Campbell emphasized that she was fortunate enough to be able to return home because many Hawaiians that relocate to the mainland don't have that same opportunity. When asked what motivated her to live in Kona, she explained that while living on the mainland, she and her family would often vacation in Kona. She explained that her connection to Kona grew as she began to learn more about the area's cultural sites and history, so after retiring, the decision to move to Kona was an obvious one. She humbly shared that her ability to live in Kona, especially with the high cost of living was due to her generating and saving enough money while living on the mainland. Mrs. Campbell opined that for her living in Kona comes with a *kuleana* of learning about the place, the people, its history, and disseminating that knowledge in a responsible and accountable way.

In recalling how she ended up joining Keauhou Canoe Club, she explained that after moving to Kona, she wanted to paddle and had to decide on a canoe club. After much thought, she joined Keauhou Canoe Club. She shared that about three-four years ago, KS approached Keauhou Canoe Club to assist with teaching their students about the *wa'a* (canoe) and since the canoe club is located on land from Pauahi, the club's membership and board willingly agreed to host the students. At that point, the canoe club identified her as the volunteer representative who would help facilitate KS's six-week educational program. She described working with club members to educate them about culturally sensitive ways to work with Hawaiian students and understanding the cultural significance of the *wa'a*. Mrs. Campbell added that her experience in working with people from outside of Hawai'i equipped her with the ability to diplomatically educate people who are not familiar with Hawaiian cultural knowledge and sensitivities.

When asked if the proposed project had the potential to impact canoe paddling, she shared that as a Hawaiian, paddling has had a profound impact on her life. She explained that most of the paddling that is done at Keauhou is done through a purely recreational lens. However, she added that there are many Hawaiian customs associated with all aspects of canoe paddling, which she observes, practices, and tries to teach to others who are unfamiliar. Mrs. Campbell shared that some of these customs include not standing on the canoe because doing so is equivalent to standing on one's ancestors. Adding to this, she shared that once the *koa* (*Acacia koa*) tree is hewn from the forest by the *kahuna* (master, priest), it is still alive and must be treated with respect. Being mindful of the types of conversations that occur on the canoe is also important. She expressed that it is important for her to share this type of knowledge

which has led to her teaching workshop/classes to club members about the Hawaiian customs and practices relevant to canoe paddling. In speaking about the cultural use of the canoes, she stated that today, most outrigger canoe paddling occurs in a sporting or recreation context rather than in a traditional manner such as navigation, transportation, or fishing. Mrs. Campbell added that their canoes have been used in certain memorial practices such as the scattering of ashes in the bay, however, she considered this to be more of a contemporary canoe culture practice rather than a traditional Hawaiian cultural practice. She related that Hawaiian burial practices are centered around returning the bones to the land. She closed by saying that her *kumu hula* taught her about the importance of knowing your boundaries when it comes to participating in certain cultural practices and sharing culturally valued information.

When asked if she was familiar with any culturally significant sites or resources in the project area, Mrs. Campbell prefaced stating that what she knew about the area was taught to her by either Auntie Lily Kong or Kalei (Auntie Lily's granddaughter, who is also a member of Keauhou Canoe Club) or through her research. She related that on the Ka'ū [south] side of the canoe club is Mō'ikeha Cave and Kaleiopapa Heiau. She added that today, Kaleiopapa is not often recognized as a *heiau* because it has been concreted over and it does not have the grandeur as other more famed *heiau*. However, she noted that based on the mapping done by Henry Kekahuna, there is some understanding as to what Kaleiopapa looked like before some of the concreting activities. Mrs. Campbell shared that the stone and the commemorative tablet have become the focal point of the *heiau*, however, she stated that the stone and tablet were added to the site in 1914. Furthermore, she added that in the area near Kaleiopapa and Mō'ikeha Cave, Auntie Lily Kong taught her where to collect the special red ochre used in traditional dyeing. She lamented that Auntie Lily Kong had passed away before she taught her how to process the dye, however, she and Kalei worked together to learn how to properly process the red ochre into a useable dye.

Concerning other ongoing cultural practices at Kaleiopapa Heiau, Mrs. Campbell shared that on March 17 of each year, the Daughters of Hawai'i and other organizations including KS come together to celebrate the birthday of King Kamehameha. In describing other places associated with Kamehameha's miraculous birth, she spoke about Pākohe, (translated as "birth canal") a small inlet located next to Kūhalalua, where Queen Keōpūolani went to soothe her birth pains. Mrs. Campbell added that she endeavors to understand this place as it was when the Queen was in labor and that the old place names help to tell that story. She emphasized that Queen Keōpūolani gave birth to two of her children at Keauhou, Kamehameha and his sister Nāhi'ena'ena.

Another ongoing cultural practice mentioned by Mrs. Campbell was associated with the *hōlua*. She believes that a portion of it has been used for certain cultural-educational programs. She shared that in the past, an *ali'i* would ride the *hōlua* down the track while another *ali'i* rode the surf on the reef of Kaula and Kalapu and the two parties would race to He'eia Bay. She stated that there used to be a tower at He'eia Bay that served as the finish line. She noted that the Wai'ula'ula Spring (mapped by Kekahuna) located in the vicinity of He'eia Bay has recently been unearthed after being buried for a long time. She added that when the spring was unearthed, the spring was found to be lined with stones.

When asked about her thoughts on the proposed project, Mrs. Campbell commented on the proposed plans for Ka'ili'ilinehe, stating that in the past, the sea wall fronting the canoe club was not there and that the beach originally extended over to where the existing pier is located. In recalling information shared with her by a member of the Machado family, she stated that the family had leased the land where the existing pier is as well as where Keauhou Canoe Club is located. Mrs. Campbell shared that the canoe club moved into its existing location some forty years ago and during that time, the club's name was Kamehameha Canoe Club. She added that the club is aware that the *hālau* will be moved a little more to the north, however, the conceptual plans do not show where, on the beach, they will be able to park and launch their canoes. She hopes a logical solution concerning the launching of the canoes and other recreational vessels is developed. She felt that improving parking on the south side of the bay would help alleviate the pedestrian traffic along the beach because due to the very limited parking on the south side, people often park on the north side of the bay and walk along the beach to get to the charter boat tours.

In looking at the proposed plans to relocate the commercial businesses along Keauhou Bay, Mrs. Campbell felt that this aspect of the plan will help restore some of the *mana* associated with the nearby sites and natural features including Kaleiopapa and the springs. She noted that along 'Ahu'ula Cliff, which is where the capes used to be dried, is the old access road, however, beyond that she was not familiar with that area. She expressed general support for the proposed heritage corridor but felt that the existing signage was sort of "gratuitous" with very little information about Mō'ikeha, so she hopes the signage content will be reexamined. In reviewing the commercial aspect of the proposed plans, Mrs. Campbell expressed a sense of reluctance but shared that she understands that the area around Keauhou Bay is considered prime real estate.

In closing, Mrs. Campbell shared that she was not aware of any cultural sites near the canoe club but pointed out there are many significant cultural sites in the area to the south of the canoe club. For her, Kaleiopapa Heiau continues to be a culturally significant place. It is where she goes to gather red ochre and honor different commemorative milestones associated with historically significant people such as Queen Keōpūolani and King Kamehameha I.

KEONE KALAWE

On March 16, 2022, a Zoom video conference interview was conducted with Mr. Keone Kalawe, a skilled archaeologist, *kuhikuhi pu'uone*, an expert in *hōlua* culture, and educator. Born in Hilo but raised in the Kapoho area of the Puna District, Mr. Kalawe shared that while growing up, he was fortunate to have spent a lot of time with his grandfather who passed a lot of knowledge about the Kapoho area to him. He added that his grandfather taught him about the *ahupua'a* system and the importance of taking care of the resources within your area and not venturing into another area because those resources are for someone else. He expressed that the teachings of his grandfather have influenced and grounded the work that he does today.

When asked how he became involved in *hōlua*, Mr. Kalawe related that sometime during the mid-1990s while attending a Hawaiian Studies course at Hawai'i Community College, his class was tasked with conducting a group project focusing on a traditional Hawaiian practice that was no longer being practiced. He and two other classmates, Mr. Likeke Teanio and Mrs. Maxine Wilcox did some preliminary research and decided to focus on *hōlua*. Their research began with looking at the construction of the *papa hōlua* (*hōlua* sled), which led them to Hulihe'e Palace in Kona. There, they observed two *hōlua* however, while examining the *hōlua* they discovered that nails were used in its construction. Later, they visited the Bishop Museum in Honolulu and saw an original *papa hōlua* in the museum's basement. From there, they began going into different communities and building *hōlua*. Later, they decided to organize and host community workshops, beginning first on Moku O Keawe, where they would share about *hōlua* culture and speak about the importance of safeguarding these resources from destruction. As part of these workshops, they built *papa hōlua* which was gifted to these communities. The workshops eventually spread to different islands. Mr. Kalawe reflected that for him, these workshops were fascinating as they brought to light a practice that people were either not familiar with or forgot about.

Even after their class together, Mr. Kalawe shared that he and Mrs. Wilcox continued learning and teaching about *hōlua* culture. He added that he and Mrs. Wilcox ended up speaking with *kūpuna* from different places and asking their thoughts and permission to study the *hōlua* in their communities. They ended up visiting select places with intact *hōlua* including ones at Kukuihaele, Kīholo, and other areas in Kona and Ka'ū. Using his background in plane table mapping, Mr. Kalawe was able to map many *hōlua*, which led him to become interested in understanding the construction of the *hōlua*. He shared that throughout time, there have been people who knew how to build the *papa hōlua* but hardly anyone who held a deep understanding of the construction of the actual slide (*kahua hōlua*) itself. He added that “for me and because of my background, when I look at the *kahua hōlua*, I look at different, I look at it as a construction style.” Mr. Kalawe related that one of his first contract work that involved mapping of a *kahua hōlua* was on KS property in North Kohala and in 1998, he and Mrs. Wilcox mapped a *kahua hōlua* at Kuamo'o, Kona.

He reflected stating “to me it is so fascinating how our *kūpuna* constructed *hōlua* and similar to *heiau* construction, you have the physical, spiritual, and the natural elements and these three components are used to construct the *kahua hōlua*.” He added, “when you say *hō-lua* and you break it down, and when you ride the *papa hōlua* it's like you're going into the next realm.” Drawing from his experience, Mr. Kalawe shared that about 99% of all *kahua hōlua* terminate in a bay and at the end of the slide there will be a cave on either the right or left side of the slide. He commented that he is familiar with only two other *hōlua* on Hawai'i Island that do not terminate in water, one being in the Hawai'i Volcanoes National Park and the other on Mauna Kea. He described one *hōlua* at Kapu'a, South Kona as being 99% intact.

In relating information about the construction style of the *papa hōlua*, Mr. Kalawe likened the tip of the runners to two hands being extended. Thus, he shared that “essentially, when you're riding the *papa hōlua*, you are an offering.” Furthermore, he added that the spiritual aspect of riding especially when transitioning from land to the ocean is symbolic of entering the depths of another realm.

Mr. Kalawe stated that all *kahua hōlua* were built to honor a particular *ali'i*; the one on Mauna Kea was built for Princess Ka'iulani and the one at Kapu'a was built for King Kalākaua. He stated that one of the remarkable aspects of *hōlua* construction is site selection and just like *heiau* construction, sometimes the same site was reused or repurposed. For example, he shared that before Kāneaka in Keauhou was built, there was another *kahua hōlua* named Pine which was much smaller than Kāneaka and dedicated to Lonoikamakahiki (whose royal residence is near the Keauhou-Kahalu'u boundary). Mr. Kalawe added that when Kamehameha I had Kauiekaouli, he commissioned the

construction of the *hōlua* and ordered that it be wider and longer which resulted in Kāneaka being built on the original Pine *kahua hōlua*. He recalled Kāneaka being about a mile long and it included a smaller branch slide that terminated at Keauhou Bay whereas Kāneaka terminated at He‘eia Bay. He recalled that while working on the *hōlua* in Keauhou the late Mr. Duane Keana‘āina pointed out the remnants of the branch slide to him several years ago near one of the golf course access roads.

In describing the *hōlua* competitions that took place at Kāneaka in Keauhou, Mr. Kalawe expressed that what is unique about Kāneaka is that when contests were held, they included two opponents with one situated on the *hōlua* and the other on a surfboard in the ocean. About midway on the *kahua hōlua* stood a tower marked with *kī* (ti leaves) that housed the referee. He added that the referee had one of the most important jobs because he was responsible for watching the surf and identifying the waves that were large enough to bring the surfer onto land. As such, the contests were held only during certain times of the year when the waves were large enough for a competition. When the referee deemed a wave suitable for riding, the *kī* was waved thus marking the start of the competition. Both opponents, one on land and one in the ocean, would ride towards the finish line which was marked by two *hōlua ki‘i* (carved images), and the contestant that crossed the *hōlua ki‘i* first was the winner.

Concerning other features of the *hōlua*, Mr. Kalawe stated that in addition to the *kahua hōlua*, there is also a running path that abuts the head of the slide on the *mauka* end. He shared that these running paths typically measure about 8-10 feet wide and vary in length, however, the running paths were set anywhere between 16-24 inches lower than the *kahua hōlua*. In detailing how the running path was used and why there is a height difference between the running path and the *kahua hōlua*, Mr. Kalawe shared the rider holding its *hōlua* would sprint down the path and hurl their body and the sled in the air. As the rider came down in the air, they would grab the sled with their hands and position it under their body before landing on the *kahua hōlua* in a face-down position. The act of jumping in the air and landing in such a manner gave the rider the momentum needed to slide down the length of the *kahua hōlua*. He stated that there are accounts of riders standing up on their *hōlua* and riding down, however this way of riding did not require the rider to use the running board, rather they stood at the top of the *kahua hōlua* and kicked off.

Mr. Kalawe stated that people have asked him why *hōlua* are so narrow and he explained that this allowed the rider to maneuver the *hōlua* down the track, which sometimes included obstacles. When asked about the obstacles, Mr. Kalawe stated that sometimes natural rock outcrops protruded into the track and sometimes there would be a ditch built into the track and the rider would have to maneuver the *papa hōlua* around such obstacles. Concerning Kāneaka, Mr. Kalawe shared that in one area of the *kahua hōlua* closer to the highway, there is a natural lava outcrop that protrudes into the track. He reminded that *kahua hōlua* were not a flat and unobstructed level plane. While most *kahua hōlua* are oriented *makai*, he shared that in Kalaupapa, Moloka‘i, the *kahua hōlua* there is oriented inland rather than *makai*. As such, Mr. Kalawe reiterated that there is a lot of variation in the construction and style of the *kahua hōlua*.

Mr. Kalawe recalled being asked why *kahua hōlua* are found in some areas but not in others. His response to this was that “people need to understand that our *kūpuna* used the natural resources.” As such, in places like Hilo and Hāmākua, *kahua hōlua* were established on grassy hills rather than constructed slides thus there are no remnants of the *kahua*. However, in places like Kona, Ka‘ū, and Puna, the available material was *pōhaku*, thus to this day, you can find remnants of the slides in these areas. Furthermore, he noted that it was common for *kahua hōlua* to be built near *ahupua‘a* boundaries and sometimes the *kahua* themselves served as the boundary marker; which is the case with Kāneaka in Keauhou. In describing the best way to observe *hōlua*, especially in the Kona area, Mr. Kalawe stated that the best observations can be made while at sea.

When asked if the *kahua* or the *papa hōlua* had different names, Mr. Kalawe shared that when speaking about the *papa hōlua*, you’ll find the *kāma‘aloa* (runners), *mana* (cross pieces)—parts that were fastened together with ‘*aha*’ (sennit) or *kaula* (rope, cord). He added that the top rails are known as *kālele*. He stated that in the past, all wood components of the *papa hōlua* were made of Hawaiian hardwoods such as *uhiuhi* (*Mezoneuron kavaense*) or *kauila* (*Colubrina oppositifolia*). Furthermore, the *kāma‘aloa* needed to be made of hardwood, and the bottom needed to be tapered and rounded otherwise there is a risk of the runners splintering or cracking. He shared that when they first started making *papa hōlua* in the 1990s, they were using ‘*ōhi‘a*’ (*Metrosideros polymorpha*). In speaking about the preparation of the ‘*aha*’, Mr. Kalawe shared that in the past, the coconut would be husked and then placed into an *imu* (underground oven) and baked. Only the fibers that withstood the cooking process were used to make the ‘*aha*’ because these were deemed most durable. He noted that *olonā* (*Touchardia latifolia*) cordage was also used sometimes but ultimately the resources found within your local environment determined what materials were used in the construction of a *papa hōlua*. He expressed that there were also woven panels that were placed between the *kālele* and these panels were sometimes made of *makaloa* (*Cyperus laevigatus*) a sedge found typically along marshlands or *lau hala* (*Pandanus odoratissimus*). In either case, he stated that the woven piece needed to be a fine weave and pliable.

In detailing the preparation of the *kahua hōlua* for use, Mr. Kalawe stated that the entire surface of the slide needed to be covered with vegetation, which again, was determined by the availability of the local resources. He recalled using plants such as banana stumps, ti leaves, and in areas like Kona, *pili* (*Heteropogon contortus*) grass was used. Furthermore, to make the slide slick, the *kālele* and the vegetation were oiled using either coconut or *kukui*. He related that “this is the reason why when our *kūpuna* rode their *papa hōlua* on the *kahua hōlua*, they rode at noon, when the sun was above because everything was all slick and warm.” He emphasized that it is important to realize how much energy and material was required to cover the surface of the *kahua hōlua* and sometimes certain *ali‘i* wanted the surface of the slide covered in *lau hala* mats. He candidly stated, “imagine the resources and the people it took to weave all these mats; you not talking about one, two mats on the slide, you talking about twenty, thirty mats piled on each other and can you imagine how wide because at Kāneaka, in some places, its forty feet wide and one mile long?” Because of these factors, he added that riding was not done in an impromptu style, it had to be planned and was not a daily activity because it took a lot of people and resources to prepare the slide. He noted that this is why the sport of *hōlua* was reserved for the *ali‘i*. Mr. Kalawe opined that preparing the slide took a tremendous number of resources from the local area and some of these resources, such as ti leaves, were important for food production. Additionally, when contests were held, it drew a number of people to that area, and those people needed to be fed. As such, he stated that this was certainly a community effort. He went on to add that over time, *hōlua* grew in size, and for a community to decide that it could afford and support all aspects of *hōlua* in terms of resources and labor also speaks to the abundance of resources within that area. He stated that it is amazing because there are multiple components to *hōlua*, from the *papa hōlua* to the *kahua* which is much larger. He believes that *hōlua* are one of the largest man-made constructions found in Hawaiian culture. In reflecting on Kāneaka, he stated “can you imagine how many people it took to move *pōhaku* from one place to another... so it’s a real massive undertaking.”

In detailing the engineering components of Kāneaka, Mr. Kalawe remarked that if you look closely at this *hōlua*, you will see that *kūpuna* constructed rolling hills into the *kahua*, which helped to slow the rider down. He stated that *hōlua* were never built as a level plane because the rider would go down at uncontrollably high speeds. Because *kahua hōlua* were built on hillsides, incorporating rolling hills into the slide’s surface made riding physically possible. Also, at Kāneaka, he shared that there is a stone wall built along the north side of the slide. In recalling some calculations that he and a few others did, it was estimated that a rider could reach speeds of 62-65 miles per hour.

Mr. Kalawe also spoke about what happened when a rider would *hala* (die, pass away) while riding. He explained that if a rider died, they would be buried at the top of the slide, before the running path. As such it is not uncommon to find burials in the area above the running path. Also, the rider’s *papa hōlua* would be burned so that their essence would go with their *papa*. He believes that this explains why *papa hōlua* are not commonly found in an archaeological context. Furthermore, Mr. Kalawe spoke about changes to the practice and noted as the practice of *hōlua* started to die out, sometimes, the *kahua* was repurposed and used as a burial site, thus over time, the function of the *hōlua* changed.

When asked if there are any particular *akua* that are associated with *hōlua*, Mr. Kalawe stated that Lono would be the main *akua* associated with *hōlua*, which is one of the reasons use of the *hōlua* was popular during the Makahiki season. However, he went on to explain that *ali‘i* could ride outside of the Makahiki season however, this was not common and it was only during Makahiki that the *maka‘āinana* (common folks) could participate in this sport. He reiterated that *hōlua* was however a sport/recreation/practice that was almost exclusive to the *ali‘i* class. Also, when *hōlua* were built, it was done so for a certain *ali‘i*, which gives *hōlua* a particular status in Hawaiian society. Mr. Kalawe opined that it was common for *ali‘i* from different areas to have their own *hōlua* but they would gather periodically to challenge each other and they brought together “nothing but the best riders.”

When asked about his thoughts on caring for Kāneaka within the context of the cultural landscape of the project area, Mr. Kalawe believed that KS has made efforts to remove trees and vegetation from the slide. He felt that this was an appropriate action especially as it relates to protecting the integrity of the *hōlua*. He explained that if large trees are not removed whether they are within the slide or adjacent to it, these trees have the potential to undermine the construction of the slide. He added that in some parts of the slide, *kūpuna* would install slabs and then place the finishing stones on top, so over the years and with earthquakes, sometimes these sections of the slide are prone to collapse. He felt it is important to address and repair any collapsed sections as part of the long-term preservation of the *hōlua*. When asked how he felt about the use of the *hōlua* in a cultural-educational context, Mr. Kalawe stated that it is important that these kinds of efforts come from the community. He felt it was important to educate and share more about the *hōlua* at Keauhou. He noted that it is possible to ride the less steep sections of the *hōlua* if it is done in a safe manner and in a cultural and educational context. He expressed that this is a part of Hawaiian culture and it is important for people to experience it. In closing, Mr. Kalawe remarked that “we need to reintroduce the *hōlua* culture” and in this way people can understand all aspects of *hōlua*. He felt it was important especially for *ali‘i* trust

to restore, preserve, and teach people about *hōlua* as it is an integral part of *ali‘i* pastimes. He has been seeing Kona-based *ali‘i* trust take pride and ownership in their *hōlua*. In summary, Mr. Kalawe stated, “at the end of the day, our community and our people are going to benefit from it because now they are going to know that there are more *hōlua* slides around.” He would like KS to realize that what they have in Keauhou is unique and monumental and it can serve as a gathering place for people to learn about *hōlua*... “we want to keep our culture alive and safeguard what we have left... this is important to the continuation of our *kūpuna* practices.”

FLOYD KAHALIOUMI

ASM staff, Lokelani Brandt conducted an in-person interview with Mr. Floyd Kahalioumi on April 5, 2022, on the shores of Keauhou Bay. Born in November 1945 in their family home in Keauhou *mauka*, Mr. Kahalioumi was raised with his maternal grandfather, Mr. Robert Kahalioumi (also known as Grandpa or Papa). Mr. Kahalioumi’s maternal lineage traces back to the lands of Keauhou and Kahalu‘u. About twenty-one years ago, Mr. Kahalioumi retired from Verizon and continues to reside in Keauhou *mauka*, a short distance from the place where he was born and raised.

He described that as a child, his family had two homes, one *mauka* and *makai*, and they would spend a week or two at their *mauka* home then come down to their *makai* home and spend anywhere from a week to two, then return *mauka*. He noted that their *makai* property was an original *kuleana* that had been in their family for many generations. During certain holidays, such as Memorial Day, the entire family would come down to the *makai* home where they fished, enjoyed the ocean, and cared for their *‘ohana* burials. He stated that they used to access their *makai* house from the old road further inland of the bay (identified on the conceptual plan as the Old Kona Road) or they used a small trail that led up ‘Ahu‘ula Pali to their house. He recalled the front of the house being built about 10 to 12 feet off the ground that overlooked Keauhou bay. The yard was paved with *‘ili‘ili* and there was an outdoor kitchen and bath.

Aside from taking care of their *kuleana* and burials, he recalled how they also fished. During the nights they fished for species like *‘upāpalu* (a species of Cardinal fish), mostly along the south side of the bay and they would throw net for *‘anae* (mullet). He recalled walking along the shoreline of the bay and throwing net, which was mostly done on the north side of the bay since the south side was rocky with small cliffs. Mr. Kahalioumi clarified that as children they never ventured into the deeper parts of the bay and any deep-sea fishing was done by Grandpa on his traditional Hawaiian fishing canoe modified with and out board motor. He recalled how Grandpa would gather *he‘e* in the north side of the bay while he and his cousin Ronald would wait on the canoe.

In detailing other aspects of Keauhou Bay, Mr. Kahalioumi remembered how the coastal road meandered along the interior part of the bay and on the *makai* side of the road is where the fishermen stored their fishing canoes. He noted that in the past, the stone wall fronting Keauhou Canoe Club was not there so the beach was more expansive. He detailed how the central part of the shoreline was built up with boulders, on top of which were built racks to store the fishing canoes. He added that when the fishermen came in, they would use Hao [*hau*] logs to drag their canoes up the beach. It was common for people who were in the area to assist the fishermen and “*hāpai* (carry) and put [their canoes] on top of the racks so that the canoes were kept safe from high tides and rough seas. The water washing up on the beach would go underneath, keeping the canoes safe.” In exchange, the fishermen often gave any helpers a share of fish.

In naming some of the families that he remembered living at Keauhou, Mr. Kahalioumi recalled the Haanio, Hoapili, and the Machado families, the latter of which operated a dry dock out of Keauhou Bay. Sharing what he remembered about the Machado drydock operation, he stated that on the north side of the existing pier is the old boat ramp, which is the ramp they used when they went *holoholo* (lit. walk, ride, sail; also a euphemism to refer to fishing). He added that on the north side of the old boat ramp were old tracks that extended from the water into the Machado drydock. He remarked that the tracks were used mostly for the old charter boats. He explained how the boats would come inside the bay, tie up to the pier where they were scrubbed. Then a trolley that was attached to the tracks would be rolled down towards the shore. From there the boats were loaded on the trolley and the trolley would be pulled inland into the dry dock using a cable system. Mr. Kahalioumi expressed that there were but few charter boats at Keauhou Bay and only during rough weather did the bay fill up with boats from elsewhere seeking refuge.

Concerning other land use activities at Keauhou, Mr. Kahalioumi recalled that the area back from the shoreline was used for ranching, which included the Hind family and Pu‘uwa‘awa‘a Ranch. In speaking about the type of vegetation in the area, he recalled the area being mostly filled with *kiawe*. He added that the old road inland of the bay was just a single-lane dirt road that was used by the ranch. As noted above, this is the same road that his family also used to access their *makai* house lot.

In describing some of the structures that used to be in and near the project area, Mr. Kahalioumi described a church in the area north of the Hoapili residence. Although he was not certain, he believes this was the site of the original Helani Church. He said that from Keauhou, the church was moved to the north side of Ali'i Drive near Kahalu'u Beach Park and from there it was relocated to Kahalu'u *mauka*. He said that there used to be a house on the Hoapili property and to the west of the Hoapili property was Doc Hill. He remembered a home located near the present-day restrooms at Ka'ili'ilinehe beach and was told that there was also a home a little *mauka* (east) of the restrooms.

When asked about the cultural sites in the area, Mr. Kahalioumi expressed that growing up, they were taught by Grandpa to leave such places alone including the birth site, Mō'ikeha Cave, Lekeleke, or *heiau* located in the Kahalu'u area. He also spoke about the brackish water pond (Ho'okūkū Pond) located near the existing restroom facility and said that he remembered that pond being a little larger and much cleaner.

When asked if he recalled any of the *tsunamis* and how the place was impacted during these events, Mr. Kahalioumi recalled standing on the pier and watching the water drain from the bay. He commented that local people would come down during the *tsunamis* to grab the stranded fish. He shared how he watched a wall of water, which appeared to have stalled near the two points of the bay slowly move inland and refill the bay. He noted that the *tsunamis* he has observed at Keauhou were not like the ones that hit places like Hilo. During one such event, he remembered how he and his cousin caught a *malolo* that got stranded on the pier.

When asked about how the area has changed over the years, Mr. Kahalioumi stated that prior to him completing high school, the concrete pier/parking area was expanded. He noted as far as he could remember, the wooden "finger" pier was already built. He recalled how the trucks and trailers would drive down along the shoreline road, the boats were unloaded using the boat ramp on the north side of the existing pier, then the trucks and trailers would park on the concrete pier. He remembered the construction of the seawall fronting Keauhou Canoe Club. In reflecting on the seawall, Mr. Kahalioumi related how he was told, "if you make the shoreline hard with the stone wall, then the beach going come hard." In clarifying the words he said anytime you build a seawall it changes the beach because it alters the flow of the ocean, which often leads to the erosion of sand and exposure of rocks. He recalled a restaurant being located behind the current Sea Quest Hawaii headquarters and that before the restaurant, it was a yacht club.

When asked about his thoughts on the proposed plans, Mr. Kahalioumi was generally supportive of some aspects of the plan including rerouting traffic flow and the culture and educational components. He did, however, want to ensure that locals have access to the pier and the ocean to swim and fish for seasonal species like *halalū* (juvenile *akule*) and *'oama* (juvenile *weke*). He felt that visitors and those coming to partake in the commercial activities should have another area to gather and park. He felt that commercial activities increases traffic congestion along the bay and it deters locals from enjoying the area. He worries that added commercial space anywhere along the bay would draw in more vehicular and pedestrian traffic.

When asked if he thought the proposed project would have an impact on the cultural resources in the area, he worried that increased visitors would continue to impact the place. He hopes that there will be something within the proposed plans that serves the Hawaiian community and includes educational opportunities for the children of Kona (i.e. Kamehameha Schools Campus). He reiterated the importance of ensuring local fishers can continue to come to Keauhou and fish from the pier for *halalū* and the bay for *'oama*. Mr. Kahalioumi believes that the sewer line that runs through the existing volleyball should be relocated elsewhere.

4. 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" (OEQC 1997:1). The guidelines also identify the types of cultural resources, associated with cultural practices and beliefs that are subject to assessment. These include other types of historic properties, both man-made and natural, submerged cultural resources, and traditional cultural properties. The origin of the concept and the expanded definition of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service (Parker and King 1998). An abbreviated definition is provided below:

"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.

"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 of 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.

SUMMARY OF BACKGROUND INFORMATION

Since time immemorial, Keauhou's importance to Hawaiian history and society has long been recognized as evidenced by the plethora of traditional and historic era accounts that call attention to distinguishing landscape features, resources, persons of historical significance, place names, practices, and ideologies. From the traditional *mo'olelo*, we know that Keauhou is associated with certain *akua* including Kāne, to whom Kamau'ai Heiau was dedicated and said to be the *heiau* where the first vegetables were introduced. Kāne's domain also included surface and subsurface freshwater. At Keauhou *pūnāwai* (springs) are found along the coastline emanating through the lava rocks or the sea floor. Several of the consulted parties recalled seeing the springs bubbling up in the ocean, or gathering spring water for subsistence purposes. Some of the more prominent springs were named including Kūhalalua located near the present-day charter boat operations and Wai'ula'ula, located near He'eia Bay. Keauhou's history also identifies with the *akua* Lono, who was closely associated with agriculture. In his rain form, Lono brought the much-needed water to the crops and assured the fertility of the land. It is also said that Lono was the king when the great

flood known as Kai-a-ka-hina-ii swept over the land. As Lono is the *akua* who presides over the annual *Makahiki* when games and competitions were held, according to one of the consulted parties, Lono is also associated with the rituals associated with the practice of *hōlua*.

The traditional *mo'olelo* identifies a long line of chiefs and other notable persons who were either born or ruled from Keauhou. The historical record also suggests that Keauhou attracted *ali'i* from the outer-island chiefdoms. As noted above, in addition to Lono being identified as the king who ruled over Keauhou, other *mo'olelo* name Pōhaku-nui-o Kāne (who ruled the lands between Keauhou and Mā'ihī), Namakaokalani, Nihooleki (who was born at Keauhou), 'Umi-a-Līloa (who constructed the famed *heiau* Ahu A 'Umi in the uplands of Keauhou) and his sons Keli'i-o-Kāloa and Keawenui-a-'Umi. In some instances, Keauhou is mentioned as a stopping place for certain *ali'i* including chiefess Kamāmalu (wife of Kamehameha III) who made a short visit to Keauhou in 1812, while en route from Ka'ū to Kona. In one account the chief, Mō'ikeha evaded capture when he hid in a cave located in the face of 'Ahu'ula Cliff. Keauhou is also the birthplace of noted Hawaiian historian, David Malo, a medical *kahuna* from King Kalākaua's era, Kamali'ikāne, and Judge John G. Hoapili who was born in Keauhou in 1833.

From the era of 'Umi-a-Līloa down to the reign of Kamehameha I and his children, Keauhou becomes particularly important as evidenced by the frequency in which this place is mentioned in the historical literature. The *ali'i* Lonoikamakahiki, who established 'Umihale, a large royal compound near the Keauhou 1st-Kahalu'u boundary, is said to have had another, albeit, smaller royal residence inland of Pueo Cove located along the north side of Keauhou Bay and to the west of the project area boundaries. Later, Kamehameha I is said to have established his residence on the ruins of Lonoikamakahiki's home at Pueo Cove. Furthermore, according to Mr. Kalawe, the royal *hōlua*, Pine (which was superseded by Kāneaka *hōlua* built for King Kauikeaouli) was dedicated to Lonoikamakahiki. Lonoikamakahiki is also said to have commissioned the construction of several *heiau* in Kahalu'u namely, Makole'ā, Kapuanoni, and at least one, Keahiolo, on the Keauhou 1st-Kahalu'u boundary. Kalani'ōpu'u, an *ali'i* from Ka'ū is said to have taken up residency at Keauhou following the death of Captain James Cook in 1779, where he amused himself in the area's famed surf and *hula*. In 1791, Kuakini (also known as John Adams Kuakini or Kaluaikonahale), son of Namahana and Ke'eumoku was born in the neighboring Kahalu'u but raised in Keauhou by Kamehe'aiku (cousin of Ke'eumoku). The chiefess Miriam Kekāuluohi was born in Keauhou in 1794 and later adopted by her maternal grandparents, Namahana and Ke'eumoku.

Of the *ali'i* accounts, those associated with Kamehameha, his sacred wife, Keōpūolani (born in 1780) and the birth of two of their children, Kauikeaouli and Nāhi'ena'ena at Keauhou are arguably the most widely known and celebrated births. The historical accounts indicate that Kamehameha brought a young Keōpūolani and her relatives, (whose *ali'i* lineage traces can be traced to the island of Maui), to Keauhou where she was raised. While there is much debate concerning Kauikeaouli's exact birthdate, March 17, 1814, was the day twice proclaimed as the national holiday to honor the king. From the published accounts, is it said Keōpūolani went to bathe in the cold waters of Kūhalalua where she was seized by her birth pains. She made her way to the confines of Kaleiopapa Heiau, located at the base of 'Ahu'ula Cliff, and gave birth to a stillborn. The *piko* was cut and the 'iewe was taken to a flat *pāhoehoe* located north of Ho'okūkū pond where it was warmed over a fire. The high priest Kapihe uttered prayers and the wandering spirit of the baby was restored to its body. The infant was then taken by Kaikio'ewa to be raised in 'O'oma, North Kona. To honor the birth of his son, it is said that Kamehameha ordered the construction of the massive *hōlua*, Kāneaka. Unlike her brother, there are but few details describing the birth of Nāhi'ena'ena. The available information specifies that she was born in 1815 and raised by her mother at Keauhou, however, by 1823, she and her mother left for O'ahu and Maui.

Concerning Kamehameha I, John Papa 'Ī'i described a canoe race in which Kamehameha competed against Akalele, a famous paddler from Kaua'i off the coast of Keauhou. Furthermore, a map prepared in 1885 by Jackson shows the ruins of Kamehameha's house between Ho'okūkū Pond and 'Ahu'ula Cliff. Concerning other sites and features that are associated with Keauhou's *ali'i* history is 'Ahu'ula Cliff, said to be the place where the *ali'i* would air-dry their capes.

Following the death of Kamehameha I in 1819, Keauhou played an important role in the infamous Battle of Kuamo'o. It was at Keauhou that the warring parties camped as negotiations to curb a full-scale war were had. As the negotiations were unsuccessful, the warring parties marched to the coast and fought on the battlefield at Lekeleke, located at the Keauhou 2nd-Honalo boundary. Within a year, the first missionaries arrived on Hawai'i Island, and their descriptions of Keauhou describe their travels to the area via the coastal trail where they encountered a quiet harbor surrounded by a small fishing village, dotted with coconut trees.

In 1848, the *Māhele 'Āina* took place which converted Hawaiian lands to a Euro-American model of fee-simple ownership. Keauhou 1st was awarded to Victoria Kamāmalu while her brother Lot Kapuāiwa (Kamehameha V)

received Keauhou 2nd. It has been estimated that as many as 100 claims were made by the tenants for land in Keauhou 1st and 2nd of which sixty-nine were awarded. Of sixty-nine awarded claims, twenty-seven LCAw (comprised of twenty-eight parcels) are located in the *makai* portion of the *ahupua'a* near and within the current project area boundaries. The size of the awarded lots within the project area ranged in size from 0.16 to 6.66 acres and most of these lots were awarded between the years 1858 through 1889. The majority of the lots awarded in the project area were for *pāhale* that were fully or partially enclosed by a dry-stacked rock wall. One of the awardees described a small enclosed garden and certain plant species were listed including *loulu*, *kou*, *niu*, *hala*, and an orange tree. Several *'ili 'āina* names were also listed and while the exact location or even spelling of these *'ili 'āina* names cannot be corroborated with definitive certainty or accuracy, the following *'ili 'āina* names were compiled for Keauhou: Papala 2, Papalanui, Waipio 1-4, Laulaulahuli (Laulaulahili or Laulauhili), Pakohe, Kaulukauhane 3, Haleokane 2, Kaohia, Haleope, Makakaulii, Paki, Haluapalala, Maili, and Puukaa.

A review of the boundary commission testimony gathered in 1886 captures detailed knowledge of the *ahupua'a* boundaries as well as identifies other traditional cultural practices and resources not recorded elsewhere. These include bird catching, *akule* fishing, known settlement areas, trails, botanical resources (i.e. *'ōhi'a*, *pili*, *mamane*, *koa*, *'iliahi*, *naio*, *mamaki*), built features (i.e. *heiau*, *hōlua*, walls) agricultural areas, *ali'i* residence, water collection areas, upland habitation caves, and how resources were distributed between the residents of the two Keauhou. While the above-identified customary practices and resources may not all be relevant to the current project area, it provides a broad scope and understanding of the types of resources and practices that were prevalent amongst the area residents.

By the late 19th century, the settlement patterns shifted as commercial industries like ranching and farming were established throughout North Kona, particularly in the uplands. However, coastal areas like Keauhou Bay persisted as fishing, churches, steamship arrivals, and mercantile businesses continued to operate out of this area. The burgeoning upland communities continued to be linked to the coastal villages via a growing network of trails that were used to support the transportation of livestock and goods. These trails also helped to maintain the traditional lifestyles of the families who would live part-time in the uplands where they raised livestock and or fished and part-time at the coast where they engaged in marine resource collection. As described in the interviews conducted as part of this study, this lifestyle was maintained well into the mid-20th century. Infrastructure such as piers was built along the shoreline and trails were improved to accommodate new modes of transportation.

Much of what we know concerning the lifestyle of the families who lived at Keauhou during the first half of the 20th century comes from ethnographic interviews with *kama 'āina* (native-born). From these interviews, we know that a dozen or so families that lived at Keauhou continued dedicating part of their time to their upland endeavors including ranching and farming, and part-time at the coast where they occupied themselves in fishing and other marine activities. The *tsunami* that struck Keauhou on April 1, 1946, leveled several homes and the roughly 50-foot-long pier that projected into the bay. After this *tsunami*, land use in a portion of the project area shifted as Charles Machado established a drydock inland of the destroyed pier. To support their family business, the Machado's built sheds, a hoist, a concrete ramp, and a marine railway. The coastal road that traversed along the shoreline was improved from a low-lying compact coral road to an elevated road constructed with a basalt rock base. Sometime during the early 1950s, the passage into the bay was deepened when the bay was dredged using dynamite.

Despite the physical changes brought about by the *tsunami*, Keauhou remained a historically meaningful location. During the early 1950s, one of the most detailed studies documenting the area's rich history and significant places was undertaken by Theodore Kelsey and Henry Kekahuna. Their work captures important changes to the project area during the 1950s, all while illuminating the historical character of this land. Kelsey and Kekahuna's maps documents traditional place names, cultural uses, and historic events that took place in different parts of the bay, and record the names of residents who lived at Keauhou during this period. As noted by nearly all of the consulted parties, the work of Kelsey and Kekahuna stands as a living treasure and serves as a critical resource for present and future generations seeking to improve their cultural understanding of Keauhou Bay.

Beginning in the 1960s and into the present day, resort and tourist-related development in the Keauhou area began to drastically change the landscape. Resorts, golf courses, road improvements and construction projects, and residential development along the bay altered both the physical landscape and the area's cultural setting. As a result of these development activities, a number of archaeological and ethnographic studies have been conducted over the years in the current project area. Collectively these studies have helped to document and shed additional light on the area's many historic resources as well as the destruction of some of these resources.

Maly and Maly's (2004a) Cultural Synthesis Study Recommendations

□ *Ilina* (burial sites) are believed to be sacred and require respect. It is the general wish of all individuals interviewed that *ilina* be protected in place. If *ilina* are discovered while some

form of land work is occurring (termed “Inadvertent discoveries”), such *ilina* should be handled in consultation with native families of the land, and in compliance with state law.

- *Heiau* should be protected.
- Kāne‘aka (the Royal *Hōlua*) and Pu‘u o Kaomilā‘ō should be protected from any further impacts.
- *Ala hele* (native trails) are an important part of the cultural landscape and life-way of the people, and should be preserved whenever possible. Use of the *ala hele* should be informed so as to foster respect of the history, traditional sites and property rights of present-day owners/residents.
The Keauhou Trail and the Mākole‘ā-Kahalu‘u Trail are believed to be of particular importance to the history of the people and the land. Formulation of treatment and access plans focusing on traditional knowledge and responsibilities should be done in consultation with elder *kama‘āina* of the Keauhou and Kahalu‘u lands.
- Caves, such as those used for burial practices, refuge, habitation, and other traditional occupations should be protected. Care must be used when using heavy equipment in the vicinity of cave openings, and when over subterranean extensions of the lava tubes systems. There is also concern about the intrusion of water and chemicals into the caves from irrigation and other activities.
- Final treatment of *ilina* features and caves—such as: left open? closed? buffers? and who may visit? etc.—should be determined in consultation with elder *kama‘āina* of the Keauhou-Kahalu‘u lands.
- Restoration of sites should only be undertaken with care and in consultation with elder *kama‘āina*. It is generally believed by many *kūpuna* that stabilization rather than restoration is a preferred treatment. Once restoration occurs, the signature and hand-work of the people of old is erased, and the story of the place is new.
- Wherever possible traditional sites should be protected, and incorporated into the landscape, thus preserving not only those sites which have been determined significant under the law, but also those sites which were important to those who came before us.
- When possible, it would be good to use the natural lay of the land and lava flow formations as assets in the development setting, rather than knock everything down, only to build it up again.
- *Mauka-makai* view planes, particularly those associated with the *hōlua*, Kāne‘aka and Pu‘u o Kaomilā‘ō, and the *mauka-makai* trails, should be protected, allowing for an *ahupua‘a*-view of the resources in their cultural context.
- Educational and interpretive opportunities should be developed in order to help future generations understand and appreciate the cultural resources protected on the Keauhou-Kahalu‘u landscape. A part of such an interpretive program should include the *ahupua‘a* concept, looking at the relationship of the elevational zones, to the life-ways of the traditional and historical families of the land. (Maly and Maly 2004a:136-137)

Marine Resources and Practices

From the culture-historical information coupled with the findings from the consultation process, nearly every type and technique employed for marine resource collection were—and to some extent continue to be—practiced at Keauhou Bay (i.e. fishing, throw net, spearing, shoreline gathering of seaweeds and other benthic species; see Figure 69). As noted by the *kama‘āina* who were born and raised at Keauhou and interviewed as part of this study, marine resource collection was the predominant activity of those families that once resided in the project area. The marine resources they collected supported their traditional lifeway of living part-time in the uplands and part-time at the coast. Furthermore, for these *kama‘āina* families, the ocean was and continues to be viewed as an extension of the land upon which they could access to procure resources for their subsistence lifestyle. As indicated by the consulted parties, fishing and gathering of marine resources are not practiced to the same degree or frequency as in the past, however, as pointed out by Mr. Kahalioumi, schools of ‘oama and *halalū*, which are valued resources, are known to seasonally inhabit the bay.

Mrs. Manuel identified a boulder (Figure 70) located at the end of the Kamehameha III Road turnaround (see Figure 69), which was used by her grandfather for fish observation. Mrs. Manuel would like her grandfather's fish observation stone preserved in place as part of the current project. If there are construction activities that will take place in the vicinity of this boulder, it is recommended that the stone be marked by temporary fencing and that the construction crew be informed of its whereabouts and significance. Mrs. Manuel spoke about Ka'ili'ilinehe Beach in the context of traditional healing and cleansing rituals. This practice which was known in her family as *'au'au* (lit. bathe) required an individual to quietly immerse themselves in the sea before engaging in the more playful or secular ocean activities. There are several known ancient cleansing/purifying rituals that involved the use of saltwater namely *hi'uwai* (purification ceremony where participants immerse in seawater or freshwater), *kai'ōlena* (to purify using saltwater and or saltwater mixed with turmeric root), and *pīkai* (to purify by sprinkling with seawater or freshwater mixed with salt).

The consulted parties spoke about the changes within and along the fringes of the bay that impacted the look and feel of the beach as well as the marine resources and associated fishing traditions. Several of the consulted parties expressed concern for the prospective project and the potential for the continued degradation of the area's marine resources. As noted by Mrs. Manuel, storm water runoff was a major concern. Thus it is recommended that efforts be made to prevent or severely limit runoff into the bay by conducting the appropriate studies and implementing storm water management measures. Failure to do so would likely result in an adverse impact on the practice of marine resource collection, healing and cleansing rituals, and on the culturally valued marine resources that inhabit the bay.



Figure 70. Fish observation boulder identified by Mrs. Manuel at the end of the Kamehameha III Road turnaround, view to the west.

Freshwater Springs, Freshwater Procurement, and Ponds

Freshwater, a valued resource, and its procurement via naturally occurring springs were identified as a customary practice. Within the project area, several of the consulted parties spoke about the presence of springs in the bay and one of the consulted parties recalled gathering freshwater from Kūhalalua spring (see Figure 69) (sometimes identified as Kaopa spring). As noted by the consulted parties, freshwater has both ecological and cultural value, and ensuring these subterranean water systems are not disrupted during the proposed project will help to ensure the long-term health and fecundity of Keauhou Bay. Although the gathering of freshwater from Kūhalalua spring is longer practiced, protecting this spring by ensuring its water continues to flow is essential to preserving this valued resource. To limit

impacts on Kūhalalua spring, it is recommended that periodic monitoring of the water flow and quality be conducted during the course of the proposed project and that data is provided to the landowner to aid in the management and decision-making processes.

Several of the consulted parties spoke about the remaining portion of Ho‘okūkū Pond (see Figure 69) as a valued cultural resource. It was pointed out by those consulted parties that the water quality and health of the pond are degraded. As this pond is closely associated with Kamehameha III’s birth story, efforts should be made to improve the health of the pond and update the interpretive signage near the pond so that its significance is contextualized within the king’s birth story.

Historic Transportation Routes

At least two trails and two historic roads were identified as valued resources. As described by nearly all of the consulted parties, the *mauka-makai*-oriented trails were used by the *kama‘āina* families to support their seasonal living practices and were later used by ranchers who used to drive their livestock to Keauhou Bay to be shipped to O‘ahu. Archaeological studies have documented two prominent trails that once intersected with the project area, including the Keauhou Trail (Site 15243) and the Keauhou-Kaināliu Trail (Site 15244) (see Figure 65), both of which were oriented in a *mauka-makai* direction. Although these trails are no longer in use and a recent archaeological investigation (Haun et al. 2021) found no surface evidence of the trails, they are still remembered by the *kama‘āina* familiar with these resources. The cultural-historical background also identified a coastal route that traversed along the shoreline of the bay. This route, the location of which is approximated in Figure 69, has been modified over the decades and has several known names including the Lower Government Road, the Coastal Government Road, Kailua-Keauhou Beach Road, and in more ancient times, the Ala loa. Historically, this coastal route connected all of the coastal communities, including important royals centers located along the Kona coast (National Park Service 2007). Lastly, and although not a traditional route per se, a section of the Old Kona Road extends through the project area (see Figure 69). One of the consulted parties described using this road as well as the lower coastal road to access their family *kuleana* parcel.

While all of these resources have been impacted by modern development or lack of use and abandonment, efforts should be made to do detailed recordation and assessment of any extant portions of these resources, including its alignment. If it is found that portions of these trails are in good condition, efforts should be made to preserve them, and consultation should be sought with descendant communities, Nā Ala Hele, the Ala Kahakai National Historic Trail and its nonprofit partner organization the Ala Kahakai Trail Association about the appropriateness of restoring the alignments and reusing these trails for the public and/or educational purposes.

Ranching History, Infrastructure, and Activities

Although ranching is not considered a traditional cultural practice per se, it is certainly a significant part of Keauhou’s history. Many of the consulted parties shared their recollections of the long-time ranching families, identified the location of previous ranching infrastructure in the project area, and described the ranching activities that occurred at Keauhou Bay. The archaeological study conducted in 2021 (Haun et al. 2021) documented three additional sites (Temporary Site Number 1608.1, 1608.2, 1608.3; see Figure 69) that have been associated with the Historic ranching era. It is recommended that efforts should be made to conduct thorough recordation of these sites and a public interpretation component highlighting Keauhou’s ranching history should be developed as part of the current project.

Kāhua Hōlua, Kāneaka

As described in the culture-historical background and reckoned by several of the consulted parties, the *hōlua*, Kāneaka was identified as an important cultural resource. This resource has been documented by archaeologists at Site 1669, however, its alignment extending *makai* from Ali‘i Highway and into the project area does not appear to be fully known and has only been estimated (see Figure 69). One of the consulted parties described observing the remnants of a secondary *hōlua* extending from Kāneaka in the vicinity of the golf course mechanic shop *mauka* of the project area. This secondary *hōlua* was said to have terminated at Keauhou Bay, whereas Kāneaka was said to have terminated at He‘eia Bay. Although historic and modern land-use activities and development have led to the destruction of that portion of this site that would otherwise be within the project area, it is recommended that developing interpretive material that contextualizes this site and its relationship to former *ali‘i*, such as Kauikeaouli, Kamehameha, and Lonoikamakahiki should be incorporated into the overall public interpretation of the Keauhou Bay area. Incorporating Kāneaka into any future cultural-educational programming planned for this area should also be strongly considered.

Heiau and Other Sites Associated with the Birth of Kamehameha III

Between 1906 and 1983, there were four archaeological studies (Kekahuna 1954; Reinecke 1930; Rosendahl et al. 1983; Stokes and Dye 1991) that have attempted to document the location and describe the extant portions of *heiau* in the project area. Of these studies, it is the early works of Stokes (1906), Reinecke (1929), and later Kekahuna (1954) that the foundational understanding of *heiau* in the Keauhou Bay area is derived. Collectively these studies have identified four *heiau* that are allegedly in the project area, namely, Kamau‘ai, Ho‘okūkū or Kaopa, Kamohoali‘i, and Kaleiopapa. In 1976, the Daughters of Hawai‘i prepared a study/proposal for the development of historic sites at Keauhou Bay (Daughters of Hawai‘i 1976). This 1976 study identified five sites of historic interest (Kaopa Spring, Ho‘okūkū Pond, Kamohoali‘i Heiau, Kaleiopapa Heiau, Kamau‘ai Heiau, ‘Ahu‘ula (‘*alaea*) Pit, and Mo‘ikeha Cave) and efforts were made to rectify historic discrepancies regarding the location of some of these sites. While there is consensus on the names of the *heiau* at Keauhou Bay, one of the major difficulties lies in determining the location of some of these sites as the locational information provided in the aforementioned studies differ greatly as reflected in Table 7.

Table 7. Locational information of *heiau* identified in the project area.

<i>Name</i>	<i>Stokes (1906)</i>	<i>Reinecke (1930)</i>	<i>Kekahuna (1954)</i>	<i>Daughters of Hawai‘i (1976)</i>
Kamau‘ai (Site 3812)	“...top of the cliff directly back of and overlooking the Keauhou landing...” (Stokes and Dye 1991:85).	Low ground behind the Wharf. In ancient times the site of Kamauai [Kamau‘ai] heiau. Kamauai signifies “to spread, or pass on, food.”	“Present end of the royal slide”	“The remains of the platform lay to the south end of the great holua.”
Ho‘okūkū or Kaopa (Site 3811)	“...near the boundary of Keauhou I... A low, rambling wall encloses a space of about 1.5 acres at the foot of a high cliff. The contour of the ground inside is similar to that outside, and within are breadfruits, <i>loulou</i> , and other trees. Also inside, however, is a large rock to which marvelous revivifying powers were attributed, and it was stated that the dead baby was placed on the stone for some days and came to life by virtue of the stone, with the aid of the priest’s prayers. It is not improbable, if all were known, that this would prove to be the site of the <i>heiau</i> of Kamau‘ai Heiau mentioned above.” (Stokes and Dye 1991:85)	“Hookuku, however, is the name of the pool midway of the W. side of the heiau, which now forms a small swamp. It was formerly <i>kapu</i> for the use of royalty. Kaopa is the name of the well S. of the heiau.”	Ho‘okūkū pond at the southwestern end of the base of ‘Ahu‘ula Cliff. (Kekahuna does not mention the name Kaopa.)	Hookuku Pond “a well stocked fish pond served the immediate use of the royal family” and in “1953-54 Hookuku Pond...was filled in and is the site of a utility transformer.” Kaopa, a spring is “in front of the present Bishop Estate residence and office [Machado House].”

Table 7 continues on next page.

Table 7. continued.

<i>Name</i>	<i>Stokes (1906)</i>	<i>Reinecke (1930)</i>	<i>Kekahuna (1954)</i>	<i>Daughters of Hawai'i (1976)</i>
Kamohoali'i	n/a	Utterly in ruins, nothing remaining except the foundation of the outer wall. It covered an area about 60x40 at the foot of the cliff.	Places it at the top of 'Ahu'ula Cliff overlooking Kaleiopapa Heiau.	Located south of the monument beneath 'Ahu'ula Cliff. Built by Kahuna Kapihe Nui but commissioned by Liholiho (Kamehameha II). Measures 60' x 40'. Only low portion of the once 10' high walls are said to remain. Stones of <i>heiau</i> area said to have been used in the construction of the road across the beach.
Kaleiopapa	n/a	n/a	Places it at the base of 'Ahu'ula Cliff, south of the Kamehameha III monument.	Speculates its location to be atop 'Ahu'ula Cliff.

End of Table 7.

Based on the available information presented in the aforementioned studies, it is concluded that Ho'okūkū and Kaopa, whose names have been sometimes used interchangeably, are the names of two distinct bodies of water—Ho'okūkū, a pond, and Kaopa, a spring—rather than a *heiau* as reported by Stokes (in Stokes and Dye 1991). Concerning the location of Ho'okūkū pond, it is concluded that its location was at the base of 'Ahu'ula Cliff and only a portion of the pond remains (see Figure 69). Regarding Kaopa, none of the studies concur on a single location; Reinecke (1930) identified it as a spring located south of an unnamed *heiau* at the base of 'Ahu'ula Cliff whereas the Daughters of Hawai'i (1976) study places it along the coast fronting the former Machado House (present-day Fair Wind headquarters) in the area identified on Kekahuna's 1954 map as Kūhalalua Spring (see Figure 69).

With the available information, this study has concluded that there were three *heiau* in the project area, Kamohoali'i, Kaleiopapa, and Kamau'ai. The author of this study, cannot say with any great certainty where Kamohoali'i, Kaleiopapa, and Kamau'ai are located, however, from the available information three areas were identified as potential locations of three named *heiau*. The possible location of these *heiau* are illustrated in Figure 69 as "Heiau #1" located at the base of 'Ahu'ula Cliff and west of the birth monument; "Heiau #2" located atop 'Ahu'ula Cliff; and "Heiau #3" located in the vicinity of the present-day golf course property *mauka* of the project area.

Although the extant features of the three *heiau* have been deemed by archaeologists as "destroyed," it is important to remember that from a Hawaiian cultural perspective, it is the site upon which the built features were constructed that is of significance. The built component helped to mark the location that was deemed significant by *nā kūpuna* and enhanced their ability to interact and maintain their relationship with their natural environment. Perpetuating the notion that these *heiau* are "destroyed" is a form of cultural erasure and it severs the ability of the Hawaiian community to reconnect to their heritage in a meaningful and productive way. Therefore, it is recommended that KS make efforts to conduct a focused study that seeks to corroborate the *heiau* names to their location. Furthermore, those areas identified in Figure 69 as potential *heiau* locations should be further investigated, demarcated, and avoided during the proposed project. Lastly, consultation should be conducted with descendants regarding the long-term care of the *heiau* locations.

From the historical record, it is clear that the *heiau* located at the base of 'Ahu'ula Cliff (possibly Kamohoali'i or Kaleiopapa) was one of several places associated with the birth of King Kamehameha I. Other places associated with the king's birth include Kūhalalua (or Kaopa), Ho'okūkū pond (see Figure 69), and the flat *pāhoehoe* used to warm the

‘iwe of the king. Historic and modern land-use activities and development have had an adverse impact on all of these sites. Nonetheless, these sites are still considered valued cultural resources as evidenced by the annual commemorative ceremonies organized by the Daughters of Hawai‘i. To ensure the annual ceremony remains undisrupted, especially during any proposed construction activities associated with the proposed project, it is recommended that the landowner coordinates and maintains open communication with the Daughter of Hawai‘i. Furthermore, updating the existing interpretive signage in a way that contextualizes the king’s birth by connecting it with the various sites associated with his birth should also be considered. The landowner is also encouraged to conduct consultation with descendants of Keauhou and the Daughter of Hawai‘i concerning the long-term preservation of those sites associated with King Kamehameha’s birth.

Habitation Sites

Several of the interviewees spoke about Historic Era habitation sites that were once located in the project area and archaeologists have also documented habitation sites. For those *kama‘āina* who were consulted as part of this study, it was evident from the interviews that they still have an attachment to those spaces around the bay where the home of their grandparents and generation before once stood. It is the author’s contention that, seeing those spaces helped them to recall important childhood memories and reflect on the impact this area has had on their lives. Sadly, those *kama‘āina* who were interviewed likely represent the last generation of Hawaiians that grew up at Keauhou Bay and can see this land from a drastically different lens. It is, therefore, recommended that the landowner and their planners continue to consult with, create space, and continue to invite their input on the proposed project. It is also recommended that efforts be made to identify and document archaeological remains of the habitation sites and that interpretive signage is developed that highlights the character of Keauhou’s historic community.

Botanical and Mineral Resources

While the Keauhou Bay area was not considered prime agricultural land, from the historical records as well as the interviewees, several indigenous plant species were identified including *loulou*, *hala*, *kou*, and *niu*. These plant species are considered valued cultural resources. It is recommended that additional research be conducted to study the endemic and indigenous plant regime that once existed at Keauhou Bay and the findings from that study inform future landscaping plans.

One of the consulted parties and the historical record also identified a mineral, red ochre (*‘alaea*) as a valued cultural resource, which is found along ‘Ahu‘ula Cliff (see Figure 69). This mineral is valued for its healing and dyeing properties. Given that this resource is not widespread, it is recommended that gathering of this resource be allowed so that the traditional practices associated with this resource may be perpetuated. As this deposit is a finite resource that does not regenerate readily, it is further recommended that monitoring of this resource be implemented to ensure it is not being overharvested or degraded.

Mo‘ikeha Cave and ‘Ahu‘ula Cliff

Mo‘ikeha Cave (Site 24264), which is located on the face of ‘Ahu‘ula Cliff (see Figure 69) were both identified as valued cultural resources. The cave which was used as a refuge and temporary habitation site has an existing preservation plan (Haun and Henry 2014). It is recommended that there be continued compliance with the preservation plan. Concerning ‘Ahu‘ula Cliff, the historical literature indicated that the southern portion of the cliff was used to air dry the feathered cloaks and capes (*‘ahu‘ula*) of the *ali‘i*, and a section of the cliff is known for its red ochre deposits, a mineral that is important in traditional healing and dyeing practices (discussed above). As such, it is recommended that this cliff be preserved and that construction activities avoid this section of the project area.

Historic Cemetery

A 1932 and 1960 tax map identified a historic cemetery (also labeled as Kau cemetery) located along the *mauka* boundary of the project area (see Figures 44, 53, and 69). There is little written history about this cemetery, however, from the oral histories conducted as part of this study as well as the interviews conducted by Maly and Maly (2004b) it is posited that sometime during the 1960s as part of the golf course development located to the east of the current project area, Bishop Estates informed the families of those buried at the cemetery of their plans to relocate the burials, at which point the families came forward and relocated the remains of their family members to different cemeteries. It is presumed that the burials that were once located in this cemetery have since been relocated as none of the consulted parties spoke about the presence of any remaining burials. However, as a cautionary measure, it is recommended that archaeological monitoring be implemented if there will be any ground-disturbing activities in this portion of the project area.

Wa'a Activities

From the interviews and the historical record, *wa'a* (canoe) have for generations been an integral part of the cultural landscape of coastal Keauhou. Traditional *wa'a* culture has evolved over the years as expressed by a few of the consulted parties. In the ancient past, *wa'a* were commonly used as a form of transportation and for fishing. While the practice of fishing using *wa'a* is still maintained as evidenced by the small fishing canoes located at Ka'ili'ilinehe Beach, modern canoe culture has evolved into the arena of competitive sport and recreation. Nonetheless, the use of the *wa'a*, whether for sport/recreation or transportation and fishing, is an ongoing and ever-evolving traditional customary practice. While the proposed plans do not appear to adversely impact canoeing at Keauhou, it is recommended that efforts be made to help enhance the shoreline of Ka'ili'ilinehe Beach to allow for improved access for launching and landing canoes. As described by the consulted parties, before the seawall fronting Keauhou Canoe Club was constructed, Ka'ili'ilinehe Beach was much more expansive which provided ample space for the many fishing canoes to land and launch. Furthermore, improving Ka'ili'ilinehe Beach, through the possible removal of the sea wall, will create more space for various marine user groups (i.e. fishing, swimming, kayaking, paddle boarding) to enjoy Keauhou Bay.

Summary of Identified Practices/Resources and Recommendations

The Keauhou Bay area is valued for its diversity of natural and cultural resources. It is precisely these resources combined with the natural setting and rich history that makes this place culturally significant. Keauhou Bay and all of its contributing elements (i.e. Kamehameha III birthplace, *heiau*, ponds, springs, habitation sites, ranching features, etc.) could be considered a historic district significant under state Criteria a, b, c, and e, and eligible for listing in the Hawai'i Register of Historic Places. In summary, the recommendations provided above and summarized in Table 8 are intended to ensure that the activities associated with the proposed Keauhou Bay Management Plan do not adversely impact any of the above-identified valued cultural resources and traditional customary practices. Conversely, failure to consider or implement the above-described recommendations has the potential to adversely impact the above-identified valued cultural resources and traditional customary practices.

Table 8. Identified practices/resources and recommendations.

<i>Identified Practice/Resource</i>	<i>State Significance Criteria</i>	<i>Recommendation</i>
Marine resource collection	n/a	Prevent stormwater runoff into Keauhou Bay. Conduct appropriate studies and implement stormwater management measures.
Springs and freshwater procurement	b, e	Conduct water quality monitoring during the course of the proposed project.
<i>Wa'a</i> practices	n/a	Improve and enhance Ka'ili'ilinehe Beach; explore possible removal of sea wall to create more beachfront access for the various user groups.
Saltwater cleansing and healing rituals and marine resources	n/a	Prevent storm water run off into Keauhou Bay. Conduct appropriate study and implement storm water management measures.
Fish observation stone	e	Preserve in place; install temporary fencing during any construction activities that may occur in the vicinity of the stone.
Trails and historic roads	b, d, e	Conduct study to identify and record any extant portions; preserve and explore possible restoration and reuse; consultation with descendant communities, relevant agencies and organizations.

Table 8 continues on next page.

Table 8. continued

<i>Identified Practice/Resource</i>	<i>State Significance Criteria</i>	<i>Recommendation</i>
<i>Kahua hōlua</i>	b, c, d, e	Develop interpretive material that contextualizes this <i>hōlua</i> within the landscape and history of Keauhou; explore possible cultural-educational programming.
Kamehameha III birthsite (Kaleiopapa Heiau)	b, e	Avoid. Ensure any construction activities associated with the project does not disrupt annual commemorative ceremonies held at site; maintain open communication with the Daughter of Hawai‘i; update exiting interpretive signs.
Kamohoali‘i and Kamau‘ai Heiau	e	Conduct study that seeks to corroborate the <i>heiau</i> names to their location. These areas should be further investigated, demarcated, and avoided during project. Consult with descendants regarding the long-term care of the <i>heiau</i> locations
Ho‘okūkū Pond	b, d	Improve water quality; update interpretive signage and contextualize within the birth story of Kamehameha III.
Mō‘ikeha Cave	b, d, e	Continue compliance with existing preservation plan.
‘Ahu‘ula Cliff	e	Construction activities should avoid ‘Ahu‘ula Cliff.
Habitation sites	d, e	Document any extant features; develop interpretive signs that highlights the character of Keauhou’s historic community.
Ranching infrastructure	d, e	Document any extant features; develop interpretive material highlighting Keauhou’s ranching history.
Red ochre (‘ <i>alaea</i>)	n/a	Allow continued gathering to support the associated traditional practices (healing and dyeing); monitoring of resource.
Botanical resources	n/a	Conduct biological study to identify endemic and indigenous plant communities; findings from study inform landscape plan.
Former cemetery	e	Archaeological monitoring.

End of Table 8.

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APPENDIX A. PUBLIC NOTICES AND AFFIDAVITS

CULTURAL IMPACT ASSESSMENT FOR THE KEAUHOU BAY MAN- AGEMENT PLAN

ASM Affiliates is preparing a Cultural Impact Assessment to inform an Environmental Impact Statement being prepared for the proposed Kamehameha Schools (KS) Keauhou Bay Management Plan (KBMP). The project area is roughly 29-acres in the vicinity of Keauhou Bay, Keauhou 1 and 2 Ahupua'a, North Kona, Hawai'i Island.

The purpose of the KBMP is to provide near (10 years) and long-term (20 years) management and land use recommendations that are consistent with KS Strategic Plan 2020- Kūhanauna and the Draft West-Hawai'i Regional Action Plan, while also responding to community issues within KS kuleana. The KBMP will guide and prioritize KS actions for future planning, improvement, and operations at Keauhou Bay.

ASM is seeking consultation with community members that have long-standing cultural connections to this area, might have knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices that may be occurring on or in the general vicinity of the project area. If you have and are willing to share any such information, please contact Lokelani Brandt lbrandt@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikaula Street, Hilo, HI 96720. Mahalo ■

Ka Wai Ola, February 2022

IN THE MATTER OF
PUBLIC NOTICE

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CULTURAL IMPACT ASSESSMENT (CIA)
KEAHOULU BAY MANAGEMENT PLAN

ASM Affiliates is preparing a CIA to inform an Environmental Impact Statement being prepared for the proposed Kamehameha Schools (KS) Keahou Bay Management Plan (KBMP). The project area is roughly 29-acres surrounding Keahou Bay, Keahou 1 and 2 Ahupua'a, North Kona, Hawaii Island.


The KBMP will provide near (10 years) and long-term (20 years) management and land use recommendations that are consistent with KS Strategic Plan 2020, Kūhaneaua and the Draft West-Hawaii Regional Action Plan, while also responding to community issues within KS kuleana. The KBMP will guide and prioritize KS actions for future planning, improvement, and operations at Keahou Bay.

ASM is seeking consultation with community members that have long-standing cultural connections to this area, might have knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices that may be occurring on or in the general vicinity of the project area. If you have and are willing to share any such information, please contact Lokelani Brandt | lbrandt@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikaula St., Hilo, HI 96720.

(HIT3157561 1/23/22)

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MidWeek	<u>0</u>	times on:
The Garden Island	<u>0</u>	times on:
Hawaii Tribune-Herald	<u>1</u>	times on:
01/23/2022		
West Hawaii Today	<u>0</u>	times on:
Other Publications:	<u>0</u>	times on:

And that affiant is not a party to or in any way interested in the above entitled matter.


Lisa Sakakida

Subscribed to and sworn before me this 24th day of January A.D. 2022

Colleen E. Soranaka, Notary Public of the First Judicial Circuit State of Hawaii
My commission expires: Jan 06 2024

Ad # 0001357561

ICSP NO.:

IN THE MATTER OF
PUBLIC NOTICE

STATE OF HAWAII

} SS.

City and County of Honolulu

Doc. Date: JAN 24 2022 # Pages: 1

Notary Name: COLLEEN E. SORANAKA First Judicial Circuit

Doc. Description: Affidavit of

Publication _____

Colleen E. Soranaka JAN 24 2022

Notary Signature _____ Date _____

COLLEEN E. SORANAKA
NOTARY PUBLIC
No. 90-263
STATE OF FLORIDA

Lisa Sakakida being duly sworn, deposes and says that she is a clerk, duly authorized to execute this affidavit of Oahu Publications, Inc. publisher of The Honolulu Star-Advertiser, MidWeek, The Garden Island, West Hawaii Today, and Hawaii Tribune-Herald, that said newspapers are newspapers of general circulation in the State of Hawaii, and that the attached notice is true notice as was published in the

Honolulu Star-Advertiser 0 times on:

MidWeek 0 times on:

The Garden Island 0 times on:


Hawaii Tribune-Herald 0 times on:

West Hawaii Today 1 times on:

01/23/2022

Other Publications: 0 times on:

And that affiant is not a party to or in any way interested in the above entitled matter.


Lisa Sakakida

Lisa Sakakida

Subscribed to and sworn before me this 24th day of January A.D. 2022

Colleen E. Soranaka, Notary Public of the First Judicial Circuit, State of Hawaii
My commission expires: Jan 06 2024

Ad # 0001357563

ICSP NO.:

CULTURAL IMPACT ASSESSMENT (CIA)
KEAUHOU BAY MANAGEMENT PLAN

ASM Affiliates is preparing a CIA to Inform an Environmental Impact Statement being prepared for the proposed Kamehameha Schools (KS) Keaouhou Bay Management Plan (KBMP). The project area is roughly 29-acres surrounding Keaouhou Bay, Keaouhou 1 and 2 Ahupua'a, North Kona, Hawai'i Island.

The KBMP will provide near (10 years) and long-term (20 years) management and land use recommendations that are consistent with KS Strategic Plan 2020- Kuhanuana and the Draft West-Hawai'i Regional Action Plan, while also responding to community issues within KS kuleana. The KBMP will guide and prioritize KS actions for future planning, improvement, and operations at Keauhou Bay.

ASM is seeking consultation with community members that have long-standing cultural connections to this area, might have knowledge of traditional cultural uses of the proposed project area; or who are involved in any ongoing cultural practices that may be occurring on or in the general vicinity of the project area. If you have and are willing to share any such information, please contact Lokefani Brandt lbrandt@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikaula St., Hilo, HI 96720.

(WHT1357663 1/23/22)

Appendix I

Archaeological Reconnaissance Survey

DRAFT

**ARCHAEOLOGICAL RECONNAISSANCE AND
SITE CONDITION UPDATE**

TMK: (3) 7-8-010:044 AND 049, 7-8-012:004, 007, AND 065



KEAUHOU 1-2 AHUPUA'A

NORTH KONA DISTRICT, ISLAND OF HAWAI'I

HAUN & ASSOCIATES

ARCHAEOLOGICAL, CULTURAL, AND HISTORICAL RESOURCE MANAGEMENT SERVICES
73-4161 KAAO ROAD, KAILUA-KONA HI 96740
PHONE: 808-325-2402 FAX: 808-325-1520

DRAFT

ARCHAEOLOGICAL RECONNAISSANCE AND

SITE CONDITION UPDATE

TMK: (3) 7-8-010:044 AND 049, 7-8-012:004, 007, AND 065

KEAUHOU 1-2 AHUPUA'A

NORTH KONA DISTRICT, ISLAND OF HAWAI'I

Prepared by:

Alan E. Haun, Ph.D.,
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October 2022

HAUN & ASSOCIATES

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PHONE: 808-325-2402 FAX: 808-325-1520

MANAGEMENT SUMMARY

Haun & Associates conducted an archaeological reconnaissance of 2.9-acres in coastal Keauhou 1-2 Ahupua'a, North Kona District, Hawai'i Island. The subject parcels consist of an approximately 1.35-acre portion of the 25.239-acre TMK: (3) 7-8-010:044, the 0.3-acre TMK: (3) 7-8-010:049, the 0.25-acre TMK: (3) 7-8-012:004, the 0.4-acre TMK: (3) 7-8-012:007, and the 0.6-acre TMK: (3) 7-8-012:065. The reconnaissance survey identified three sites consisting of a possible historic driveway and building foundation (Site 1608.1), an historic house foundation and associated pathways (Site 1608.2) and a series of stone walls (Site 1608.3).

Site 1608.1 consists of a possible historic driveway and building foundation located in TMK: (3) 7-8-010:044.

Site 1608.2 is a complex comprised of an historic house foundation and stone pathways located in TMK: (3) 7-8-012:004. Based on Kekahuna's (1954) map of Keauhou Bay, this site was occupied by Mrs. E.P. Hodgins.

Site 1608.3 consists of a complex of interconnected walls situated in TMK: (3) 7-8-012:007 and 065. These walls are located on land formerly owned by Alice Woods, based on Kekahuna's (1954) map.

The three sites identified during the reconnaissance survey will require Archaeological Inventory Survey level documentation. Following documentation the sites would likely be recommended for no further work. The three sites are tentatively assessed as significant solely under Criterion "d" for their information content. No sites or features are presented in the remaining parcels examined during the reconnaissance survey.

The current project also consisted of a Site Condition Update of sites in two parcels previously surveyed by Haun Associates. TMK: 7-8-010:044 is a 25.239-acre parcel on the inland side of Kamehameha III Road and Kaleiopapa Road. The majority of this parcel was covered by an Archaeological Inventory Survey by Haun and Henry (2010a). This survey identified 15 sites with 32 features. Of these 15 sites, three were recommended for data recovery (Sites 5674¹, 24261 and 24266) and three sites were recommended for preservation (Sites 4348, 24263, and 24264). The nine remaining sites were recommended for no further work.

The three preservation sites and two of the data recovery sites (excluding Site 5674) were relocated during the project and their conditions were reevaluated. No significant changes were noted at four of the five sites (Sites 4348, 24261, 24263 and 24266), with some impacts noted within the Site 24264 cave. Extensive efforts were made to relocate the Site 5674 permanent habitation complex; however, the reported location of this site is completely covered by dense night-blooming cereus thicket. Clearing of vegetation at this site exhausted the proposed level of effort proposed for this project and additional clearing will be required to determine the current condition of the site.

Haun & Associates (Haun and Henry 2010b) also examined a 1.08-acre parcel north of the intersection of Kaleiopapa Road and Ehukai Streets (TMK: [3] 7-8-012:098). This survey identified two sites with a total of six features. Both sites were recommended for no further work by Haun and Henry (2010b:28) and no attempt was made to relocate them during the present project.

Based on recommendations from Nā Ala Hele Hawai'i Trail and Access System and the Ala Kahakai National Historic Trail, two areas within the TMK: 7-8-010:044 portion of the project area, totaling 1.97-acres, were also re-examined during the project in order locate the remains of two historic trails (Sites 15243 and 24259) and the Kau Cemetery. These sites are depicted on historic maps of the area and their reported locations were cleared of vegetation and carefully examined. No intact remnants of the Sites 15243 and 24259 trails are present; however, a possible remnant

¹ All sites listed on the State Inventory of Historic Places (SIHP). Site numbers are 5 digit sequential numbers by island : 50 = State of Hawai'i, 10= Island of Hawai'i, 37= Kealahakua quadrangle, 5674=Site number

of the Kau Cemetery, consisting of a section of formed concrete was identified. The Site 24261 pavement, previously recommended for data recovery was also observed within the reported location of the Kau Cemetery.

Widespread mechanical disturbance within the TMK: 7-8-010:044 portion of the project area appears to have occurred between 1954 and 1976, indicated by aerials views of the area. This disturbance was also observed by Haun and Henry (2010a) during the AIS of the parcel. These impacts potentially resulted in the destruction of the Sites 15243 and 24259 trails and the Kau Cemetery. Additional clearing with the Kau Cemetery area, along with data recovery of the Site 24261 pavement is required to determine if extant remnants of the cemetery remain.

Cover photograph - Current condition of the Entrance to Site 24264 Mo'ikeha Cave (view to east)

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INTRODUCTION

At the request of G70 on behalf of Kamehameha Schools (KS), Haun & Associates completed an archaeological reconnaissance survey of approximately 2.9-acres in coastal Keauhou 1-2 Ahupua‘a, North Kona District, Hawai‘i Island (**Figure 1** and **Figure 2**). The subject parcels consist of an approximately 1.35-acre portion of the 25.239-acre Tax Map Key (TMK) (3) 7-8-010:044, the 0.3-acre TMK: (3) 7-8-010:049, the 0.25-acre TMK: (3) 7-8-012:004, the 0.4-acre TMK: (3) 7-8-012:007, and the 0.6-acre TMK: (3) 7-8-012:065).

The project also included a Site Condition Update of sites in two parcels previously subjected to Archaeological Inventory Surveys (AIS) Haun & Associates. These consist of TMK: (3) 7-8-010:044 on the inland side of Kamehameha III Road (Haun and Henry 2010a) and TMK: (3) 7-8-012:098, a 1.08-acre parcel north of the intersection of Kaleiopapa Road and Ehukai Streets (Haun and Henry 2010b).

The fieldwork for the present project was conducted between September 13, 2021 and October 6, 2022 by Haun & Associates Project Supervisors Solomon Kailihiwa, M.S and Juliana Kailihiwa, B.A, and a crew of four archaeologists (Dan Trout, B.A., Ben Seay, B.A., Leesha Villacorte, B.A., and Nicole Lui), under the direction of Dr. Alan Haun. Approximately 153 labor hours were required to complete this portion of the project. This report includes an historic documentary research section, the results of the archaeological reconnaissance, an update on the condition of previously identified sites in the project area, and a conclusion section. Kauikeaouli Birth Stone

BACKGROUND

As stated, two parcels within the project area were previously subjected to AIS surveys by Haun & Associates. These projects are summarized below. The Haun and Henry (2010a) AIS of TMK: (3) 7-8-010:044 indicates that a total of 22 sites with 39 features have been documented within this parcel. These 22 sites consist of seven sites that were destroyed prior to the Haun and Henry (2010a) project and 15 sites recorded during the project. Of the 15 documented sites, nine were newly identified during the project and six were identified during previous studies of the parcel. The 15 sites consist of the Kauikeaouli (Kamehameha III) Birth Stone (Site 4348; also National Register of Historic Places [NRHP] Site 78001018), three permanent habitation sites (Sites 5674, 24261, and 24266), a temporary habitation lava tube (Site 24264), seven historic habitation sites (Sites 24255-24258, 24262, 24265, and 24267), a portion of the Old Kailua Road (Site 24259), a livestock control wall (Site 24260), and an anchialine Pond (Site 24263). Other sites that apparently have been destroyed include a portion of a *hōlua* slide (Site 1669), a portion of the Keauhou Trail (Site 15243), two *heiau* (Kamohoalii and Kaleiopapa), a portion of an historic cemetery, and residential sites dating to the mid-1800s and earlier. **Figure 3** depicts the sites in the Haun and Henry (2010a) project area and they are summarized in **Table 1**. A third *heiau* (Kāmau‘ai Heiau) was located just outside the boundary of TMK: (3) 7-8-010:044 within the adjacent Kona Country Club golf course.

Haun and Henry (2010a:76) accessed all 15 extant sites as significant under Criterion “d”. These sites have yielded information important for understanding prehistoric and historic land use in the project area. The Site 4348 Kauikeaouli Birth Stone is also significant under Criteria “b”, and “e” for its association with the life of an important person in Hawaiian History and for its cultural value to the Hawaiian people. The Site 24263 pond, is potentially a remnant of Ho‘okūkū Pond and is additionally assessed as significant under Criterion “c” as a good example of a site type. The Site 24264 Mo‘ikeha Cave is additionally assessed as significant for its cultural value (Criterion “e”) because of its association with the legendary chief Mo‘ikeha. Nine sites were recommended for no further work or preservation (Sites 24255-24260, 24262, 24265 and 24267). Three sites, all located at the base of the Ahu‘ula Cliff are recommended for preservation (Sites 4348, 24263, and 24264). The three remaining sites (Sites 5674, 24261 and 24266) were recommended for data recovery. This report was reviewed and accepted by the Department of Land

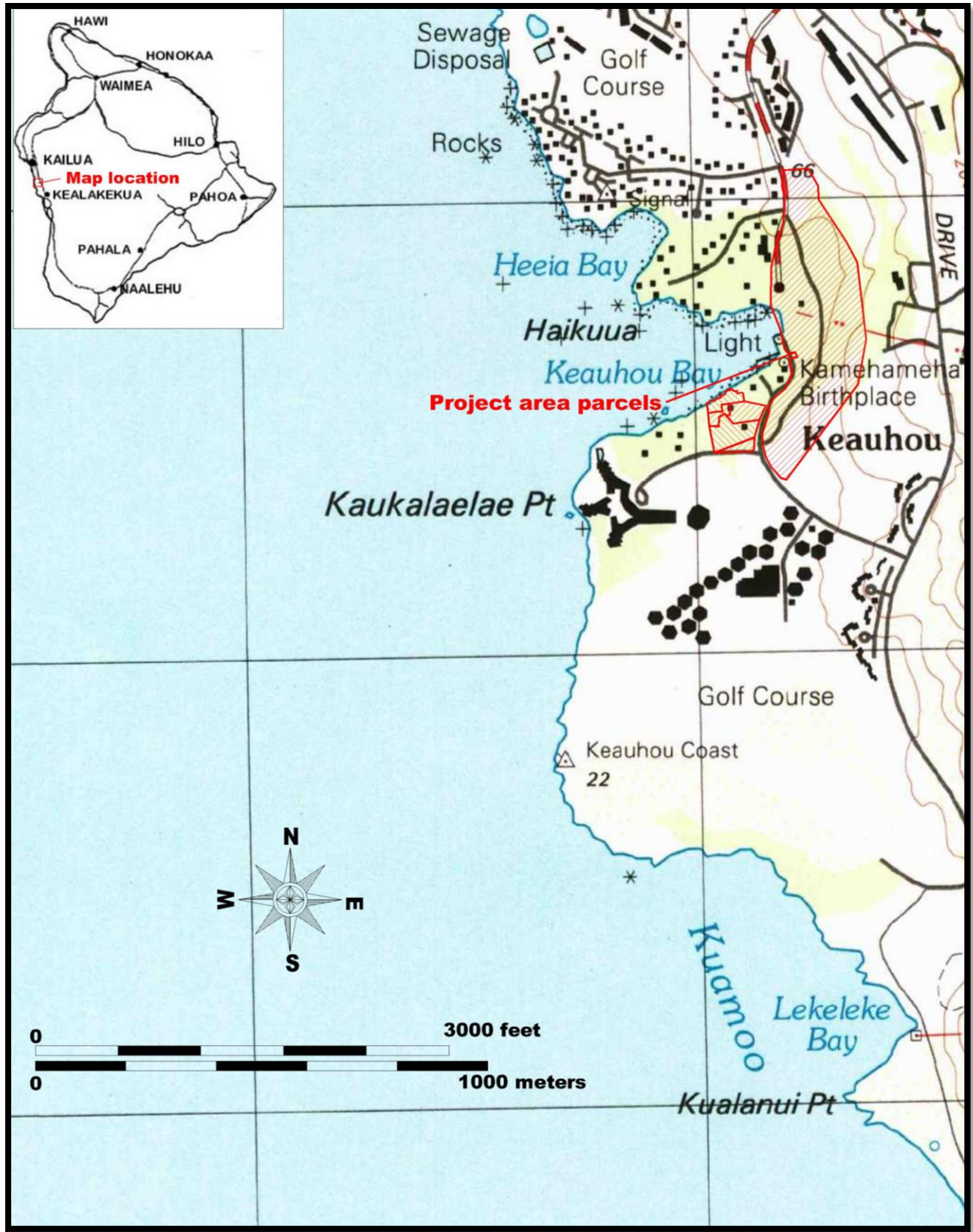


Figure 1. Portion of USGS 1996 7.5 Kealahou quadrangle showing project area (obtained from usgs.gov).

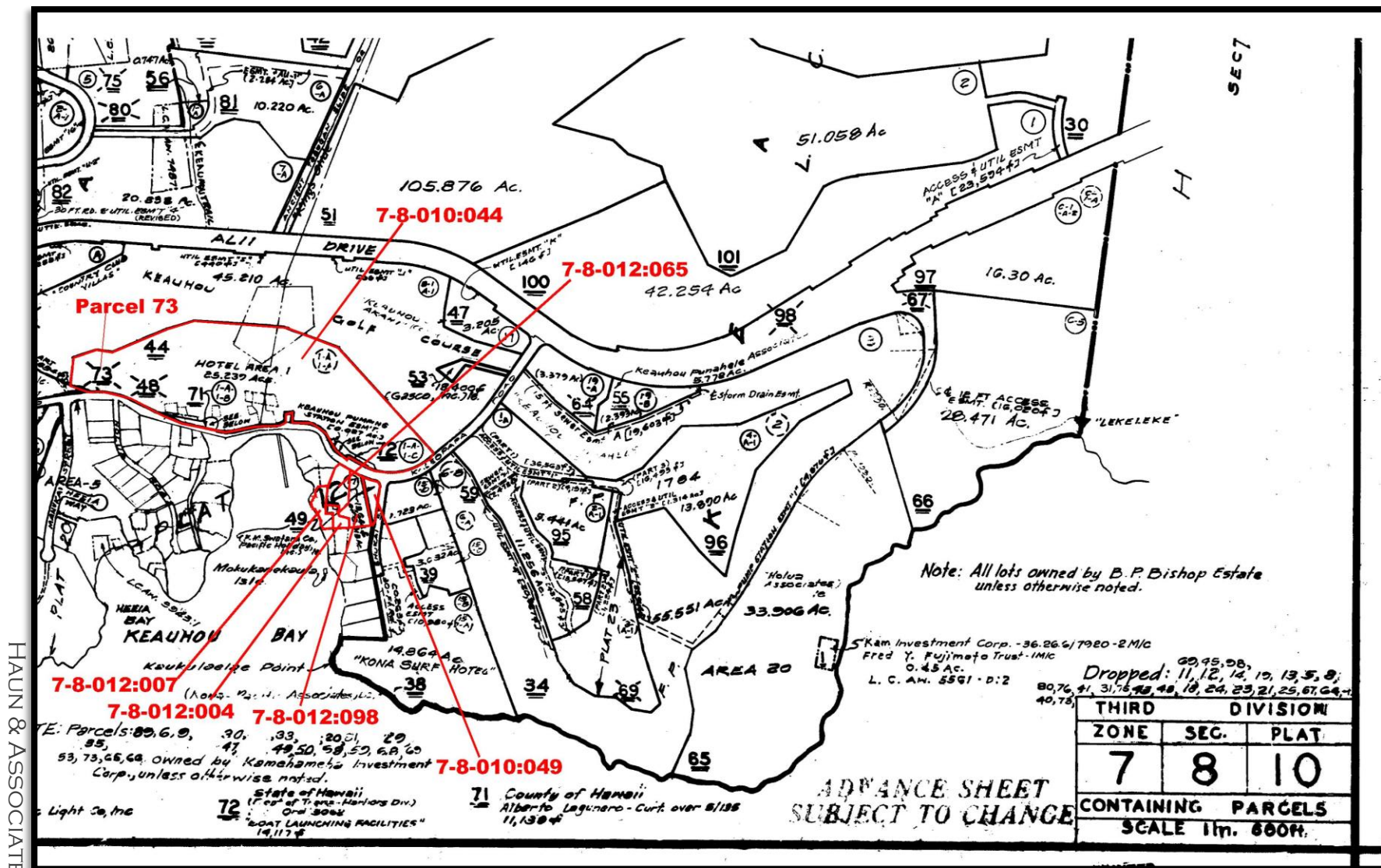


Figure 2. Portion of TMK: (3) 7-8-010 showing project area parcels (obtained from hawaiicounty.gov).

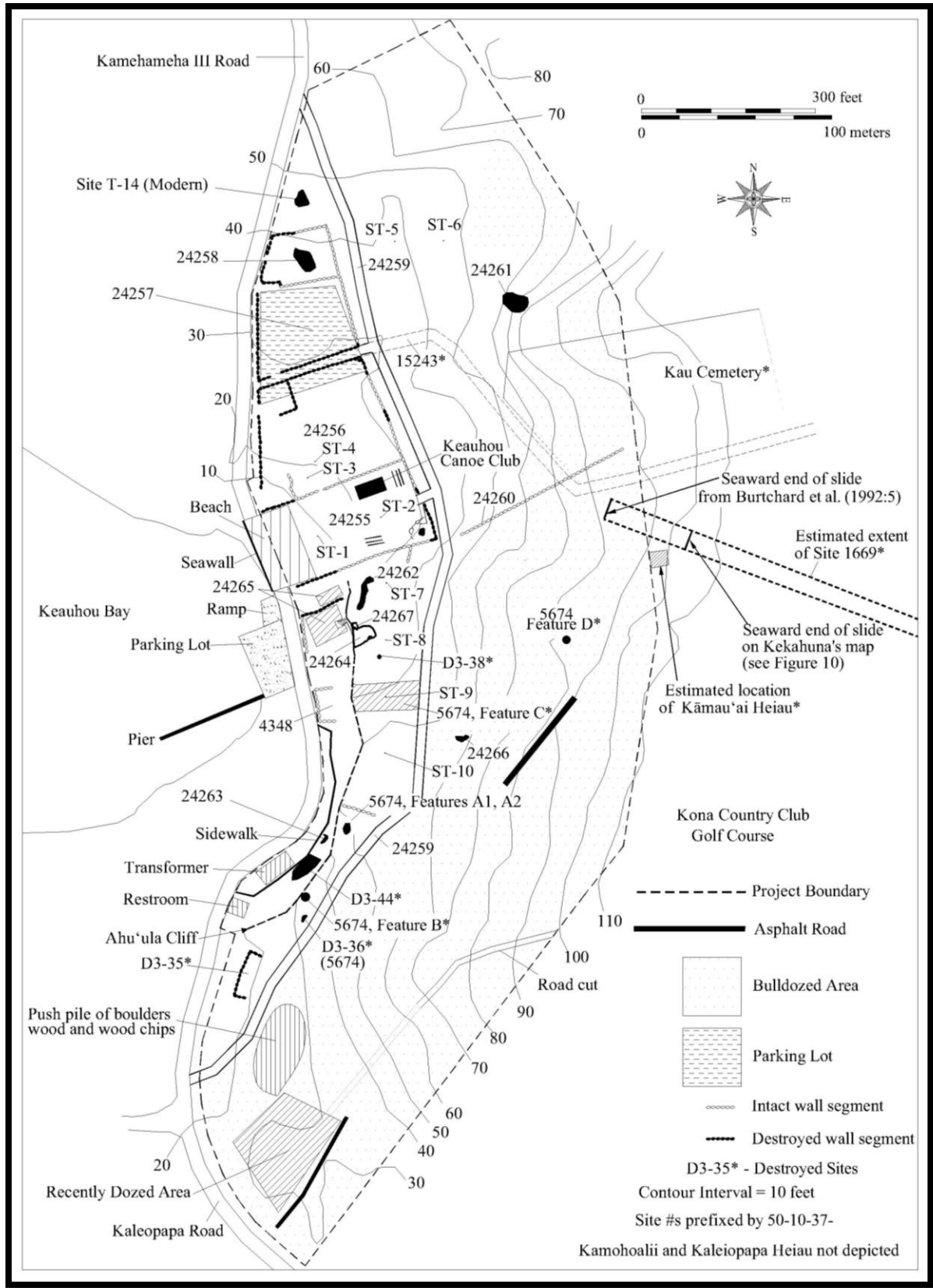


Figure 3. Haun and Henry (2010a:20) site location map in TMK: (3) 7-8-010:044.

Table 1. Summary of sites.

SIHP Site No.	NRHP Site No.	Bishop Museum Site No.	Other Name/Number	Type	Function	TMK Parcel	Significance Assessment	Condition Assessment	Mitigation Measures				
									Prepare Archaeological Site Preservation Plan and implement preservation measures	Prepare Archaeological Data Recovery Plan, implement dayta recovery and report results	Clear vegetation	AIS level documentation, and prepare AIS report	No further work
4348	78001018	D3-43	Kauikeaouli Birth Stone	Endosure	Ceremonial	(3) 7-8-010044	b, d, e	Unaltered, good condition	1				
5674*	-	D3-36, D3-37	-	Complex (12)	Permanent Habitation, Ranching, Possible Burial	(3) 7-8-010044	d	Undetermined		1	1		
24215	-	-	-	Overhang	Storage	(3) 7-8-010098	d	Undetermined					1
24216	-	-	-	Complex (5)	Historic Habitation	(3) 7-8-010098	d	Undetermined					1
24255	-	-	-	Complex (2)	Historic Habitation	(3) 7-8-010044	d	Undetermined					1
24256	-	D3-41	-	Complex (3)	Historic Habitation	(3) 7-8-010044	d	Undetermined					1
24257	-	-	-	Endosure	Historic Habitation	(3) 7-8-010044	d	Undetermined					1
24258	-	-	-	Endosure	Historic Habitation	(3) 7-8-010044	d	Undetermined					1
24259	-	-	Old Kailua Road	Road	Transportation	(3) 7-8-010044	d	Undetermined					1
24260	-	-	-	Wall	Livestock Control	(3) 7-8-010044	d	Undetermined					1
24261	-	-	-	Pavement	Permanent Habitation	(3) 7-8-010044	d	Unaltered, fair condition		1			
24262	-	D3-40	-	Terrace	Historic Habitation	(3) 7-8-010044	d	Undetermined					1
24263	-	-	Ho'okūkū Pond	Pool	Water acquisition	(3) 7-8-010044	c, d, e	Altered, good condition	1				
24264	-	D3-42	Molikeha Cave	Cave	Temporary Habitation	(3) 7-8-010044	d, e	Altered, good condition	1				
24265	-	-	-	Complex (4)	Historic Habitation	(3) 7-8-010044	d	Undetermined					1
24266	-	-	-	Pavement	Permanent Habitation	(3) 7-8-010044	d	Unaltered, fair condition		1			
24267	-	D3-39	-	Endosure	Historic Habitation	(3) 7-8-010044	d	Undetermined					1
-	-	-	Temporary Site 1608.1	Complex (2)	Historic Habitation	(3) 7-8-010044	d	Altered, poor to fair condition			1	1	
-	-	-	Temporary Site 1608.2	Complex (4+)	Historic Habitation	(3) 7-8-012:004	d	Altered, poor to fair condition			1	1	
-	-	-	Temporary Site 1608.3	Wall	Livestock control	(3) 7-8-012:007	d	Altered, poor to fair condition			1	1	

* - Site Partially Destroyed
SIHP Site #s. prefixed by 50-10-37-

and Natural Resources/State Historic Preservation Division (SHPD) in a March 4, 2013 letter (Log No. 2010.4060, Doc. No. 1302MV23).

The Haun and Henry (2010b) AIS of TMK: (3) 7-8-010:098 identified two sites with a total of six features (**Figure 4**). The sites consist of a small overhang assigned a storage function (Site 24215) and an historic habitation complex comprised of two walls, a retaining wall, a walled overhang and a modified outcrop (Site 24216). Both sites are assessed as significant solely for their information content (Criterion “d”). The mapping, written descriptions, photography, and test excavations at the sites adequately documented them and no further work or preservation was recommended (Haun and Henry (2010b:28). The report was reviewed and accepted by the (SHPD) in a February 27, 2012 letter (Log No. 2010.4058, Doc. No. 1202MV17).

HISTORICAL DOCUMENTARY RESEARCH

The project area is located in the *ahupuaʻa* of Keauhou 1-2, in the district of North Kona (**Figure 5**). Keauhou is literally translated as “the new era or the new current” (Pukui and Elbert 1986:104). Maly and Wong-Smith (1999) conducted archival-historical documentary research and oral history interviews for a Cultural Impact Assessment done in conjunction with the Environmental Impact Statement (EIS) for the Mamalahoa Highway Bypass that is inland of the project area parcels. Maly and Maly (2001) conducted archival-historical documentary research and extensive oral history interviews for the seventeen *ahupuaʻa* that spanned from Keauhou 2 to Kealahou. The following summary of historical documentary research and oral historical information pertaining to Keauhou is derived from these two studies and the extensive sections on Keauhou’s history presented by Tomonari-Tuggle (1985) and Burtchard (1996).

According to legend, Lono, the Hawaiian god of agriculture, fertility, and rain originally lived at Keauhou where he discovered the primary Hawaiian cultigens taro, sweet potatoes, sugar cane, bananas, yams, and kava. Early events documented in the Kona regional traditional history are associated with ‘Umi-a-Liloa. Hawaiʻi Island was first unified under the rule of ‘Umi-a-Liloa and Kona was selected as a dwelling place of chiefs. The area lies within the realm of the traditional Hawaiian political authority that was centered in the Kailua-Keauhou area from at least the 15th century to the reign of Kamehameha I. ‘Umi-a-Liloa is also associated with an upland *heiau* in Keauhou 2, Ahu-a-Umi.

After the death of Captain Cook in 1779, the Hawaiʻi Island Chief Kalaniʻōpuʻu moved to Keauhou where he could surf. Kamehameha’s father-in-law, Keʻeaumoku, was given Keauhou in return for his assistance in Kamehameha’s unification of Hawaiʻi Island in 1791. Native historian David Malo was born in Keauhou in about 1793. Kamehameha’s wife, Keōpualani, was raised from the age of 10 in Keauhou beginning around 1790. She was the mother of Liholiho (Kamehameha II) and Kauikeaouli (Kamehameha III), who was born there in 1814. The Kamehameha III birthplace shrine is situated within the current project area inland of Kaleiopapa Road and seaward of the Ahuʻula Cliff. This site is designated as Site 4348 and is discussed in detail in a following section.

Kamehameha I reportedly built a large *hōlua* slide which is in Keauhou for Kauikeaouli (Site 1669 – discussed below). Governor Kuakini and Kekāuluohi were also raised in Keauhou. In the late 1700s to early 1800s Kamehameha I monopolized foreign commerce including the provisioning of trading and whaling ships and beginning in 1811 the sandalwood trade. The *hōlua* and numerous *heiau* near the coast in the Keauhou-Kahaluʻu area attest to the longstanding importance of the area as a royal center.

The Lekeleke burial ground is situated in the seaward portion of Keauhou 2 (see **Figure 5**). It is well known because of its association with Kekuakalani’s religious rebellion against the young King Liholiho. The rebellion was prophesized by the *kōhūla* (prophet or seer) Kapihe in the 1770s. Kamehameha’s consort, Kaʻāhumanu aided the young king in the overthrow of the *kapu* system in 1819. After Liholiho formally dissolved the ancient system by eating with his mother, Keōpuolani, and Kaʻāhumanu, the king ordered the destruction of *heiau* and overthrow of

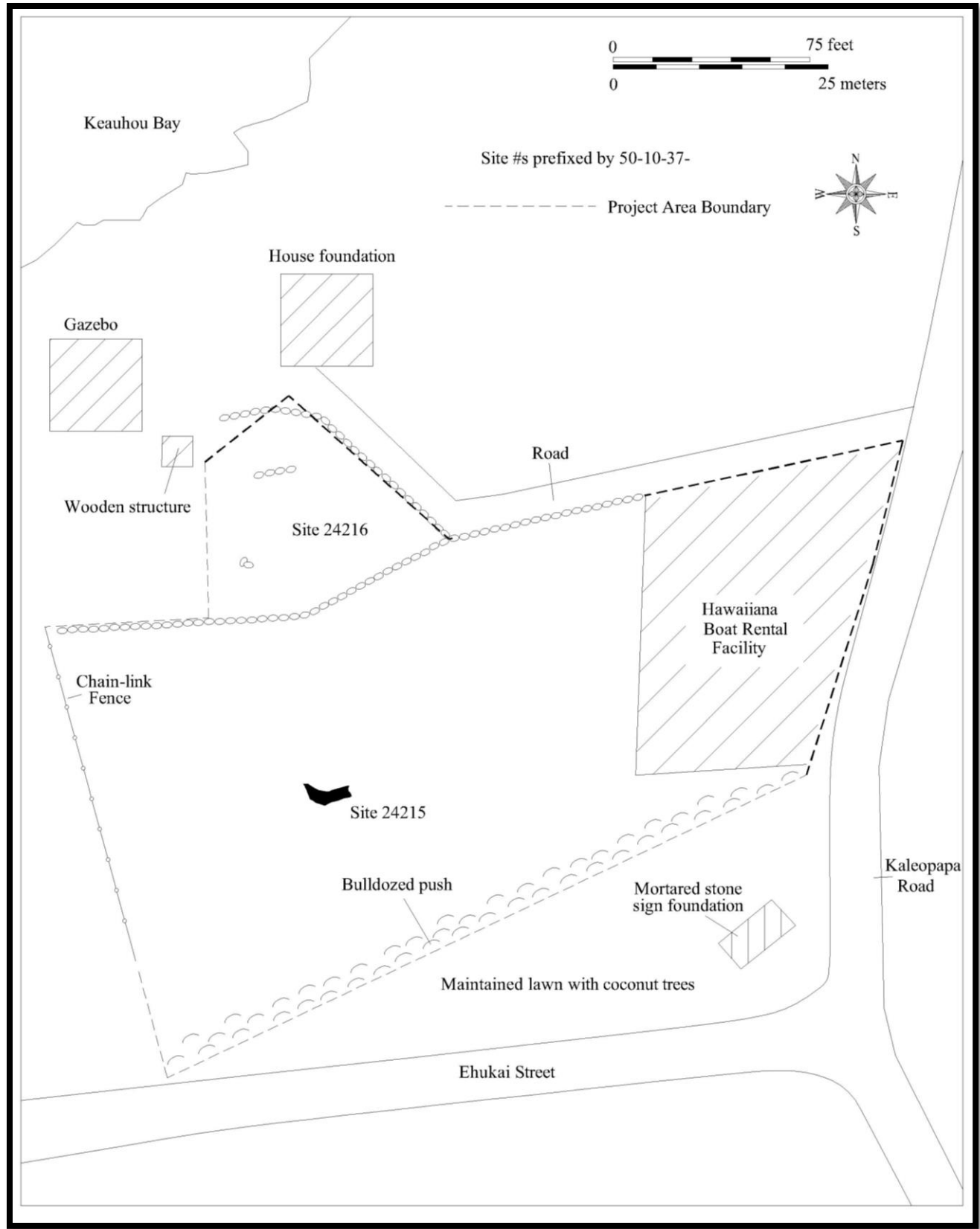


Figure 4. Haun and Henry (2010b:18) site location map in TMK: (3) 7-8-012:098.

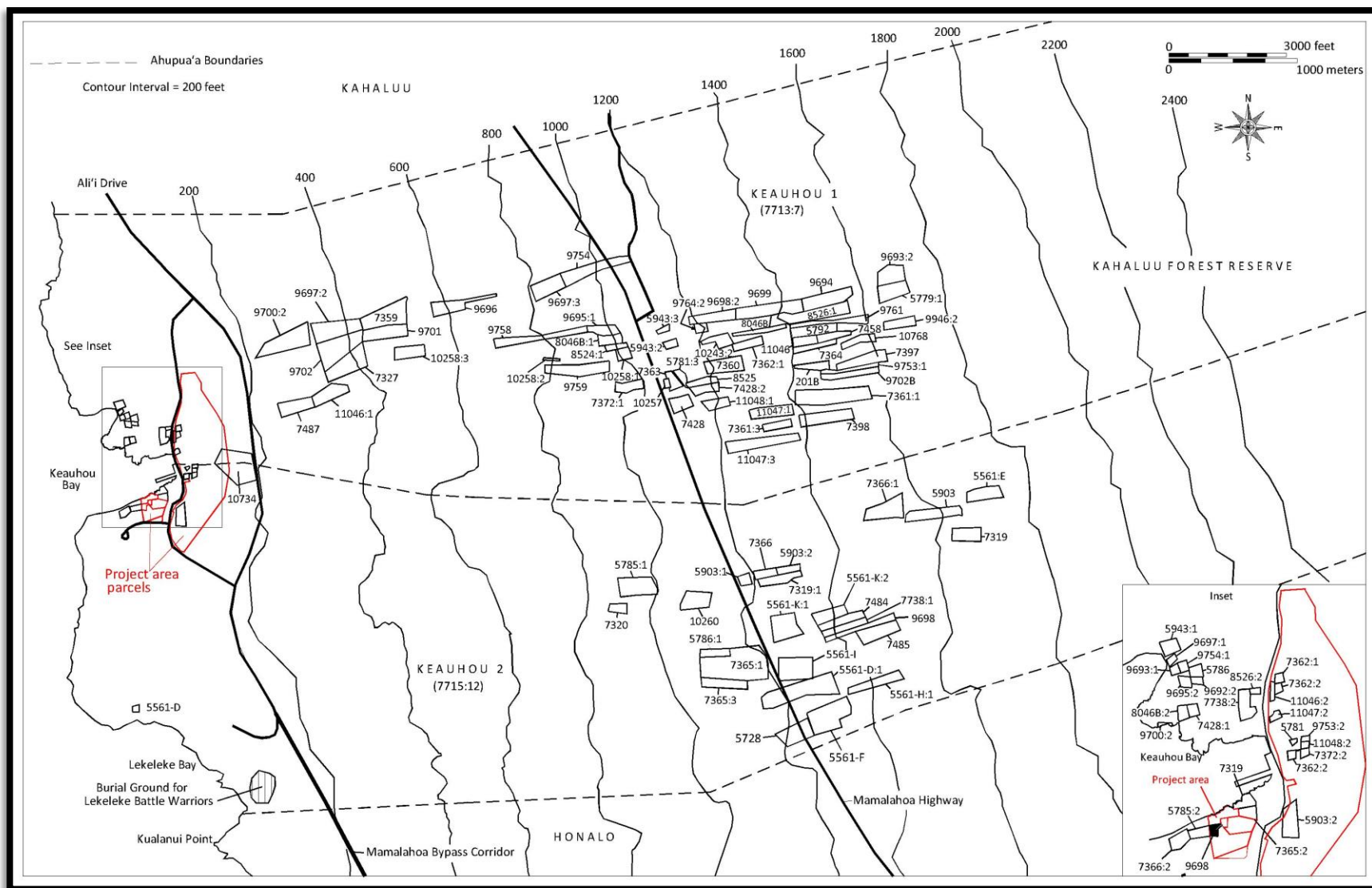


Figure 5. Ahupua'a boundaries and Land Commission Awards.

the old idols. Liholiho's cousin, Kekuaokalani, who was the keeper of the war god Kūkā'ilimoku, was enraged by the destruction of the ancient *kapu* system and mounted a rebellion from Ka'awaloa. After a failed attempt to peacefully end the rebellion by Keōpuolani, Liholiho's forces, led by Kalanimoku met Kekuaokalani's forces initially at Lekeleke in Keauhou 2. After an initial skirmish at Lekeleke, the main battle occurred in Kuamo'o near the coast. After a furious battle Kekuaokalani was finally killed and his forces dispersed.

Native Hawaiian historic accounts and the observations of early foreign visitors such as Ellis and Wilkes describe the extensive cultivated slopes that included Keauhou. The cultivated lands, today known as the Kona Field System, were in intensive use during late prehistoric times. The project area is situated in the inland portion of the *kula* zone of the system. The first missionaries arrived in Kailua in 1820, but only stayed a few months. They returned in 1823 and were given land to establish missions and by 1825 schools. In 1823, Ellis (1963) counted nineteen *heiau* and 610 houses along the coastal trail from Kailua to Keauhou, and eight *heiau* and 443 houses between Keauhou and Ka'awaloa. The early missionary census and other data documented a substantial population in Kona including a large settlement surrounding Keauhou Bay in the 1820s; however, the population decreased dramatically over the next two decades due to death and dislocation caused by introduced diseases, droughts, fires, and famine.

The gradual shift from subsistence farming to a market economy began with the introduction of coffee, corn, pumpkins, cotton, pineapple, and Irish potatoes in the 1820s to 1840s. Other introduced early historic crops included melons, cabbage, onions, oranges, and tobacco. Keauhou served as port where firewood, sandalwood, and produce were shipped. The introduction of cattle ranching and commercial coffee production in the mid-1800s caused further change to the traditional agricultural system.

In the 1840s, political acts of the Hawaiian Kingdom government would change the land tenure system in Hawai'i. All lands were segregated into one of three categories: "Crown Lands" owned by the occupant of the throne, "Government Lands" controlled by the state, and "*Konohiki* Lands" controlled by the chiefs; and "were all subject to the rights of native tenants" (Chinen 1958:29, Beamer 2014:143). In 1846, King Kamehameha III appointed a Board of Commissioners commonly known as the Land Commissioners, to "confirm or reject all claims to land arising previously to the 10th day of December, AD 1845." Notices were frequently posted in *The Polynesian* (Moffat and Kirkpatrick 1995); however, the legislature did not acknowledge this act until June 7, 1848 (Chinen 1958:16; Moffat and Kirkpatrick 1995:48-49) and the act is known today as *The Great Māhele*. In 1850, the Kingdom government passed laws allowing foreigners to purchase fee simple lands (Speakman 2001:91). The Kuleana Act of 1850 allowed for fee simple land ownership by commoners.

During the *Māhele*, Keauhou 1 was given to Victoria Kamamalu (LCA 7713, Apana 7) and Keauhou 2 was given to Lot Kapuaiwa (Kamehameha V; LCA 7715, Apana 12). The locations of all except four of these Land Commission Awards (LCA) awards are shown in **Figure 5**. The locations of LCAs 4053, 5630, 9702B-2, and 9752 do not appear on current tax maps. The Waihona 'Aina (2000) *Māhele* Database; which is a compilation of data from the Indices of Awards (Indices 1929), Native Register (NR n.d.), Native Testimony (NT n.d.), Foreign Register (FR n.d.) and Foreign Testimony (FT n.d.); lists seventy-two awarded LCA claims for 133 parcels within Keauhou 1-2. These claims by 67 claimants list of total of 210 claimed parcels. The locations of all except four of these Land Commission Awards (LCA) awards are shown in **Figure 5** (excluding LCAs 4053, 5630, 9702B-2, and 9752).

The awarded *kuleana* claims range from 0.2 to 6.6 acres in area with an average of 2.88 acres. Most of the claims included a coastal house lot and at least two or three cultivated parcels at differing elevations corresponding with zones of the Kona Field System. The testimonies for the Keauhou claims are atypical in the rarity of claimed parcel boundary descriptions. The testimonies refer to thirty-nine *'ili* land divisions. Waipio is mentioned eleven times, Paki is listed for ten parcels, followed by Opuokaha and Haliipalala (8), Haleape (7), Kamuku and Laulaulahili (6), Kaohia (4) and four parcels each for Maili, Pakohe, Papalanui, and Puuloa. Most of the remaining names are only mentioned once.

The awarded parcels are concentrated in six areas. One cluster of awarded parcels is situated between approximately 900 and 1,500 feet elevation in Keauhou 2. A small cluster of four parcels is situated between 1,500 and 1,750 ft elevation also in Keauhou 2. A large cluster of parcels spans the area between 200 and 1,700 ft elevation in Keauhou 1. There are 19 parcels concentrated around Keauhou Bay and there is a smaller cluster of seven parcels that front He'eia Bay to the north.

The awarded claim testimonies describe 34 house lots with at least 55 houses. Enclosing walls are mentioned for 24 house lots. The testimonies refer to over 400 cultivated plots, sections, *māla* and *kīhāpai*. Specific crops mentioned include taro (126 plots), sweet potatoes (110), coffee (39), pumpkins (5), gourd (2), pineapples (3), *olonā* (1), and a variety of trees (coconut [22], *kou* [21], orange 15), *loulou* [13], palm [6], *hala* [4], *noni* [2], papaya [2], and *hau* [1]). Two gardens are described as enclosed with walls.

There are ten LCA parcels present within the present project area (LCAs 5781, 5903, 7362, 7372, 9698, 9753, 10374, 11046, 11047, and 11048; see **Figure 5**). LCA 5781 is a small parcel in the west-central portion of the TMK: (3) 7-8-010:044. It is one of three parcels awarded to Kanehoa. Another parcel is situated inland at approximately 1,300 foot elevation. The location of the third parcel is not depicted on the current tax maps.

LCA 5903 is a large parcel situated in the southern portion of TMK: (3) 7-8-010:044. It is one of four parcels awarded to Paiki. The other three parcels are situated between approximately 1,180 and 1,650 ft elevation. The coastal parcel is probably where Paiki's house lot was situated. The testimony indicates that the lot had one house and was enclosed. There were twelve *loulou* palms and a *hala* tree growing in the house lot, which may explain the relatively large area of this probable house lot parcel.

Three LCAs are situated adjacent to each other in the west-central portion of TMK: (3) 7-8-010:044 (LCA 7372:2, 9753:2, and 11048:2). LCA 7372 was awarded to Kaikuaana and consists of two parcels totaling 1.6 acres. Only the coastal, probable house lot parcel appears on current tax maps. In the following testimony given by Kaikuaana reference is made to at least three separate parcels, "Greetings to the Land Commissioners: Here is the size of my taro *kihāpāis*. Their combined size is 157. The *kihāpāis* in Kaulu [*kalu'ulu*] are 144 in size. The *kihāpāis* in the kula are 144 in size....Furthermore, my house is 64 in circumference."

LCA 9698 was awarded to Kapela and is located in TMK: (3) 7-8-012:004. It is comprised of two parcels totaling 2.3-acres. The coastal parcel 0.16-acres, with a second lot situated between approximately 1,350 and 1,500 feet, the coastal parcel is an enclosed house lot with three *kou* trees and the inland parcel comprised of *kīhāpai*.

LCA 9753 was awarded to Kaluahinenui. The award consisted of two parcels totaling 1.29 acres, with one located in TMK: (3) 7-8-010:044. The other parcel is situated inland between approximately 1,450 and 1,600 ft elevation. The claim testimony describes five inland *kīhāpai*, two coconut trees, and a house lot, presumably the parcel in the project area. It contained two houses and was enclosed with a stone wall.

LCA 11048 was awarded to Haluapo consisting of two parcels totaling 1.3 acres. The other parcel is situated inland between approximately 1,150 and 1,250 ft elevation. The claim testimony mentions twelve *kīhāpai*. The small coastal parcel in the project area probably was also a house lot. It was probably enclosed by a stone wall because the adjoining lots on north and south sides were enclosed.

LCA 7362 includes three parcels in the project area. Two, labeled *apana* 1 and 2 are situated in the northwestern portion of the project area. A third parcel, also labeled *apana* 2 on current tax maps, is situated in the west-central portion of the project area. A fourth parcel, labeled *apana* 1, is situated inland between 1,200 ft and 1,400 ft elevation. These parcels were awarded to Kaanoano and his father Kapahāhaimoku. Translated testimony in support of the claim was given by Keamohuli as follows:

He [Keamohuli] has seen in the ili land at Kaohia, 2 land sections; at Haleape, 1 section; at Makakanalii, 1 section; and 1 house lot...The land has been partially cultivated and Kaanoano had enclosed the house lot where he has had to [two] house[s]. He died in 1849, his wife is living there now. Plants and 1 orange tree are in Kaohia ili land, Kapahahaimoku the father of Kaanoano planted them. (Waihona Aina 2000)

LCA 11046, Apana 1 is situated adjacent to the northwestern portion of TMK: (3) 7-8-010:044. It was awarded to Molale, who also received two other larger parcels: one situated at 300 foot elevation and the other situated at 1,400 foot elevation. His claim was for 3 sections of land and a house lot. The small coastal parcel next to the project area was probably the house lot, which according to the testimony had one house and was enclosed, presumably with a stone wall.

LCA 11047 is situated in the west-central portion of TMK: (3) 7-8-010:044. The parcel is one of three awarded to Poopoopuu, and it was also probably a house lot based on its small area. The claim testimony does not mention a house lot. Two larger parcels, labeled Apana 1 and 3, are situated inland between 1,200 and 1,400 foot elevation.

Public Instruction Records cited by Maly and Maly (2001:214) list two schools in Keauhou in 1847. The teachers were Kaihe and Keliiahue. School records from 1848 list four teachers and 108 students at the two Keauhou schools. Tax records from 1849 list 60 people subject to taxation in Keauhou. Maly and Maly (2001:21-22) quote a Hawaiian language newspaper article that describes an inspection of schools in Kona. Two schools are reported for Keauhou in 1856. The school of Kanakaokahialii had 25 students with marginal proficiency.

Records documenting the late 1800s in Keauhou are limited. Tax records indicate a decrease in tax payers from 72 in 1857 to 24 in 1881 (Tomonari-Tuggle 1985:31). A Chinese retail store was established in Keauhou in 1867. Jackson's 1885 map of Keauhou Bay, obtained from the Archives Division of the Hawai'i Department of Accounting and General Services (DAGS; <http://ags.hawaii.gov/survey/map-search>), shows a settlement of at least twenty-six structures, mostly situated on the north side of the bay (**Figure 6**). Eight of the structures have walled yards surrounding them, several of which are located in the TMK: (3) 7-8-010:044 portion of the project area. Scattered coconuts are also depicted. This map also shows Kauikeaouli (Kamehameha III) birth place and a structure labeled "Old ruin of Kamehameha 1st House" at the base of the cliff, just outside the project area to the west.

Commercial sugar cane cultivation in Kona was attempted in the late 1800s and early 1900s, but was abandoned by the mid-1920s (Kelly 1983). **Figure 7** is a portion of the 1924 Territory of Hawaii U.S Geological Survey Kainaliu quadrangle map, also obtained from DAGS. This map shows the Old Kailua Road that extends inland to Kainaliu (Site 24259), and a trail or road extending from the coast along the south side of Keauhou Bay that continues south. It also depicts the inland/seaward oriented Keauhou Trail (Site 15243) that once existed in the project area. Two houses are shown at the coast south of Keauhou Bay. The West Hawai'i Railroad extends through the *ahupua'a* half way between the coast and inland highway. Construction of the railroad began in 1901 by the West Hawai'i Railway Company (Condé and Best 1973). The railroad was constructed to transport sugar cane to the Kailua Sugar Company Mill situated in Waiaha. Cattle ranching and coffee cultivation continued during the late 1800s and 1900s. The West Hawai'i Railroad extends through the Keauhou Ahupua'a half way between the coast and inland highway.

Figure 8 is a 1924-1925 Bernice P. Bishop estate map of Keauhou provided by the Nā Ala Hele Hawai'i Trail and Access System. This map depicts the Keauhou Trail (Site 15243), the Old Kailua Road (Road to Kainaliu; Site 24259), and the Old Government Beach Road that extended through the area. It also depicts the Kau Cemetery, the seaward half of which is shown extending into the project area boundaries.

Kekahuna's 1954 map of Keauhou Bay and He'eia Bay to the north, obtained from the Bishop Museum online library (<http://data.bishopmuseum.org/Kekahuna>), shows a nearly continuous series of residences fronting the bay (**Figure 9**). Twenty-seven named individuals are associated with the structures. A ranch gate and the Hind Ranch water pump

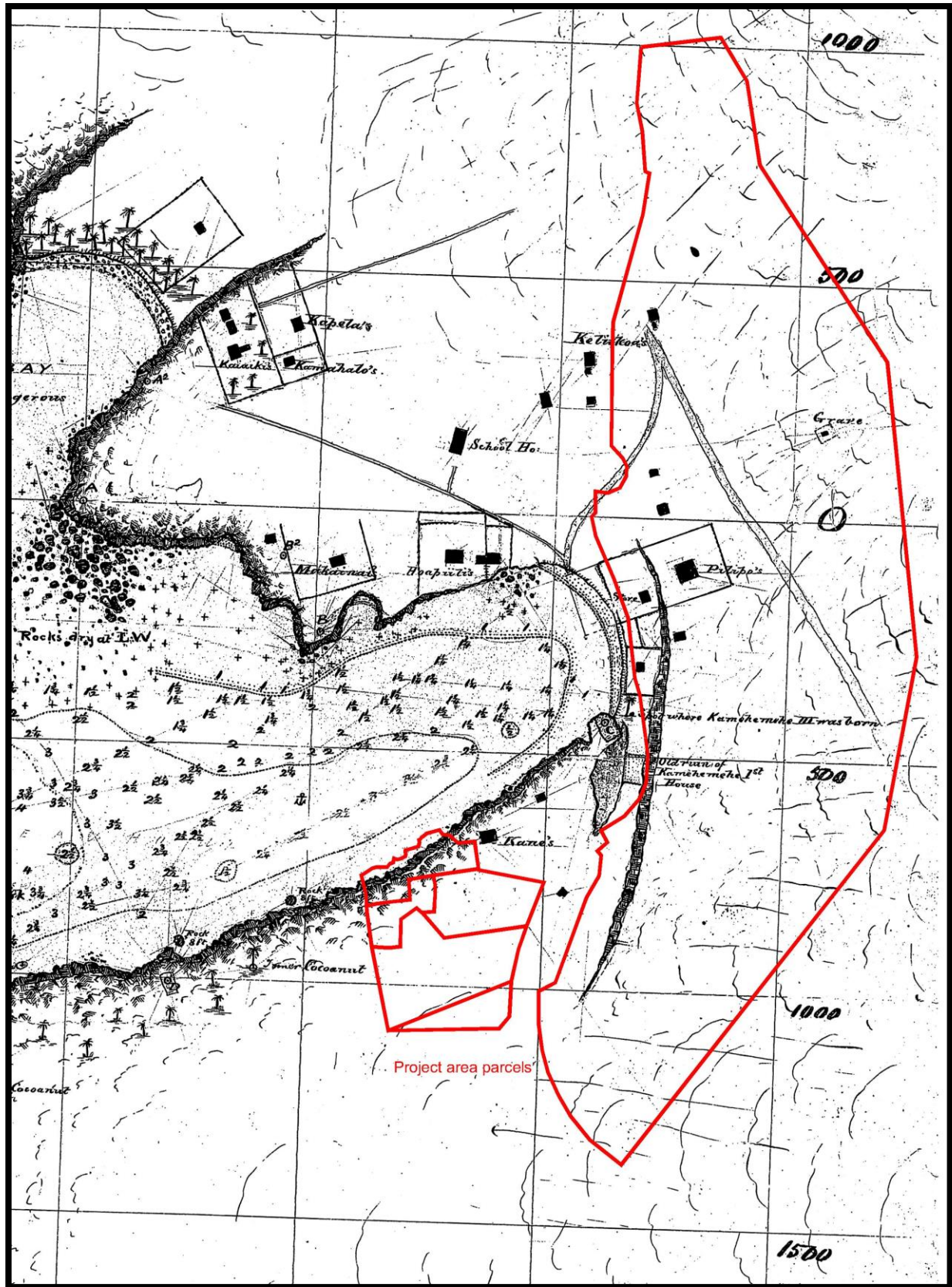


Figure 6. Portion of Jackson's 1885 Register Map No. 1320 of Keauhou Bay (obtained from DAGS).

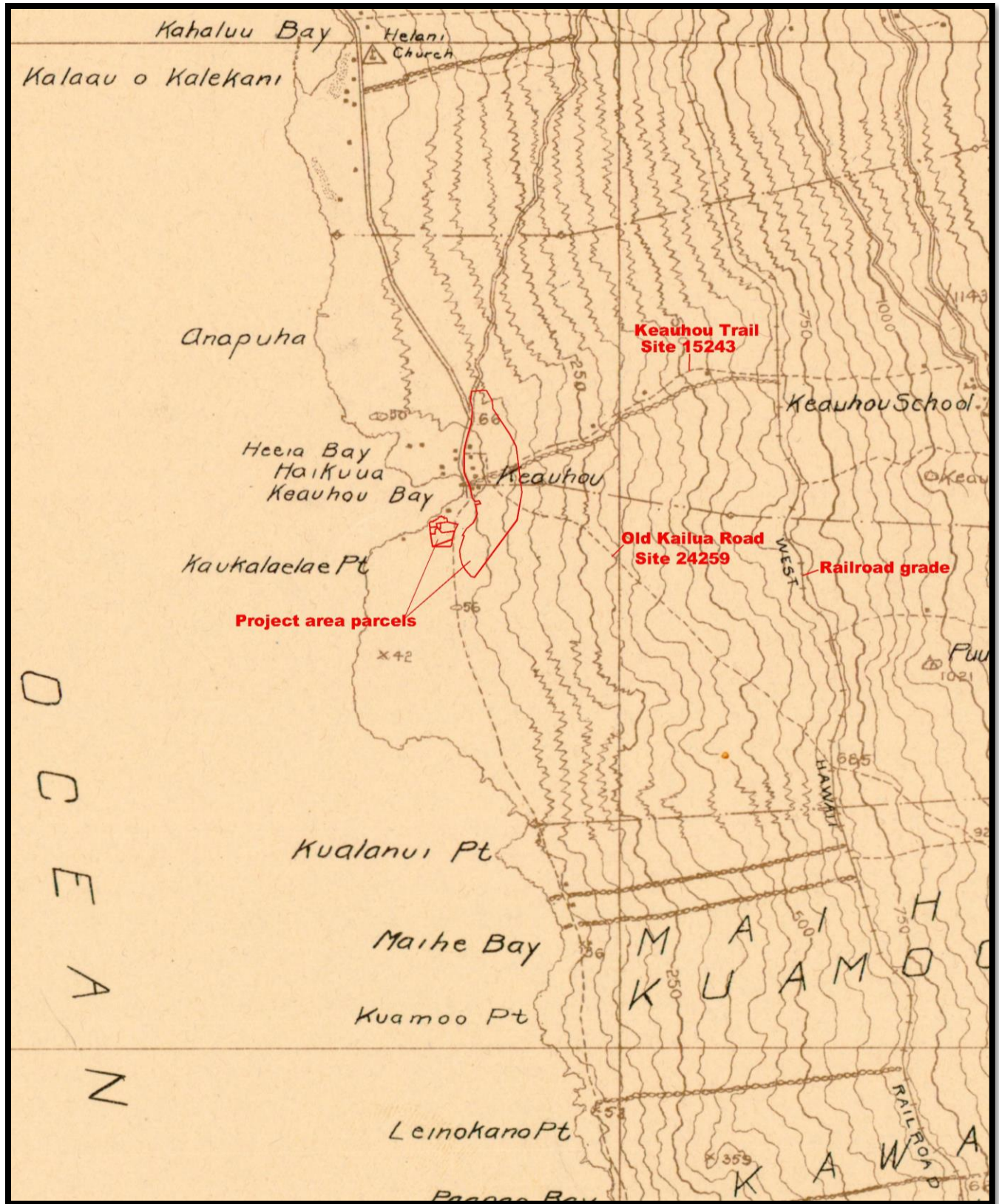


Figure 7. Portion 1924 U.S. Geological Survey Kainaliu Quadrangle showing project area (obtained from DAGS).

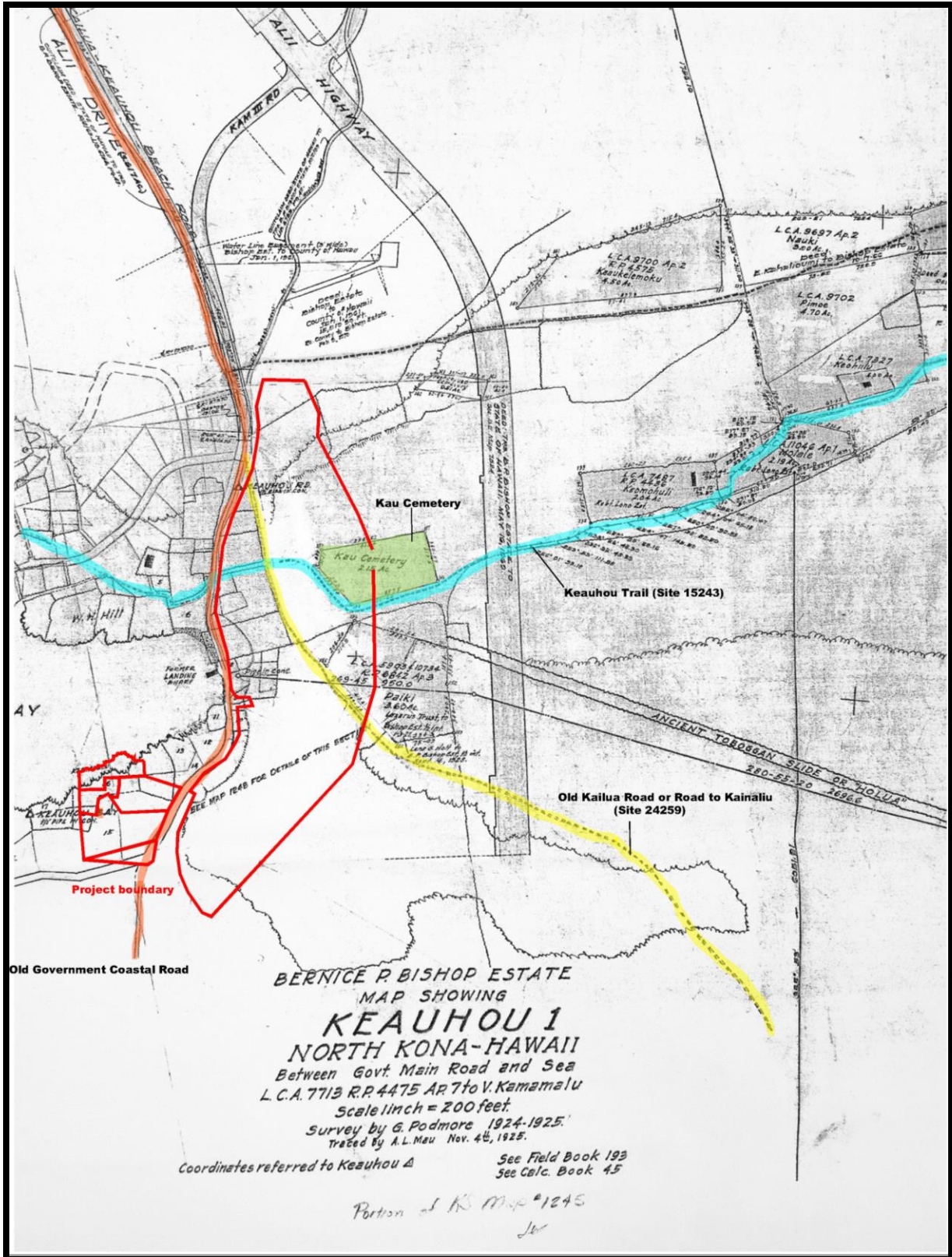


Figure 8. Portion of Bernice P. Bishop Estate Map of Keauhou 1 (obtained from Nā Ala Hele).



are shown on the inland side of the road to Kaʻawaloa on the south side of the bay. Two named springs, a boat pier, three private piers, a chapel, and a dry dock are also shown. Several sites that are located in the current project area are depicted on **Figure 9**. These sites are described in detail in the following Reconnaissance Survey Findings section.

There are three named *heiau* that reportedly once existed within or immediately adjacent to the TMK: (3) 7-8-010:044 portion of the project area (Kamohoalii Heiau, Kaleiopapa Heiau, and Kāmauʻai Heiau). Kekahuna's (1954) map of Keauhou Bay (see **Figure 9**) indicates that Kamohoalii Heiau was situated on top of the Ahuʻula Cliff inland from Keauhou Bay (see Item "H"). According to this map, only a few large stones existed at the time Kekahuna's map was prepared. Kekahuna's (1954) map also depicts the presence of Kaleiopapa Heiau situated adjacent to the Site 4348 Kauikeaouli Birth Stone (discussed below) and seaward of the Ahuʻula Cliff. No structure or information concerning this heiau is presented on this map.

A reference indicating the location of the Kāmauʻai Heiau is situated at the bottom of Kekahuna's (1954) map of Keauhou Bay (see **Figure 9**). It reads, "To the present end of the Royal Slide, and the remnant of Kāmauʻai Heiau." **Figure 10** is Kekahuna's 1953 map of the Famous Holua at Keauhou (Site 1669; discussed below). According to this map, Kāmauʻai Heiau was situated 69 feet seaward of the end of the slide, within a large "recently built" enclosure, and measured approximately 100 feet long and 50 feet wide. Kekahuna's maps were georeferenced during the present project with the results indicating that the Kāmauʻai Heiau was situated just inland of the eastern boundary of TMK: (3) 7-8-010:044, with the adjacent the adjacent Kona Country Club golf course. No remnants of the Site 1669 slide or the Kāmauʻai Heiau were identified in this portion of the project area and were likely destroyed during construction of the golf course.

In 1976, in a manuscript prepared by the Daughters of Hawaii for Kamehameha Investment Corporation, the following information is presented concerning the two heiau:

South of the monument (Site 4348), on the adjoining property, lies Kamohoalii Heiau. This heiau was built by the Kahuna Kapihe Nui, by command of Kalaʻninui Liholiho, King Kamehameha II. The heiau measured sixty feet by forty feet. It lay beneath Ahuʻula Cliff and was used for royal family ceremonies...Atop Ahuʻula Cliff... are the remains of another heiau; name unknown. Referred to by one authority as Kamohoalii in an early writing, only a few large stones remain of the heiau. Kamohoalii Heiau proper, the one below the cliff, is also known to have been called Kaleiopapa Heiau. This later name might have been the name of the heiau above the cliff. (Daughters of Hawaii 1976:2)

Neither heiau are mentioned in Stokes (Stokes and Dye 1991) or Thrum (1908), and these heiau are not depicted on Jackson's 1885 map of Keauhou Bay (see **Figure 6**). Both Stokes and Thrum cite the presence of Hoʻokūkū or Kaopa Heiau located in the vicinity of the Site 4348 Kauikeaouli Birth Stone. According to Stokes:

A low rambling wall encloses a space about 1.5 acres at the foot of a high cliff...within are breadfruit, loulou and other trees...[and] a large rock to which marvelous revivifying powers were attributed, and it was stated that the dead baby was placed on the stone for some days and came to life by virtue of the stone...(Stokes and Dye 1991:85)

Thrum (1908) indicates that the Hoʻokūkū Heiau likely represented a "famous sacred locality" rather than an actual structure.

Rosendahl et al. (1983) made an effort to locate the remains of a heiau along the top of the Ahuʻula Cliff. This survey did not locate any structural remains of a heiau. This report does postulate that the Bishop Museum Site No. D3-37 (re-designated as Feature A of Site 5674; discussed below) may have corresponded to part of a larger structure;

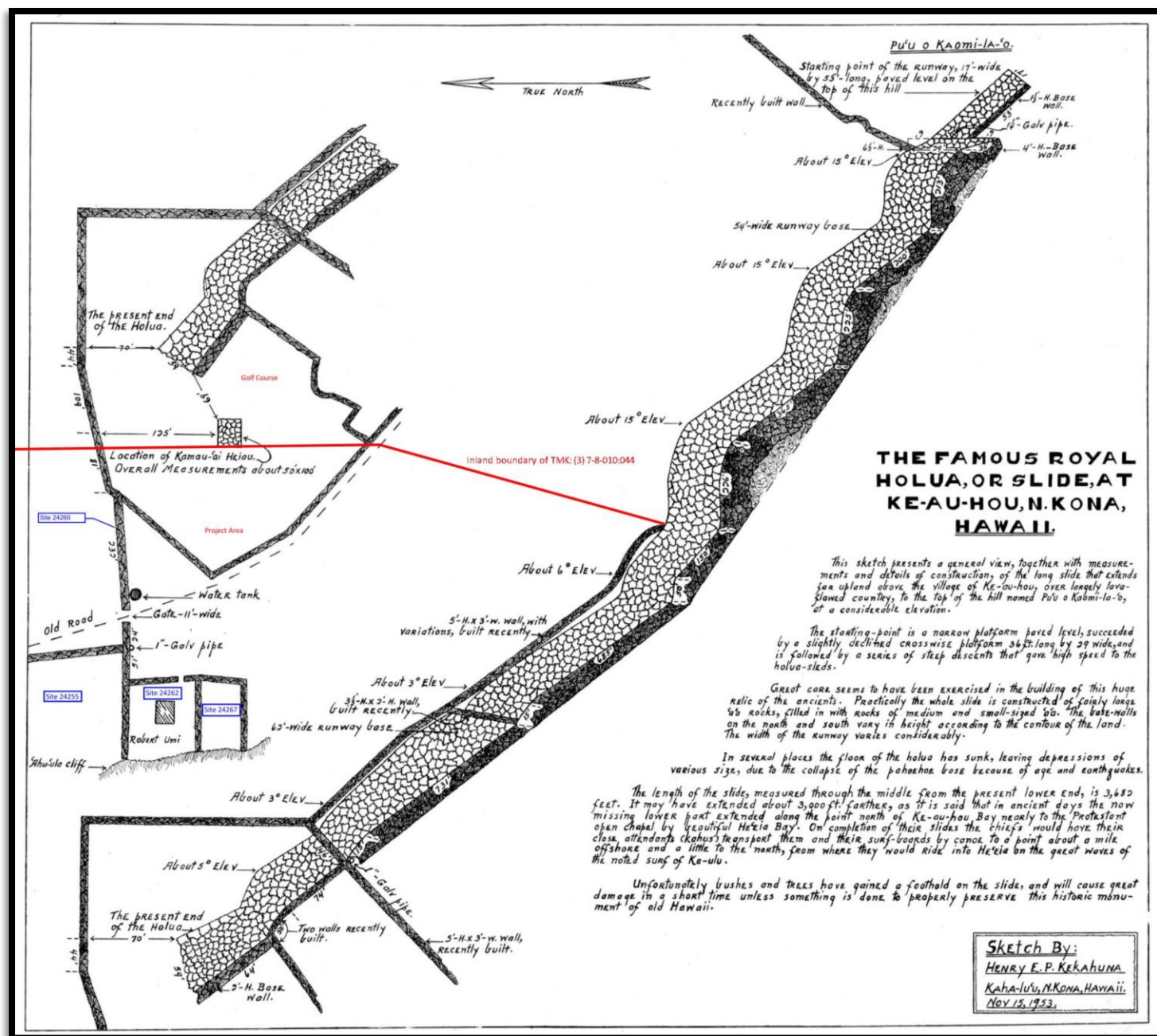


Figure 10. Kekahuna's 1953 Map of the Holua Slide at Keauhou (obtained from www.data.bishopmuseum.org/Kekahuna).

however, they also postulate that, “there is no reason to suspect that D3-37 might have been part of a heiau (1983:31).

The area along the top of the cliff was also carefully examined by Haun and Henry (2010a) and no surface evidence of a site was found. Subsurface testing was undertaken in this area during the Haun and Henry (*ibid*) project. Three shovel tests were excavated 30 meters apart, extending between Sites 5764 and 24262 on the level soil area inland from the top of the Ahu’ula cliff line and seaward of the Site 24259 road. The excavation of these shovel tests identified similar soil deposits, consisting of two soil layers over bedrock. The upper layer contained marine shell, waterworn coral and historic debris, with no cultural material in the underlying soil. Soil and stone push piles were noted in the area, indicating the area had been bulldozed in the past.

A portion of a *hōlua* slide (Site 1669) also potentially once extended into the TMK: (3) 7-8-010:044 portion of the project area (see **Figure 3**). According to Burtchard et al. (1992:287), the intact portion of the slide is approximately 915 meters in length, “from its upper platform to the point where it is cut by Ali’i Drive.” The portion of the slide seaward of Ali’i Drive has been destroyed, although Burtchard et al. states that, “contour changes would suggest that it originally terminated above He’eia and Keauhou Bay...” (*ibid.*). No evidence of the slide remains in the project area; however, Burtchard et al.’s site map (1992:5) indicates it may have once existed within it.

Kekahuna’s 1953 map of the slide (see **Figure 10**) however, shows that the seaward end terminated in the adjacent Kona Country Club golf course, inland of the project area. This map shows that the seaward end was situated within a large, “recently built” enclosure, in close proximity to the previously discussed Kāmau’ai Heiau. The map also describes the construction of the slide as follows:

Great care seems to have been exercised in the building of this huge relic of the ancients. Practically the whole slide is constructed of fairly large ‘a’a rocks, filled in with rocks of medium and small sized ‘a’a. The base-walls on the north and south vary in height according to the contour of the land. The width of the runway varies considerably.

According to Tomonari-Tuggle (1985:46), the Site 1669 Holua Slide was one of the largest in the islands, having originated more than a mile inland and measuring 15-20 meters in width and as much as 5.0 meters in height. Baker (1915:82) indicates that the slide was, “built before his reign for Kamehameha III to slide down on sleds, with his friends over the grass-covered slide made slippery with kukui-nut oil. According to Burtchard et al. (1992:287, the intact portion of the slide is approximately 915 meters in length, “from its upper platform to the point where it is cut by Ali’i Drive.” The portion of the slide seaward of Ali’i Drive has been destroyed, although Burtchard et al. (*ibid*) states that, “contour changes would suggest that it originally terminated above He’eia and Keauhou Bay...” Haun and Henry (2010a) found no evidence of the slide or the enclosure constructed around the seaward end. in the project area.

A portion of the Keauhou Trail (Site 15243) also apparently once existed within TMK: (3) 7-8-010:044. This trail is an inland-seaward transportation route that originated near Keauhou Bay and extended inland a distance of at least 2,500 meters. Burtchard et al. (1992) documented inland portions of the trail, from approximately 400 feet elevation inland to the Kuakini Highway at approximately 900 feet. According to Burtchard et al. (1992:303, the trail, “appears as a flat, easily traversed pathway when not choked with grass.” Kekahuna’s (1954) map of Keauhou Bay indicates that the Keauhou Trail, labeled as “Old Road to Upland” once extended through the TMK: (3) 7-8-010:044 portion of the project area (see **Figure 9**). This map depicts a walled passage extending between two large enclosures with the trail continuing inland to the east. The southernmost enclosure was designated Site 24256 by Haun and Henry (2010a; see **Figure 3**) and the northern enclosure was designated Site 24257. The examination during the previous AIS revealed that the walled passage and large portions of the Site 24256 and 24257 enclosures have been destroyed. Currently this area is occupied by a gravel parking lot with no evidence of the trail present.

An historic cemetery is depicted on a Bernice P. Bishop Estate 1924-1925 map of Keauhou 1 (see **Figure 8**). The seaward half of the cemetery is reportedly located in the northeastern portion of the project area in an area that has been impacted by bulldozing. No evidence of this cemetery was identified by Haun and Henry (2010a) and it is not depicted on any of the other historic maps of the area.

RECONNAISSANCE SURVEY FINDINGS

Four TMK parcels and a portion of a fifth were subjected to reconnaissance survey during the project. These areas were examined with crew members spaced at 5 to 10 meter intervals. Ground surface visibility was fair to good in the majority of the parcels, except in portions of TMK: (3) 7-8-012:065, where an area of dense bougainvillea, night-blooming cereus, and *kiawe* was encountered. The location of the sites identified in the subject parcels were determined with the aid of a Spectra Precision Mobile Mapper 20 device using the North American Datum (NAD) 1983 datum. The accuracy of the GPS device for a single point is +/- 1 to 3 meters. The location of these areas and the identified sites are presented in **Figure 11** and **Figure 12**. The results of the reconnaissance survey are presented below.

TMK: (3) 7-8-10:044 is a 25.239-acre parcel located east of Kamehameha III Road and Keauhou Bay. The majority of this area was subjected to an AIS by Haun and Henry (2010a), with the exception of an approximately 1.35-acre area formerly comprised of Parcel 73 (see **Figure 2**). This area was subsequently added to TMK: (3) 7-8-010:044. The southern portion of this area is currently in use for boat storage and parking (**Figure 13**). Evidence of mechanical grading was observed at the northern end of the parcel, potentially related to the development of the adjacent golf course. An area of surface a'ā lava is present (**Figure 14**) with the vegetation consisting of *kiawe*, *koa haole*, grasses and vines (**Figure 15**). The survey of these parcels identified a possible historic driveway (**Figure 16**) and building foundation located on the approximate boundary between the two parcels, north of the parking area. This site is assigned temporary number **Site 1608.1**. It will require AIS level documentation. The site is tentatively assessed as significant under Criterion "d" for its information content and will likely be recommended for no further work following AIS documentation.

Based on the recommendations from Nā Ala Hele Hawai'i Trail and Access System and the Ala Kahakai National Historic Trail, discussed in the following Conclusion section, two areas within TMK: 7-8-010:044, totaling 1.97-acres, were also subjected to reconnaissance survey in an attempt to locate the remains of two historic trails (Sites 15243 and 24259) and the Kau Cemetery (**Figure 17**). The trail corridors were identified on the 1954 aerial (**Figure 18**), and Esri shp files were created for use in the field. Information from the 1924-1925 map of Keauhou 1 (see **Figure 8**) was used to delineate the approximate location of the Kau Cemetery within the project area. Mechanical disturbance within the project area was identified on a 1976 aerial photograph and this information was used to identify the inland extent of the reconnaissance survey areas (**Figure 19**). The shp files created from these data were loaded into a Spectra Precision MobileMapper 20 GPS unit to guide the survey efforts in the field. The corridors were delineated in the field using a combination of blue & white striped and orange flagging tape. The guinea grass within the corridors was then cleared by Forest Solutions, Inc. (FSI) personnel to improve ground surface visibility. Haun & Associates archaeologist, Leesha Villacorte, B.A. monitored the grass clearing from between September 28 and October 6, 2022. The corridors were then systematically examined by Project Supervisor, Solomon Kailihiwa, M.S., and archaeologists Leesha Villacorte, B.A., and Nicole Lui.

The northern-most corridor was centered on the reported path of the Site 15243 trail and encompassed an area of approximately 1.26-acres (see **Figure 17**). The ground surface within this corridor shows evidence of past mechanical grubbing (**Figure 20** and **Figure 21**), with the boulders and cobbles from the area having been pushed to the base of the knoll that is the possible location of Kau Cemetery. All of the *koa haole* trees in the area are uniform in size and weathered scars from metal-tracked vehicles were observed on rocks. No remnants of the Site 15423 trail are present; however possible portions of the Kau Cemetery were noted.

The reported location of the Kau Cemetery is situated to the north of this corridor (see **Figure 17**). The approximate location of the cemetery was determined by utilizing the 1924-1925 map of Keauhou 1 (see **Figure 8**) and the 1954 aerial photograph of the area (see **Figure 18**). The remains of the cemetery appear to be situated on a small rocky



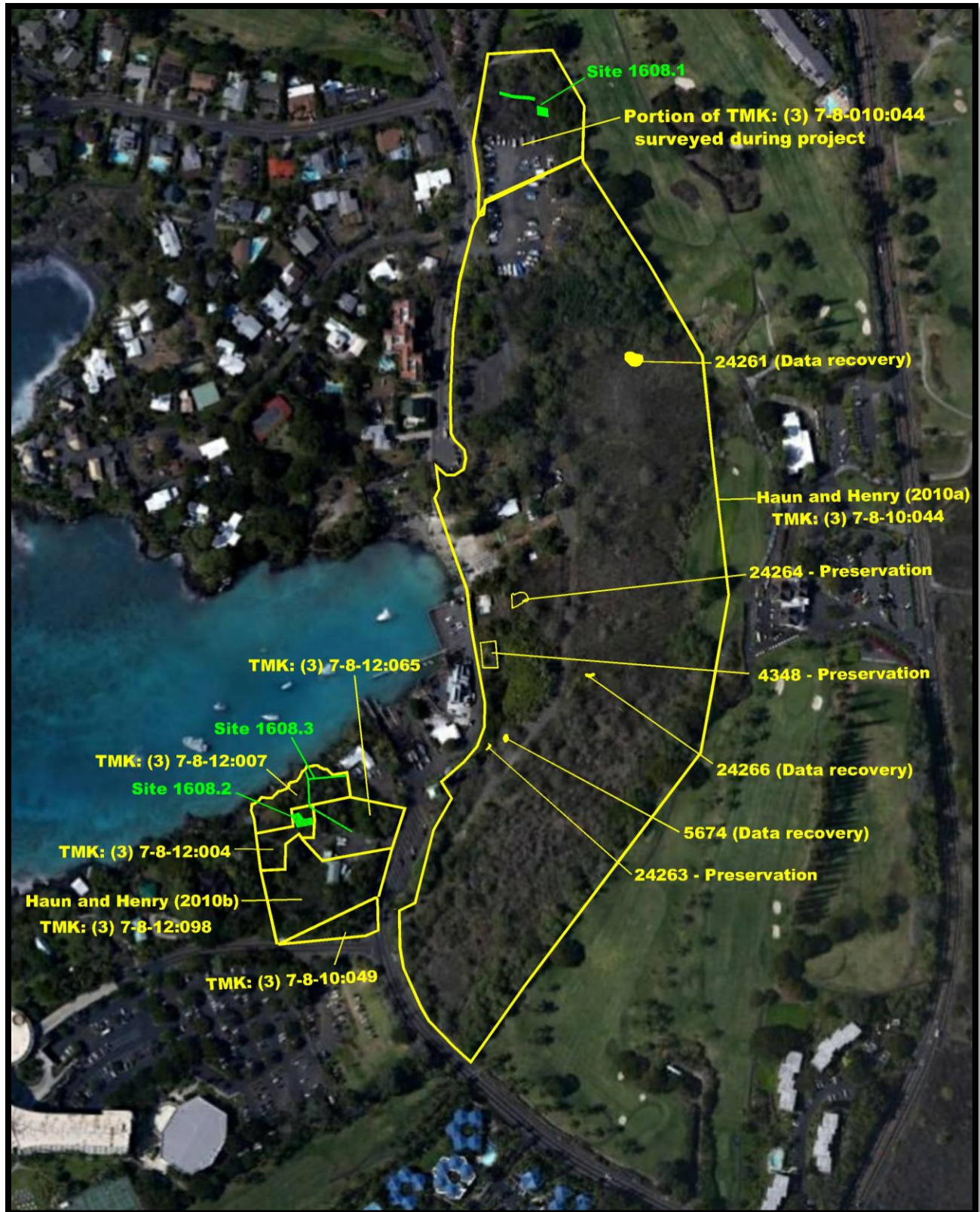


Figure 12. Aerial view of project area vicinity showing survey areas and sites (from Google Earth).



Figure 13. Boat storage and parking area (view to east-southeast).



Figure 14. Surface lava flow in TMK: (3) 7-8-010:044 (view to northeast).



Figure 15. Portion of TMK: (3) 7-8-010:044 surveyed during project (view to southeast).



Figure 16. Possible Site 1608.1 driveway in TMK: (3) 7-8-010:044 (view to east).

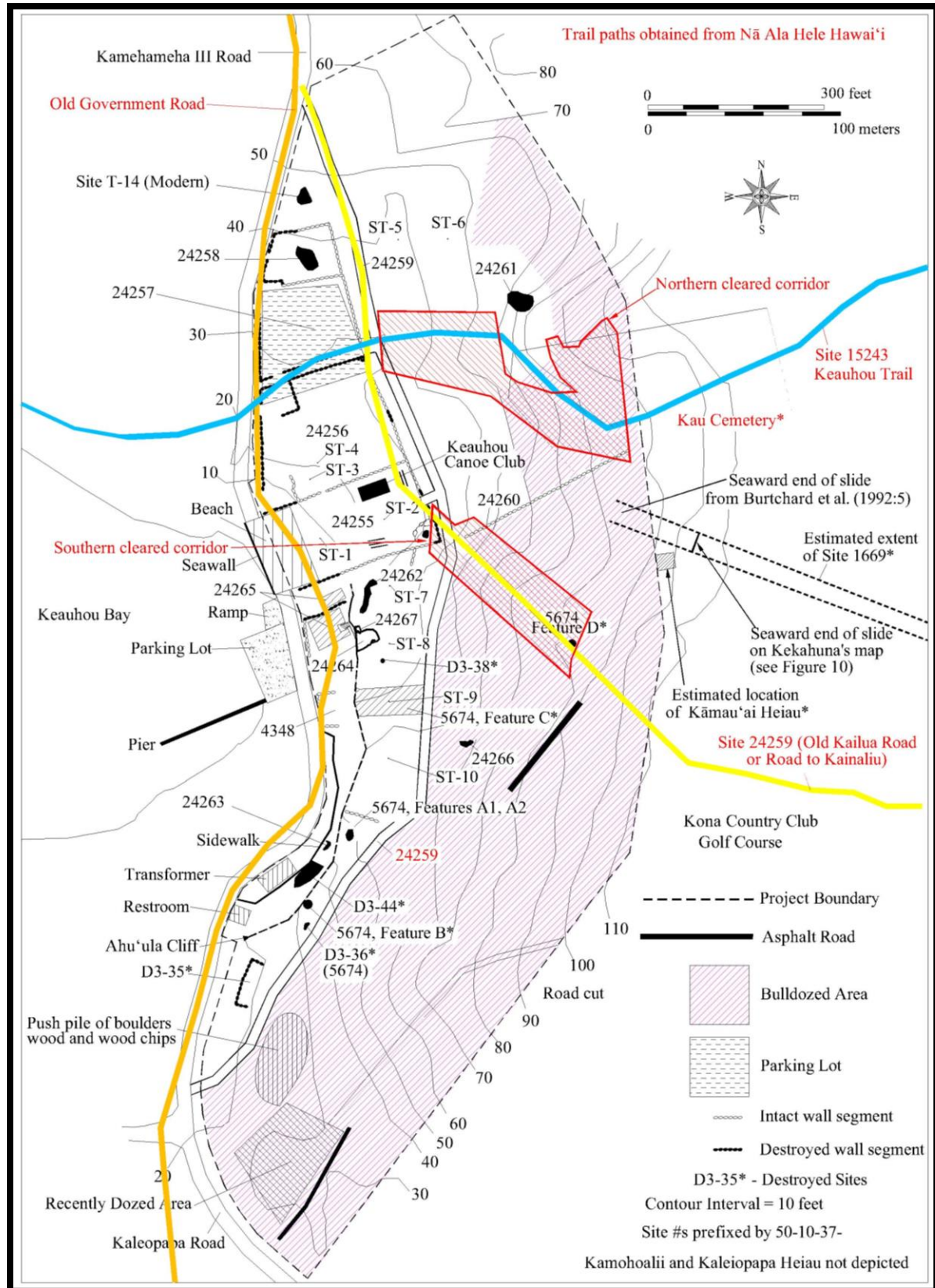


Figure 17. Project area trails and Kau Cemetery on Haun and Henry (2010a) site location map showing cleared corridors.

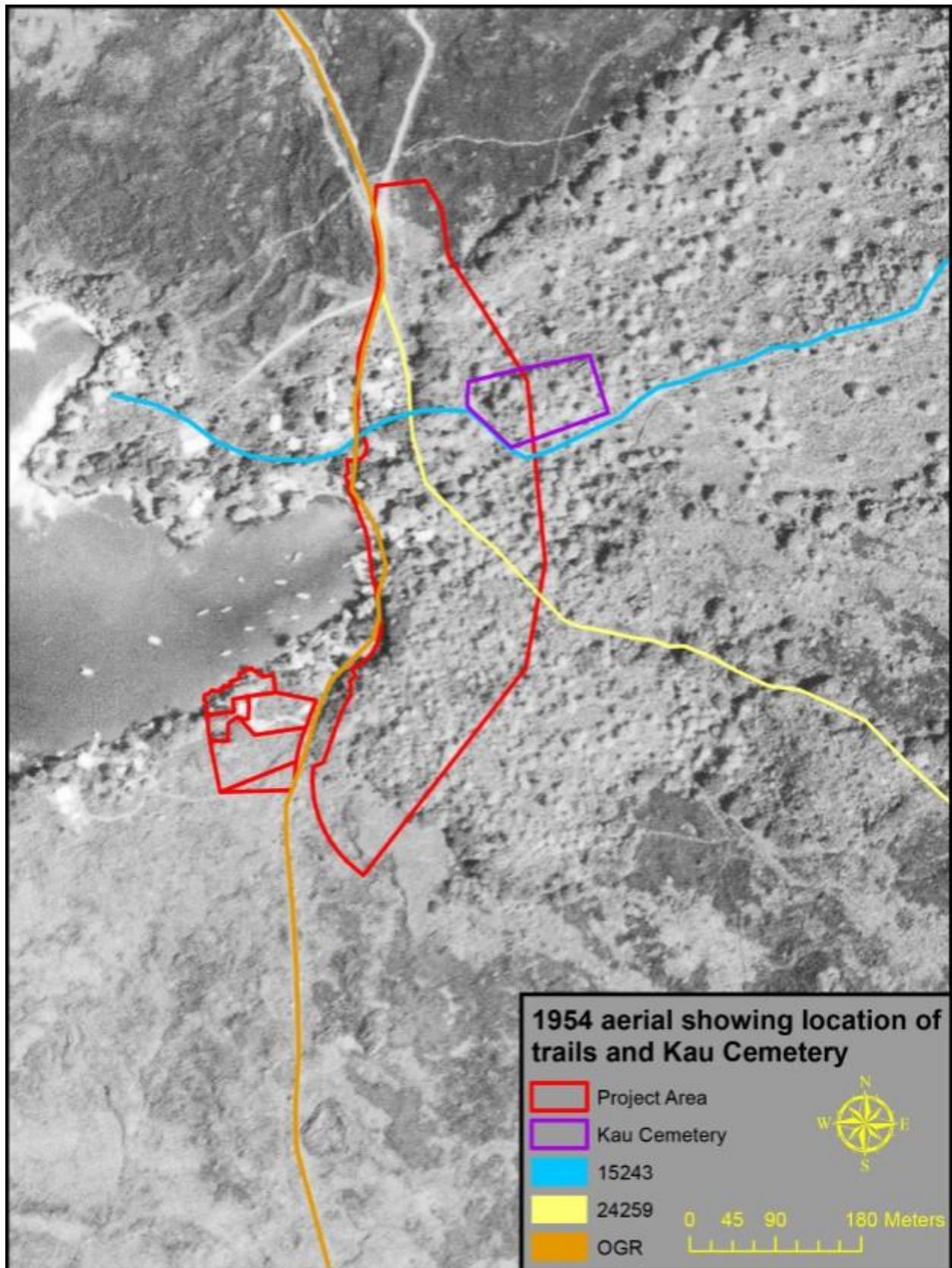


Figure 18. Project area trails on 1954 aerial view of project area vicinity (obtained from University of Hawai'i at Manoa online library).

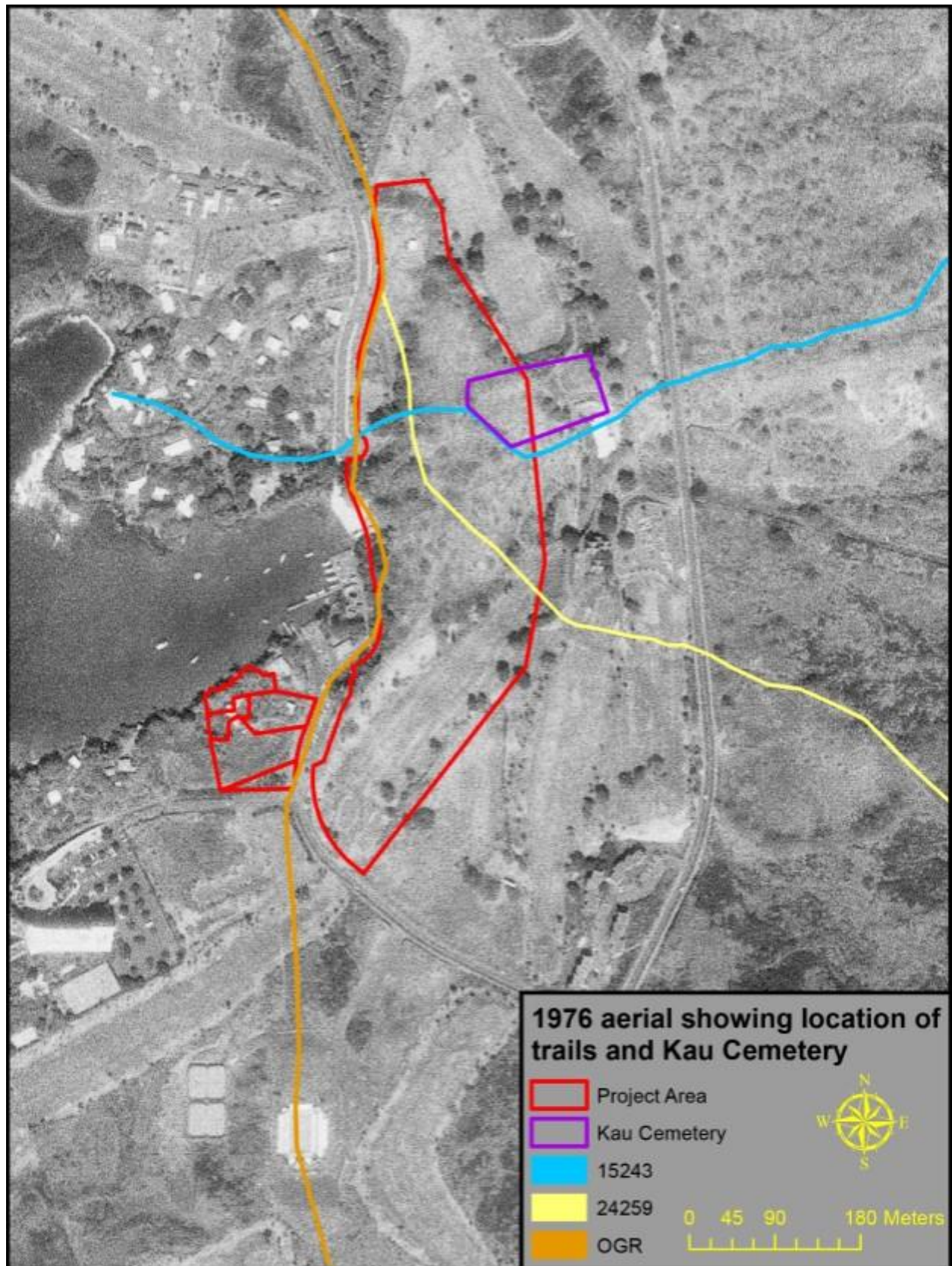


Figure 19. Project area trails on 1976 aerial view of project area vicinity (obtained from University of Hawai'i at Manoa online library).



Figure 20. Site 15243 corridor cleared of grass (view to east-southeast).



Figure 21. Site 15243 corridor cleared of grass (view to west).

knoll, with the eastern two thirds of the cemetery having been destroyed by the construction of the adjacent golf course. The top of the knoll shows evidence of grubbing, consisting of weathered scarring on rocks created by a metal-tracked vehicle and uniform height of the *koa haole* trees in the area (**Figure 22**).

A section of formed concrete is present in the portion of the Kau Cemetery survey area cleared by FSI (see **Figure 22**). One surface of the concrete was smooth and does not show any of the large pebble and small cobble aggregate within the rest of the fragment and most likely represents its outer surface. The side opposite of the outer surface is covered with large a'ā pebbles and small cobbles. It is possible that section of concrete may be a portion of a disturbed grave, possibly a fragment of a capstone, that has been displaced by the grubbing of the area.



Figure 22. Cleared portion of Kau Cemetery showing section of concrete (view to northwest).

Site 24261 was also observed within the reported location of the Kau Cemetery (see **Figure 17**). As previously discussed, this is a large paved area located on the northern side of a knoll in the northeastern portion of TMK: 7-8-010:044, and was interpreted as the foundation for a permanent habitation structure by Haun and Henry (2010a). This site is slated for data recovery. It is possible that this site may also represent a remnant of the Kau Cemetery. The surface of the pavement is currently completely overgrown by guinea grass, but it was assessed during an earlier phase of this project.

The southern corridor follows the reported location of the Site 24259 trail, encompassing an area of approximately 0.71-acres. This corridor is mostly devoid of boulders and cobbles, and the *koa haole* trees are of uniform height, many of which have multiple trunks suggesting they had been cut or cleared to the ground in the past (**Figure 23**). Linear mounds created by bulldozer blades were observed in the area. The inland most part of the corridor had been grubbed more recently than the rest of the corridor. The *koa haole* trees are younger than the rest of the trees in the area and a line of tree stumps and boulders and cobbles created by a bulldozer blade delineated the western edge of this more recent grubbing (**Figure 24**). No remnant of the Site 24259 trail is present.



Figure 23. Site 24259 corridor cleared of grass (view to northwest).



Figure 24. Site 24259 corridor showing recently cleared area (view to south).

TMK: (3) 7-8-010:049 is a 0.3-acre roughly triangular-shaped parcel located at the intersection of Kaleiopapa Road and Ehukai Streets. It has been graded and landscaped with a lawn, ornamental plants, propane torches, and a sign for the Outrigger Kona Resort and Spa (**Figure 25**). No historic properties are present in this parcel.

TMK: (3) 7-8-012:004 is a 0.25-acre parcel located to the northwest of the Haun and Henry (2010b) survey area. The reconnaissance in this area identified a complex comprised of a house foundation, retaining walls, and walking paths designated as **Site 1608.2**. An overview of the site is presented in **Figure 26**. This site is depicted on Kekahuna's (1954) map of Keauhou Bay as having been owned Mrs. E.P. Hodgins (see **Figure 9**). It is also located in the approximate location of LCA 9698 that was awarded to Kapela in the *Māhele*. This site will also require AIS level documentation. Site 1608.2 is tentatively assessed as significant under Criterion "d" for its information content and will likely be recommended for no further work following AIS documentation.

TMK: (3) 7-8-012:007 is a 0.4-acre parcel situated to the north of Parcels 004 and 065. The survey of this area indicates that the walking paths from Parcel 4 extend into it (**Figure 27**), and that there is a small pavilion at the west end of the parcel. According to Kekahuna's 1954 map, the western half of parcel 7 was occupied by Mrs. E.P. Hodgins. A wall bisects this parcel, designated as **Site 1608.3**. As with Sites 1608.1 and 1608.2, this site will also require AIS level documentation. It is tentatively assessed as significant under Criterion "d" for its information content and will likely be recommended for no further work following AIS documentation.

TMK: (3) 7-8-012:065 is an 0.6-acre parcel located to the northeast of the Haun and Henry (2010b) survey area. This parcel has been partially developed for use as boat storage and parking area. The wall in TMK: (3) 7-8-012:007 extends into this parcel (**Figure 28**). The portion of this parcel north of the boat parking and east of the wall is covered by dense bougainvillea, night-blooming cereus, and *kiawe*. The vegetation needs to be cleared to facilitate an AIS.



Figure 25. Overview of Parcel (3) 7-8-010:049 (view to southwest).



Figure 26. Overview of Site 1608.2 (view to southwest).



Figure 27. Walking path in TMK: (3) 7-8-012:007 (view to north).



Figure 28. View towards wall in TMK: (3) 7-8-012:065 (view to north).

SITE CONDITION UPDATE

As stated, efforts were made to relocate six archaeological sites previously identified by Haun and Henry (2010a) during an AIS of the 25.239-acre TMK: (3) 7-8-010:044. These consist of three sites recommended for data recovery (Sites 5674, 24261 and 24266) and three sites that were recommended for preservation (Sites 4348, 24263, and 24264; see **Figure 11** and **Figure 12**). Of these six sites, five were relocated (excluding Site 5674). The nine remaining sites identified by Haun and Henry (2010a) were recommended for no further work. The results of the Site Condition Update are presented below.

Site 4348

Site 4348 consists of the Kauikeaouli (Kamehameha III) Birth Stone situated within a mortared stone enclosure inland of Kaleiopapa Road and seaward of the Ahu‘ula Cliff. The site was documented by Kekahuna (1954), Emory et al. (1971), Hammett (1980), Rosendahl et al. (1983), and Haun and Henry (2010a). This site is depicted on Kekahuna’s 1954 map of Keauhou Bay (see **Figure 9**) which provides the following description:

A monument to the memory of King Ka-mehameha III, or Kau-i-ke-ao-uli, now in charge of the Daughters of Hawaii, here lies an enclosure near the base of ‘Ahu-‘Ula Cliff. On this spot, Queen Keo-opu‘-o-lani, tabu state wife (wahine kapu) of King Kamehameha I, gave birth, following a bath in the cold water of the near-by sea-spring of Ku-hala-lua, to the stillborn prince Kau-i-ke-ao-uli. Providentially he was resuscitated to become the future king. (Born Aug 11, 1813; made King in June 6, 1825; married his Queen Ka-lama, daughter of Ka-pihe-nui, Feb 2, 1837; died in Honolulu, Dec 15, 1854.

A plaque set in concrete on a basalt boulder is located in the landscaped interior of the enclosure that surrounds the site. According to Tomonari-Tuggle (1985), this boulder is the site where the stillborn baby was brought back to life. The plaque reads:

Kauikeaouli, Kamehameha III
Son of Kamehameha I and Keopuolani
Born March 17, 1814
Died December 15, 1854
Ka Moi Lokomaikai

According to Rosendahl et al. (1983), this plaque was originally unveiled by Queen Liliuokalani in a ceremony sponsored by the Daughters of Hawaii in Honolulu at Kawaiha‘o Church on March 17, 1914. In August 1914, the plaque was transported to its current location via a double canoe and a second ceremony was held when the plaque was set permanently onto the boulder. Site 4348 was also designated as National Register of Historic Places (NRHP) Site 78001018 in 1978 (**Appendix A**).

The enclosure surrounding the site is constructed of cut, stacked and faced cobbles and small boulders and is 16 meters long (north-south) and 4 to 4.5 meters wide. The enclosure is open to the east, facing the cliff line. A second modern plaque, provided by Keauhou Resort is located at the southern end of the enclosure, commemorating Kamehameha’s life. A concrete sidewalk is located adjacent to the southern end of the enclosure. This sidewalk extends upslope to the east, then angles to the south, paralleling the cliff line and extending to and beyond the Site 24263 pond (discussed below). A stone wall that appears identically constructed to the enclosure extends to the south from the southern edge of the sidewalk, paralleling the inland edge of Kaleiopapa Road. The area between this wall and the sidewalk is landscaped. The site was placed on the National Register of Historic Places in 1978 and has been maintained by the Daughters of Hawaii since 1973 through a 75-year lease agreement with the Bernice Pauahi Bishop Estate (Lease No. 22,571). Site 4348 was unaltered and in good condition and was recommended for preservation during the Haun and Henry (2010a) AIS.

Site 4348 was relocated during the present project. The site was not mapped during the Haun and Henry (2010a) AIS; however, a detailed map of the site was prepared during the present project (**Figure 29**). The documentation of the site during the current project indicates its condition is unchanged since the prior study. Overviews of the site are presented in **Figure 30** and **Figure 31**.

Site 5674

Site 5674 was initially identified as a complex of five widely dispersed features or feature complexes previously identified by Rosendahl et al. (1983). According to Rosendahl et al., “These [features] were assigned a single state number by the present project, not because they are related chronologically or otherwise, but because they are a remnant population, unified by virtue of their extant and isolated status.” (1983:29). The initial features of the site consisted of a platform, which corresponded to Emory et al.’s (1971) Site D3-36, a wall (Site D3-37), the Feature B complex comprised of five historic features, the Feature C complex comprised of a cultural deposit and a mound, and the Feature D complex comprised of a large pavement and a terrace. These features were located in an area 233 meters long by 10 to 72 meters wide, encompassing an area of 7,227 square meters.

The documentation of the site area by Haun and Henry (2010a) indicates all of the features except the Site D3-37 wall have been destroyed. The Site D3-37 wall was designated Feature A1 by Haun and Henry (2010a) and a newly identified paved area was found adjacent to the Feature A1 wall (Feature A2). These features are depicted in **Figure 32**. A 1.0 by 1.0 meter test unit (TU-207.6) was excavated into the center of the pavement by Haun and Henry (2010a). This excavation revealed a stone architectural layer (Layer I), over a soil deposit (Layer II), over bedrock (see **Figure 32**). A variety of cultural material was recovered from both layers.

The remaining portions of Site 5674 were interpreted as the disturbed remnant of a permanent habitation complex. The Feature A wall potentially served to delineate the boundaries of a yard, which contained the Feature B pavement. Road construction and other modern/historic ground surface disturbance have apparently destroyed the east and southern sides of the enclosure, which was likely open to the west, facing the ocean. The Feature A2 pavement is too small to have functioned as the foundation for a permanent habitation structure (7.4 sq meters) based on Cordy’s (1981) definition. It is possible that this pavement may have served as the foundation for a special purpose structure such as a sleeping structure, a cookhouse, or storage area. It is possible that the bulldozed push pile located along the southeastern side of the site may represent the displaced remnant of a more substantial structure. The presence of the wall, which may have enclosed the site, suggests that this portion of the site was constructed between the late 1700s to early 1800s after free-ranging cattle became a problem and before historic artifacts were widely distributed. These features were altered and in poor to fair condition during the Haun and Henry (2010a) AIS. The site was recommended for data recovery.

Extensive efforts were made to relocate the Site 5674 permanent habitation complex during the present project; however, the reported location of this site is completely covered by dense night-blooming cereus (**Figure 33**). Clearing of vegetation at this site exhausted the budget proposal for this project and additional clearing will be required to determine the current location and condition of the site.

Site 24261

Site 24261 is a large paved area located on the northern side of a knoll in the northeastern portion of the Haun and Henry (2010a) survey area. The pavement roughly oval in shape and is 12.9 meters long (northwest by southeast) and 9 meters wide (**Figure 34**). This paved area extends from the north side of the knoll and slopes down moderately to the north and northwest, ending at the base of the slope. Twenty waterworn basalt cobbles are scattered over the surface of the site. There is a relatively level paved area at the southeastern end of the larger pavement that is

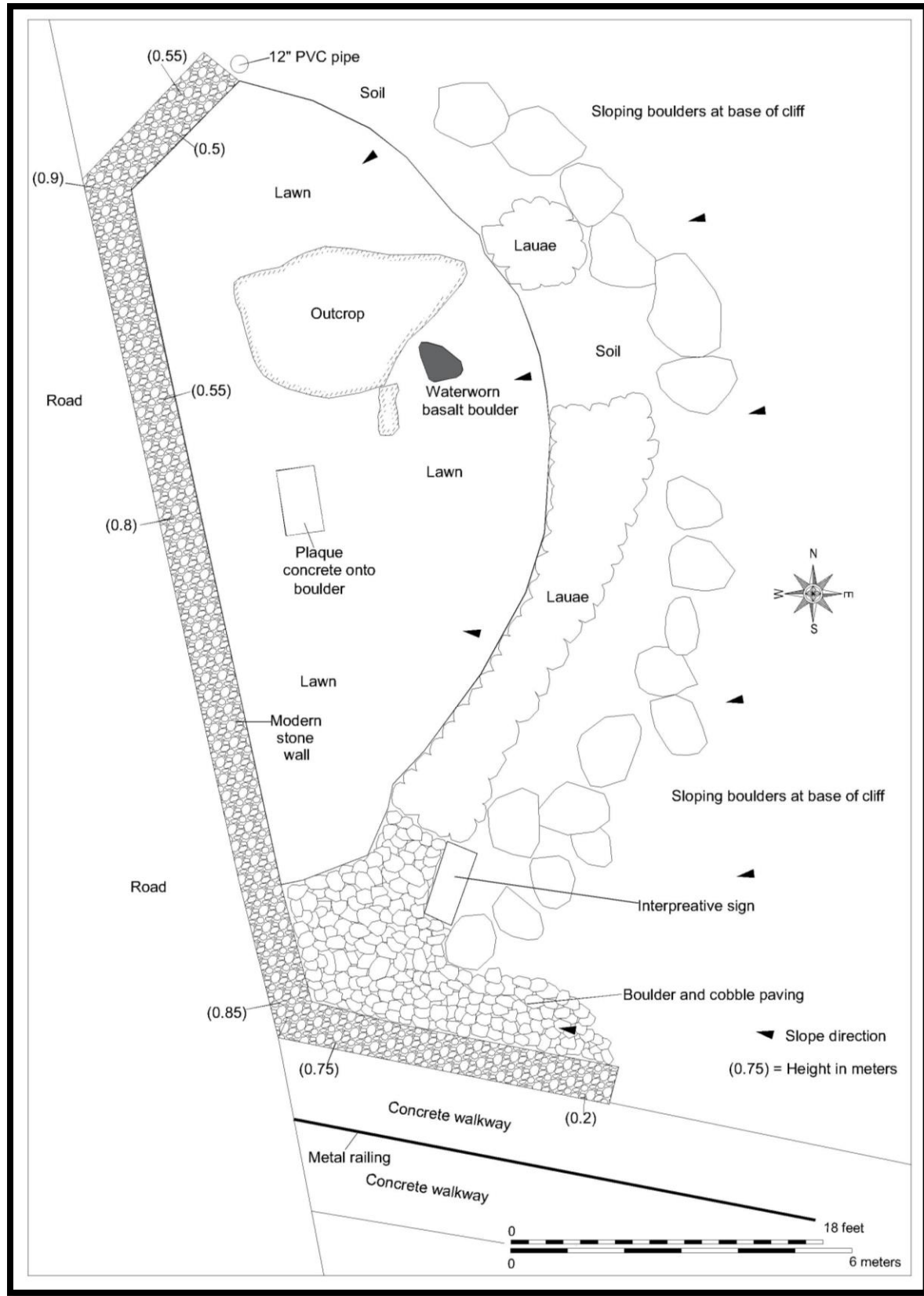


Figure 29. Site 4348 plan map.



Figure 30. Site 4348 overview (view to southeast).



Figure 31. Close-up of plaque at Site 4348 (view to southeast).

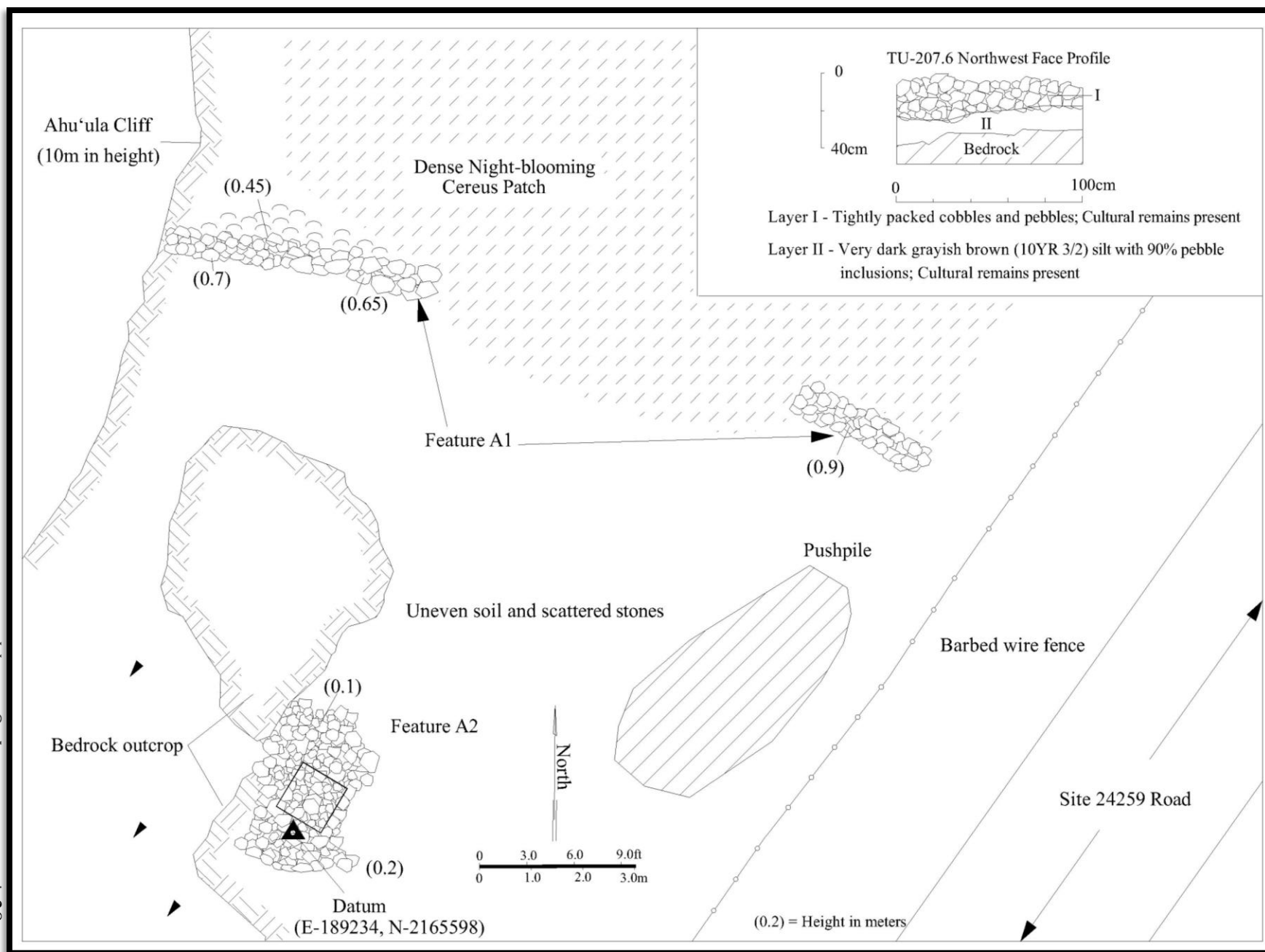


Figure 32. Site 5674 plan map and profile of TU-207.6 (from Haun and Henry 2010a:31).



Figure 33. Night-blooming cereus in Site 5674 area (view to north).

7.6 m long (east-west) and from 2.2 to 3.65 meters wide. An alignment of four small boulders is situated near the northern edge of this level pavement, measuring 1.6 meters in length. Two of the 20 waterworn basalt cobbles noted at the site are located on the surface of the level pavement. No other cultural material was noted on the surface of the site by Haun and Henry (2010a).

Haun and Henry (2010a) excavated a 3.0 meter long (east-west) by 1.0 meter wide test unit (TU-207.3) into the level pavement in the area containing the four aligned small boulders. This excavation revealed a stone architectural layer (Layer I) overlying two soil deposits (Layers II and III) resting on bedrock (see **Figure 34**). Cultural material was recovered from Layers I and II, although none was present in Layer III. Site 24261 was interpreted as the foundation for a permanent habitation structure by Haun and Henry (2010a). The site was unaltered and in fair condition and was recommended for data recovery.

Site 24261 was relocated during the present project. The site has not been significantly impacted since the Haun and Henry (2010a) AIS, except for a back dirt pile on the surface of the structure created during the excavation of TU-207.2. The plan map of this site (see **Figure 34**) has been modified to depict the pile. Current overviews of the site are presented in **Figure 35** and **Figure 36**.

Site 24263

Site 24263 is an anchialine pond located at the base of the Ahu'ula Cliff in the southwestern portion of the Haun and Henry (2010a) project area. The site is located 62 meters south of the Site 4348 Kauikeaouli Birth Stone, situated between a concrete sidewalk and the base of the cliff. The pond is roughly L-shaped and is 5.1 meters long (northeast by southwest and ranges in width from 3.0 to 4.8 meters wide. An area of stacked boulders line the pool along the northwest side, measuring 1.4 to 1.8 meters in height above the surface of the water. The water varies in depth from





Figure 35. Current condition of Site 24261 (view to west).



Figure 36. Current condition of Site 24261 (view to south-southwest).

0.3 to 0.6 meters. There is a retaining wall of stacked cobbles and boulders along the south side of the pond at the base of the cliff. A low overhang is located south of the wall, containing a large waterworn basalt boulder and the skeleton of a cat. The area surrounding the pool is landscaped and there is an interpretative sign describing the flora adjacent to the pool.

Kekahuna's 1954 map of Keauhou Bay depicts the Ho'okūkū Pond which apparently was once located on both sides of Kaleiopapa Road (see **Figure 9**). The inland end of this pond roughly correlates with the location of Site 24263. Item "L" on Kekahuna's map indicates that Ho'okūkū Pond was filled in at the time the map was made, although it appears likely that at least a portion of this named pond may have survived.

Site 24263 was interpreted as a probable water source that was likely utilized by occupants of the area by Haun and Henry (2010a). It was altered and in good condition during the previous AIS and was recommended for preservation.

The site was not mapped during the Haun and Henry (2010a) AIS; however, a detailed map of the site was prepared during the present project (**Figure 37**). The documentation of the site during the current project indicates it has not been significantly impacted since the prior study. Overviews of the pond are presented in **Figure 38** and **Figure 39**.

Site 24264

Site 24264 is a cave located at the base of Ahu'ula Cliff, inland from Keauhou Bay. This cave is referenced as Mo'ikeha Cave and according to Kekahuna's (1954) map of Keauhou Bay (see **Figure 9**), the Chief Mo'ikeha, hid in the cave, "...with only his legs barely visible to escape pursuers from Kau. Fortunately he was undetected and his life was saved".

The cave was examined by Emory et al. (1971) who states that at the time of their survey, the cave was being used for wood storage. Emory et al. indicates that the cave was only of traditional importance and, "as it would be swept by high waves, the floor is not likely to preserve material of archaeological interest" (1971:45). Haun and Henry (2010a) indicates that the cave has been cleared of the wood and trash since 1980.

The entrance to the cave is situated at the base of the cliff. The entrance is 9.9 meters wide (north-south) and from 1.3 to 1.8 meters in height and opens onto a large, roughly oval-shaped chamber that is 10.6 meters long (east-west) and 6.0 to 9.9 meters wide (**Figure 40**). The floor throughout the cave is comprised of level soil with scattered marine shell and small amounts of modern debris. An area of surface bedrock is present along the east and northeast sides of the chamber. The interior ceiling heights range from 0.5 to 1.8 meters.

Several modern modifications were noted by Haun and Henry (2010a) within the interior of the cave. A small 1.4 meter square enclosure is located on the exposed bedrock floor at the northeast end of the cave. The enclosure walls are 0.32 to 0.5 meters wide and 0.3 to 0.35 meters in height. The interior of the enclosure is filled with ash and burnt wood suggesting that the enclosure functions as a modern fire pit. A second modification was noted along the southern wall, consisting of a narrow, linear terrace. This terrace is 5.1 meters long (northeast by southwest), 0.4 to 0.85 meters wide and 0.4 to 0.5 meters in height. A concentration of cow bones is present on the surface of the terrace at the west end and modern trash is scattered over the surface. The terrace appears to be recently constructed.

Haun and Henry excavated a 1.0 by 1.0 meter test unit (TU-207.4) into the cave floor, 2.0 meters east of the dripline. This excavation revealed eight soil deposits over bedrock. All eight of the soil layers contained cultural material. The upper two deposits (Layers I and II) contained mixed historic and indigenous cultural material, with the underlying layers containing only indigenous material. The testing revealed substantial stratified cultural deposits extending to nearly a meter in depth. The majority of the deposits were likely deposited by wave action based on the coarse sandy nature of the layers and the presence of waterworn inclusions; however, the Layer III deposit is comprised of a silty clay that is probably a colluvial deposit.

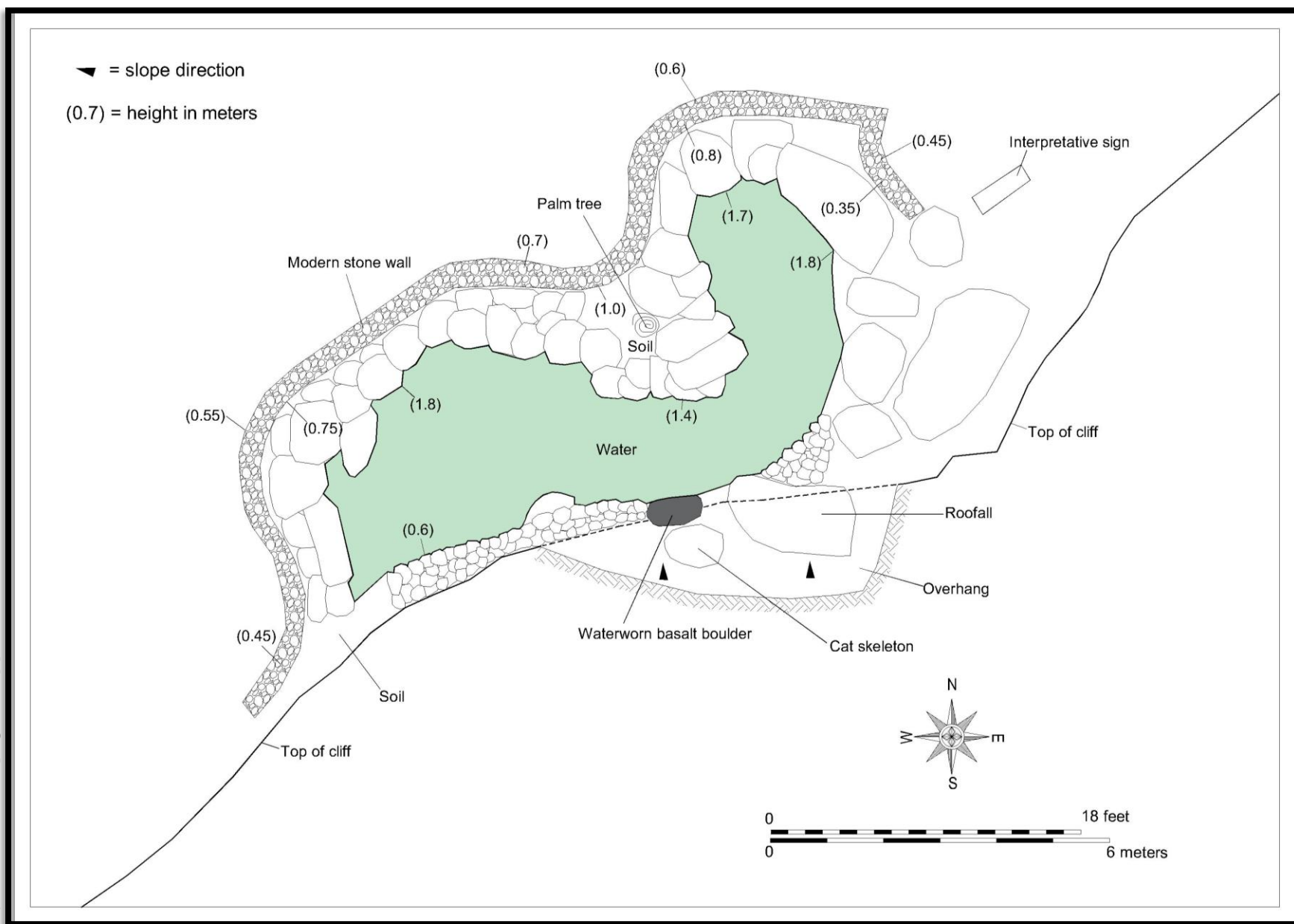


Figure 37. Plan map of Site 24263.



Figure 38. Overview of Site 24263 pond (view to southwest).



Figure 39. Overview of Site 24263 pond (view to south).

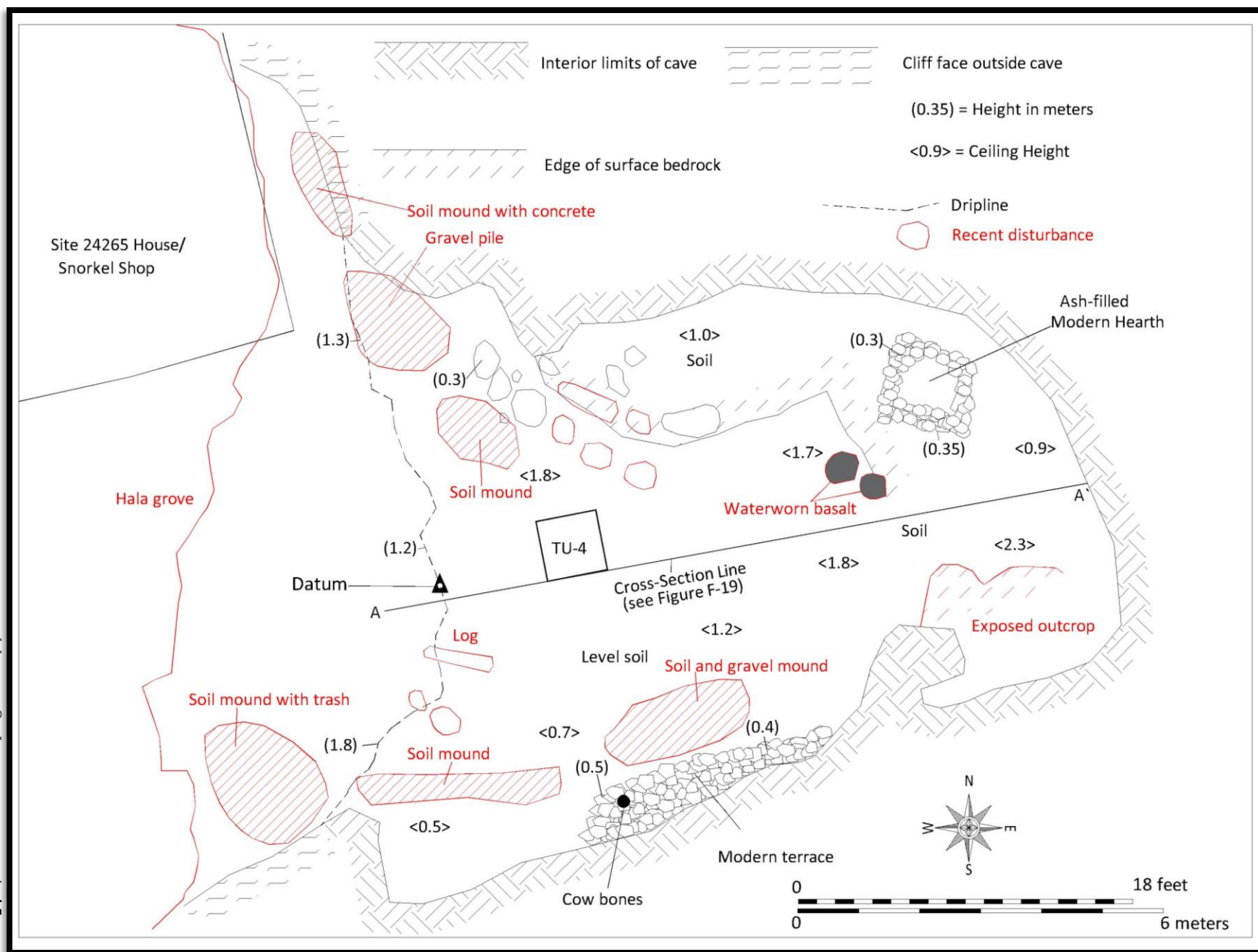


Figure 40. Site 24264 plan map (modified from Haun and Henry 2010a:56).

Site 24264 was interpreted as a recurrently utilized temporary habitation site by Haun and Henry (2010a). based on its formal type and on the presence of the stratified cultural deposits. It was altered and in good condition and was recommended for preservation.

The site was relocated during the present project. The documentation of the site indicates the cave was dismantled impacted since the Haun and Henry (2010a) AIS. The Site 24265 house and snorkel shop to the northwest of the cave has been abandoned and the areas to the west of the entrance are comprised of a *hala* grove. There are several new piles of soil and or gravel inside the cave, along with waterworn and subangular stones and a log that were not present during the previous AIS. The plan map of this site (see **Figure 40**) has been modified to depict the pile. The current condition of Site 24264 is shown on the cover of this report and in **Figure 41** and **Figure 42**.

Site 24266

Site 24266 is a low pavement located in the southern half of the Haun and Henry (2010a) survey area, situated in an area of uneven soil, outcrops and scattered stones, at the base of a slope that angles down to the west (**Figure 43**). The pavement is roughly oval in shape and is 6.5 meters long (east-west) and from 2.3 to 2.6 meters in width. The east and west sides of the structure are comprised of rough, uneven cobble pavements that range in height from 0.15 to 0.3 meters. The central portion of the site consists of a level cobble pavement that ranges in height from 0.13 to 0.24 meters above the surrounding ground surface. Cultural material noted on the surface of the site consist of seven waterworn basalt cobbles and on small waterworn basalt boulder.

Haun and Henry (2010a) excavated a 2.3 meter long by 1.0 meter wide test unit (TU-207.5) through the center of the level cobble pavement. This excavation revealed an architectural layer (Layer I), over two soil deposits. Cultural material was recovered from Layer I and II, with none present in Layer III.

Site 24266 was interpreted as the foundation for a permanent habitation structure by Haun and Henry (2010a). It was unaltered and in fair condition and was recommended for data recovery.

The site was relocated during the present project. With the exception of a back dirt pile on the surface of the structure adjacent to TU-207.5, the site has not been altered since the Haun and Henry (2010a) AIS. The plan map of this site (see **Figure 43**) has been modified to depict the pile. Current overviews of the site are presented in **Figure 44** and **Figure 45**.



Figure 41. Current condition of entrance to Site 24264 Mo'ikeha Cave (view to southeast).



Figure 42. Current condition of interior of Site 24264 Mo'ikeha Cave (view to east).

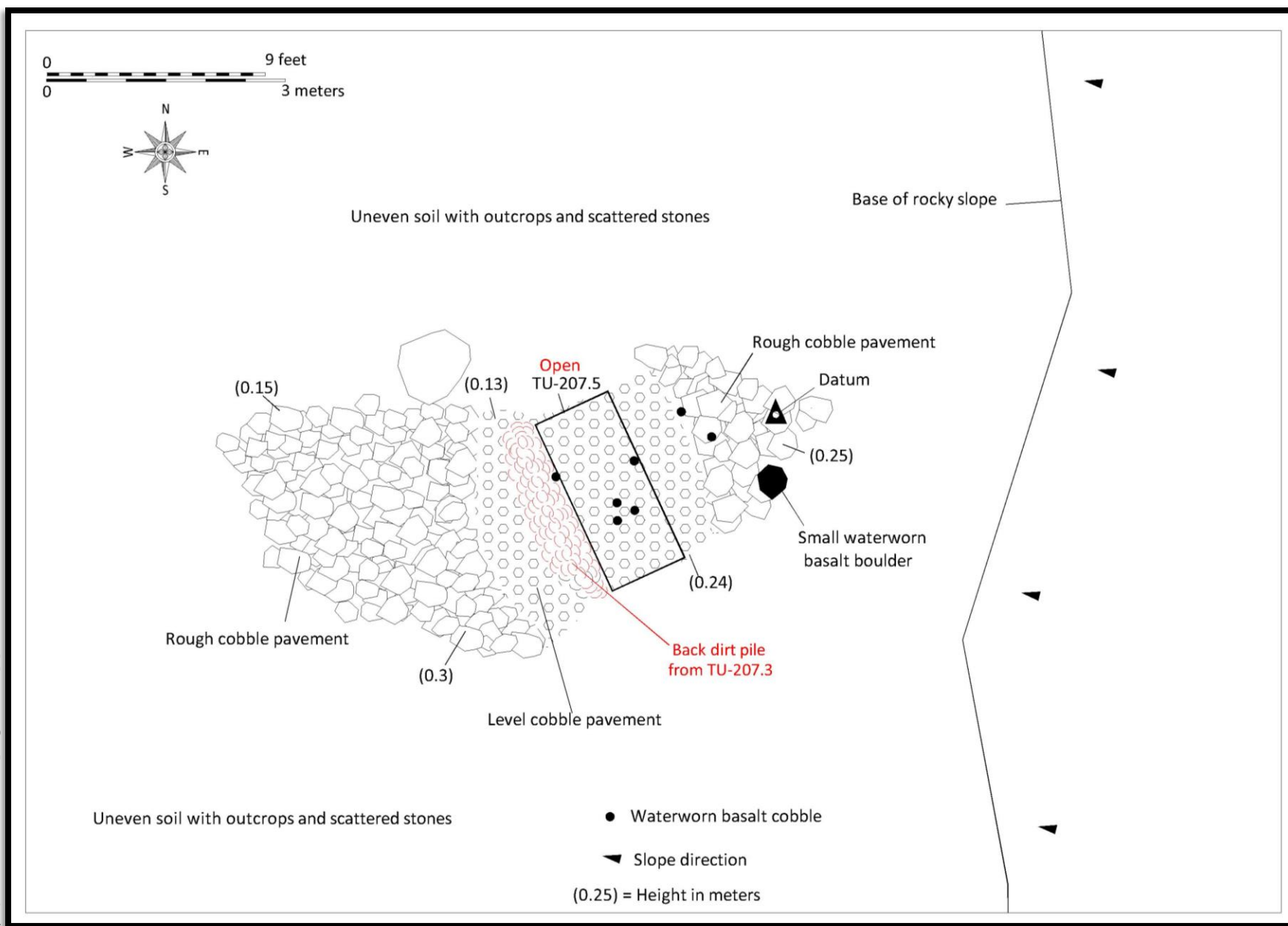


Figure 43. Site 27266 plan map (modified from Haun and Henry 2010a:67).



Figure 44. Current condition of Site 24266 (view to north).



Figure 45. Current condition of Site 24266 (view to west).

CONCLUSION

The current project resulted in the identification of three previously unidentified sites (Sites 1608.1, 1608.2 and 1608.3), the relocation of three preservation sites (Sites 4348, 24263, and 24264) and two data recovery sites (Sites 24261 and 24266) previously identified by Haun and Henry (2010a). The third data recovery site (Site 5674) was not relocated during the project. The sites in the project area parcels are assessed for significance based on Hawai'i Administrative Rules (HAR) §13-284-6. According to (HAR) §13-284-6 (b), a site must possess integrity of location, design, setting, materials, workmanship, feeling, and/or association and shall meet one or more of the following criteria:

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

Sites 1608.1 and 1608.2 are preliminarily interpreted as historic habitations with associated features, and Site 1608.3 as an historic wall likely used to restrict the movement of cattle. These sites appear to be altered and are in poor to fair condition. They are tentatively assessed as significant under Criterion "d". Following documentation these sites will likely be recommended for no further work.

Sites 4348, 24263 and 24264 were recommended for preservation by Haun and Henry (2010a:76). Site 4348 consists of the Kauikeaouli Birth Stone. The site is unaltered and in good condition and was assessed as significant under Criterion "b", "d" and "e" by Haun and Henry (*ibid.*). Site 24263 consists of the Ho'okūkū Pond. It is altered and in good condition and was assessed as significant under Criterion "c", "d" and "e". Site 24264 is the Mo'ikeha Cave. It is altered and in good condition and was assessed as significant under Criterion "d" and "e".

Sites 24261 and 24266 were recommended for data recovery by Haun and Henry (*ibid.*). These sites were interpreted as permanent habitations during the initial AIS. They are unaltered and in fair condition, and were assessed as significant under Criterion "d". As stated, Site 5674 was not relocated during the present project. This site was also interpreted as a permanent habitation by Haun and Henry (*ibid.*) and assessed as significant under Criterion "d".

Additional work required to mitigate or preserve the sites within the project area will consist of the following:

1. Clear dense vegetation in TMK: (3) 7-8-012:065 north of the boat parking area and east of the Site 1608.3 wall to determine if previously undocumented sites are present;
2. Clear vegetation at Sites 1608.1, 1608.2 and 1608.3 and at any sites identified in TMK: (3) 7-8-012:065.
3. Complete AIS level documentation for Sites 1608.1, 1608.2, and 1608.3 and for any additional sites identified during clearing. This will include preparation of scaled plan maps, site descriptions, photographic documentation, and subsurface testing if warranted. Permanent SIHP site numbers will be obtained to replace the temporary designations assigned during the Reconnaissance Survey. On completion of the AIS report, it will be submitted to SHPD for review and approval;
4. Clear dense vegetation in vicinity of Site 5674 to determine current site condition;

5. Prepare Archaeological Data Recovery Plan (ADRP) for Sites 5674, 24261 and 24266 to be submitted to SHPD for review and approval;
6. Conduct data recovery at Sites 5674, 24261 and 24266 following SHPD approval of ADRP;
7. Prepare and submit Archaeological Data Recovery Report (ADRR) to SHPD for review and approval;
8. Prepare Archaeological Site Preservation Plan (ASPP) for Sites 4348, 24263, and 24264 to be submitted to SHPD for review and approval; and
9. Implement ASPP.

Consultation was conducted with the Nā Ala Hele Hawai'i Trail and Access System and the Ala Kahakai National Historic Trail regarding the trails and roads present in the project area. These agencies provided nearly identical recommendations for the Site 15243 Keauhou Trail, the Site 24259 (Old Kailua Road or Road to Kainaliu), and the Old Government Beach Road that once through and adjacent to the seaward side of the project area.

The recommendations are as follows:

Site 15243 (Keauhou Trail)

- Verify any archaeological evidence for any trail remains, combined with historical map references. Include onsite consultation with Nā Ala Hele and the Ala Kahakai National Historic Trail staff;
- Honor the alignment of the Keauhou Trail, even if archaeological evidence has been displaced. Consider utilizing the trail corridor as a pedestrian access incorporated into the interpretive path network. Consult with Nā Ala Hele and the Ala Kahakai National Historic Trail staff on interpretive signage content; and
- As part of the re-establishment of the Old Kona Road, mark the crossing of the Keauhou Trail with inlaid natural, native stone pavers.

Site 24259 (Old Kailua Road or Road to Kainaliu)

- Verify any archaeological evidence for any remnant precursor trail that escaped the construction of the Old Kona Road, combined with historical map references. Include onsite consultation with Nā Ala Hele and the Ala Kahakai National Historic Trail staff;
- Include the re-established Old Kona Road as a public access vehicular easement; and
- Honor the alignment of the Kainaliu Trail, even if archaeological evidence has been displaced. Consider incorporating the trail alignment into the interpretive path network. Incorporate the alignment as part of the pedestrian infrastructure for "Boutique Resort". Consult with Nā Ala Hele and Ala Kahakai National Historic Trail staff on interpretive signage content.

Old Government Road (Beach Road)

- Honor the alignment of the Old Government Road by designing better continuity for pedestrian access flow, connecting Kamehameha III Road and Kaleiopapa Road. Uphold the commitments of the 2003 MOA and the resulting Cultural Trails Plan. Include onsite consultation with Nā Ala Hele and Ala Kahakai National Historic Trail staff; and
- As part of the project area trail network discussed in the EISPN and community meeting, please consider including the interpretation of the alanui aupuni (OGR)/ala loa as part of the overall interpretation of this special place.

Figure 46 is a 1937 aerial photograph of the Keauhou Bay area obtained from Nā Ala Hele that has the three trails plotted on it. This image shows the Keauhou Trail and the Old Kailua Road or Road to Kainaliu, extending inland from the coast, with the Old Government roughly paralleling the shoreline. These trails were then superimposed onto a 1954 aerial photograph of the area obtained from the University of Hawai'i at Manoa online library (<http://magis>).

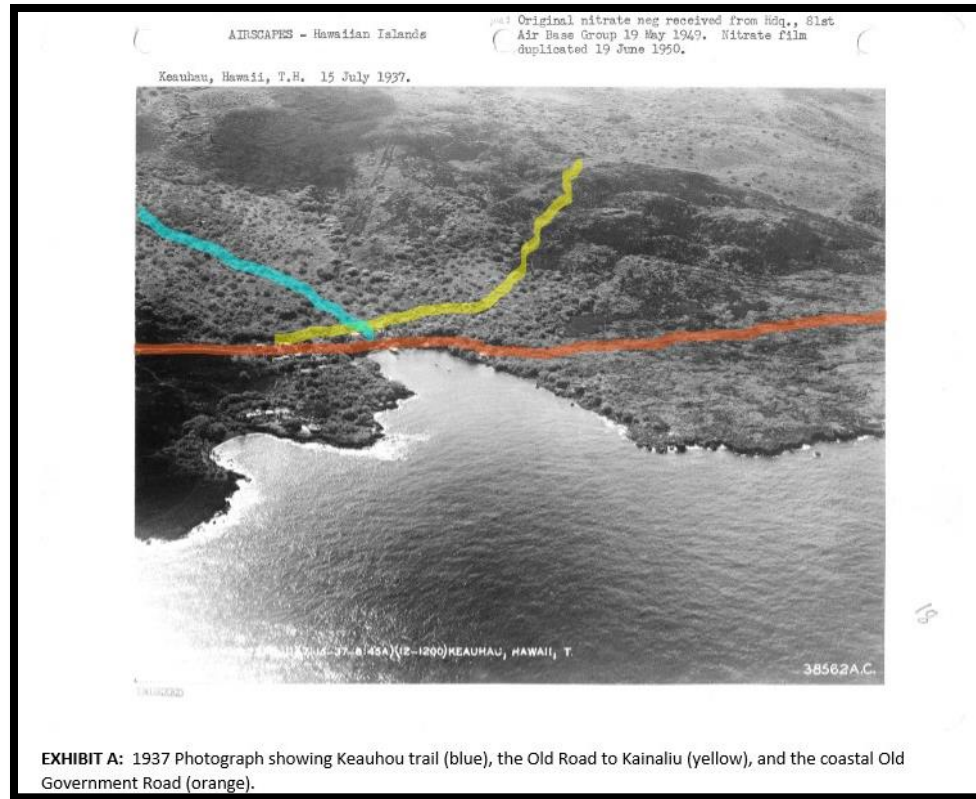


Figure 46. Project area trails on 1937 aerial view of project area vicinity (obtained from Nā Ala Hele).

manoa.hawaii.edu; see **Figure 18**), onto a proposed development map (**Figure 47**) and onto the Haun and Henry (2010a) site location map for TMK: (3) 7-8-010:044 (**Figure 17**). These overlays indicate that the Site 15243 Keauhou Trail roughly follows the path of the trail as depicted on other maps, with the Old Government Road following the current path of Kaleopapa Road in the south, Kamehameha III Road in the north, and extending slightly into the project area in the intervening areas. The Site 24259 Old Kailua Road or Road to Kainaliu however diverges inland from the path as depicted by Haun and Henry (2010a), extending southeast outside the project rather than continuing south.

Nā Ala Hele also noted the presence of the Kau Cemetery on a 1924-1925 map of Keauhou 1 (see **Figure 8**) and indicate it is in the B4 Zone of the proposed development. The seaward half of the cemetery is reportedly situated in the northeastern portion of the project area in an area impacted by bulldozer disturbance.

As discussed, 1.97-acres within TMK: 7-8-010:044 were cleared of vegetation and examined in order to determine if any portions of the Sites 15243 and 24259 trails and the Kau Cemetery remain in the project area. No sections of either trail are present, although a section of concrete possibly representing a capstone or other remnant of the cemetery was observed. It is also possible that the Site 24261 pavement, recommended for data recovery, may be associated with the cemetery. Widespread mechanical disturbance within TMK: 7-8-010:044 appears to have occurred between 1954 and 1976, indicated by aerials views of the area presented in **Figure 18** and **Figure 19**. This disturbance was also observed by Haun and Henry (2010a) during the AIS of the parcel (see **Figure 17**). These impacts potentially resulted in the destruction of the Sites 15243 and 24259 trails and the Kau Cemetery. Additional clearing with the Kau Cemetery area, along with data recovery of the Site 24261 pavement is required to determine if extant remnants of this site remain.

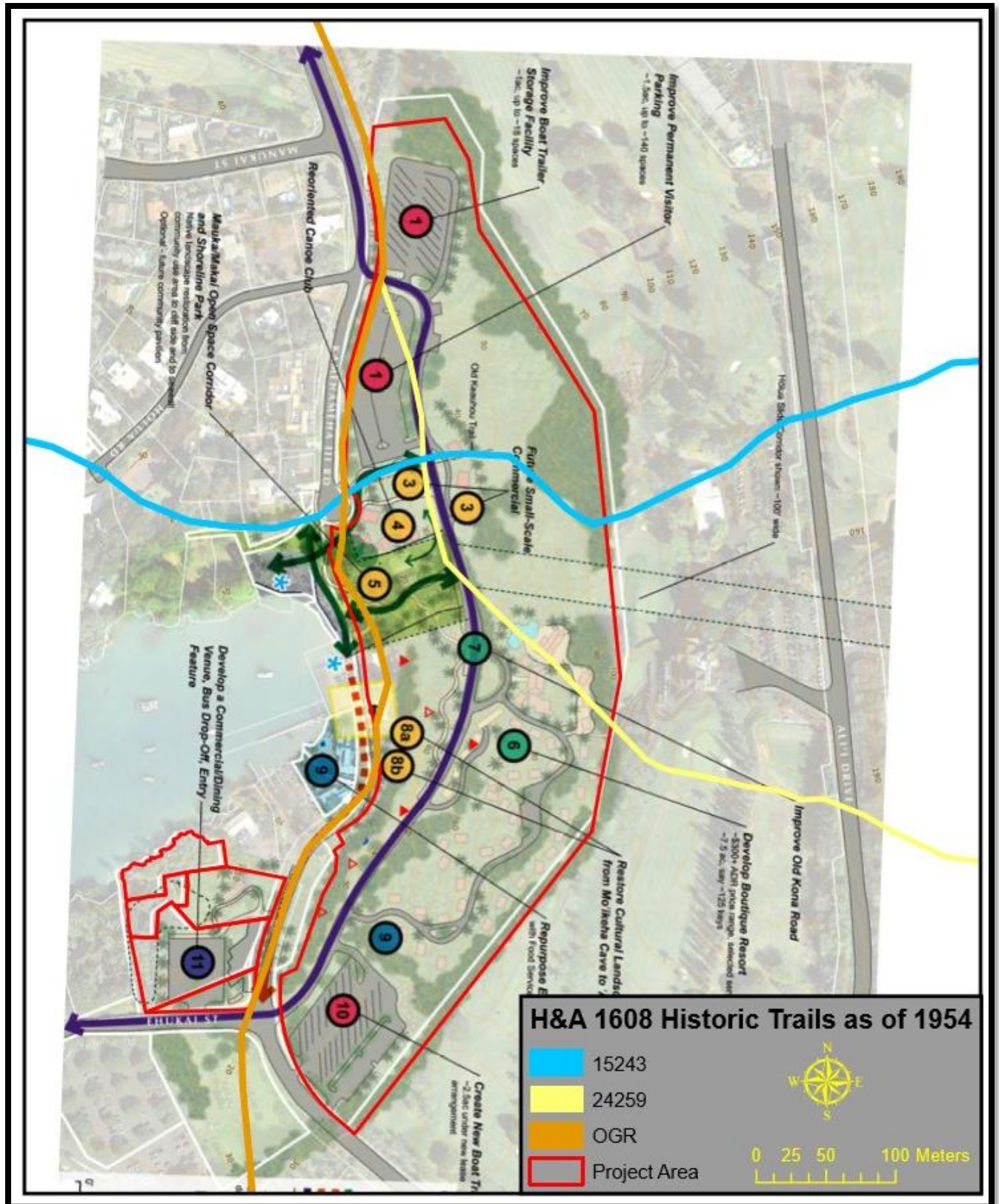


Figure 47. Project area trails on proposed development map.

TRANSLATION OF HAWAIIAN WORDS¹

ahupua'a - traditional Hawaiian land unit usually extending from the uplands to the sea

āpana - piece, slice, portion, fragment, section, segment, installment, part, land parcel, lot, district, sector, ward, precinct; chop, as of lamb. A kuleana, land division may consist of several *āpana*.

hala - pandanus or screw pine (*Pandanus odoratissimus*)

heiau - pre-Christian place of worship, shrine

hōlua - sled, especially the ancient sled used on grassy slopes; the sled course

kapu - taboo, prohibition

kāula - prophet, seer, magician

kīhāpai - small land division

konohiki - headman of an *ahupua'a* land division under the chief

kou - native tree (*Cordia subcordata*)

kuleana - small piece of property, as within an *ahupua'a*

loulou - native fan palms(*Pritchardia*)

Māhele - land division of 1848

māla - garden, plantation, patch, cultivated field

makai - towards ocean

mauka - inland

ononā - native shrub (*Touchardia latifolia*)

pu'u - hill, peak or cone

¹ - from wehewehe.org

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2017 Hawai'i Electronic Library - Nā Puke Wehewehe 'Ōlelo Hawai'i

APPENDIX A. NRHP SITE 78001018 FORM

Form No. 10-300 (Rev. 10-74)	PH0661597	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> DATA SHEET FOR NPS USE ONLY RECEIVED JAN 30 1978 DATE ENTERED JUL 24 1978 </div>
UNITED STATES DEPARTMENT OF THE INTERIOR NATIONAL PARK SERVICE		
NATIONAL REGISTER OF HISTORIC PLACES INVENTORY -- NOMINATION FORM		
SEE INSTRUCTIONS IN <i>HOW TO COMPLETE NATIONAL REGISTER FORMS</i> TYPE ALL ENTRIES -- COMPLETE APPLICABLE SECTIONS		
1 NAME		
HISTORIC	** Kamehameha III's Birthplace	
AND/OR COMMON		
Kauikaeouli Stone		
2 LOCATION		
STREET & NUMBER		
CITY, TOWN		
Keauhou		VICINITY OF 2
STATE	CODE	COUNTY
Hawaii	15	Hawaii
		CODE 001
3 CLASSIFICATION		
CATEGORY <input type="checkbox"/> DISTRICT <input type="checkbox"/> BUILDING(S) <input type="checkbox"/> STRUCTURE <input type="checkbox"/> SITE <input type="checkbox"/> OBJECT	OWNERSHIP <input type="checkbox"/> PUBLIC <input checked="" type="checkbox"/> PRIVATE <input type="checkbox"/> BOTH PUBLIC ACQUISITION <input type="checkbox"/> IN PROCESS <input type="checkbox"/> BEING CONSIDERED	STATUS <input type="checkbox"/> OCCUPIED <input type="checkbox"/> UNOCCUPIED <input type="checkbox"/> WORK IN PROGRESS ACCESSIBLE <input type="checkbox"/> YES: RESTRICTED <input checked="" type="checkbox"/> YES: UNRESTRICTED <input type="checkbox"/> NO
PRESENT USE <input type="checkbox"/> AGRICULTURE <input type="checkbox"/> COMMERCIAL <input type="checkbox"/> EDUCATIONAL <input type="checkbox"/> ENTERTAINMENT <input type="checkbox"/> GOVERNMENT <input type="checkbox"/> INDUSTRIAL <input type="checkbox"/> MILITARY		
<input type="checkbox"/> MUSEUM <input checked="" type="checkbox"/> PARK <input type="checkbox"/> PRIVATE RESIDENCE <input type="checkbox"/> RELIGIOUS <input type="checkbox"/> SCIENTIFIC <input type="checkbox"/> TRANSPORTATION <input type="checkbox"/> OTHER		
4 OWNER OF PROPERTY		
NAME		
Daughters of Hawaii		
STREET & NUMBER		
2913 Pali Highway		
CITY, TOWN		
Honolulu		VICINITY OF
		STATE Hawaii 96817
5 LOCATION OF LEGAL DESCRIPTION		
COURTHOUSE, REGISTRY OF DEEDS, ETC.		
Hawaii Bureau of Conveyances		
STREET & NUMBER		
403 South Queen Street		
CITY, TOWN		
Honolulu		STATE Hawaii 96809
6 REPRESENTATION IN EXISTING SURVEYS		
TITLE		
State Historic Preservation Office Site #10-37-4383		
DATE		
1973		FEDERAL <input checked="" type="checkbox"/> STATE <input type="checkbox"/> COUNTY <input type="checkbox"/> LOCAL <input type="checkbox"/>
DEPOSITORY FOR SURVEY RECORDS		
State Office of Historic Preservation		
CITY, TOWN		
Honolulu		STATE Hawaii

7 DESCRIPTION

CONDITION		CHECK ONE	CHECK ONE
<input type="checkbox"/> EXCELLENT	<input type="checkbox"/> DETERIORATED	<input checked="" type="checkbox"/> UNALTERED	<input checked="" type="checkbox"/> ORIGINAL SITE
<input type="checkbox"/> GOOD	<input checked="" type="checkbox"/> RUINS	<input type="checkbox"/> ALTERED	<input type="checkbox"/> MOVED DATE _____
<input type="checkbox"/> FAIR	<input type="checkbox"/> UNEXPOSED		

 DESCRIBE THE PRESENT AND ORIGINAL (IF KNOWN) PHYSICAL APPEARANCE

Originally a pili (grass) house stood in the near vicinity of the Kauikeaouli stone. This house was where the birth actually occurred. No remains of the house or house foundations are visible today.

The Kauikeaouli Stone is a rounded, dark, volcanic boulder protruding about 24 inches from the ground at its highest point, and about 4 inches at its lowest point. It is about 18 inches across and was originally somewhat saucer-shaped. It is presently capped with a bronze tablet set in a cement base. The tablet bears the inscription: "Kauikeaouli Kamehameha III Son of Kamehameha I and Keopulani. Born March 17, 1814 Died December 15, 1854. Ka Moi Lokomaikai"

The stone is situated on a .035 acre parcel of land bounded by a low lava stone and mortar wall on the ocean or makai side and a cliff on the mountain or mauka side. The stone and surrounding land are maintained in good condition by its owner the Daughters of Hawaii.

Appendix J

Historic Architecture Reconnaissance Level Survey

Project Name: Keauhou Bay Hind house (Sea Quest Hawai'i) and Machado House (Fair Wind Cruises)

Prepared: January 2023

Ms. Mayu Tamayori on behalf of G70 conducted this Architectural Reconnaissance Level Survey (RLS). Ms. Tamayori is qualified as an Architectural Historian per the Secretary of the Interior Professional Qualifications Standards.

Statement of Project Objectives

This project is under a state historic preservation review per HRS 6E-42. An RLS was conducted per the State Historic Preservation Division's requirement as part of an application of the renovation permit application for the buildings.

Methodology

Historical research was conducted via a review of archival resources, public repositories, and other primary sources such as past studies, published books and other professional publications, and a succinct review of articles from professionally trustworthy online sources. Additionally, a site visit was completed on August 18, 2022, to verify: 1) the current condition of the building, 2) if original features that lend to the building's historical integrity still exist, and 3) how the building has changed over time from the original design.

Historic Context

By the early 20th century, the Kona uplands were becoming rapidly developed for agricultural and ranching purposes. At Keauhou Bay, infrastructure was built to support these activities including stacked rock corrals, water troughs, a pump house, gates, and wharf to operate inter-island cattle shipping. The landscape of the area was also improved with the planting of monkeypod and Kiawe trees to provide shade as well as grasses to support the cattle. Thomas C. White, who was a rancher and businessman, was one of the ranchers who shipped cattle out from the bay. He leased the land along the bayfront as well as the uplands of Keauhou and Kahalu'u where he operated a cattle ranch.

A circa 1900 photo of the bay shows his house where he and his wife Elizabeth hosted many celebrations. One of the notable ones is a ceremony to unveil a stone tablet commemorating the centennial of King Kamehameha III's birth on August 15, 1914. Queen Lili'uokalani and other noted Hawaiians attended the ceremony and breakfast was served at the White residence.

On April 1, 1946, a tsunami struck the coast of Keauhou Bay, destroying multiple homes and a pier. The Thomas C. White house was among the homes destroyed. Following the tsunami, Charles Machado obtained leases from Bishop Estates to redevelop areas damaged at Keauhou Bay. It is unknown when precisely that Thomas White ended the lease of the land, however a 1924 survey map shows that Mr. White had constructed and reconfigured the stone walls near the base of the 'Ahu'ula Cliff mauka of his residence. During an interview in 2004 with Mr. White's nephew, Billy Paris, he mentioned that after his uncle gave up the lease in Keauhou and Kahalu'u, his grandfather Robert Hind began leasing the land at Keauhou.¹ The

¹ Hawaii Cattlemen's Association, Paniolo Hall of Fame with Billy Paris by La'i Mitchell, August of 2004.

dates were not specified during the interview, but this conveyance might have happened during the 1930s to 1940s when Charles Machado also began to lease land at Keauhou Bay.

Charles Machado was born in Kona, Hawai'i in 1916 and began his career as a police officer for the Kona Police during World War II. He was the manager of the Machado Coffee Farms and Machado Stores in Captain Cook and Nāpō'opo'o and later started the Kona Marine Railway. He also established the Captain Cook Cruise tours and the Leilani Pearl Harbor Cruise. He was active with marine sports and was a past member of the Kona Rotary Club, the Waikīkī Rotary Club, and the Hōnaunau Canoe Club. In addition, he was a member of the canoe team that won eight gold medals in the 1936 Territorial races held at Honolulu Harbor. He passed on August 8th, 1994, at age of 78.

The first group of projects Charles Machado worked on as part of the bay's reconstruction was to build a dry dock and wooden pier to serve his small fleet of fishing boats and recreational boats between 1950 and 1954. Moorings for his vessels were also developed in the bay in the 1950s and 1960s in a rather disorderly fashion using discarded metal objects as anchors. His fleet included twelve boats in total, nine of which were moored in the bay. After the completion of this first group of projects, he next began construction of a house for his family in 1956, which is currently being used as an office for Sea Quest Hawai'i. This house has often been referred to as the Hind House. The "Hind" name might come from Robert Hind since he was leasing the land prior to Charles Machado.

Charles Machado built another house, referred to as the Machado House, in 1960 or 1961 which is currently used as an office and retail space for the Fair Wind Cruises charter boat tour company.² It is unknown when Charles Machado ended the lease of the land from the Bishop Estates, but most likely these two house's ownerships transferred to the Bishop Estate when the lease ended. He also leased the land where the existing Keauhou Cone Club is located. The Cone Club moved its current location about forty years ago, therefore it is presumed that the lease was ended in the late 1960s to early 70s.³

Resort development around the Keauhou Bay area began in the 1960s. To support the growth of this area, Charles Machado's wooden pier was upgraded in 1973 or 1974. A concrete boat ramp was constructed in the early 1980s shortly after the Hawai'i Department of Transportation assumed authority of the harbor facilities in 1978. In 1992 the harbor facilities were transferred to the Department of Land and Natural Resources, Division of Ocean Recreation and Boating .

It is unknown when Machado's two houses began to be used for commercial office/retail spaces. After the 2011 tsunami struck the area, both houses underwent extensive renovations to repair the damages inflicted. The Hind house completed a major renovation of both exterior and interior spaces which included the provision of a new floor plan for dining, serving lanai,

² Hawaii county's real property record shows the first house was built in 1952 and second house was in 1961. The 1956 and 1960/1961 date was referred from the interview with Charles Machado's son Lionel Machado on Department of Land and Natural Resources, *Draft Environmental Assessment Keauhou Bay Offshore Moorings*, 51.

³ Group 70 International, Inc. Cultural Impact Assessment for Kamehameha Schools' Keauhou Bay, page 102.

kitchen, bathrooms, and storage in 2013. In addition to these repairs, the Machado house also added a new ramp and sidewalk to meet Americans with Disabilities Act (ADA) requirements.

Site Location

The Hind house (Sea Quest Hawai'i) is located at TMK (3) 7-8-012:013, with a 10,005 S.F. lot and the Machado house (Fair Wind Cruises) is located at TMK (3) 7-8-012:014, with a 14,354 S.F. lot. Both buildings are located along the Keauhou Bay and are owned by Kamehameha Investment Corporation.

Description of the Structures

Hind House (Sea Quest Hawai'i)

The Hind House is a single story, new 2x4 wood studs framed structure with new wood sidings and has a covered lanai and open pavilion. The current L shaped footprint measures about 57' long x 22' wide on the north side and 43' wide on the south side. Originally it was built as a single wall construction with lava rock pony wall and canec ceiling but was renovated to the double wall construction with gypsum board ceiling when the structure went through the renovation and repair works after the 2011 tsunami. The original footprint was a rectangular structure with open lanai approximately 51' long x 32' wide. The structure sits on a concrete slab foundation and has a corrugated metal gable roof. Most of the original features such as the windows have been replaced and newly installed with vinyl or wood framed windows, and doors are also replaced and newly installed with wood sliding doors or metal roll up doors. The interior of the building has a retail space, one women and men bathrooms, storages, and a commercial kitchen.

The north front elevation has the following:

- A new detached concrete paved open pavilion with wood posts and corrugated metal gable roof.
- A new ADA concrete ramp leading to the original lanai area on the south end of the covered lanai.
- The original concrete covered lanai is 6" higher from the open pavilion area, which has the original lava rock pony wall with round ohia wood posts for roof. The lava rock pony wall is 16" wide x 22" high with a concrete cap. On top of the ohia wood posts, square wood posts were placed to meet the new roof height. The lanai runs the entire original front elevation length and is approximately 51' long x 7' wide.
- North end retail space has two roll up doors. 8' wide x 8' high concrete lava rock veneer wall sits next to the roll up door. A new metal swing door was installed approximately 5' away from the wall.
- South end new addition wall has a vinyl sliding window.

The east elevation (short width side) has the following:

- The 3'- 6" wide opening between the structure and original lava rock pony wall which leads to the lanai.
- The structure has an original lava rock pony wall and the new 2x4 wood studs double wall, with three new vinyl single hung windows.

The south rear elevation has the following:

- The original lava rock pony wall continues from the east elevation and ends at the 51' point. From there, a new addition of the double wood wall was added for approximately 6'.
- From the east end, the exterior wall has three new vinyl single hung windows and two new vinyl windows.
- At the west end, a new flat roof storage area was added.

The west elevation (long width side) has the following:

- New 2x4 wood studs framed with new wood sidings exterior wall.
- From the south end, the exterior wall has a new vinyl sliding window and new metal roll up door.

Machado House (Fair Wind Cruises)

The Machado house is located on a slightly higher site than the rest of the area of the bay and has lava rock retaining walls surrounding the site. It is a single story, new wood studs framed structure with new wood sidings, and has a covered lanai. The rectangular shaped footprint measures about 87' long x 20' wide. The original single wall is partially left at the south end and the rest were replaced with the double walls. The structure sits on a concrete masonry unit foundation with combination/intersecting corrugated metal roof. Most of the original features such as the windows and doors have been replaced or newly installed. The interior of the building has a retail space, two bathrooms, storages, two offices, and a commercial kitchen. At the center of the structure, where the retail space is has four original, 2'-9" wide x 6'-9" high lava rock pony walls. The retail area has an open ceiling with exposed roof rafters. The south office space where the partial single wall is, has an original wood panel ceiling.

The east front elevation has the following:

- Concrete covered lanai which measures approximately 36' long x 9'-5" wide with wood posts to support the new roof. And a concrete step which runs the entire length of the lanai leading to the retail space.
- The new ADA concrete ramp leading to the covered lanai is located at the south end of the elevation.
- From the center retail space to the north end storage space, there is an open covered corridor. The wood stairs with wood railings leading to the entry of the storage are located at the south end of the corridor.
- The center retail space has three new vinyl sliding doors. Two new two fixed windows and new two jalousie windows are at the intersecting roof end.
- South end office space has two new vinyl sliding windows.

The north elevation has the following:

- Two new vinyl single hung windows and new wood screen at the gable roof end.

The east rear elevation has the following:

- The rear elevation area is enclosed with a new wooden fence.

- It has two new wood structure additions. One is a storage area with corrugated shed roof on the south side of the elevation which is detached from the main structure. And another is attached to the main structure with a commercial kitchen and storage spaces, which is located slightly north from the center of the main structure with a combination roof.
- From the north end storage space to the new commercial kitchen space, there is a concrete open covered corridor with concrete steps. The north end storage has a new wood door.
- The bathroom is located next to the north end storage space and has a new wood door. Another storage space is located next to the bathroom and has a new wood door.
- Two new circle casement windows are located at the center of the exterior wall, between the shed roof addition and the commercial kitchen addition.
- The south end office has a new wood door and wood stairs that leads to the space. Its exterior wall has two new vinyl sliding windows.

The south elevation has the following:

- One new vinyl sliding window at the west side and window opening which has a window unit at the east side of the exterior wall.
- One third of the east wall is an original single wall.

Evaluation of Significance

Both Sea Quest Hawaii Building and Fair Wind Cruises Building were evaluated against the Hawai'i Administrative Rules (HAR) Sec. 13-275-6 Evaluation of Significance.

Under Criterion (1)a, both buildings are eligible for its association with development of the Keauhou Bay area history and development. However, much of the area has been altered historically with very few remnants of other contributing elements still remaining.

Under Criterion (1)b, both buildings do not have direct association with an important historic person. Although both buildings are built by Charles Machado, it does not appear that that his role and contributions to broad patterns of history of Keauhou go beyond the provided information.

Under Criterion (1)c, neither buildings are eligible since they both went through several renovations and do not have many original features.

Under Criterion (1)d, both buildings are not considered likely to yield information important for research on prehistory or history.

Under Criterion (1)e, both buildings do not 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.

Seven Aspects of Integrity

Hind House (Sea Quest Hawai'i)

☒Location ☐Design ☐Setting ☐Materials ☐Workmanship ☐Feeling ☐Association

The building is located at the original site.

Machado House (Fair Wind Cruises)

☒Location ☐Design ☐Setting ☐Materials ☐Workmanship ☐Feeling ☐Association

The building is located at the original site.

Bibliography

Newspaper

1. Machado, Charles "Charley" Pihanaokalani Sr. Obituary. September 9, 1994. Honolulu Advertiser.

Report

1. Department of Land and Natural Resources, Division of Boating and Ocean Recreation. Draft Environmental Assessment Keauhou Bay Offshore Moorings. February 2016.
2. Group 70 International, Inc. Cultural Impact Assessment for Kamehameha Schools' Keauhou Bay Management Plan. April 2022.
3. Hawaii Cattlemen's Association, Paniolo Hall of Fame with Billy Paris by La'i Mitchell, August of 2004.
4. Kumu Pono Associates LLC. Appendix A– Oral History Interviews: ' Ina Lei Ali'I – Keauhou A Me Kahalu'U Ma Kona, Hawai'i A Cultural Synthesis For The Royal Lands of Keauhou And Kahalu'U, District Of Kona, Island Of Hawai'i (Tmk Overview Sheet 7-8-10). April 2004.

Public Record

1. County of Hawaii Real Property Tax Office. Parcel No. (3) 7-8-012:013.
2. County of Hawaii Real Property Tax Office. Parcel No. (3) 7-8-012:014.

Photos

Sea Quest Hawaii Building



1. North Elevation



2. East Elevation



3. South Elevation



4. West Elevation



5. Covered Lanai with Original Lava Rock Pony Wall And Ohia Tree Wood Posts



6. Newly Renovated Retail Space

Fair Wind Cruises Building



7. East Elevation



8. North Elevation



9. East Elevation



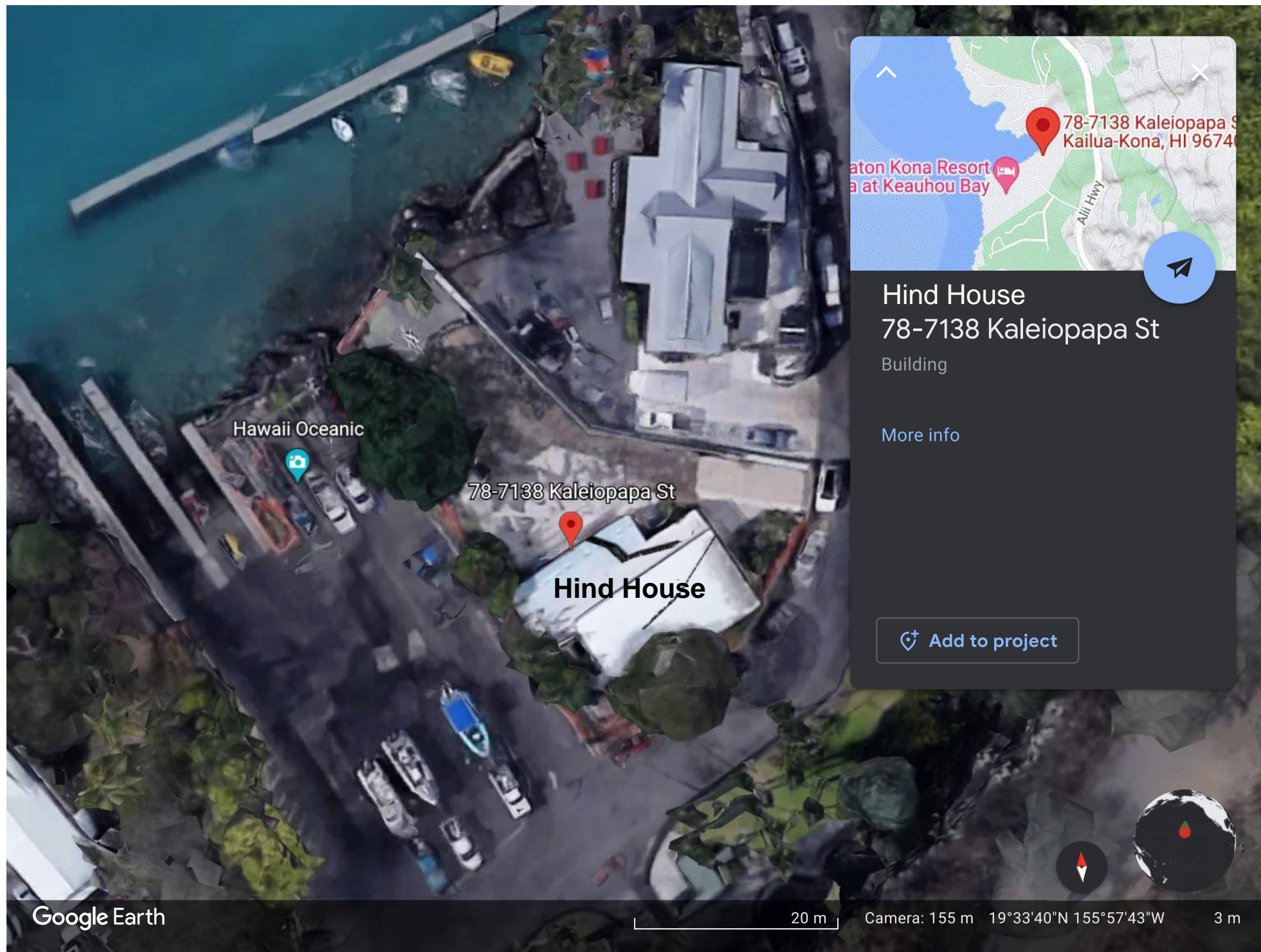
10. South Elevation



11. Original Interior Lava Rock Pony Wall



12. Original Interior Single Wall Office Space





Machado House
78-7130 Kaleiopapa St

[More info](#)

[Add to project](#)

Google Earth

30 m

Camera: 186 m 19°33'40"N 155°57'43"W

4 m

Appendix K

Biological Assessment

**A natural resources assessment
for selected Kamehameha Schools parcels
at Keauhou Bay on the Island of Hawai'i**



AECOS Inc.
45-939 Kamehameha Highway
Suite 104
Kāne'ohe, Hawai'i 96744

May 20, 2021

A natural resources assessment for selected Kamehameha Schools parcels at Keauhou Bay on the Island of Hawai‘i

May 20, 2021

AECOS No. 1681

Eric B. Guinther, Reginald E. David, and David Miranda

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Introduction

Kamehameha Schools (KS) is the major landowner at Keauhou Bay, located in North Kona District 5.8 mi (9.3 km) south of Kailua-Kona (Figure 1). Well-known for its rich cultural resources, ocean recreational activities, and resort-quality environment, the Bay is heavily used by visitors and community groups, resulting in congestion and conflict of uses. Kamehameha Schools has developed a management plan (Keauhou Bay Management Plan) to provide near- (10-year) and long-term (20-year) management and land use recommendations consistent with KS Strategic Plan 2020-Kūhanauna and the draft West-Hawai‘i Regional Action Plan, while also responding to community issues within KS *kuleana* (KS, 2018).

AECOS Inc. was contracted to conduct terrestrial natural resources surveys of selected parcels (TMKs: 7-8-010: 044 and 100; 7-8-012:004, 007, 013, 014, 049, 061, 065, 098, 101, and 103) around Keauhou Bay as part of KS due diligence for entitlements and management considerations for future development on the subject parcels. This report presents the results of surveys undertaken by AECOS biologists¹.

Site Description

The KS parcels around Keauhou Bay surveyed for this report are shown in Figure 2. The largest parcel, TMK: 7-8-010:044, is the least developed, having a

¹ This report is intended to become part of the public record and incorporated into an EA for the subject project.

boat yard parking near the north end off Kamehameha III Road, some structures in the middle near the harbor area, and partly bisected north to south by an abandoned unimproved road. A cluster of six parcels along the south shore of the Bay are mostly unoccupied but show concrete foundations and pads of former dwellings. Two parcels in the harbor area are fully occupied by active businesses. The three parcels at the north side of the harbor off Kamehameha III Road are developed as a roadway and a park, but parcel TMK: 7-8-012:027 is mostly submerged land at the back end of the Bay.

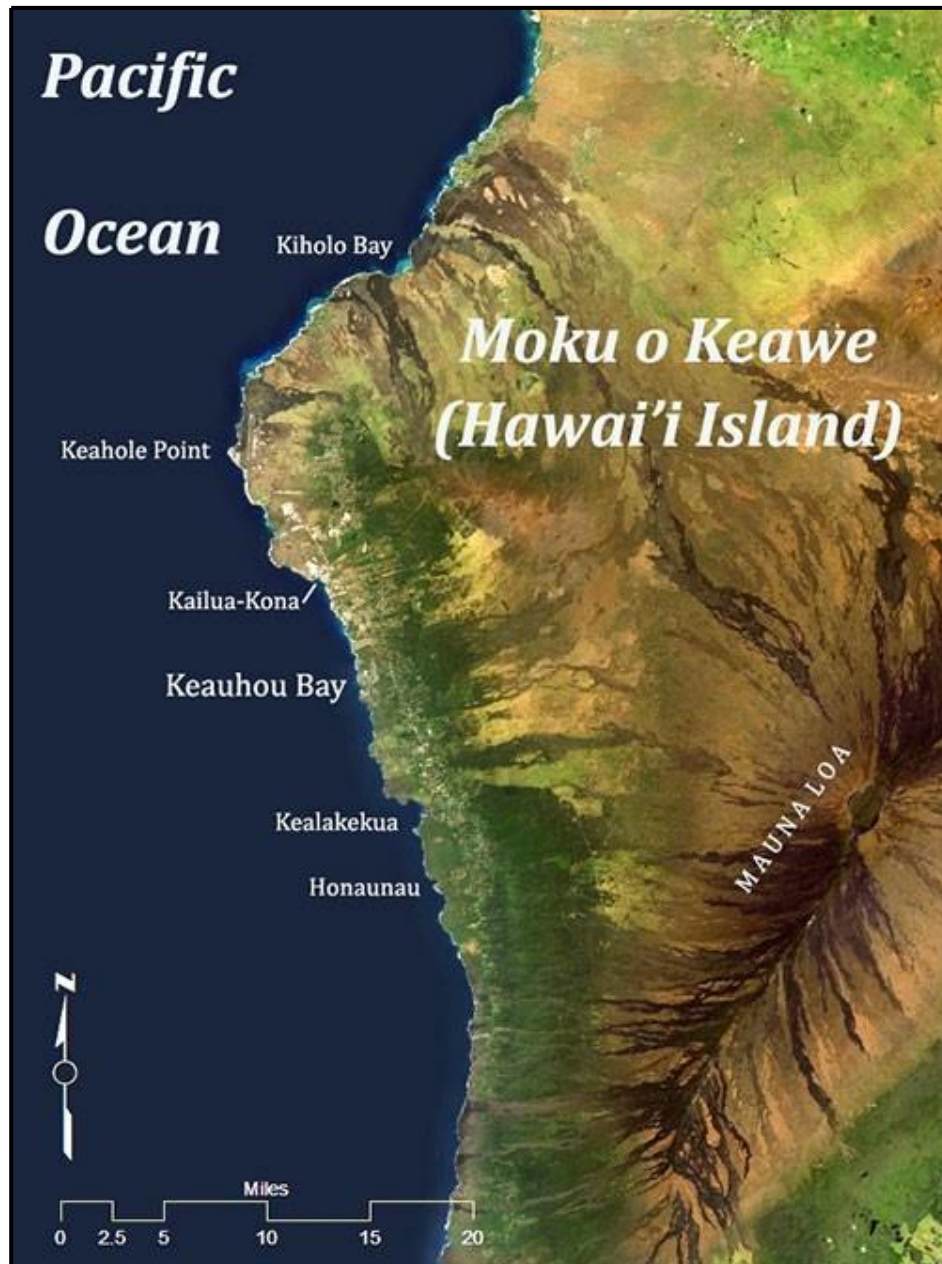


Figure 1. Location of Keauhou Bay on the west coast of the Island of Hawai'i.

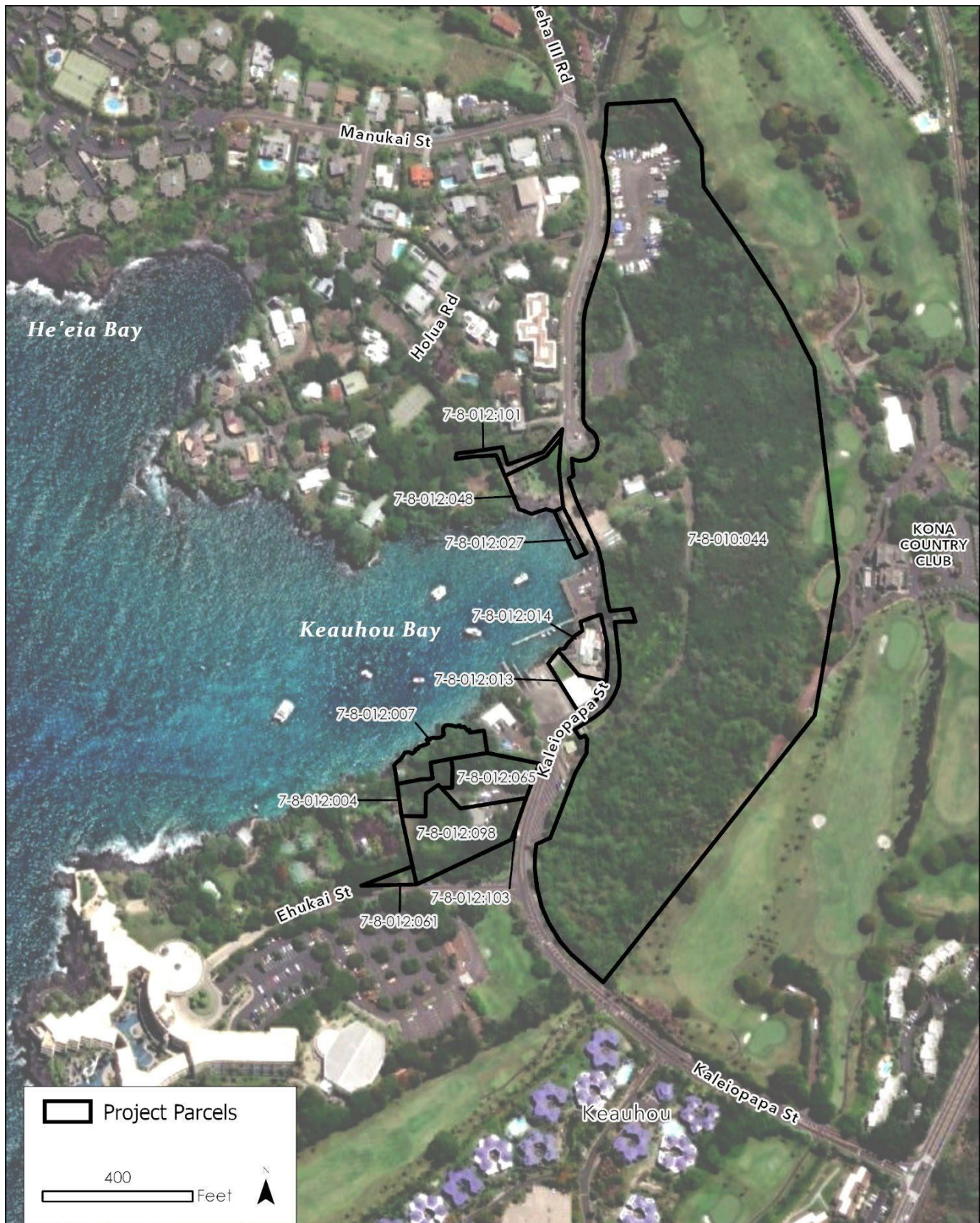


Figure 2. Kamehameha Schools parcels at Keauhou Bay, Island of Hawai'i.

Methods

Botanical Survey

AECOS botanists Eric Guinther and David Miranda surveyed the Project site on October 27, 2021. Plant species were identified as they were encountered during wandering transects that covered 11 of the subject parcels². Species names follow *Manual of the Flowering Plants of Hawai'i* (Wagner, Herbst, & Sohmer, 1990; Wagner & Herbst, 1999) for native and naturalized flowering plants *Hawai'i's Ferns and Fern Allies* (Palmer, 2003) for ferns, and *A Tropical Garden Flora* (Staples & Herbst, 2005) for ornamental plants. More recent name changes for naturalized plant species follow Imada (2019).

Terrestrial Vertebrates Survey

Avian Survey

A bird survey was conducted by Reginald David in the morning hours of October 27, 2021. Birds were identified to species by audio and visual observation aided by Leica 8 X 42 binoculars, and by listening for vocalizations. Avian species abundance was estimated at 8 count-stations distributed more or less evenly across the project area. A single eight-minute avian point-count was made at each of the count-stations. Weather conditions were ideal, with unlimited visibility, no precipitation, and winds between 1 and 5 kilometers per hour. The avian phylogenetic order and nomenclature used in this report follows the AOU Check-List of North and Middle American Birds 2020 and the Sixty second Supplement to the Check-list of North American Birds (Chesser et al., 2020, 2021).

Mammalian Survey

A list was made of mammals encountered during the survey. Indicators of mammalian presence, such as tracks, scat, and other sign were noted. Mammalian phylogenetic order and nomenclature follow *Mammal Species of the World* (Wilson and Reeder, 2005). Hawaiian names are given for native species.

² One parcel, TMK: 7-8-012:061, could not be accessed as it was inside a walled compound surrounding a private residence. Parcel TMK: 7-8-012:027 appears to be mostly submerged land.

Results

Vegetation

A majority of the survey area, as represented by parcel TMK: 7-8-010: 044, is forested, with an understory of mostly grasses. Parcels on the south side of the Bay are similarly in forest, but this area shows much evidence of former structures (concrete pads and walkways). Parcels abutting the southeast shore are developed into commercial use areas and landscaping. Parcels abutting the inner north side off the Bay are developed as a park (see cover photo). TMK: 7-8-012:027 is absent vegetation.

Flora

A listing of plants recorded during the October 2021 survey is presented as Table 1 and shows 112 species observed by the survey as occurring on the Project properties. Of these, 7 are native (all indigenous; no endemics) and 6 are early Polynesian introductions. The native species are: two sedges (*Cyperus polystachyos* and *Fimbristylus cymosa*), *hala* (*Pandanus tectorius*), *naupaka kahakai* (*Scaevola sericea*), *hau* (*Hibiscus tiliaceus*), *‘uhaloa* (*Waltheria indica*), and *‘ilie’e* (*Plumbago zeylanica*). All are common species in Hawai‘i. The early Polynesian introductions are: *niu* (*Cocos nucifera*), *ki* (*Cordyline fruticosa*), *kou* (*Cordia subcordata*), *milo* (*Thespesia populnea*), *‘ihi‘ai* (*Oxalis corniculata*), and *noni* (*Morinda citrifolia*). These species are as well very common throughout the islands.

Table 1. Plant species observed at the Project site.

Species listed by family	Common name	Status	Abundance	Notes
FERNS AND FERN ALLIES				
NEPHROLEPIDACEAE				
<i>Nephrolepis multiflora</i> (Roxb.) F.M. Jarrett ex C.V. Morton	swordfern	Nat	U	
POLYPODIACEAE				
<i>Phymatosorus grossus</i> (Langsd. & Fisch.) Brownlie.	<i>laua‘e</i>	Nat	R	
PTERIDACEAE				
<i>Pityrogramma calomelanos</i> (L.) Link	silver fern	Nat	R	
<i>Pteris vitata</i> L.	ladder fern	Nat	R	<1>

Table 1 (Continued).

Species listed by family	Common name	Status	Abundance	Notes
FLOWERING PLANTS				
MONOCOTS				
ALOEACEAE				
<i>Aloë vera</i> (L.) N.L. Burman	aloe vera	Orn	R	
ARACEAE				
<i>Epipremnum pinnatum</i> (L.) Engler	pothos	Nat	Ua	
<i>Xanthosoma</i> sp.	---	Nat	R	<1>
ARECACEAE				
<i>Cocos nucifera</i> L.	niu, coconut palm	Pol	U	
<i>Dypsis lutescens</i> (H. Wendl.) Beentje & J. Dransfield	areca palm	Orn	R	
<i>Livistona chinensis</i> (Jacq.) R. Br. ex Mart.	Chinese fan palm	Nat	R	<2>
<i>Pitchardia thurstonii</i> F. Mueller & Drude	---	Orn	Uo	
ASPARAGACEAE				
<i>Cordyline fruticosa</i> (L.) A. Chev.	ki, ti	Pol	R	<1,2>
<i>Dracaena sanderiana</i> M.T. Masters	sanderiana	Orn	R	
<i>Sansevieria trifasciata</i> Prain	bowstring-hemp	Orn	R	
<i>Xanthosoma</i> sp.	---	Orn	R	<3>
BROMELIACEAE				
<i>Billbergia pyramidalis</i> (Sims) Lindley	summer-torch	Orn	R	
Indet.	---	Orn	R	<2>
COMMELINACEAE				
<i>Commelina benghalensis</i> L.	hairy honohono	Nat	Uc	
CYPERACEAE				
<i>Cyperus polystachyos</i> Rottb.	---	Ind	U	
<i>Cyperus rotundus</i> L.	nut grass	Nat	Uc	
<i>Fimbristylus cymosa</i> <i>spathaceae</i> (Roth) T. Koyama	---	Ind	Uo	
<i>Kylinga brevifolia</i> Rottb.	kili'o'opu	Nat	R	
<i>Kylinga mindorensis</i> Steud.	kili'o'opu	Nat	Uo	
HELICONIACEAE				
<i>Heliconia</i> sp.	---	Orn	R	
<i>Heliconia rostrata</i> Ruiz & Pavón	parrot's-beak heliconia	Orn	R	
LILIACEAE				
<i>Crinum asiaticum</i> L.	giant lily	Nat	R	

Table 1 (Continued).

Species listed by family	Common name	Status	Abundance	Notes
PANDANACEAE				
<i>Pandanus tectorius</i> S. Parkinson ex Z.	<i>hala</i>	Ind	U	
POACEAE				
<i>Chloris barbata</i> (L.) Sw.	swollen fingergrass	Nat	O	<2>
<i>Chloris divaricata</i> R. Br.	stargrass	Nat	R	
<i>Cynodon dactylon</i> (L.) Pers.	Bermuda grass	Nat	U	<2>
<i>Eleusine indica</i> (L.) Gaertn.	wiregrass	Nat	U	
<i>Eragrostis amabilis</i> (L.) Wight & Arnott	Japanese lovegrass	Nat	Oc	
<i>Eragrostis pectinacea</i> (Michx.) Nees	Carolina lovegrass	Nat	Uo	
<i>Megathyrsus maximus</i> (Jacq.) B.K. Simon & W.L. Jacobs	Guinea grass	Nat	AA	<2>
<i>Melinis repens</i> (Willd.) Zizka	Natal redtop	Nat	C	<2>
<i>Sporobolus</i> sp.	rattail grass	Nat	O	
ZINGIBERACEAE				
<i>Alpinia purpurata</i> (Vieil.) K. Schum.	red ginger	Orn	R	
FLOWERING PLANTS				
EUDICOTS				
ACANTHACEAE				
<i>Asystasia gangetica</i> (L.) T. Anderson	Chinese violet	Nat	A	<2>
<i>Barleria repens</i> C. Nees	---	Nat	Uo	
<i>Justicia betonica</i> L.	white shrimp plant	Nat	Oc	
<i>Pseuderanthemum carruthersii</i> (Seem.) Guillaumin	false eranthemum	Orn	R	<2>
AMARANTHACEAE				
<i>Amaranthus viridus</i> L.	slender amaranth	Nat	R	
<i>Amaranthus spinosus</i> L.	spiny amaranth	Nat	R	
ANACARDIACEAE				
<i>Mangifera indica</i> L.	mango, <i>manakō</i>	Nat	R	
<i>Schinus terebinthifolius</i> Raddi	Christmas berry	Nat	O	<2>
APOCYNACEAE				
<i>Nerium oleander</i> L.	oleander	Orn	R	
<i>Plumeria rubra</i> L.	graveyard flower	Orn	R	
<i>Thevetia peruviana</i> (Pers.) K. Schum.	be-still tree	Orn	U	
ASCLEPIADACEAE				
<i>Stapelia gigantea</i> N. E. Brown	giant toad plant	Nat	Uc	<2>

Table 1 (Continued).

Species listed by family	Common name	Status	Abundance	Notes
ASTERACEAE (COMPOSITAE)				
<i>Bidens cynapiifolia</i> Kunth	---	Nat	R	
<i>Pluchea indica</i> (L.) Less.	Indian fleabane	Nat	U	<2>
<i>Sphagneticola trilobata</i> (L.) Pruski	wedelia	Nat	O	
<i>Tridax procumbens</i> L.	coat buttons	Nat	C	<2>
BORAGINACEAE				
<i>Cordia subcordata</i> Lam.	kou	Pol	Oo	
<i>Tournefortia argentea</i> L. fil.	tree heliotrope	Nat	R	
BUDDLEIACEAE				
<i>Buddleia asiatica</i> Lour.	dog tail, <i>huelo 'ilio</i>	Nat	R	
CACTACEAE				
<i>Hylocereus undatus</i> (Haworth) Britt. & Rose	night-blooming cereus	Nat	Uo	<2>
<i>Opuntia ficus-indica</i> (L.) Mill.	pānini	Nat	R	
CAPPARACEAE				
<i>Cleome gynandra</i> L.	wild spider flower	Nat	U	
CARICACEAE				
<i>Carica papaya</i> L.	papaya	Nat	R	
CLUSIACEAE				
<i>Clusia rosea</i> Jacq.	autograph tree	Nat	C	<2>
COMBRETACEAE				
<i>Conocarpus erectus</i> L.	button mangrove	Orn	U	<2>
<i>Terminalia catappa</i> L.	tropical almond	Nat	Uo	
CONVOLVULACEAE				
<i>Ipomoea obscura</i> (L.) Ker-Gawl	---	Nat	O	
CRASSULACEAE				
<i>Crassula</i> cf. <i>ovata</i> (P. Mill.) Druce	jade plant	Orn	R	
<i>Kalanchoë tubiflora</i> (Harv.) Raym.-Hamet	chandelier plant	Nat	R	<1>
CUCURBITACEAE				
<i>Momordica charantia</i> L.	balsam pear	Nat	R	
GOODENACEAE				
<i>Scaevola sericea</i> L.	<i>naupaka kahakai</i>	Ind	R	
EUPHORBIACEAE				
<i>Codiaeum variegatum</i> (L.) Blume	croton	Orn	R	
<i>Euphorbia hypericifolia</i> L.	graceful spurge	Nat	R	
<i>Euphorbia hirta</i> L.	garden spurge	Nat	Uc	<2>
<i>Euphorbia prostrata</i> Aiton	prostrate spurge	Nat	R	

Table 1 (Continued).

Species listed by family	Common name	Status	Abundance	Notes
EUPHORBIACEAE (cont.)				
<i>Euphorbia tirucalli</i> L.	pencil tree	Nat	R	
<i>Phyllanthus debilis</i> Klein ex Willd.	niruri	Nat	R	
<i>Phyllanthus tenellus</i> Roxb.	---	Nat	R	<2>
<i>Ricinus communis</i> L.	castor bean	Nat	R	
FABACEAE				
<i>Bauhinia</i> sp.	orchid tree	Orn	R	<3>
<i>Calliandra haematocephala</i> Haskarl	<i>lehua haole</i>	Orn	R	
<i>Chamaecrista nictitans</i> (L.) Moench	partridge pea	Nat	U	<2>
<i>Delonix regia</i> (Bojer ex Hook.) Raf.	royal poinciana	Nat	R	<1>
<i>Desmanthus pernamhucanus</i> (L.) Thellung	virgate mimosa	Nat	U	<2>
<i>Desmodium tortuosum</i> (Sw.) DC.	Florida beggarweed	Nat	R	
<i>Indigofera suffruticosa</i> Mill.	indigo	Nat	R	
<i>Leucaena leucocephala</i> (Lam.) deWit	<i>koa haole</i>	Nat	A	<2>
<i>Mimosa pudica</i> L.	sensitive plant	Nat	U	
<i>Neonotonia wightii</i> (Wight & Arnott) Lackey	glycine vine	Nat	R	
<i>Pithecelobium dulce</i> (Roxb.) Benth.	<i>'opiuma</i>	Nat	O	<2>
<i>Prosopis pallida</i> (Humb. & Bonpl. ex Willd.) Kunth	<i>kiawe</i>	Nat	C	
<i>Samanea saman</i> (Jacq.) Merr	monkeypod	Nat	O	
<i>Senna occidentalis</i> (L.) Link	coffee senna	Nat	Uc	<2>
<i>Tamarindus indica</i> L.	tamarind	Orn	R	
LECYTHIDACEAE				
<i>Barringtonia asiatica</i> (L.) Kurz	autograph tree	Nat	O	
MALVACEAE				
<i>Abutilon grandifolium</i> (Wild.) Sweet	hairy abutilon	Nat	R	<2>
<i>Talipariti tiliaceum</i> (L.) Fryxell	<i>hau</i>	Ind	R	
<i>Sida ciliaris</i> L.	---	Nat	Uo	
<i>Sida rhombifolia</i> L.	Cuba jute	Nat	U	
<i>Thespesia populnea</i> (L.) Sol ex Correa	<i>milo</i>	Pol	Oc	
<i>Waltheria indica</i> L.	<i>'uhaloa</i>	Ind	Oc	<2>

Table 1 (Continued).

Species listed by family	Common name	Status	Abundance	Notes
MORACEAE				
<i>Ficus microcarpa</i> L. f.	Chinese banyan	Nat	U	<2>
NYCTAGINACEAE				
<i>Boerhavia coccinea</i> Mill.	false <i>alena</i>	Nat	R	
<i>Bougainvillea spectabilis</i> Wild.	bougainvillea	Orn	U	
OXALIDACEAE				
<i>Oxalis corniculata</i> L.	' <i>ihi'ai</i>	Pol	R	
PASSIFLORACEAE				
<i>Passiflora foetida</i> L.	running pop	Nat	U	
<i>Passiflora suberosa</i> L.	<i>huehue haole</i>	Nat	R	
PHYTOLACCACEAE				
<i>Rivina humilis</i> L.	coral berry	Nat	R	
PLUMBAGINACEAE				
<i>Plumbago auriculata</i> Lam.	blue plumbago	Orn	R	
<i>Plumbago zeylanica</i> L.	' <i>ilie'e</i>	Ind	R	
PORTULACACEAE				
<i>Portulaca pilosa</i> L.	---	Nat	R	
<i>Talinum triangulare</i> (Jacq.) Willd.	---	Nat	C	<2>
RUBIACEAE				
<i>Hedyotis corymbosa</i> (L.) Lam.	---	Nat	R	
<i>Morinda citrifolia</i> L.	<i>noni</i>	Pol	O	
<i>Pentas lanceolata</i> (Forsk.) Deflers	pentas	Orn	R	

Legend to Table 1

STATUS = distributional status for the Hawaiian Islands:

Ind = indigenous; native to Hawaii, but not unique to the Hawaiian Islands.

Nat = naturalized, exotic, plant introduced to the Hawaiian Islands since the arrival of Cook Expedition in 1778, and well-established outside of cultivation.

Orn = A cultivated plant; a species not thought to be naturalized (spreading on its own) in Hawai'i.

Pol = An early Polynesian introduction. Introduced before 1778.

ABUNDANCE = occurrence ratings for plant species:

R - Rare seen in only one or perhaps two locations.

U - Uncommon seen at most in several locations

O - Occasional seen with some regularity

C - Common observed numerous times during the survey

A - Abundant found in large numbers; may be locally dominant.

AA - Very abundant abundant and dominant; defining vegetation type.

Table 1 (Continued).

Lower case letters (o, c, a) following qualitative rating of abundance indicate a localized abundance greater than occurrence rating. For example, Oc would be a plant encountered fairly regularly and common within a local area.

NOTES: <1> – Naturalized species found here planted in the landscaping as an ornamental.

<2> – Component of the forest *mauka* of the harbor (undeveloped portion of TMK: 7-8-010: 04 mauka of the old unimproved road).

<3> – Plant lacking key diagnostic characteristics (flower, fruit); identification, therefore, uncertain.

Avian Fauna

A total of 295 individual birds of 13 species, representing 11 separate families, were recorded during station counts (Table 2). One of the species detected Pacific Golden-Plover (*Pluvialis fulva*) or *kolea* is an indigenous migratory shorebird species. The remaining 12 species recorded during the course of this survey are alien to the Hawaiian Islands.

**Table 2. Avian species detected on KS Lands at Keauhou Bay
October 2021**

<u>Common Name</u>	<u>Species</u>	Order Family	Status	RA
COLUMBIFORMES				
COLUMBIDAE - Pigeons & Doves				
Spotted Dove	<i>Streptopelia chinensis</i>		A	2.38
Zebra Dove	<i>Geopelia striata</i>		A	9.13
CHARADRIIFORMES				
CHARADRIIDAE - Lapwings & Plovers				
Charadriinae - Plovers				
Pacific Golden-Plover	<i>Pluvialis fulva</i>		IM	0.13
PELECANIFORMES				
ARDEIDAE - Herons, Bitterns & Allies				
Cattle Egret	<i>Bubulcus ibis</i>		A	0.13

Table 2 (continued).

Common Name	Species	Order Family	Status	RA
PSITTACIFORMES				
PSITTACULIDAE - Lories, Lovebirds, and Indomalayan and Papua-Australasian Parrots				
Rose-ringed Parakeet	<i>Psittacula krameri</i>		A	0.50
PASSERIFORMES				
ZOSTEROPIDAE - White-eyes				
Warbling White-eye	<i>Zosterops japonicus</i>		A	8.88
STURNIDAE - Starlings				
Common Myna	<i>Acridotheres tristis</i>		A	10.00
ESTRILDIDAE – Estrildid Finches				
Java Sparrow	<i>Padda oryzivora</i>		A	0.88
Common Waxbill	<i>Estrilda astrild</i>		A	0.38
PASSERIDAE - Old World Sparrows				
House Sparrow	<i>Passer domesticus</i>		A	0.50
FRINGILLIDAE - Fringilline and Carduline Finches & Allies				
Carduelinae - Carduline Finches and Hawaiian Honeycreepers				
House Finch	<i>Haemorhous mexicanus</i>		A	2.75
CARDINALIDAE - Cardinals & Allies				
Northern Cardinal	<i>Cardinalis cardinalis</i>		A	0.63
THRAUPIDAE - Tanagers				
Thraupinae - Core Tanagers				
<u>Yellow-billed Cuckoo</u>	<i>Paroaria coccyzoides</i>		A	0.63

Key to Table 2.

Status:

A = Naturalized, non-native species (introduced).

IM = Indigenous, migratory species.

RA : Relative Abundance ~ Species count / number of point-count stations (n=8).

Avian diversity and densities were in keeping with the generally developed nature of much of the site. Two species, Common Myna (*Acridotheris tristis*) and Zebra Dove (*Geopelia striata*), accounted for 52% of all birds recorded during station counts. The most frequently recorded species was Common Myna, accounting for 27% of the total number of individual birds recorded.

Mammals

Three terrestrial mammalian species were detected during the course of this survey. We saw numerous small Indian mongoose (*Herpestes javanicus auro-punctatus*) within the area. Domestic cat (*Felis catus*) was seen at several

locations within the Project area. Domestic dog (*Canis lupus familiaris*) was seen being walked on a leash, and several dogs were heard barking from locations outside of the survey area. As well, tracks and scat of dogs, cats, and mongooses were encountered along the proposed roadway corridor.

Discussion and Recommendations

Recommendations are partly based on U.S. Fish and Wildlife Service, Animal Avoidance and Minimization Measures (USFWS-PIFWO, nd). Implementation of the recommendations (provided below as bulleted items) by the Project contractor will minimize impacts to listed species to the maximum extent practicable.

Floral Resources

No plants listed by either state or federal statute as threatened or endangered were found on the Project parcel (HDLNR, 1996; USFWS, nd-a). Although 12% of the extant plant species are indigenous natives or early Polynesian introductions (“canoe plants”), none is particularly rare in the Islands or abundant in the survey area. This percentage of “native” to total species is a typical result for lowland surveys in Hawai‘i. Nearly all native plants recorded are rare or uncommon here but widely distributed state-wide and many are represented by plantings and not natural populations. No adverse impacts to rare or culturally sensitive or listed (HDLNR, 1998; USFWS, nd-a) plant species will result from the proposed project.

An area at the back of the harbor abutting TMK: 7-8-010: 044 but not included in our survey and not on land that is part of the subject project plans surrounds Ho‘okūkū Pond and has been carefully planted and maintained in a variety of native plant species. Project plans call for extending this native vegetation and connecting walkway as part of improvements proposed for the back of the harbor area that is on KS land (KS, 2022).

Invertebrate Resources

Blackburn’s sphinx moth (*Manduca blackburni*) is an endangered sphingid moth known from limited locations on the Island of Hawai‘i (HDLNR, 2005; HDLNR-DOFAW, 2021). The larva of this species is a Solanaceae specialist and its’ native host plants are not present on the site nor in the general vicinity. However, as these native host species have become exceedingly rarer in nature, this endemic moth has adapted to non-native solanaceous species, particularly

tree tobacco (*Nicotiana glauca*), a common weed in the islands. We did not record tree tobacco in the area nor were any other plants in the Family Solanaceae observed.

Avian Resources

The findings of the avian survey are consistent with the location of the property and habitats present there. As previously mentioned, one of the species detected is a native species. Pacific Golden-Plover is an indigenous migratory shorebird species that nests in the high Arctic during the late spring and summer months, returning to Hawai'i and the tropical Pacific to spend the fall and winter months each year. The birds usually leave Hawai'i and return to the Arctic in late April or the very early part of May. Pacific Golden-Plover is a commonly countered shorebird throughout the Hawaiian Islands during late summer through mid-spring months.

Waterbirds

No waterbirds were detected during this survey and no suitable habitats exist for either of the two endangered Hawaiian waterbirds: Hawaiian Coot (*Fulica alai*) or the endemic sub-species of the Black-necked Stilt (*Himantopus mexicanus knudseni*) found on the Kona coast. Nēnē (*Branta sandvicensis*) is present in North Kona, but so far not seen in the Keauhou area (David, 2022).

Seabirds

It is possible that the endangered Hawaiian Petrel (*Puffinus sandwichis*), Band-rumped Storm-Petrel (*Hydrobates castro*), and the threatened Newell's Shearwater (*Puffinus newelli*) over-fly the Project area between April and the middle of December each year in small numbers. The primary cause of mortality in Hawaiian Petrels and Newell's Shearwaters in Hawai'i is thought to be predation by alien mammalian species at the nesting colonies (USFWS, 1983; Simons and Hodges, 1998; Ainley et al., 2001). Collision with man-made structures is considered the second most significant cause of mortality of these seabird species in Hawai'i. Nocturnally flying seabirds, especially fledglings on their way to sea in the summer and fall, can become disoriented by exterior lighting. Disoriented seabirds may collide with man-made structures and, if not killed outright, become easy targets of opportunity for feral mammals (Hadley, 1961; Telfer, 1979; Sincock, 1981; Reed et al., 1985; Telfer et al., 1987; Cooper and Day, 1998; Podolsky et al., 1998; Ainley et al., 2001; Hue et al., 2001; Day et al., 2003). No suitable nesting habitat exists within or close to the project area for any of the three seabird species discussed here.

The principal potential impact that the construction of the proposed project poses to protected seabirds is the increased threat that birds will be downed after becoming disoriented by lights associated with the project during the nesting season. The two main areas that outdoor lighting could pose a threat to these nocturnally flying seabirds is if, 1) during construction it is deemed expedient, or necessary to conduct night-time construction activities, 2) following build-out, the potential operation of security lighting during the seabird nesting season.

- If night-time construction activity or equipment maintenance is proposed during the construction phases of the project, all associated lights should be shielded, and if flood/work lights are used, they should be placed on poles that are high enough to allow the lights to be pointed directly at the ground (Reed et al., 1985; Teller et al., 1987). Deleterious impacts to transiting seabirds can be avoided if construction occurs during daylight hours and all outdoor lighting installed is fully “dark sky compliant” (HDLNR-DOFAW, 2016). HDLNR recommends avoiding construction-related night-time lighting between September 15 and December 15 (DLNR, 2022).

Hawaiian Hawk

Hawaiian Hawk (*Buteo solitarius*) was not recorded during this survey, nor expected as this species is rarely seen at the low elevations of the Keauhou area (David, 2022). The proposed redevelopment of these lands will not have adverse impacts on this state-listed species.

Mammalian Resources

The findings of the mammalian survey are consistent with the location of the properties and habitats present. Although no rodents were recorded in our survey, it is likely that some of the four established alien Muridae found on Hawai‘i—roof rat (*Rattus rattus*), brown rat (*Rattus norvegicus*), Polynesian rat (*Rattus exulans hawaiiensis*), and European house mouse (*Mus musculus domesticus*)—use various resources found within the general project area on a seasonal basis. All of these introduced rodents are deleterious to native ecosystems and the native fauna dependent on them.

No mammalian species currently protected or proposed for protection under either the federal or State of Hawai‘i endangered species programs were detected during the course of this survey (DLNR, 2015; USFWS, n. d.).

Hawaiian hoary bat

It is probable that Hawaiian hoary bats overfly the project area on a seasonal basis, as they have regularly been seen foraging and displaying over Keauhou Bay in the fall (David, 2022). The principal impact that construction may pose to bats is during clearing and grubbing phases when vegetation is removed. The removal of vegetation within the project area could temporarily displace individual bats using trees for roosting. As bats use multiple roosts within their home territories, the potential disturbance resulting from the removal of the vegetation is likely to be minimal. However, during the pupping season, females carrying their pups may be less able to vacate a roost site as the tree is felled. Further, adult female bats sometimes leave their pups in the roost tree while they forage. Very small pups may be unable to flee a tree that is being felled.

- Potential adverse impacts from such disturbance can be avoided or minimized by not clearing woody vegetation taller than 4.6 m (15 ft) between June 1 and September 15, the period in which bats may have pups.

Other Resources of Potential Concern

Both endangered Hawaiian monk seals (*Monarchus schauinslandi*) and the threatened Pacific green sea turtle (*Chelonia mydas*) are regularly reported from Kona waters (David, 2022). Although unlikely, either species could haul out along the shoreline close to the dock or by the canoe club beach landing.

- If either species is detected within 100 m (300 ft) of ongoing construction, operations must cease and not continue until the animal has departed the area on its own accord.

Critical Habitat

No federally delineated Critical Habitat for any species occurs within the Project area (USFWS, nd-b). There is no equivalent designation under State of Hawai'i endangered species statutes.

Summary Conclusions

The terrestrial field surveys conducted in October 2021 by AECOS biologists found no species listed as threatened or endangered by state or federal statutes on any of the project parcels at Keauhou Bay. All of the surveyed parcels are much disturbed or are developed (commercial operations, access roads, public

park). The potential does exist that several listed species might transit or utilize the general area on occasion. These include: Black-necked Stilt, Nēnē, Hawaiian Petrel, Band-rumped Storm-Petrel, Newell's Shearwater, Hawaiian monk seal, and Pacific green sea turtle. In all such cases, the general precaution applies whenever an endangered animal species is observed within 100 m (300 ft) of on-going construction activity: work potentially disturbing to the animal should cease until the animal departs the area voluntarily. Only the endangered Hawaiian hoary bat is deemed to potentially utilize resources within the project area. Adverse impacts to this species could occur if trees over 4.6 m (15 ft) in height are removed between June 1 and September 15.

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Appendix L

Biological Survey of Ho‘okūkū Pond

Biological Survey for Ho'okūkū Pond

Keauhou Bay, Kona, Hawai'i Island

March 2022

A biological survey of the Ho'okūkū Pond was performed by Janice Jensen of G70 at approximately 10:30 am on Thursday March 10, 2022.

The anchialine pool appeared overall to be in an advanced state of degradation. The Pond contains a large buildup of mud and organic matter, particularly around the edges, leaving the water to pool towards the center. The water level at the time of the survey was extremely low (estimated < 2 inches in depth.) Majority of the pool was covered in thick mats of filamentous green algae (*Rhizoclonium sp.*)



Figure 2 Large buildup of organic matter and sediment in the Pond. Filamentous green algae mats occupy majority of the remaining area where water pools.



Figure 1 View of Ho'okūkū Pond from the upper walkway, facing toward the public restroom. Water levels were extremely low.

In one corner of the pond where sediment had built up, black and yellow mud dauber wasps (*Sceliphron caementarium*) were observed continuously visiting holes at the base of the rock wall, likely the location of a nest.

Six juvenile individuals of a single species of freshwater prawn (*Macrobrachium sp.*) were observed in the pool. Though the individuals could not be examined close-up to accurately determine their species, a baseline assessment of the Pond conducted by Aquatic Resources Management (2019) noted both the native *Macrobrachium grandimanus* and the

introduced Tahitian prawn (*Macrobrachium lar*) as potential species. Hundreds of brown shells of the red-rimmed melania snail (*Melanoides tuberculata*) were scattered throughout the Pond, particularly in

the thick algae mats. No fish, native 'ōpae 'ula, or other species of marine invertebrates previously known to inhabit the Pond were observed during this survey.



Figure 3 Sediment build up and the potential location of a black and yellow mud dauber wasp nest in the northeastern corner of the Pond.



Figure 3 Close up of Pond biota: filamentous green algae, two juveniles of the *Macrobrachium* sp. of freshwater prawn, and a cluster of red-rimmed melania snails.



Figure 5 Juvenile freshwater prawns amidst a collection of the Pond's organic detritus.

The table below lists the species observed in Ho'okūkū Pond during the survey on March 10, 2022. A single alga taxa was identified along with three invertebrate taxa, two of which were marine. A key with explanations of the abbreviations used in the checklist is provided below.

CHECKLIST KEY

Biogeographic Status

- Nat Naturalized: Introduced to Hawai'i by humans, either directly or indirectly, since Western contact. Includes ornamentals and plants that may have formerly been cultivated.
- Ind Indigenous species: Occurs naturally both within and outside of the Hawaiian Islands.
- Inv Invasive species: An alien species which has been introduced by human assistance and is recognized to have deleterious effects on the native species or environment.
- Unk Unknown: Species could not be identified.

Abundance

- R Rare: 1-3 individuals observed.
- U Uncommon: Several to a dozen individuals observed.
- O Occasional: Found regularly at the site.
- C Common: Observed numerous times; makes up a large portion of the community.
- A Abundant: Large numbers observed; likely a locally-dominant species.

Scientific Name	Common/Hawaiian Names	Status	Abundance
ALGAE			
CLADOPHORACEAE			
<i>Rhizoclonium sp.</i>	filamentous green algae	Nat	A
INVERTEBRATES			
PALAEMONIDAE			
<i>Macrobrachium sp.</i>	freshwater prawn	Unk	U
SPHECIDAE			
<i>Sceliphron caementarium</i>	black and yellow mud dauber wasp	Nat	U
THIARIDAE			
<i>Melanoides tuberculata</i>	red-rimmed melania/brown spiral shells	Nat	A

Appendix M

Mobility Analysis Report



Keauhou Bay Management Plan: Mobility Analysis Report (Draft)

Prepared for
Group 70 International, Inc.

May 12, 2022

FEHR  PEERS

SD21-0408

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1. Executive Summary

This report presents the results of the Mobility Analysis Report (MAR) for the proposed Keauhou Bay Management Plan (KBMP) project (the project). The plan is for a 53-acre site located on the western shore of the Hawai'i Island, approximately 14 miles south of Kona International Airport and six (6) miles south of central Kailua-Kona. Regional access to the site is provided by Ali'i Drive with local access provided by Kamehameha III Road and Kaleiopapa Street. The project site and study area are depicted on **Figure 1**.

The KBMP will guide development within the site for the next 20 years, and the project proposes to construct new development and relocate and repurpose existing land uses for Kamehameha Schools. The project includes a variety of cultural and recreation uses, commercial activities, and resort facilities. Development will occur over time and a new formalized roadway link between Kamehameha III Road and Kaleiopapa Street using the Old Kona Road alignment will improve overall site access and enhance area connectivity.

The study first forecasts 2035 traffic volumes without the development of the project, and then forecasts volumes with the development of the proposed project uses. It documents estimated traffic movements at the analyzed intersections then determines average delay times and the resulting level of service (LOS) ratings. This study recommends specific mitigation measures to address locations where undesirable levels of service are projected. In addition, potential impacts to pedestrian, bicycle and transit facilities and services were also evaluated.

The project is estimated to generate 1,928 new weekday daily vehicle trips, including approximately 155 new vehicle trips during the weekday morning peak hour, 230 new vehicle trips during the weekday afternoon peak hour, and 361 new vehicle trips during the Saturday midday peak hour.

The traffic impact analysis was evaluated pursuant to guidelines established by the County of Hawai'i. The State of Hawai'i Department of Transportation Highways Division (HDOT) does not maintain or operate any facilities within the study area. Weekday a.m. and p.m. peak hour and Saturday midday peak hour capacity analysis was conducted for the four (4) existing study intersections in the vicinity of the project site. All four of the intersections currently operate at a desirable operating level during all three peak hours.

For the baseline analysis, four (4) intersections were analyzed. The baseline intersection conditions include the improvement of the Old Kona Road alignment with the project condition, along with growth in background traffic in the study area. While these changes are expected to increase delays in 2035, all intersections are expected to operate at a desirable operating level during three peak hours. The project is



not expected to result in any significant vehicular impacts. A review of the potential shift in existing traffic volumes with the new roadway connection indicates that a shift is unlikely and would only result in up to one additional vehicle per minute during the highest peak hour period on a Saturday. Regardless, the study intersections would all still operate well above the desired minimum operating level.

The proposed project is expected to generate bicycle and pedestrian trips to and from the project site, although the total volumes are expected to be low. Regardless, the project will provide a shared-use path for pedestrians and bicycles along the Old Kona Road alignment to enhance safety and improve multimodal connectivity between the existing and proposed land uses (parks, open spaces, hotels, restaurants, etc.). Accordingly, the project is not expected to result in any significant active transportation impacts.

It is also expected that there will be a slight increase in transit ridership however is not anticipated to increase to a level that would substantially affect existing transit facilities and services.



2. Introduction

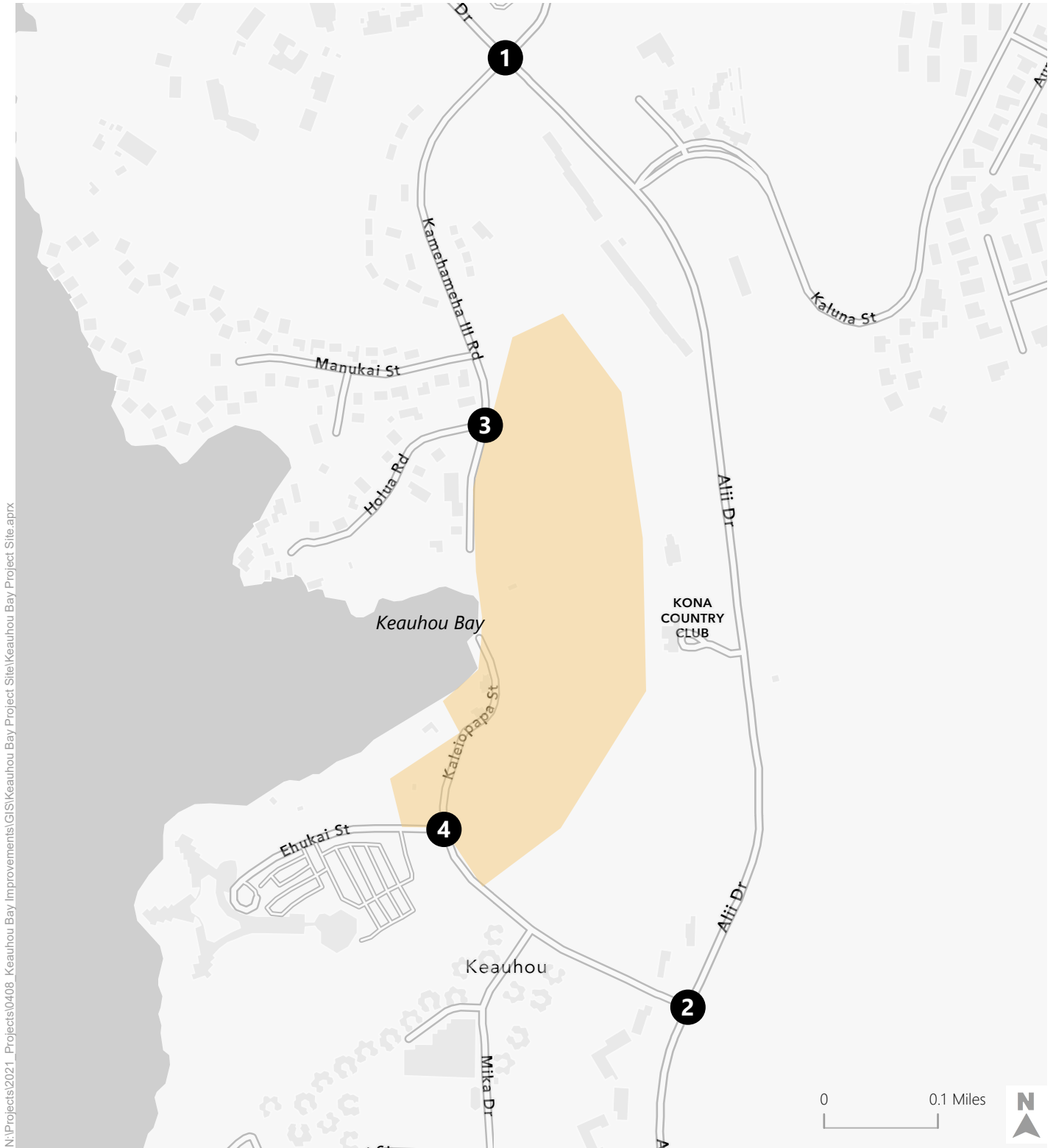
This mobility analysis report (MAR) presents the results of the study conducted by Fehr & Peers for the Keauhou Bay Management Plan (KBMP) (hereafter referred to as “project”) located in the Kahaluu-Keauhou region of the Hawai‘i Island. Under the direction of Kamehameha Schools, the KBMP will guide development within the project site for the next 20 years, and the plan includes construction of new uses in addition to relocating, repurposing, and enhancing existing land uses. Fehr & Peers provided transportation planning and engineering services to assist with the development of the project site plan including input on required infrastructure (e.g., roadways) and multi-modal facilities to provide access to and through the site. In addition, this MAR will inform the environmental impact statement (EIS) for the project.

The MAR identifies the impacts of the proposed project on the surrounding transportation system and was conducted in accordance with the requirements of the County of Hawai‘i, which has jurisdiction over all the study roadways and transportation facilities within the study area. The State of Hawai‘i Department of Transportation – Highways Division (HDOT) does not own or operate any roadways within the study area. This chapter includes a description of the assumptions and methods used to conduct the study, as well as a discussion of the results.

2.1 Project Description

The project site is located on the western shore of the Hawai‘i Island approximately 14 miles south of Kona International Airport, and six (6) miles south of central Kailua-Kona. Regional access to the site is provided by Ali‘i Drive with local access provided by Kamehameha III Road and Kaleiopapa Street. The site is generally bounded by Kamehameha III Road, Ali‘i Drive, Kaleiopapa Street, and Keauhou Bay. **Figure 1** illustrates the study area for the proposed project and its site location.





- Project Site Study
- Intersections



Figure 1

Project Site and Study Intersections

The site for this project includes approximately 29 acres and includes a variety of existing recreation uses, commercial activities, and underutilized parcels. The project proposes to construct new development and to relocate and repurpose existing land uses under the direction of Kamehameha Schools. New uses will include a variety of cultural and recreation opportunities, commercial activities, and resort facilities. In addition, new formalized off-street parking lots will be constructed to minimize impacts to existing public streets and to minimize parking intrusion into adjacent neighborhoods.

Project development will occur over 20 years and a new formalized roadway link between Kamehameha III Road and Kaleiopapa Street using the Old Kona Road alignment will improve overall site access and enhance area connectivity. According to the project team, the proposed site redevelopment is expected to be completed and fully operational by 2035. **Figure 2** illustrates the proposed project site plan and improvements.

2.2 Project Study Area

The transportation analysis focused on evaluating the potential project-related traffic impacts at four (4) existing intersections in the vicinity of the proposed project. The analyzed intersections are listed below:

1. Ali'i Drive / Kamehameha III Road
2. Ali'i Drive / Kaleiopapa Street
3. Kamehameha III Road / Hōlua Road (w/ future site driveway connection)
4. Kaleiopapa Street / Ēhukai Street (w/ future site driveway connection)

Turning movement counts data collection at intersections were conducted on September 16, 2021, and September 18, 2021. And segments counts were collected on September 16 through 18, 2021 and September 30 through October 2, 2021. The study intersections were evaluated during the highest one-hour of travel demand of the weekday morning (6:00 to 9:00 AM) and evening (3:30 to 6:30 PM) peak periods, as well as Saturday midday (11:30 AM to 1:30 PM) peak periods. Traffic counts were collected during the weekday AM, weekday PM, and Saturday midday peak periods at the first two study intersections in September 2019. The total number of bicyclists and pedestrians crossing each street leg were also counted at each study intersection.

2.3 Intersection Analysis Scenarios

The operations of the study intersections were evaluated during the weekday morning and evening peak hours for the following scenarios:



Existing (2021) Conditions – The analysis of existing traffic conditions was based on 2021 counts collected for analyzed peak hours. The existing conditions analysis includes a description of key area streets and highways and an assessment of bicycle, pedestrian, and transit facilities and services in the study area.

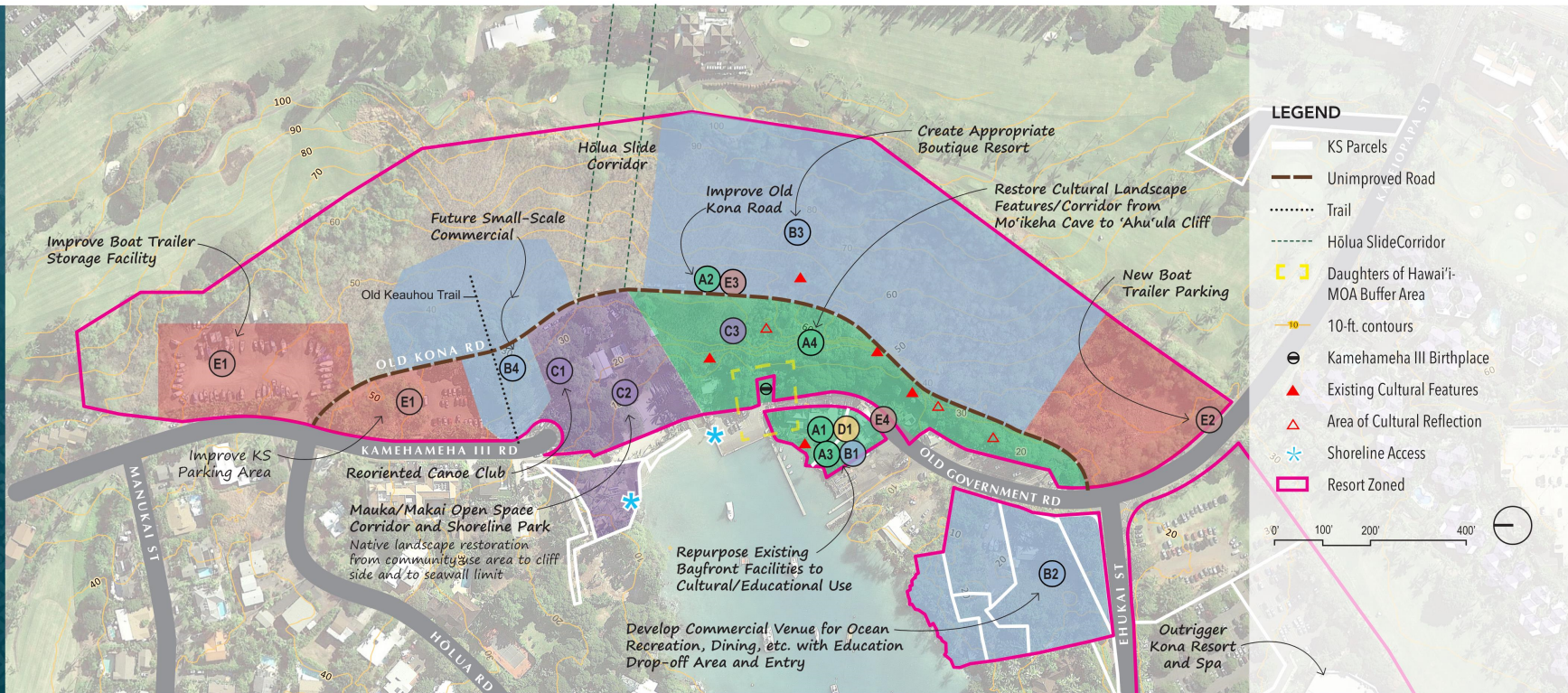
Baseline (2035) Conditions – Future traffic volumes in the anticipated completion year of full project buildout were projected by increasing the existing volumes using an annual growth factor to account for ambient growth. This scenario does not include any project traffic.

Baseline (2035) Plus Project Conditions – Traffic projections from baseline Conditions plus traffic estimated from the completion and full occupancy of the project.



THE PLAN

- Includes short-term and long-term management and land use plans to guide operations and prioritize future improvements at Keauhou Bay based upon community values and Kamehameha Schools' Strategic Plan.
- The project area includes approximately 29 acres of Kamehameha Schools lands in the Keauhou Bay area.
- Facilitates cooperation and collaboration between Kamehameha Schools, community/education partners and stakeholders in the management of natural, cultural, and commercial resources.



KEAUHOU BAY MANAGEMENT PLAN RECOMMENDATIONS

A Establish a Heritage Management Corridor	B Reposition & Develop Commercial Bayfront Areas and Appropriate Density Resort Area	C Reorient Recreational and Community Use	D Maintain and Establish New Place-based Cultural Educational Areas	E Manage Vehicle, Boat and Pedestrian Circulation & Wayfinding
<p>A1 Relieve commercial /vehicle congestion away from wahi pana.</p> <p>A2 Re-establish old Kona road as main vehicle thoroughfare.</p> <p>A3 Repurpose existing commercial facilities to culture/education to reduce impact in corridor.</p> <p>A4 Restore Cultural Landscape and extend pedestrian friendly walking path along Ahu'ula Cliff to Mo'ikeha Cave.</p>	<p>B1 Relocate existing commercial operators away from culturally sensitive areas.</p> <p>B2 Organize existing ocean recreation commercial operators and food and beverage establishment in a new facility.</p> <p>B3 Create sustainable, low rise, Boutique Resort on resort-zoned upper plateau of Bay area.</p> <p>B4 Explore opportunities for commercial kipuka where appropriate.</p>	<p>C1 Improve public access by establishing a Mauka/ Makai Corridor.</p> <p>C2 Expand Ka'ili'ilinehe Beach Park as the entry to an open space, Shoreline Corridor.</p> <p>C3 Consider open space and walking path above 'Ahu'ula Cliff to ensure protection of view planes and culturally significant areas.</p>	<p>D1 Repurpose existing Bayfront facilities to support educational programming with a community collaborator.</p> <p>D2 Cultivate community collaborator capacity to include Bay area management & community-based economic development.*</p>	<p>E1 Improve boat and vehicle parking on north side of Bay.</p> <p>E2 Alleviate congestion by exploring opportunities with DLNR/DOBOR on potential relocation/expansion of boat trailer parking.</p> <p>E3 Re-establish old Kona road to relieve vehicular congestion at Bayfront in heritage corridor.</p> <p>E4 Explore access management opportunities with Hawai'i County & DLNR to address traffic and deliveries at Harbor/Pier.</p> <p>E5 Organize active commercial/resort uses to the south side, and community/recreational use to the north side.*</p> <p>E6 Implement a comprehensive wayfinding & interpretive signage plan.*</p>

* Applies to entire project area

Figure 2

Project Site Plan

2.4 Traffic Analysis Methods

The analysis of roadway operations performed for this study is based on procedures presented in the *Highway Capacity Manual 6th Edition* (HCM 6), published by the Transportation Research Board in 2016. The operations of roadway facilities are described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, which is the least congested operating conditions, to LOS F, which is the most congested operating conditions. LOS E represents “at-capacity” operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions. The methodologies for signalized and unsignalized intersections are described below.

2.4.1 Signalized Intersections

The method described in Chapter 19 of HCM 6 was used to prepare the LOS calculations for the signalized study intersections. This LOS method analyzes a signalized intersection’s operation based on average control delay per vehicle. Control delay alone is used to characterize LOS for the entire intersection or an approach. Control delay includes the initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. The average control delay for signalized intersections was calculated using the Synchro 11.0 analysis software and is correlated to a LOS designation as shown in **Table 1**.

2.4.2 Unsignalized Intersections

Unsignalized intersection operations were evaluated using the method contained in Chapter 20: Two-Way Stop-Controlled Intersections of the HCM. LOS ratings for stop-sign-controlled intersections are based on the average control delay expressed in seconds per vehicle. At two-way or side-street-stop-controlled intersections, the average control delay is calculated for each minor-street-stopped movement and the major street left turns, not for the intersection as a whole. For approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. For approaches with multiple lanes, the control delay is computed for each movement; the movement with the worst (i.e., longest) delay is presented for two-way stop-controlled (TWSC). The average control delay for unsignalized intersections is calculated using Synchro 11.0 analysis software and is correlated to a LOS designation as shown in **Table 2**.



Table 1: Signalized Intersection Level of Service Criteria

Level of Service	Description	Delay in Seconds
A	Progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	≤ 10.0
B	Progression is good, cycle lengths are short, or both. More vehicles stop than with LOS A, causing higher levels of average delay.	> 10.0 to 20.0
C	Higher congestion may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, though many still pass through the intersection without stopping.	> 20.0 to 35.0
D	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high V/C ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	> 35.0 to 55.0
E	This level is considered by many agencies to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high V/C ratios. Individual cycle failures are frequent occurrences.	> 55.0 to 80.0
F	This level is considered unacceptable with oversaturation, which is when arrival flow rates exceed the capacity of the intersection. This level may also occur at high V/C ratios below 1.0 with many individual cycle failures. Poor progression and long cycle lengths may also be contributing factors to such delay levels.	> 80.0

Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.

Table 2: Unsignalized Intersection Level of Service Criteria

Level of Service	Description	Delay in Seconds
A	Little or no delay	≤ 10.0
B	Short traffic delay	> 10.0 to 15.0
C	Average traffic delays	> 15.0 to 25.0
D	Long traffic delays	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic delays with intersection capacity exceeded	> 50.0

Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.

2.4.3 Significant Impact Criteria

The analysis of future conditions compares the baseline or “no project” condition with conditions that include project-generated traffic assuming full build-out and occupancy. This is done to determine



whether the addition of project traffic is expected to result in a significant impact on the surrounding roadways. Based on Guidelines from the County of Hawai'i Chapter 25 (Zoning), Article 2 (Administration and Enforcement), Division 4 (Amendments), Section 46 (Concurrency Requirements), the minimum desired operating standard for a signalized intersection is LOS D for the overall intersection. Additionally, a significant impact is defined to occur when the operations of an intersection changes from LOS D or better to LOS E or F. Also, when evaluating intersection movement or approach LOS at any location, other factors should be considered in the analysis, such as traffic volumes and potential secondary impacts to pedestrian, bicycle, and transit travel.

Each of the identified significant impacts could be further categorized as either a cumulative impact or a project-specific impact. At a signalized intersection, if the addition of project traffic is expected to degrade desirable service levels (LOS D or better) to undesirable service levels (LOS E or F), then the new development is considered to have a project-specific-impact. Alternatively, if the intersection LOS is determined to be LOS E or F without the project and the project adds traffic to this location, causing the delay to increase by five (5) seconds or more, then this result would be characterized as a cumulative impact.

For unsignalized intersections, the criterion for a project impact is the same as for signalized intersections regarding LOS as described above, but one or more signal warrants must also be met. The signal warrants used for this evaluation are those described in Chapter 4C of the Manual of Uniform Control Devices (MUTCD, 2009) published by the U.S. Department of Transportation Federal Highways Administration (FHWA). However, the project is determined to have a potentially significant cumulative impact when it adds traffic to a study location which includes a controlled approach operating at an unacceptable level (i.e., LOS E or F) *and* one or more volume-based signal warrants are met.

The County of Hawai'i does not publish impact criteria for pedestrian, bicycle, and transit impacts. For this analysis, these impacts are evaluated based on whether a proposed project would: 1) conflict with the existing or planned pedestrian, bicycle, or transit facilities and services, or 2) create substantive walking, bicycling, or transit use demand without providing adequate and appropriate facilities for non-motorized mobility. Existing facilities for pedestrians, bicycles, and transit users were inventoried to evaluate the quality and scope of facilities/services currently in place. The assessments of planned pedestrian, bicycle, and transit facilities were conducted using the information in planning documents, such as the *Bike Plan Hawai'i (2012)*, *Statewide Pedestrian Master Plan (2013)*, and *County of Hawai'i Transit and Multi-Modal Transportation Master Plan (2018)*. For these modes, if the proposed project is expected to conflict with existing or planned improvements to pedestrian and bicycle facilities, or if the project is expected to generate a substantial demand which could warrant additional transit service, then the project would be determined to have a project-specific impact to non-motorized modes of transportation.



3. Existing Conditions

This chapter describes the study area's existing transportation network and includes a discussion of the roadway, bicycle, pedestrian, and transit facilities. Overall, the assessment of the existing conditions relevant to this study establishes the scenario against which the future baseline and proposed project changes may be compared.

3.1 Roadway System

The key roadways providing access to the site are described below.

Ali'i Drive is a two-lane County collector road serving the coast of Hawai'i between Kona and Captain Cook. Ali'i drive passes through the Keauhou area and is the only link between Kamehameha III Road and Kaleiopapa Street. North of Kamehameha III Road, Ali'i Drive is a 2-lane undivided road with bike lanes and a 30 miles per hour (mph) speed limit. South of Kamehameha III Road, Ali'i Drive becomes a 2-lane roadway with a center buffer lane that is used for left-turn pockets at intersections and a 35-mph speed limit. Within the project vicinity, parking is not allowed on the street.

Kamehameha III Road is a two-lane County collector road connecting Ali'i Drive to the Hawai'i Belt Road (Highway 11) according to the Kona Community Development Plan. In the vicinity of the project, Kamehameha III Road transitions to a local road with a speed limit of 25 mph makai of Ali'i Drive. Between Manukai Street and Keauhou Bay, parking is not allowed on the street.

Kaleiopapa Street is a two-lane local County local road serving the southern side of Keauhou Bay. On-street parking is allowed on both sides of the street except on some sections where signage prohibit parking. Kaleiopapa Street's posted speed limit is 25 mph. Presence of speed humps on this street helps to moderate vehicle travel speed (see **Figure 3**).

3.2 Transit Facilities

The County of Hawai'i Mass Transit Agency provides bus service to Hawai'i Island in the form of Hele-On busses. Two Hele-on routes serve stops in the project vicinity. Route 201, the Kona Trolley serves Keauhou shopping center at the intersection of Ali'i Drive and Kamehameha III Road. Route 204 serves the Outrigger Kona Resort & Spa at Kaleiopapa Street.



Figure 3: Speed hump on Kaleiopapa Street



3.3 Pedestrian Facilities

Pedestrian facilities consist of crosswalks, curb ramps, and pedestrian signals at signalized intersections, as well as sidewalks and paths along segments between intersections. Partial sidewalks are present along the mauka of Ali'i Drive between the Keauhou Shopping Center and Kaluna Street, and the mauka of Kamehameha III Road between Manukai Street and its southern terminus at Keauhou Bay Beach Park. Pedestrians were observed walking on the shoulders where sidewalks are not provided along Kamehameha III Road and Ali'i Drive. No sidewalk is provided on Kaleiopapa Street. However, pedestrians were observed on the shoulder and on the street during the field observation (see **Figure 4**). Speed humps on Kaleiopapa helps to reduce vehicle speed. High visibility crosswalks are provided at the intersections on Ali'i Drive at Kamehameha III Road and at Kaleiopapa Street.

Pedestrian access across the Bayfront from Kamehameha III Road and Kaleiopapa Street does not include a continuous accessible and well-signed path. The most direct path between Kamehameha III Road and Kaleiopapa Street includes an asphalt path that leads to the beach area behind the sea wall where outrigger canoes are stored. Pedestrians must cross the beach and then use a narrow opening to access a short flight of stairs leading to the parking lot asphalt parking lot adjacent to the Fair Wind Hula Kai Cruise building entrance. This path does not comply with American with Disabilities Act (ADA) requirements and is not intuitive for first-time visitors to the site. Potential pedestrian safety concerns were observed during the field visit and are explained in Section 3.6.



Figure 4: Pedestrians at the End of Kaleiopapa Street



3.4 Bicycle Facilities

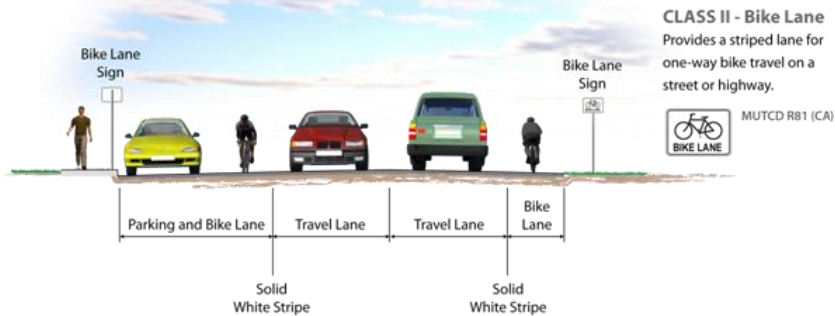
Bicycle facilities generally consist of four types of facilities, which are outlined below:

- *Bike or Shared Use Paths* provide a separate right-of-way and are designated for the exclusive use of bicycles and pedestrians (or exclusively bicycles) with vehicle and pedestrian cross-flow minimized. Generally, the recommended pavement width for a two-directional bike or multi-use path is ten (10) feet.

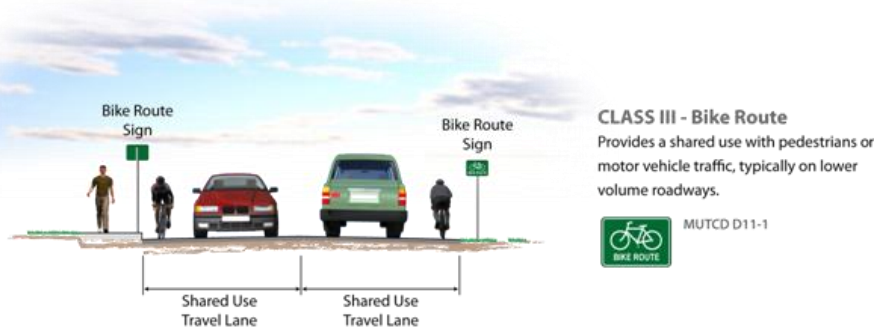


- *Bike Lanes* provide a restricted right-of-way and are designated for the use of bicycles with a striped lane on a street or highway. Bicycle lanes are generally five (5) feet wide. Adjacent vehicle parking and vehicle/pedestrian cross-flow are permitted.

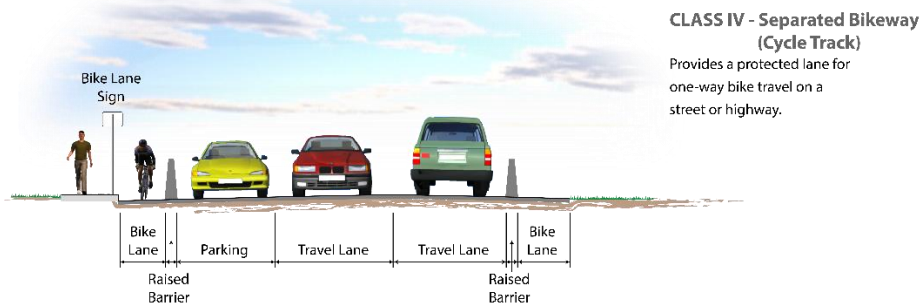




- *Bike Route or Signed Shared Roadways* provide for a right-of-way designated by signs or shared lane pavement markings, or "sharrows," for shared use with pedestrians or motor vehicles.



- *Separated Bikeways or Cycle Tracks* provide a restricted right-of-way with physical separation and are designated for the use of bicycles with a raised barrier such as curbs or bollards. Separated bikeways are generally five (5) feet wide with a three (3) foot minimum horizontal and vertical separation area. Adjacent vehicle parking is permitted, and vehicle/pedestrian cross-flow is restricted to selected locations (e.g., driveways) indicated by breaks in the barrier and buffer.



No bicycle facilities or signage is provided indicating cycling routes within the project area. During the field observations, bicyclists were observed riding on the shoulders along Ali'i Drive, Kamehameha III Road, and Kaleiopapa Street (see **Figure 5**).

Figure 5: Bicyclist on Ali'i Drive



3.5 Existing Traffic Operations

Four (4) existing signalized intersections were studied:

- Ali'i Drive and Kaleiopapa Street, and
- Ali'i Drive and Kamehameha III Road.
- Kamehameha III Road & Hōlua Road
- Kaleiopapa Street & Ēhukai Street

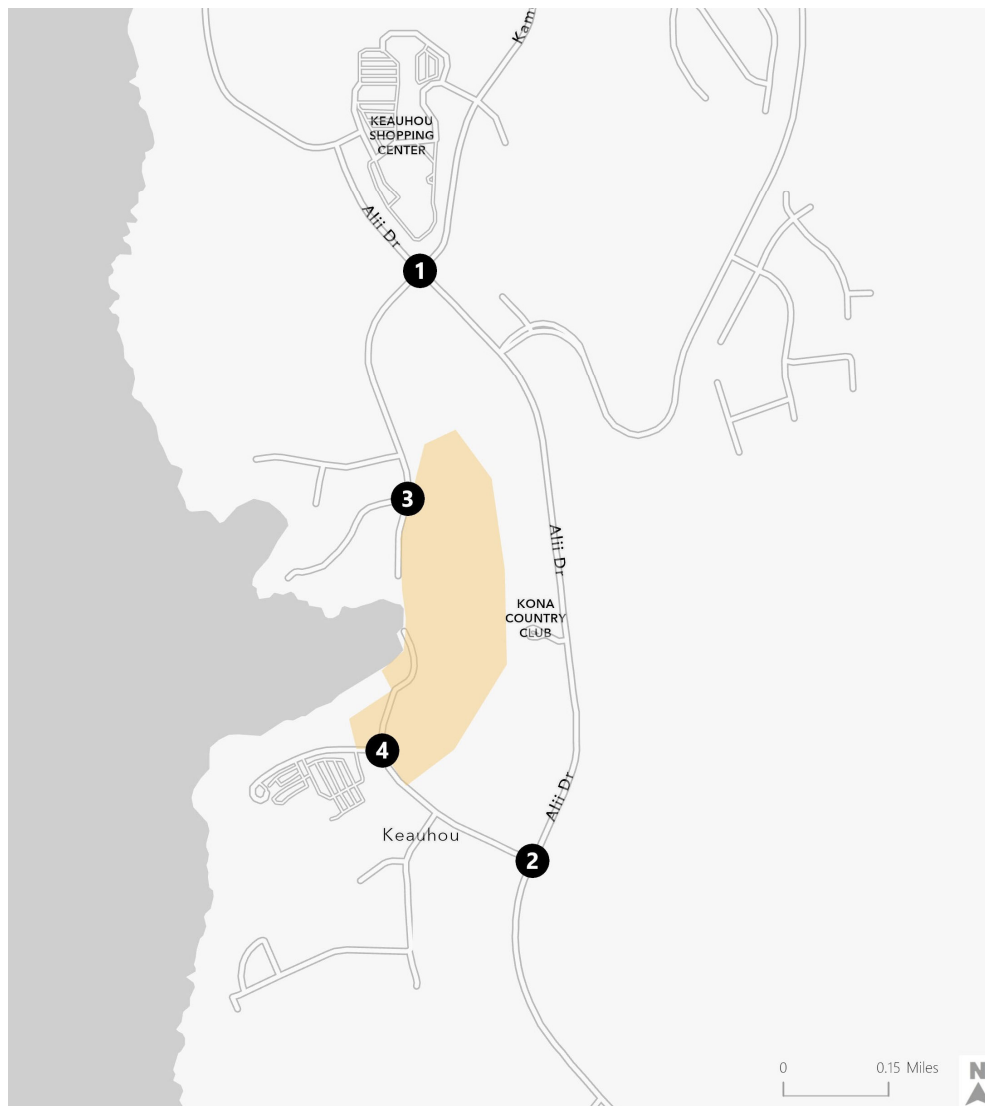
The AM peak hour traffic in the study area occurs from 7:15 – 8:15 AM for intersections, and the PM peak hour occurs between 3:45 and 4:45 PM for Ali'i Drive and Kaleiopapa Street, and between 4:00 and 5:00 PM for Ali'i Drive and Kamehameha III Road. Existing lane configurations and signal timing and phasing were obtained through field observation.

Figure 6 shows existing peak hour AM and PM turning movement counts for weekdays, and Midday (MD) peak hour counts for Saturdays, as well as lane configurations and traffic control devices at each study intersection. Traffic count data sheets are provided in **Appendix A**.

Roadway segment counts were collected for a Thursday through Saturday on Kaleiopapa Street just north of the Ēhukai Street and Kamehameha III Road just south of the Hōlua Street. They were used to validate the project trip generation and quantify the amount of traffic that uses that segment of the road.

Roadway segment counts are provided in **Appendix A**.





LEGEND

● Study Intersections

Project Site

Weekday AM (PM) [Saturday MD] Peak Hour Traffic Volumes

↕ Lane Configuration

AM PM SAT MD Level of Service (LOS)

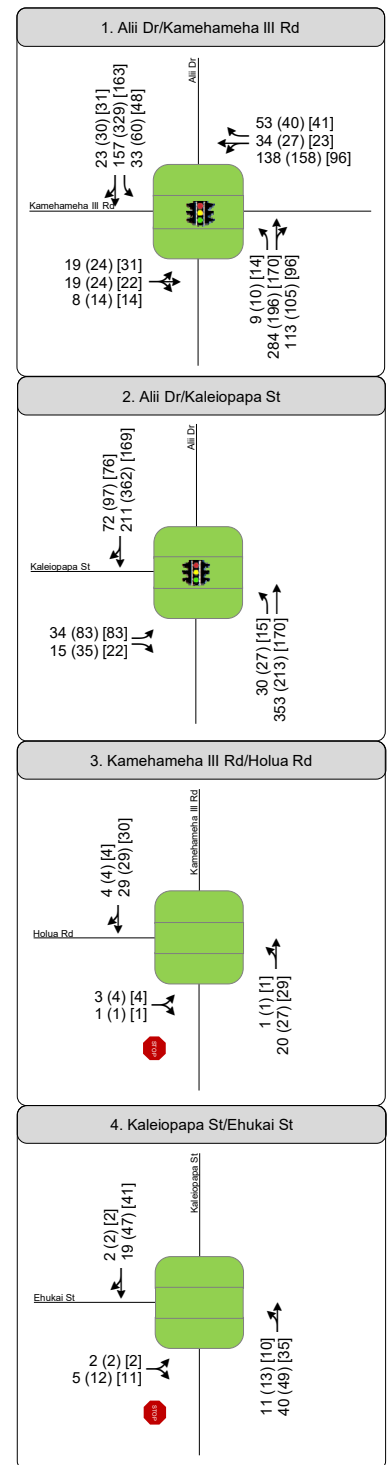


Figure 6

Peak Hour Traffic Volumes and Lane Configurations
Existing (2021) Conditions



Existing peak-hour vehicle volumes and lane configurations were used to calculate levels of service for each of the study intersections. The results of the existing LOS analysis are presented below in **Table 3**, and the corresponding LOS calculation sheets are included in **Appendix B**. The results of the calculations indicate that both intersections operate at a desirable service level (LOS D or better) during all peak periods. No overall intersection or individual turning movement has a LOS below B.

Table 3: Existing Intersection Level of Service

Study Intersection	Traffic Control	Peak Hour	Existing (2021) Conditions	
			Delay	LOS
1. Ali'i Drive & Kamehameha III Road	Signalized	Weekday AM	10.2	B
		Weekday PM	10.5	B
		Sat MD	9.2	A
2. Ali'i Drive & Kaleiopapa Street	Signalized	Weekday AM	5.6	A
		Weekday PM	8.2	A
		Sat MD	7.3	A
3. Kamehameha III Road & Hōlua Road	Side Street Stop Control	Weekday AM	8.7	A
		Weekday PM	8.8	A
		Sat MD	8.8	A
4. Kaleiopapa Street & Ēhukai Street	Side Street Stop Control	Weekday AM	8.6	A
		Weekday PM	8.7	A
		Sat MD	8.7	A

Source: Fehr & Peers, 2021.

3.6 Field Observations

Field observations conducted in September 2021 showed that traffic moves well throughout the study area during the AM and PM peak hour and during the Saturday midday peak hour. No significant vehicle queues were observed during the field visit. Overall, the calculated existing peak hour intersection operating levels at the study intersections shown in **Table 3** are representative of field conditions. There were delays at the end of Kamehameha III Road and Kaleiopapa Street due to drivers of cars and boat trailers seeking on-street parking and making U-turn if there was no parking space available.

The driveway connects the end of Kaleiopapa Street at the boat ramp to the parking lot adjacent to the dock operates as a shared road for pedestrians, tour vans, boats, and vehicles. However, it does not have the characteristics of a typical shared street which include things like tactile pavement (delineates use) and treatments to reduce traffic speeds like visual street narrowing, street trees/landscaping, and changes in



materials and colors. Additionally, drivers have limited sight distance for observing pedestrians on the driveway due to vehicles parked at the turn, shadows, etc. (see **Figure 7**).

Lastly, this road does not provide a formalized turn around area for vehicles at the end of the Kaleiopapa Street near the boat ramp where drivers look for available parking. Vehicles that turn around at this location temporarily cause delay for other vehicles and can result in safety concerns for pedestrian and bicyclists in the area.

Figure 7: Pedestrians on Bayfront Road



3.7 Parking Observations

Parking observations were conducted in two broad areas: Kamehameha III Road and Kaleiopapa Street.

Kamehameha III Road

Two parking lots on the east side of the Kamehameha III Road near its southern terminus on the project site. The parking lot on the north side (mostly north of the Hōlua Drive intersection) is a designated for boat trailer parking that serves the Keauhou Bay. Boat trailer parking was observed to be nearly half-full during the peak periods. The parking area on the south side (Sea Quest Hawai'i Parking) is a public parking lot intended for use by visitors to the various commercial uses.

On-street parallel parking is allowed on both sides of the Kamehameha III Road south of Manukai Street except near driveways where signs are installed to prohibit parking. In addition to the parallel spaces, nine (9) parking stalls are striped in the cul-de-sac at the south end of the street. On-street parking serves both the buildings across the street (Keauhou Kai Apartment Buildings) and Keauhou Bay visitors. On-street parking was observed to be nearly full during the Friday AM and Saturday Midday peak periods. Some vehicles were observed to travel down the street to end and turn back due to lack of available street parking. A few Keauhou Bay visitors were observed to park on the north side of the Hōlua Road intersection and were not captured in the tube counts. **Table 4** summarizes the detailed parking counts based on field observations.

Table 4: On-Street and Off-Street Parking Counts on Kamehameha III Road

Location	Field Observation Day/Time		
	Friday 8:30 AM	Friday 4:00 PM	Saturday 10:30 AM
Parking Area at the South End of Kamehameha III Road	4	5	7
Kamehameha III Road South of Hōlua Road	17	6	14
Kamehameha III Road North of Hōlua Road	3	2	6

Source: Fehr & Peers, 2021.

Kaleiopapa Street

Multiple parking areas are provided along Kaleiopapa Street. At the north end of Kaleiopapa Street just south of the beach area, nine (9) parking stalls are provided for passenger vehicles. On the east side of Kaleiopapa Street just north of the Ēhukai Street, sixteen parking stalls including one (1) accessible space are provided for vehicles with boat trailers. At the top of the boat ramp, four (4) parking stalls are provided for passenger vehicles, including two accessible spaces.



On-street parking is allowed on both sides of the street in designated areas except near driveways and turning areas where signage and pavement markings prohibit parking. The area was observed to be generally full during the field visit. Some visitors with boat trailers were also observed to use the on-street parking available just south of the Ēhukai Street. **Table 5** details the on- and off-street parking counts for the Kaleiopapa Street area based on field observations.

Table 5: On- and Off-Street Parking Counts on Kaleiopapa Street

Location	Field Observation Day/Time		
	Friday 8:30 AM	Friday 4:00 PM	Saturday 10:30 AM
Parking Area at the End of Kaleiopapa Street	9	9	6
Boat Trailer Parking Area	10	7	2
Parking Area at the Top of the Boat Ramp	4	4	2
On-street Parking North of Ēhukai Street	23	11	17
On-street Parking South of Ēhukai Street	23	0	28

Source: Fehr & Peers, 2021.



4. Baseline (2035) No Project Conditions

To evaluate the potential impacts of traffic generated by the proposed project on the surrounding street system, it was necessary to first develop estimates of future traffic conditions in the area without the project. Baseline traffic conditions without the project reflect traffic increases due to regional growth and development. This scenario is referred to as baseline or “no project” conditions. The forecasted future traffic volumes were then used as a baseline to identify impacts on the roadway system from the project. Development of this baseline traffic scenario is described in this chapter.

4.1 Baseline (2035) Traffic Volumes

A growth factor was applied to existing traffic volumes to account for future study area growth. This factor was derived using State of HDOT historical counts. HDOT average daily traffic (ADT) counts on Ali'i Drive between Kaleiopapa Street and Kaluna Street shows a 0.5% annual increase in vehicular volumes from 2015 to 2016. Therefore, a background annual growth rate of 1% was used to provide more conservative baseline volumes. The growth rates were compounded over the fourteen-year timeframe (2021 to 2035) and applied to each of the existing intersection turning movement traffic volumes collected in September 2021. The resulting volumes were also rounded to the nearest ten (10).

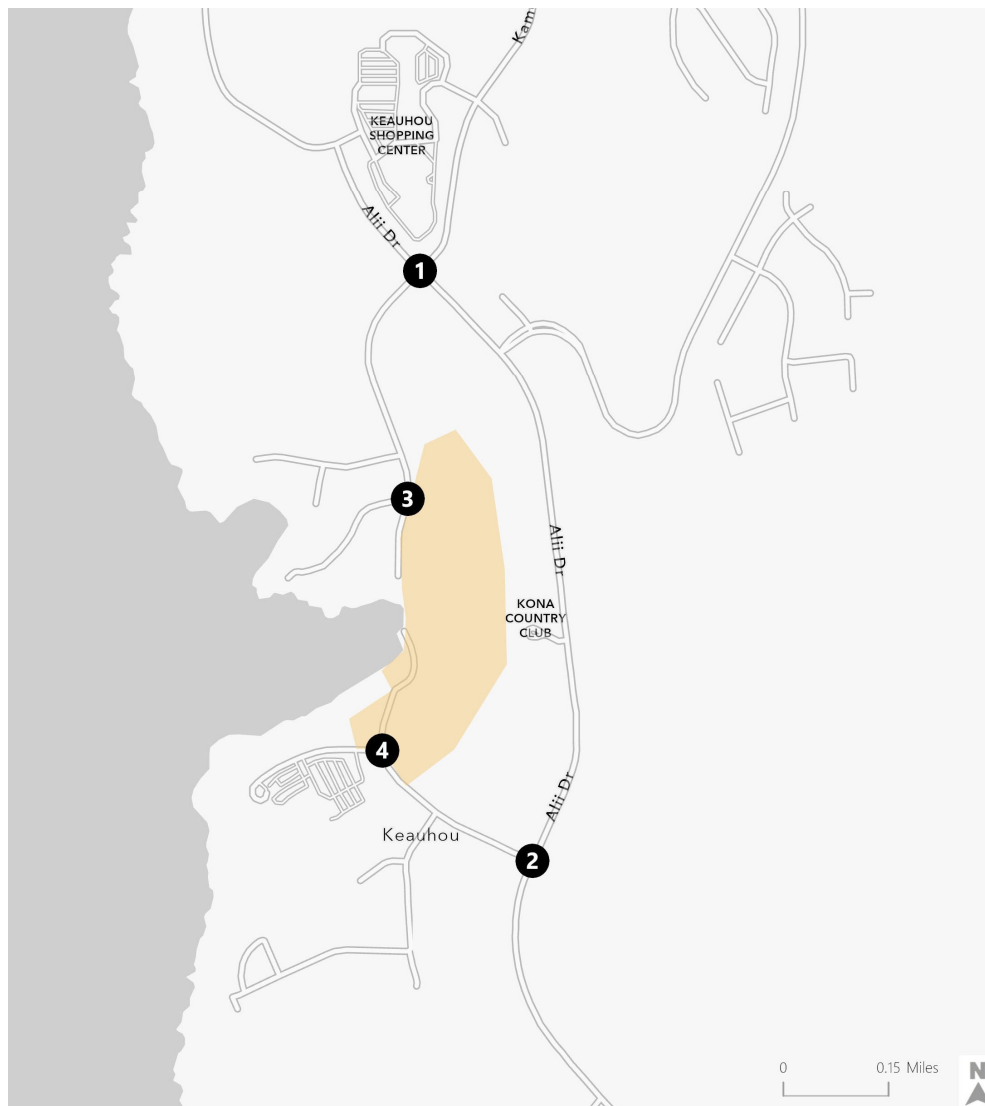
4.2 Baseline (2035) Street Roadway Improvements

No significant developments or future construction projects are expected in the surrounding area that would significantly affect the roadway geometrics (e.g., number of lanes, lane width, roadway boundary) or traffic volumes at the study intersections. This is based on research according to The HDOT Highways Program Status map¹ and Kona Community Development Plan (Amended September 2019). The intersection lane configurations and traffic control devices are expected to remain the same as under Existing Conditions.

Figure 8 illustrates the forecasted peak hour traffic volumes for the Baseline (2035) No Project Conditions.

¹ <https://histaegis.maps.arcgis.com/apps/MapSeries/index.html?appid=39e4d804242740a89d3fd0bc76d8d7de>





LEGEND

● Study Intersections

■ Project Site

Weekday AM (PM) [Saturday MD] Peak Hour Traffic Volumes

↕ Lane Configuration

AM PM SAT MD Level of Service (LOS)

A-C

D

E

F

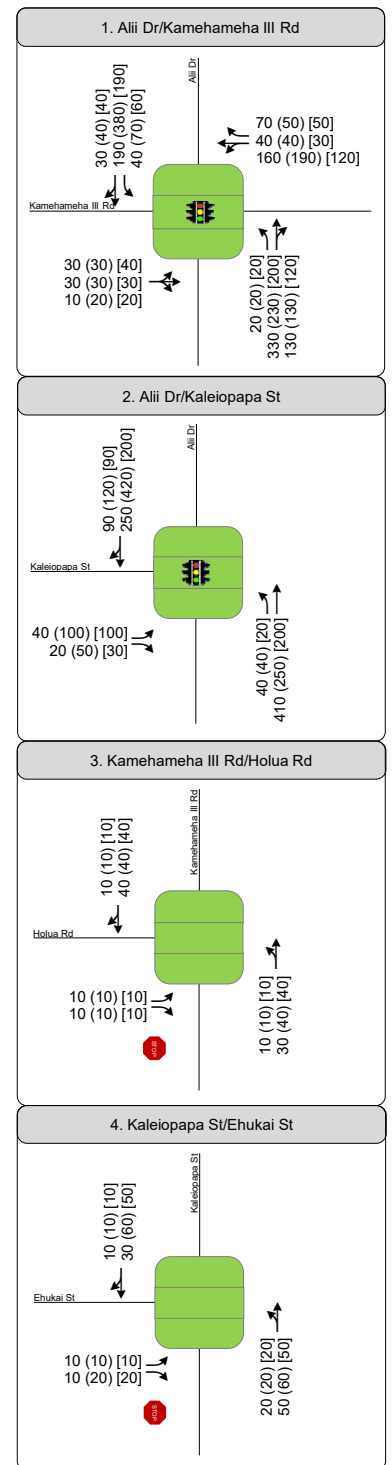


Figure 8

Peak Hour Traffic Volumes and Lane Configurations Baseline (2035) Conditions



4.3 Baseline (2035) No Project Levels of Service

Levels of service (LOS) calculations were conducted using the data in Sections 4.2 and 4.3 to evaluate the operating levels of the study intersections under Baseline (2035) No Project Conditions with the forecasted growth in traffic. The results of the LOS analysis are presented in **Table 6**. The corresponding LOS calculation sheets are included in **Appendix C**. The analysis results indicate that all study intersections are expected to continue operating at LOS D or better under Baseline (2035) No Project Conditions. The changes in operations from Existing Conditions are the result of the addition of the forecast traffic growth.

Table 6: Baseline (2035) No Project Intersection Level of Service

Study Intersection	Traffic Control	Peak Hour	Baseline (2035) Conditions	
			Delay ¹	LOS
1. Ali'i Drive & Kamehameha III Road	Signalized	Weekday AM	11.1	B
		Weekday PM	11.9	B
		Sat MD	10.1	B
2. Ali'i Drive & Kaleiopapa Street	Signalized	Weekday AM	6.1	A
		Weekday PM	8.8	A
		Sat MD	7.7	A
3. Kamehameha III Road & Hōlua Road	Side Street Stop Control	Weekday AM	9.3	A
		Weekday PM	9.3	A
		Sat MD	9.3	A
4. Kaleiopapa Street & ʻĒhukai Street	Side Street Stop Control	Weekday AM	9.4	A
		Weekday PM	9.5	A
		Sat MD	9.4	A

Source: Fehr & Peers.

Notes:

¹ Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.



5. Project Traffic Estimates

This chapter describes the anticipated number of vehicle trips and directionality of those trips that would result from implementation of the proposed project. Future traffic added to the roadway system by the project is estimated using a three-step process: (1) trip generation, (2) trip distribution, and (3) trip assignment. The first step estimates the amount of project-generated traffic which will be added to the roadway network. The second step identifies the direction of travel to and from the project site and the proportion of traffic on each potential travel path. The new trips are assigned to specific street segments and intersection turning movements during the third step. This process is described in more detail in the following sections.

5.1 Trip Generation

The vehicle trip generation for the proposed project was estimated using a combination of standard trip rates from national and other sources. published in the *Trip Generation Manual* (11th Edition, 2020) by the Institute of Transportation Engineers (ITE). For land uses such as beach park that do not have an equivalent in the ITE manual, we used *Brief Guide of Vehicular Traffic Generation Rates for the San Diego region*² developed by the San Diego Association of Governments (SANDAG). These trip totals were then adjusted using the Mixed-Use (MXD) Trip Generation Model developed by Fehr & Peers and the Environmental Protection Agency (EPA), which is based on statistically superior data compared to the mixed-use methodology used by ITE alone. This model accounts for the site context and other factors to estimate potential internalization and multimodal trip reductions, where trips will be made by walking, bicycling and transit.

As shown in **Table 7**, the proposed project is expected to generate a total of 1,928 net new daily vehicle trips on a weekday, including 155 net new vehicle trips during the AM peak hour (98 inbound/57 outbound) and 230 net new vehicle trips during the PM peak hour (109 inbound/121 outbound). On a Saturday, the project is estimated to generate 361 net new vehicle trips during Saturday midday peak hour (181 inbound/180 outbound). The number of daily Saturday trips is not provided however, it could be generally estimated if needed based on the relationship between the average of the weekday AM and PM proportions of weekday daily traffic.

² https://www.sandag.org/uploads/publicationid/publicationid_1140_5044.pdf



Table 7: Project Vehicle Trip Generation Estimates

Strategy	Trip Generation Category (Source)	Size	Unit	Weekday							Saturday ⁵		
				Daily	AM			PM			Midday		
					In	Out	Total	In	Out	Total	In	Out	Total
A3/D1	Library (ITE)	2	ksf	144	1	1	2	8	9	17	14	12	26
A4	Beach, Ocean or Bay shoreline park (SANDAG)	0.9	acre	54	4 ¹	2 ¹	6 ¹	2	4	6	6 ²	10 ²	16 ²
A4	Beach, Ocean or Bay shoreline park (SANDAG)	2.0	acre	120	8 ¹	5 ¹	13 ¹	5	8	13	14 ²	20 ²	34 ²
B2	Strip Retail Plaza (<40k) (ITE)	11.62	ksf	633	17	11	28	39	38	77	46	31	77
	Fast Casual Restaurant (ITE)	3	ksf	252	21 ¹	17 ¹	38 ¹	21	17	38	54	44	98
B3	Resort Hotel (ITE)	150	room	503	35	13	48	27	35	62	33 ³	43 ³	76 ³
B4	Strip Retail Plaza (<40ksf) (ITE)	2	ksf	109	3	2	5	7	7	14	8	6	14
C2	Beach, Ocean or Bay shoreline park (SANDAG)	2.2	acre	132	9 ¹	6 ¹	15 ¹	6	9	15	16 ²	23 ²	39 ²
<i>Total</i>				<i>1,947</i>	<i>98</i>	<i>57</i>	<i>155</i>	<i>115</i>	<i>127</i>	<i>242</i>	<i>191</i>	<i>189</i>	<i>380</i>
<i>Reduction⁴</i>				<i>1,947</i>	<i>-</i>	<i>-</i>	<i>-</i>	<i>6</i>	<i>6</i>	<i>12</i>	<i>10</i>	<i>9</i>	<i>19</i>
<i>Net Trip</i>				<i>1,928</i>	<i>98</i>	<i>57</i>	<i>155</i>	<i>109</i>	<i>121</i>	<i>230</i>	<i>181</i>	<i>180</i>	<i>361</i>

Source: Fehr & Peers, ITE Trip Generation Manual (11th Edition, 2020), and SANDAG Trip Generation Rates.

Notes:

¹ PM trip rates are used as the AM trip rates. Because the AM trip rates were lower than what this land use in this project is expected to generate.

² Saturday trip generation rate for this land use is not provided. To calculate the Saturday trips, the ratio of weekday PM to Saturday rates from the public park land use from ITE Trip Generation Manual multiplied by weekday PM trip rates of this land use.

³ Similar to the previous note with only difference that Hotel land use from the ITE Trip Generation Manual used as a reference land use to calculate the PM weekday to Saturday trip rate.

⁴ It is expected that the reduction is underestimated given all of the complementary uses on the site. The actual trip gen would be lower than estimated.

⁵ The number of daily Saturday could be generally estimated based on the relationship between the average of the weekday AM and PM proportions of weekday daily traffic.



5.2 Trip Distribution and Assignment

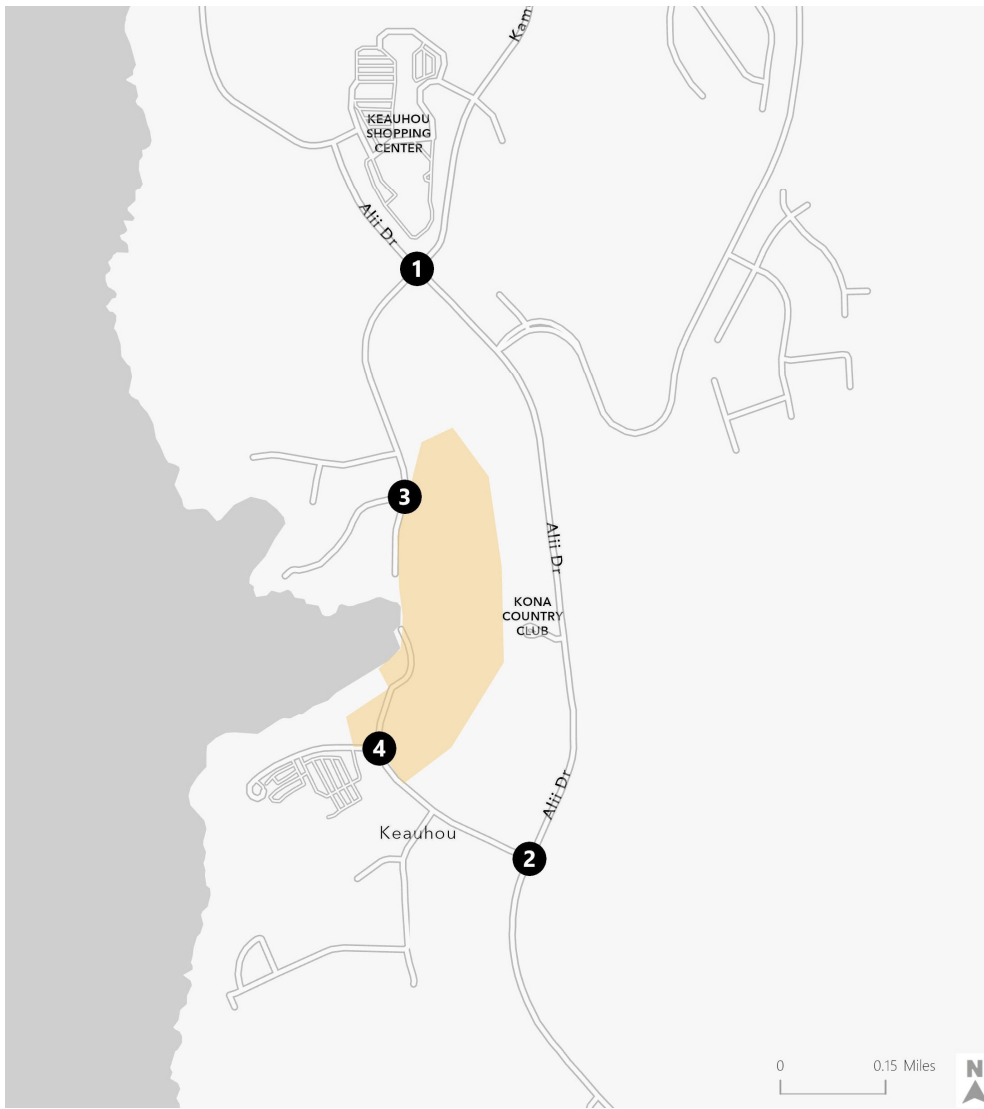
The geographic distribution of trips generated by the proposed project is dependent on characteristics of the street system serving the project site; the level of accessibility of routes to and from the project site; and recreational and retail areas to which local residents and other visitors would be drawn (e.g., parks, shopping destinations, services, and restaurants), as well as lodging area that would draw visitors from Hawai'i Island, the rest of the State, and elsewhere. The resulting overall trip distribution pattern estimates for the peak hour project-generated traffic are shown on **Figure 9** and are listed below:

- 60% to/from the north along Ali'i Drive
- 25% to/from the south along Ali'i Drive
- 15% to/from the east Kamehameha III Road

Using the estimated trip generation and the distribution patterns discussed above, the traffic generated by the proposed project was assigned to the individual turning movements at intersections within the street network. **Figure 10** details the project's trip assignment at each study intersection.

Also, with addition of the project, the trip assignment on Kaleiopapa Street and Kamehameha III Road will change based on the new and repurposed land uses, the parking locations, and the new connection of Old Kona Road. Therefore, the baseline no project volumes were reassigned for conditions with the project in place.





LEGEND

- Study Intersections
- Project Site
- ↔ X Trip Distribution Percentage

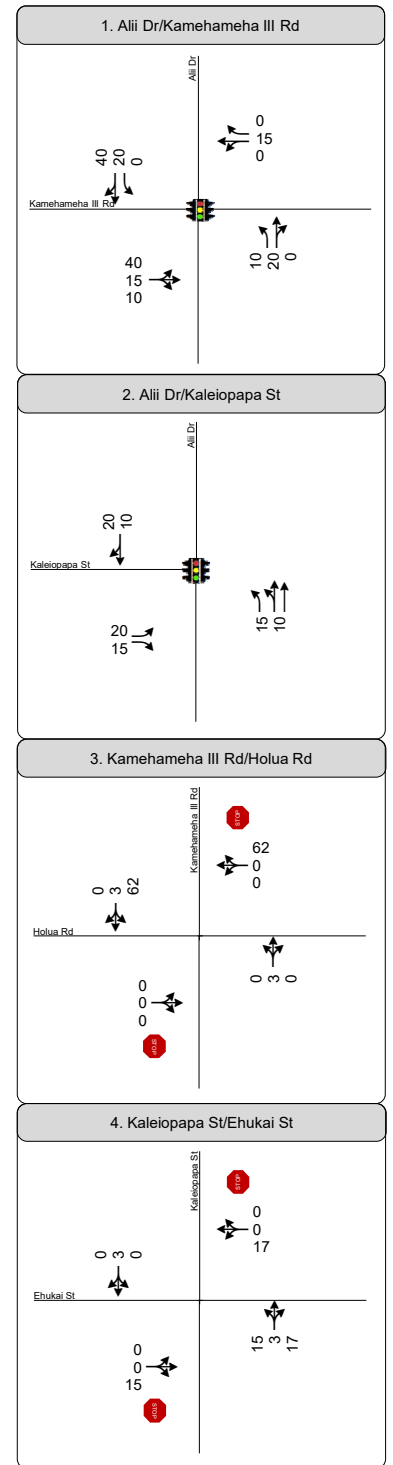
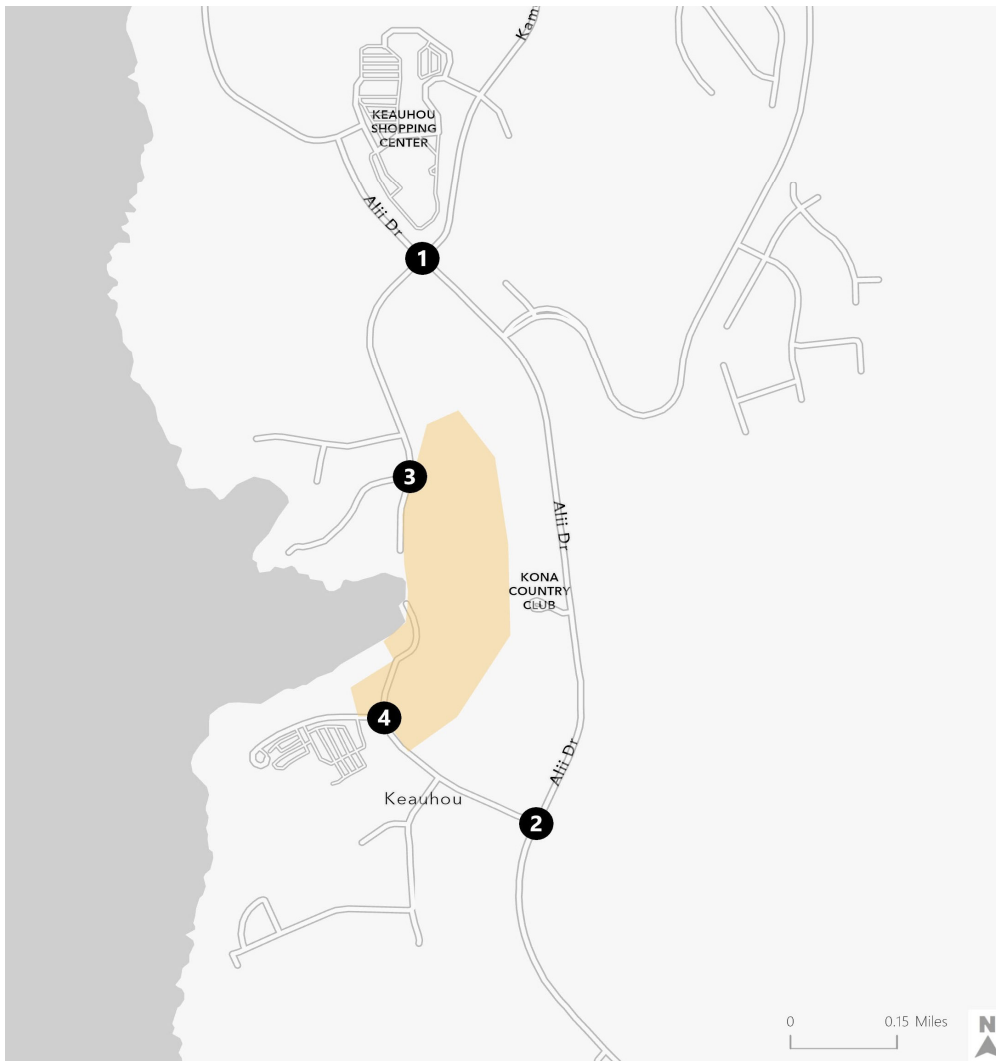


Figure 9

Project Trip Distribution





LEGEND

● Study Intersections

■ Project Site

Weekday AM (PM) [Saturday MD] Peak Hour Traffic Volumes

↕ Lane Configuration

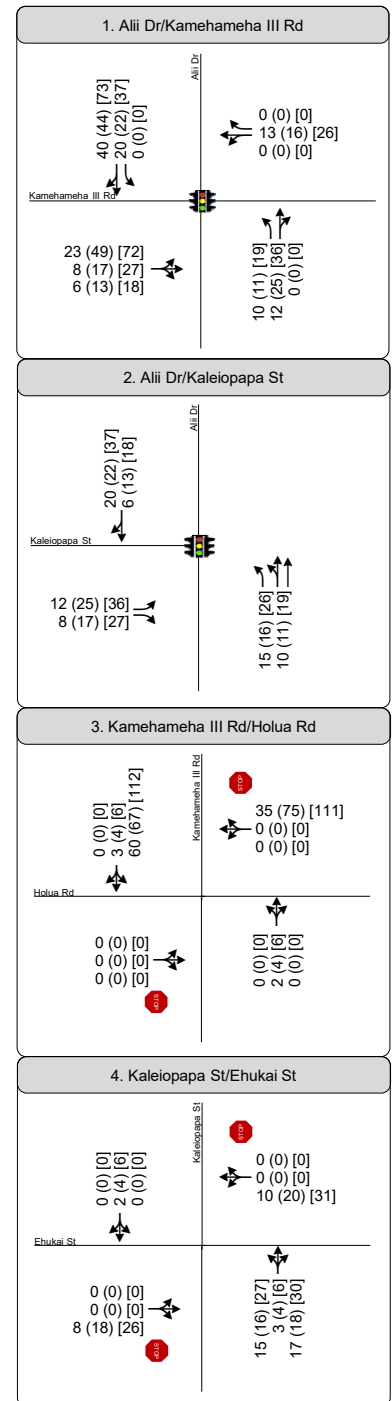


Figure 10

Project Trip Assignment



6. Baseline (2035) Plus Project Conditions

This section describes the analysis of potential impacts on the roadway system due to projected future increases in traffic, including traffic generated by the project in 2035. The Baseline (2035) Plus Project roadway network is the same network assumed under the Baseline No Project scenario. The analysis compares the project levels of service (LOS) at each study intersection with and without the addition of project-generated trips to determine potential impacts on the transportation network.

6.1 Project Roadway Improvements

The proposed project will improve the Old Kona Road to provide improved connectivity between Kaleiopapa Street to Kamehameha III Road and to enhance access to some new developments along the road. No other roadway improvements for vehicular movements are proposed as part of the project.

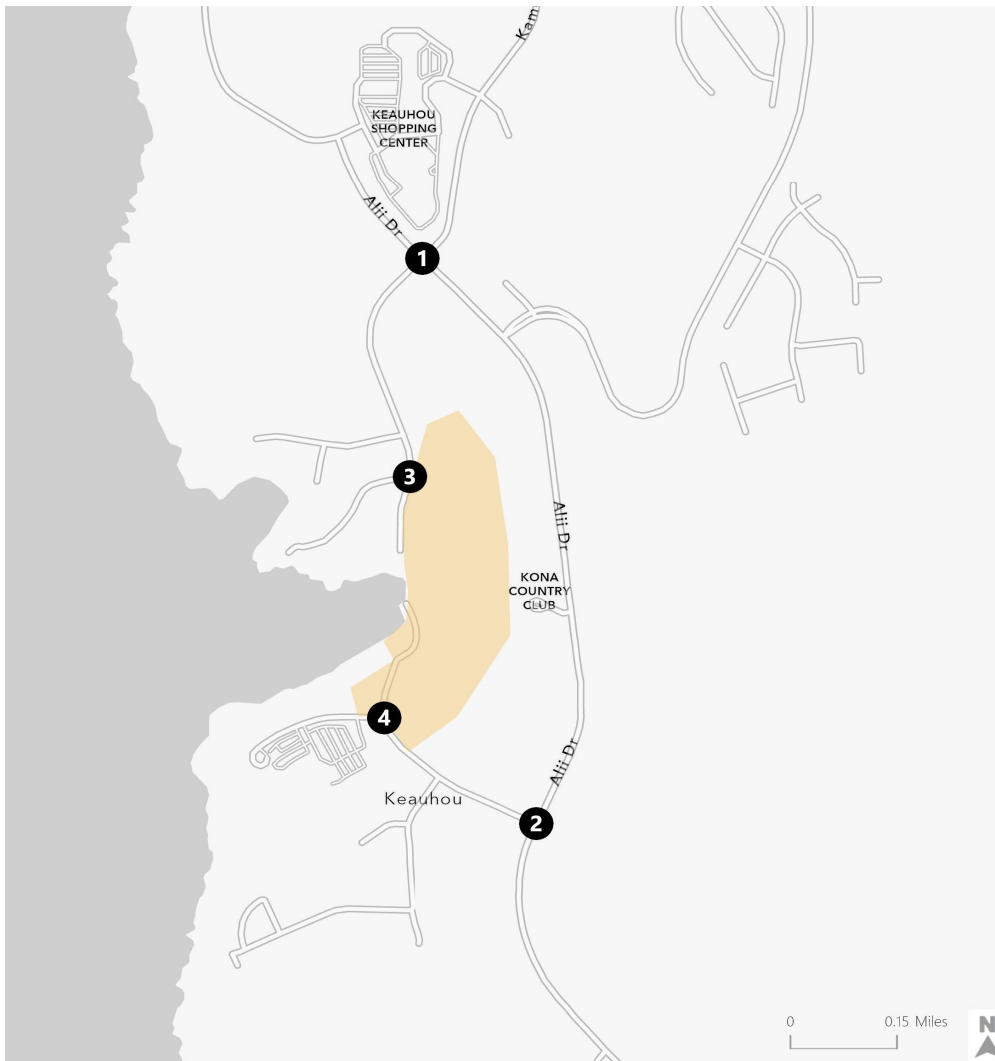
6.2 Baseline (2035) Plus Project Intersection Level of Service

Figure 11 presents the forecasted Baseline (2035) Plus Project AM, PM, and Saturday midday peak hour volumes. The peak hour volumes were used to analyze operations using the LOS methodology described in **Section 2.4**.

The LOS analysis results for the study intersections under both Baseline (2035) No Project and Plus Project conditions are presented in **Table 8**. Detailed LOS results for intersection movements and corresponding LOS calculation sheets are included in **Appendix D**. The results indicate that under Baseline (2035) Plus Project conditions, all study intersections are anticipated to continue to operate at LOS D or better during the AM and PM peak hours with the addition of project-generated traffic.

All unsignalized intersections are projected to operate with acceptable LOS (LOS D or better), so no signal warrant analysis is needed.





LEGEND

● Study Intersections

■ Project Site

Weekday AM (PM) [Saturday MD] Peak Hour Traffic Volumes

↕ Lane Configuration

AM PM SAT MD Level of Service (LOS)

A-C

D

E

F

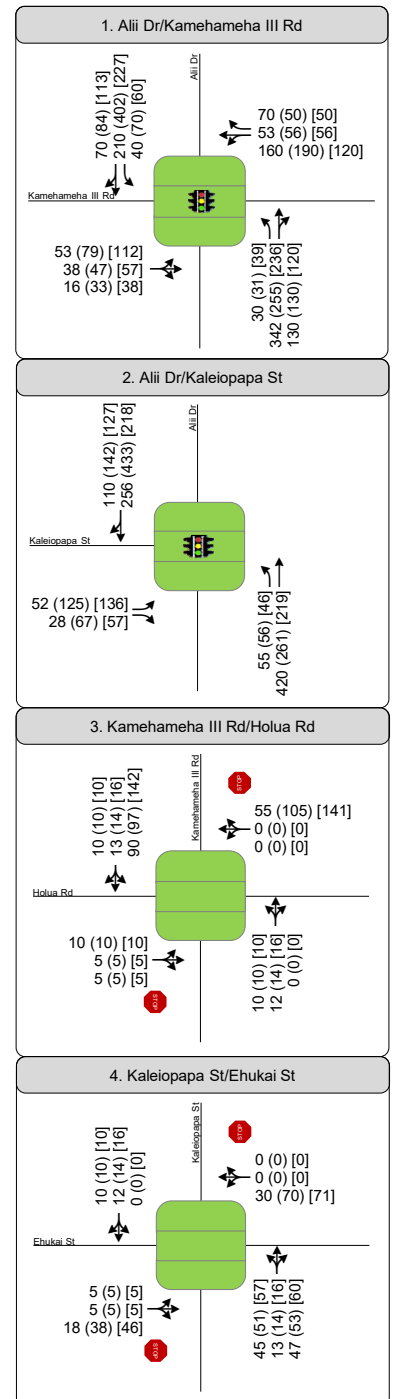


Figure 11

Peak Hour Traffic Volumes and Lane Configurations
Baseline (2035) Plus Project Conditions



Table 8: Baseline (2035) Plus Project Intersection Level of Service

Study Intersection	Traffic Control	Peak Hour	Beeline (2035) Conditions		Baseline Plus Project Conditions		Change in Delay
			Delay ¹	LOS	Delay ¹	LOS	
1. Ali'i Drive & Kamehameha III Road	Signalized	Weekday AM	11.1	B	11.5	B	0.4
		Weekday PM	11.9	B	12.8	B	0.9
		Sat MD	10.1	B	11.4	B	1.3
2. Ali'i Drive & Kaleiopapa Street	Signalized	Weekday AM	6.1	A	6.6	A	0.5
		Weekday PM	8.8	A	9.6	A	0.8
		Sat MD	7.7	A	8.9	A	1.2
3. Kamehameha III Road & Hōlua Road	Side Street Stop Controlled	Weekday AM	9.3	A	11.1	B	1.8
		Weekday PM	9.3	A	11.7	B	2.4
		Sat MD	9.3	A	13.2	B	3.9
4. Kaleiopapa Street & Ēhukai Street	Side Street Stop Controlled	Weekday AM	9.4	A	10.5	B	1.1
		Weekday PM	9.5	A	11.4	B	1.9
		Sat MD	9.4	A	11.8	B	2.4

Source: Fehr & Peers.

Notes:

¹ Whole intersection weighted average stopped delay expressed in seconds per vehicle for signalized intersections. The vehicular delay for the worst movement is reported for side-street stop-controlled intersections.

6.3 Potential Traffic Impacts

Based upon the impact significance criteria and the results of the operations analysis presented in Section 6.2, development of the proposed project is not expected to result in any significant traffic impacts under any of the study peak periods.

As noted in Section 5.2, new trips to the project site were distributed based on a variety of factors including existing traffic volumes, street characteristics and accessibility, and the location of new land uses and new parking areas. No diversion of existing traffic volumes was assumed in the analysis included in Section 6.2 because: 1) the general arrangement of land uses (e.g., commercial vs beach uses) is not changing substantially with the project, 2) the roadway on the Old Kona Road alignment is planned to be designed as an internal circulation access roadway (i.e., with narrow lanes and speed control devices) and not as a higher capacity through road, and 3) it is not possible to accurately estimate the specific number of existing vehicles that might shift with the new connection since the shift will be based on individual



driver behavior/choice. That said, the existing volumes were reviewed to determine the maximum shift that could occur. Based on the distribution of existing traffic that predominantly access the bay to and from the north, the potential shift could involve some traffic that currently uses Kaleiopapa Street to use Kamehameha III Road with the planned connection. It is estimated that no more than 30 vehicle trips per direction could be diverted from Kaleiopapa Street to Kamehameha III Road during the Saturday peak hour, which includes the highest volumes at the site. This additional volume could be an average of up to one additional vehicle per minute but would not significantly affect operations at the intersections on Kamehameha III Road, or be noticeable to other drivers on the roadway.

6.4 Active Transportation and Transit Impacts

6.4.1 Planned Active Mode and Transit Improvements

Some pedestrian and cycling facilities, and transit route improvements are planned for the project area and vicinity. All planned active transportation and transit improvements are focused on Ali'i Drive or roadways outside the immediate project area, with none planned for Kaleiopapa Street or Kamehameha III Road makai of Ali'i Drive.

Planned pedestrian facilities from *the Kona Community Development Plan* include sidewalks along Ali'i Drive and a path along the planned Kahului – Keauhou Parkway³. The project area is not included in any areas of concern in the *Hawai'i Statewide Pedestrian Master Plan*; however, the plan does include broader recommendations for pedestrian facilities across the state.

Bike Plan Hawai'i (2003) includes multiple improvements in the project vicinity for bicycling infrastructure. The Ali'i Drive extension is a path planned between Lekeleke Bay and Kealakekua Bay south of the project site. Additionally, a signed shared road is planned on Ali'i Drive between Palani Road and Keauhou Road. Shared road marking and signage are planned for Kamehameha III Road between Kuakini Highway (Highway 19) and Ali'i Drive in the project vicinity⁴.

The *County of Hawai'i Transit and Multi-Modal Transportation Master Plan* includes three routes which serve the project area, with two currently serving the area and a third planned. Route 90 will provide select trips between Pahala and South Kohala, along Ali'i Drive and Kamehameha III Road.

6.4.2 Potential Active Mode and Transit Impacts

Implementation of the proposed project will not conflict with any existing pedestrian facility, and it will not preclude the implementation of any other potential enhancements to walking (e.g., a path or sidewalk

³ County of Hawai'i Kona Community Development Plan, 2008.

⁴ Hawai'i Department of Transportation Bike Plan Hawai'i Master Plan, Appendix E – Proposed Bicycle Facilities (Map List). 2012



along a facility where it does not currently exist). Similarly, bicycle trips will be generated by the project, but development of the project is not expected to conflict with any existing or planned bicycle facility. For people who walk and bike, separate pedestrian and bicycle facilities are not currently provided near Keauhou Bay. The proposed project is expected to generate bicycle and pedestrian trips to and from the project site, although the total volumes are expected to be low. Regardless, the project will provide a shared-use path for pedestrian and bicycles along the Old Kona Road alignment to enhance safety and improve multimodal connectivity between the existing and proposed land uses (parks, open space, hotel, restaurant, etc.). This will allow a park-once option for all site visitors such that they will be able to visit multiple uses within the site without having to drive a vehicle.

The proposed project is also expected to generate new transit trips by visitors to the site, as well as by employees of the commercial uses and the resort. New transit users are expected to utilize Route 204 and the existing stop on Kaleiopapa Street as the nearest transit stop. However, this increase in ridership is not expected to increase to a level that would substantially affect existing transit facilities and services.



7. Site Access, Circulation, and Parking

This chapter includes a review of the site access and on-site circulation for vehicles, pedestrians, and bicyclists.

7.1 Site Access Assessment

Primary vehicular site access will be provided via Kaleiopapa Street and Kamehameha III Road. While these access points exist today, the new connection between them via Old Kona Road does not. This new linkage will allow vehicles destined for the site to now use either Kamehameha III Road or Kaleiopapa Street to access the site. As noted in Chapter 6, Both approaches on Old Kona Road at these intersections will be controlled by a stop sign.

The parking lot serving the commercial area located makai of Ēhukai and Kaleiopapa Streets will provide vehicular access via a driveway located on each fronting street. Access to the proposed resort will also be provided by driveways along Old Kona Road. The only other parking lot not directly accessed by Old Kona Road is the proposed boat trailer lot at the south end of the site, and the outbound and inbound driveways will intersect Kaleiopapa Street approximately 50 and 200 feet mauka of the Old Kona Road intersection, respectively.

Because the largest parking field will be located at the north end of the site and the primary source of trips is to and from the north in Ali'i Drive, no substantial change in travel patterns is anticipated. Due to relatively low traffic volumes and desirable operating levels during peak periods, no additional vehicular access points are needed or recommended.

Bicyclists and pedestrians are also expected to access the project site. As noted in Section 6.6, multimodal access to the site will be enhanced by providing a shared-use path linking different uses of the site. In addition, the implementation of new sidewalks along Ali'i Drive and the shared road signing and striping on Kamehameha III Road and Ali'i Drive will provide access for pedestrians and bicycles to the surrounding land uses such as the Keauhou Bay shopping center.

Overall, site access is considered acceptable, and no additional access modifications.



7.2 On-Site Circulation & Parking

Most vehicles accessing the site will park in the designated lots located at either end of Old Kona Road. This roadway will link the north and south ends of the site, but this connection is intended to be a low-speed, local connection with characteristics similar to a driveway or alley (i.e., not a collector-type roadway intended to serve through traffic). As such, we recommend that it include narrow travel lanes and traffic calming devices such as speed humps (or raised crosswalks where appropriate) at 300- to 600-foot intervals to moderate travel speeds and to minimize through traffic between the neighborhoods located on the north and south sides of Keauhou Bay.

Use of the Old Kona Road alignment will minimize potential congestion and provide a more formalized circulation path for vehicles which reduces conflicts and improve safety. It is also intended to minimize the traffic shift as a result of the connection provided between Kamehameha III Road and Kaleiopapa Street. For example, with the connection provided by Old Kona Road, boats parked in the boat parking lot on Kamehameha III Road no longer need to turn around and enter from Kaleiopapa Street to launch their boats into the Bay. Overall, on-site circulation is considered adequate, and no modifications are recommended.

The proposed project will provide 126 parking stalls in lot at the north end of the site to accommodate visitors to the beach park, cultural sites, outrigger canoes, educational uses, and tour vendors. An approximate 60-space lot is proposed for the commercial uses and dining venue located near the Ēhukai Street/Kaleiopapa Street intersection, and the existing 10 parking spaces close to the boat pier will be maintained. In addition, parking for the proposed resort will include a total of roughly 170 spaces or roughly one space per unit plus some additional parking for employees. Provision of all these spaces is intended to reduce the amount of on-street parking and to ensure that the site accommodates as much parking on-site as feasible.

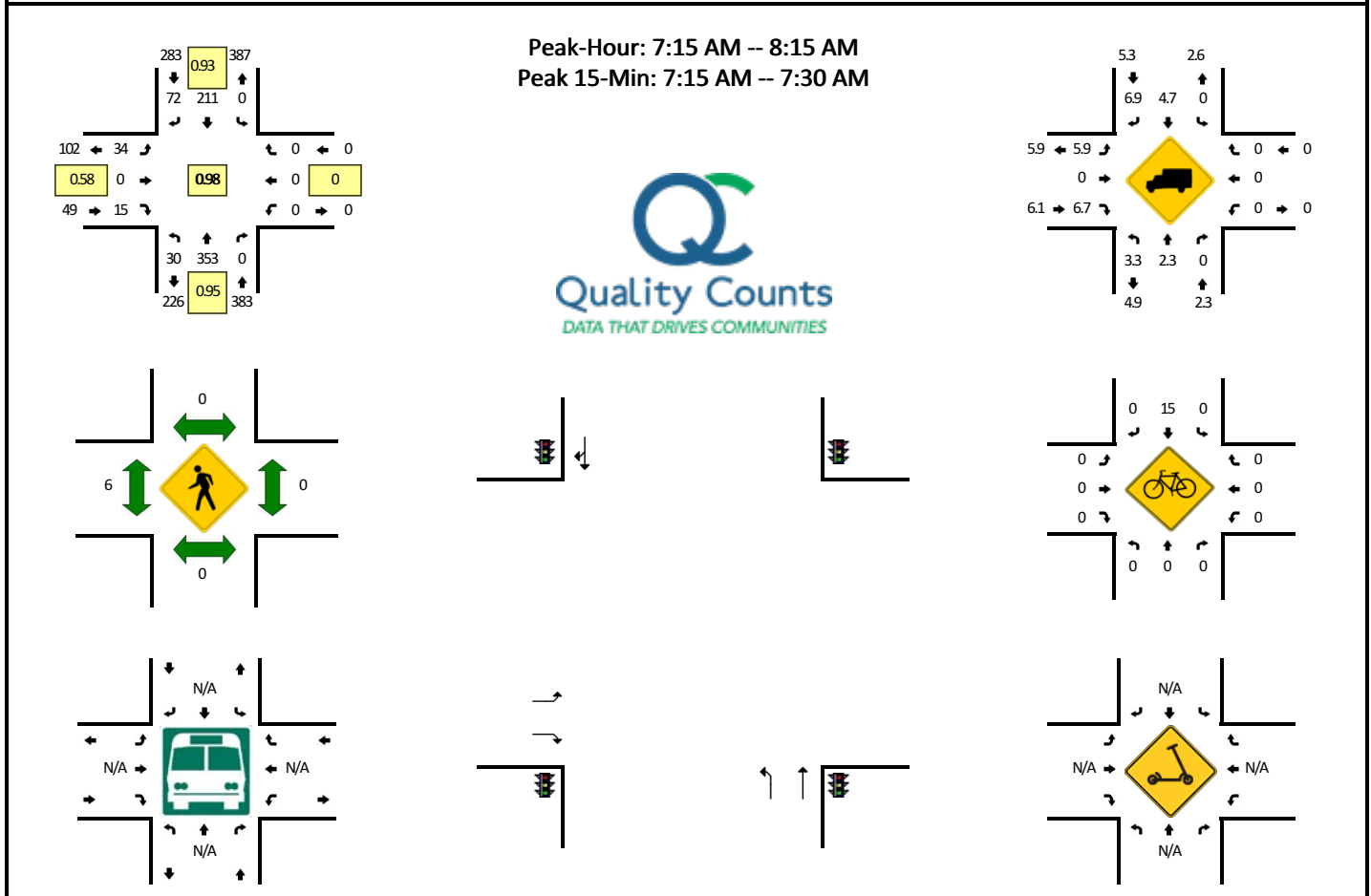
Given the mix of proposed uses, many visitors to the site are expected to visit more than one use during a single trip. For example, some beachgoers and canoe paddlers are expected to visit the commercial/dining uses, as will resort visitors and people using the boat ramp. Thus, the site will benefit from a “park once” strategy and will ultimately less parking than would be required for each individual land use. Even if parking demand exceeds the site supply at selected times, on-street parking is expected to be available given the substantial increase in off-street supply to serve the existing and new uses. This approach is more sustainable in that it will utilize an existing resource, and require less new impermeable surfaces for parking.



Appendix A: Traffic and Segment Counts

LOCATION: Alii Hwy -- Kaleiopapa St
CITY/STATE: Kahaluu-Keauhou, HI

QC JOB #: 15561801
DATE: Thu, Sep 16 2021

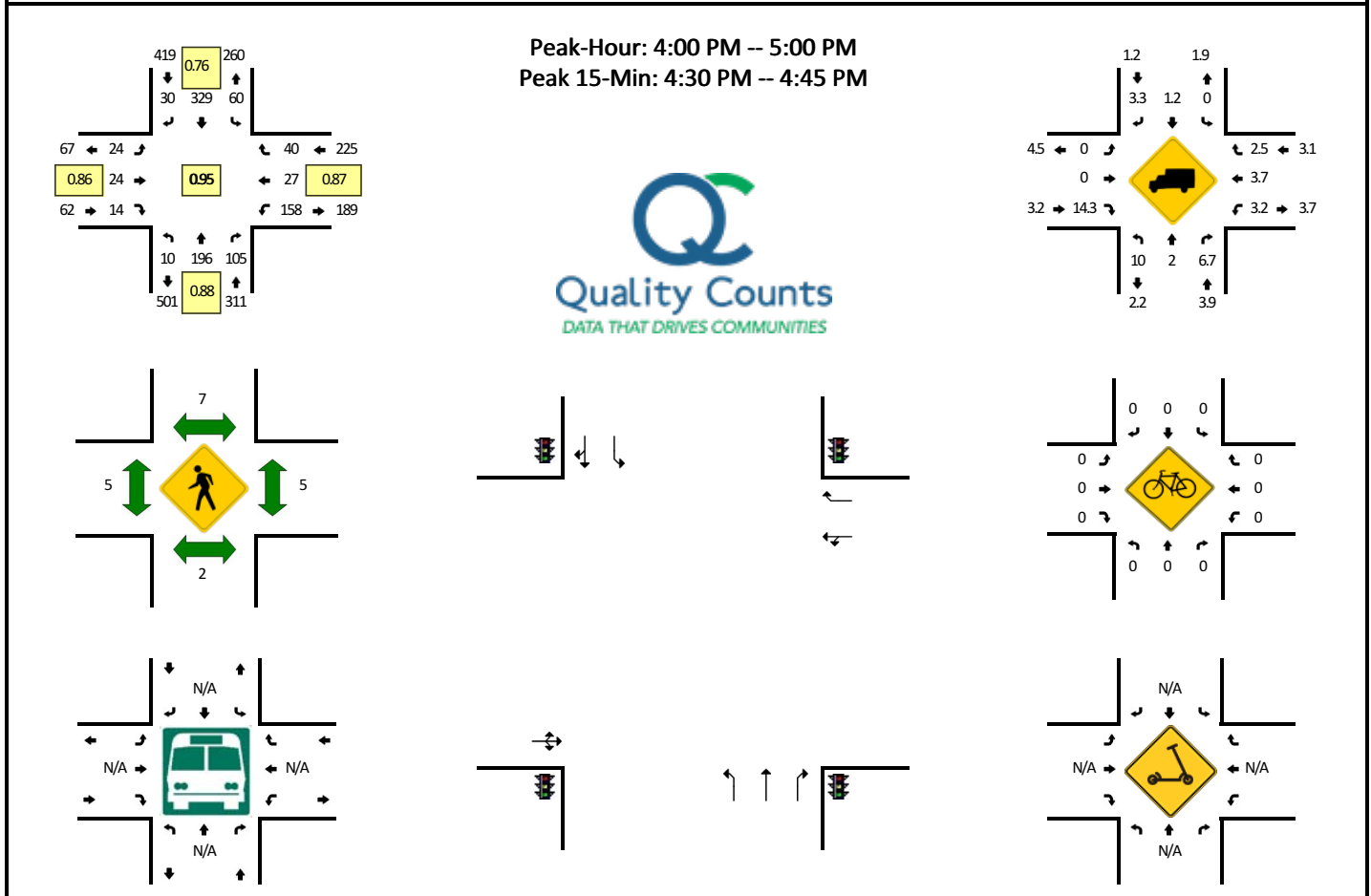


15-Min Count Period Beginning At	Alii Hwy (Northbound)				Alii Hwy (Southbound)				Kaleiopapa St (Eastbound)				Kaleiopapa St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	1	17	0	0	0	10	4	0	5	0	1	0	0	0	0	0	38	
6:15 AM	0	33	0	0	0	8	7	0	10	0	2	0	0	0	0	0	60	
6:30 AM	5	45	0	0	0	34	7	0	9	0	2	0	0	0	0	0	102	
6:45 AM	5	71	0	0	0	36	9	0	5	0	0	0	0	0	0	0	126	326
7:00 AM	2	60	0	0	0	45	19	0	8	0	2	0	0	0	0	0	136	424
7:15 AM	7	94	0	0	0	50	22	0	6	0	4	0	0	0	0	0	183	547
7:30 AM	11	89	0	0	0	60	10	0	9	0	0	0	0	0	0	0	179	624
7:45 AM	8	78	0	0	0	58	18	0	5	0	4	0	0	0	0	0	171	669
8:00 AM	4	92	0	0	0	43	22	0	14	0	7	0	0	0	0	0	182	715
8:15 AM	4	54	0	0	0	35	19	0	12	0	6	0	0	0	0	0	130	662
8:30 AM	7	50	0	0	0	39	10	0	7	0	4	0	0	0	0	0	117	600
8:45 AM	2	61	0	0	0	55	5	0	13	0	6	0	0	0	0	0	142	571
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	28	376	0	0	0	200	88	0	24	0	16	0	0	0	0	0	732	
Heavy Trucks	0	12	0	0	0	8	4	0	4	0	0	0	0	0	0	0	28	
Buses																		
Pedestrians	0	0			0	0			8				0	0			8	
Bicycles	0	0			0	4	0		0	0	0		0	0	0		4	
Scooters																		

Comments:

LOCATION: Alii Hwy -- Kamehameha III Rd
CITY/STATE: Kahaluu-Keauhou, HI

QC JOB #: 15561805
DATE: Thu, Sep 16 2021

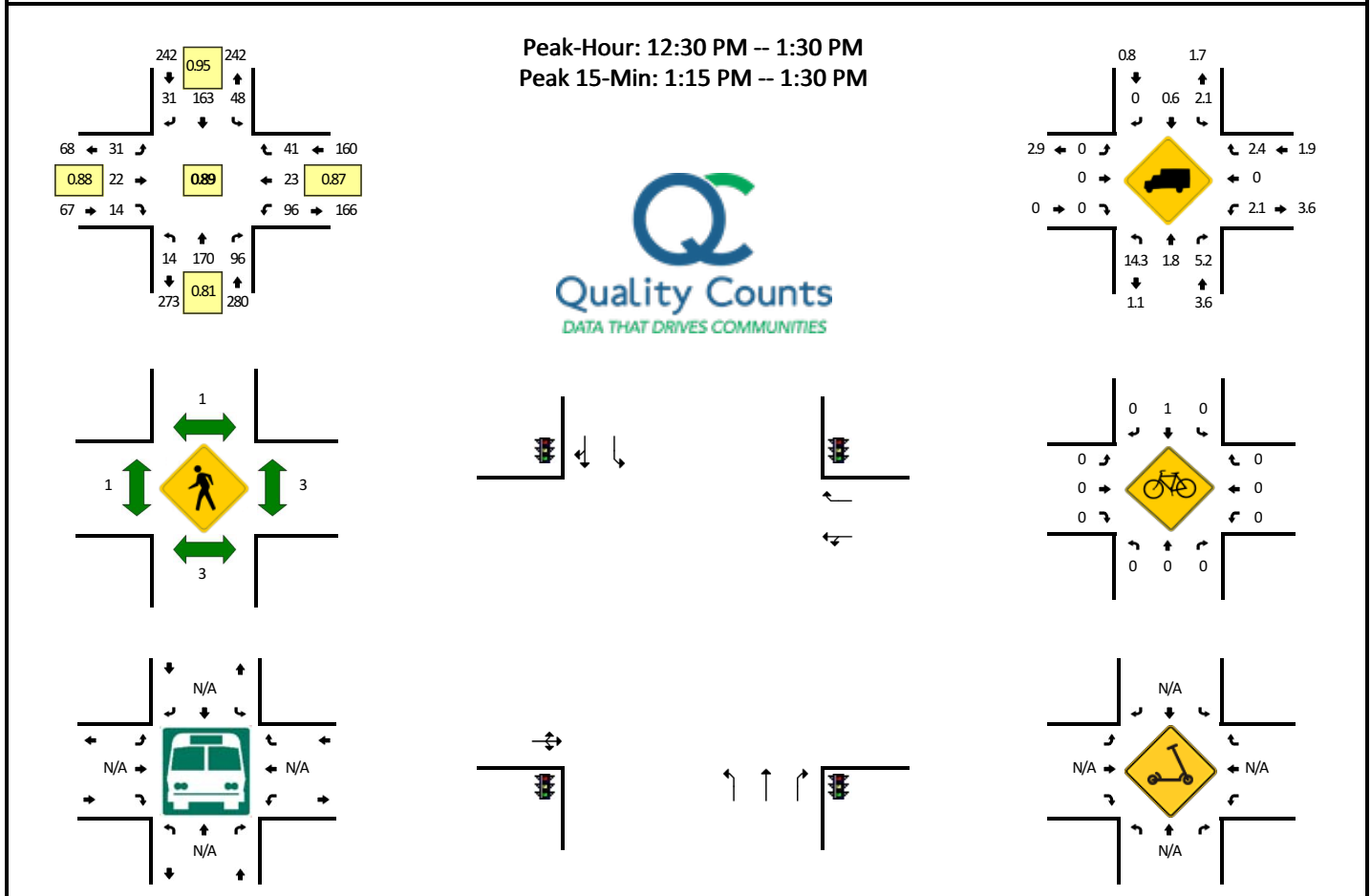


15-Min Count Period Beginning At	Alii Hwy (Northbound)				Alii Hwy (Southbound)				Kamehameha III Rd (Eastbound)				Kamehameha III Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	2	60	25	0	6	59	7	0	4	7	2	0	37	10	14	0	233	
3:45 PM	1	54	30	0	11	54	7	0	8	13	3	0	55	4	16	0	256	
4:00 PM	1	48	39	0	12	72	5	0	2	7	6	0	40	8	10	0	250	
4:15 PM	4	47	27	0	10	71	8	0	7	5	3	0	44	6	9	0	241	980
4:30 PM	2	42	25	0	20	107	10	0	10	6	2	0	32	4	7	0	267	1014
4:45 PM	3	59	14	0	18	79	7	0	5	6	3	0	42	9	14	0	259	1017
5:00 PM	2	40	20	0	16	73	9	1	2	8	3	0	41	7	13	0	235	1002
5:15 PM	1	45	24	0	19	72	10	0	4	1	2	0	42	1	9	0	230	991
5:30 PM	2	36	16	0	18	69	11	0	5	3	2	0	41	7	9	0	219	943
5:45 PM	2	23	19	0	10	61	7	0	7	9	2	0	36	5	15	0	196	880
6:00 PM	3	26	34	0	11	53	6	0	11	7	1	0	40	6	14	0	212	857
6:15 PM	1	26	25	0	14	39	6	0	8	4	3	0	31	2	9	0	168	795
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	8	168	100	0	80	428	40	0	40	24	8	0	128	16	28	0	1068	
Heavy Trucks	0	0	12		0	12	4		0	0	0		12	0	0		40	
Buses																		
Pedestrians		8				12				4				4			28	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scooters																		

Comments:

LOCATION: Alii Hwy -- Kamehameha III Rd
CITY/STATE: Kahaluu-Keauhou, HI

QC JOB #: 15561806
DATE: Sat, Sep 18 2021

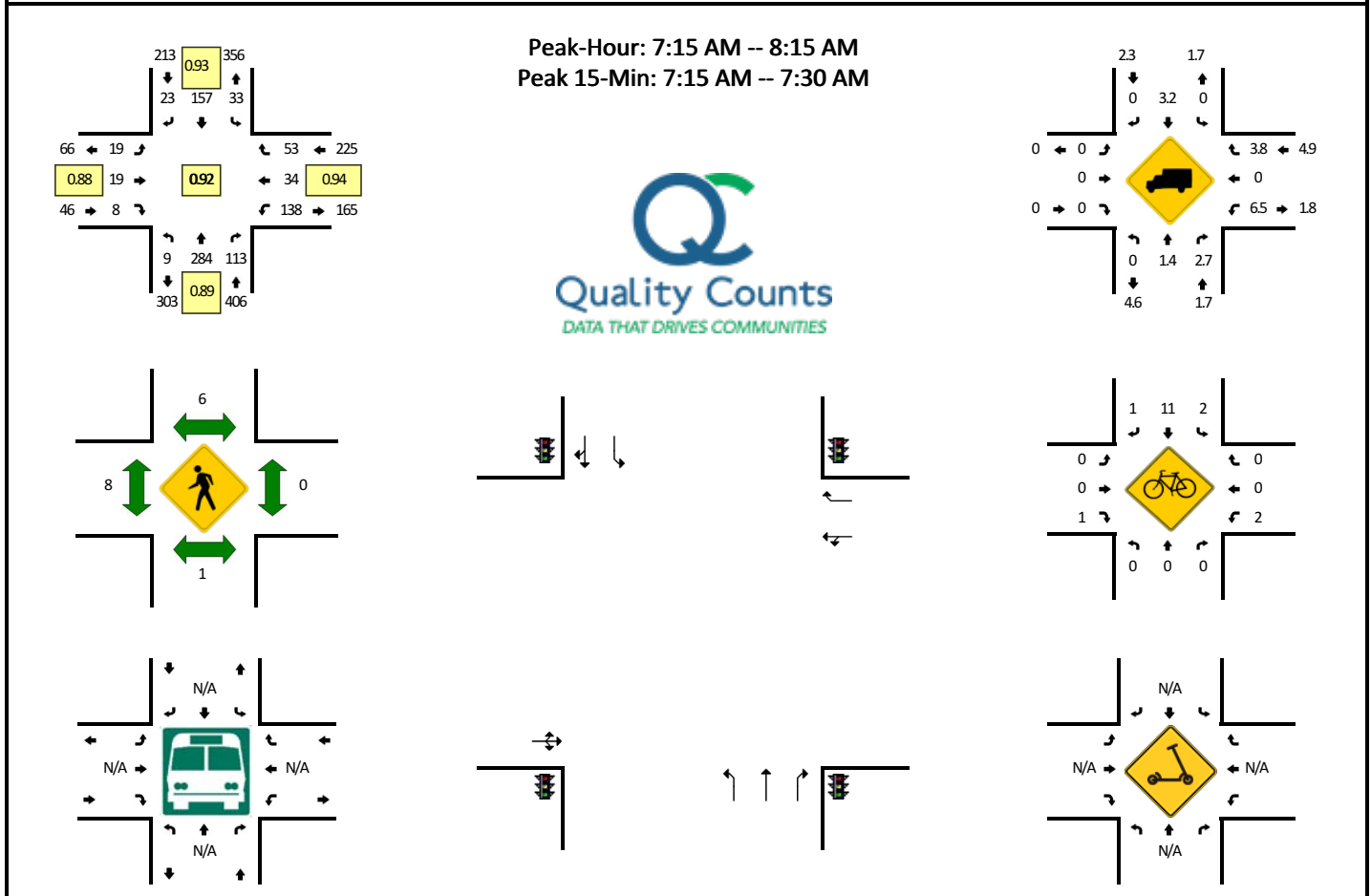


15-Min Count Period Beginning At	Alii Hwy (Northbound)				Alii Hwy (Southbound)				Kamehameha III Rd (Eastbound)				Kamehameha III Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
10:30 AM	3	42	27	0	14	37	6	0	9	4	1	0	20	2	13	0	178	
10:45 AM	0	33	24	0	19	47	6	0	9	9	3	0	24	5	14	0	193	
11:00 AM	1	47	18	0	14	49	4	0	5	4	1	0	24	2	13	0	182	
11:15 AM	2	48	24	0	19	44	5	0	3	7	5	0	15	1	12	0	185	738
11:30 AM	2	39	23	0	17	49	3	0	4	5	1	0	27	4	12	0	186	746
11:45 AM	1	38	21	0	14	50	10	0	3	2	4	0	19	3	13	0	178	731
12:00 PM	3	57	25	0	16	42	2	2	5	5	3	0	24	6	7	0	197	746
12:15 PM	0	40	27	0	10	45	7	0	1	3	3	0	24	5	16	0	181	742
12:30 PM	4	29	27	0	12	45	7	0	5	6	4	0	19	3	8	0	169	725
12:45 PM	1	44	22	0	7	38	9	0	8	8	2	0	21	8	11	0	179	726
1:00 PM	8	40	19	0	19	37	8	0	7	2	6	0	26	7	11	0	190	719
1:15 PM	1	57	28	0	10	43	7	0	11	6	2	0	30	5	11	0	211	749
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	4	228	112	0	40	172	28	0	44	24	8	0	120	20	44	0	844	
Heavy Trucks	4	4	8		0	4	0		0	0	0		4	0	4		28	
Buses																		
Pedestrians		0				0				0				0			0	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scooters																		

Comments:

LOCATION: Alii Hwy -- Kamehameha III Rd
CITY/STATE: Kahaluu-Keauhou, HI

QC JOB #: 15561804
DATE: Thu, Sep 16 2021

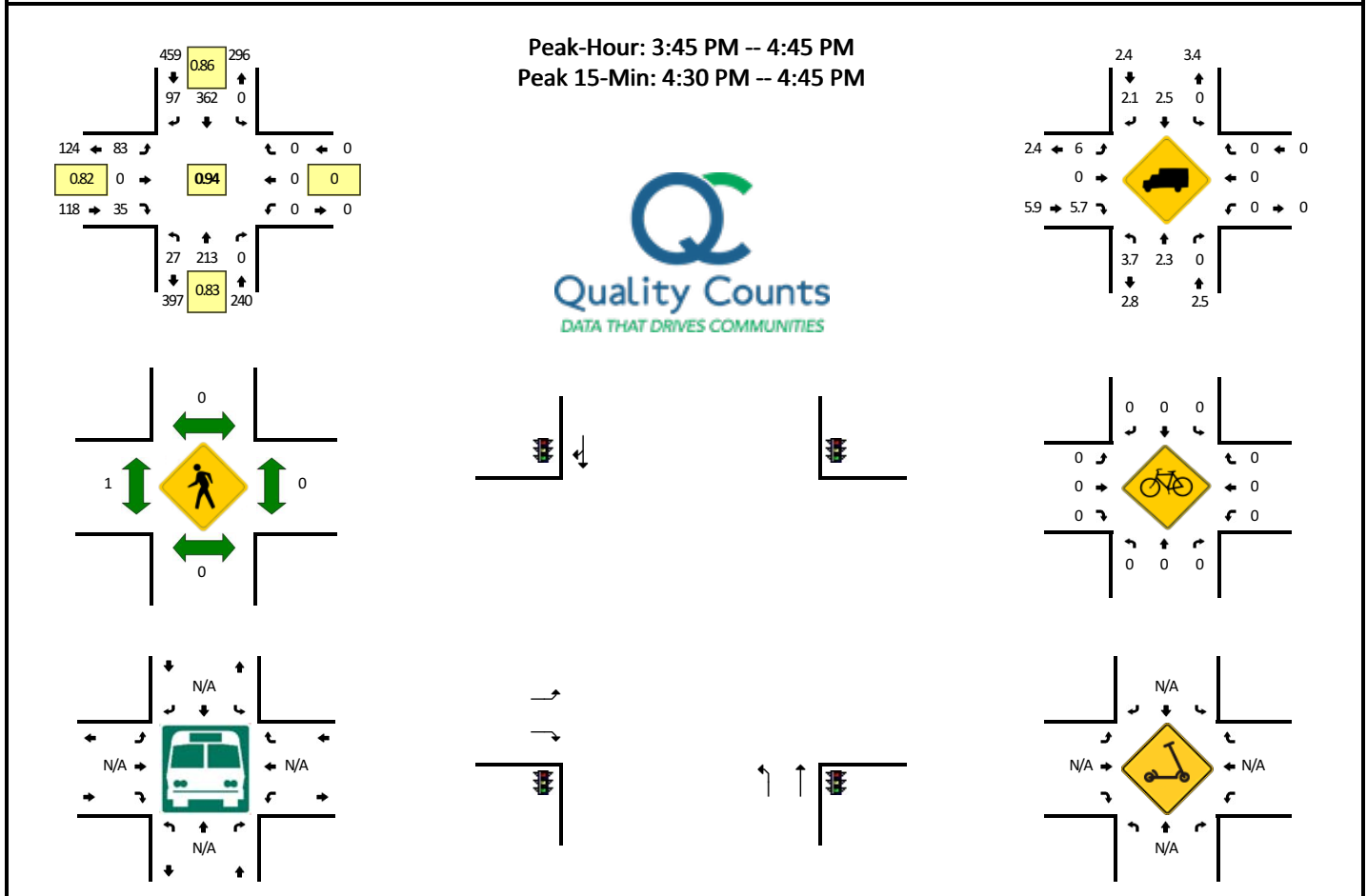


15-Min Count Period Beginning At	Alii Hwy (Northbound)				Alii Hwy (Southbound)				Kamehameha III Rd (Eastbound)				Kamehameha III Rd (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	7	13	0	4	9	1	0	0	5	1	0	8	0	3	0	51	
6:15 AM	1	18	26	0	5	9	2	0	1	1	1	0	13	2	3	0	82	
6:30 AM	1	35	20	0	8	26	2	0	1	2	1	0	14	2	9	0	121	
6:45 AM	4	54	29	0	7	23	4	0	8	3	1	0	32	7	6	0	178	432
7:00 AM	0	42	24	0	7	34	5	0	2	6	5	0	27	2	13	0	167	548
7:15 AM	0	83	31	0	7	42	6	0	4	6	3	0	36	10	14	0	242	708
7:30 AM	5	67	26	0	6	36	9	0	8	1	2	0	37	8	14	0	219	806
7:45 AM	2	69	22	0	6	47	4	0	2	7	1	0	33	8	14	0	215	843
8:00 AM	2	65	34	0	14	32	4	0	5	5	2	0	32	8	11	0	214	890
8:15 AM	3	43	30	0	14	26	5	0	6	0	3	0	28	1	11	0	170	818
8:30 AM	1	44	19	0	15	36	6	0	5	4	1	0	25	3	15	0	174	773
8:45 AM	5	49	30	0	6	27	4	0	5	7	1	0	25	5	17	0	181	739
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	332	124	0	28	168	24	0	16	24	12	0	144	40	56	0	968	
Heavy Trucks	0	4	4		0	8	0		0	0	0		0	0	0		16	
Buses																		
Pedestrians	0	0			0	0			4				0				4	
Bicycles	0	0	0		0	16	4		0	0	4		4	0	0		28	
Scooters																		

Comments:

LOCATION: Alii Hwy -- Kaleiopapa St
CITY/STATE: Kahaluu-Keauhou, HI

QC JOB #: 15561802
DATE: Thu, Sep 16 2021

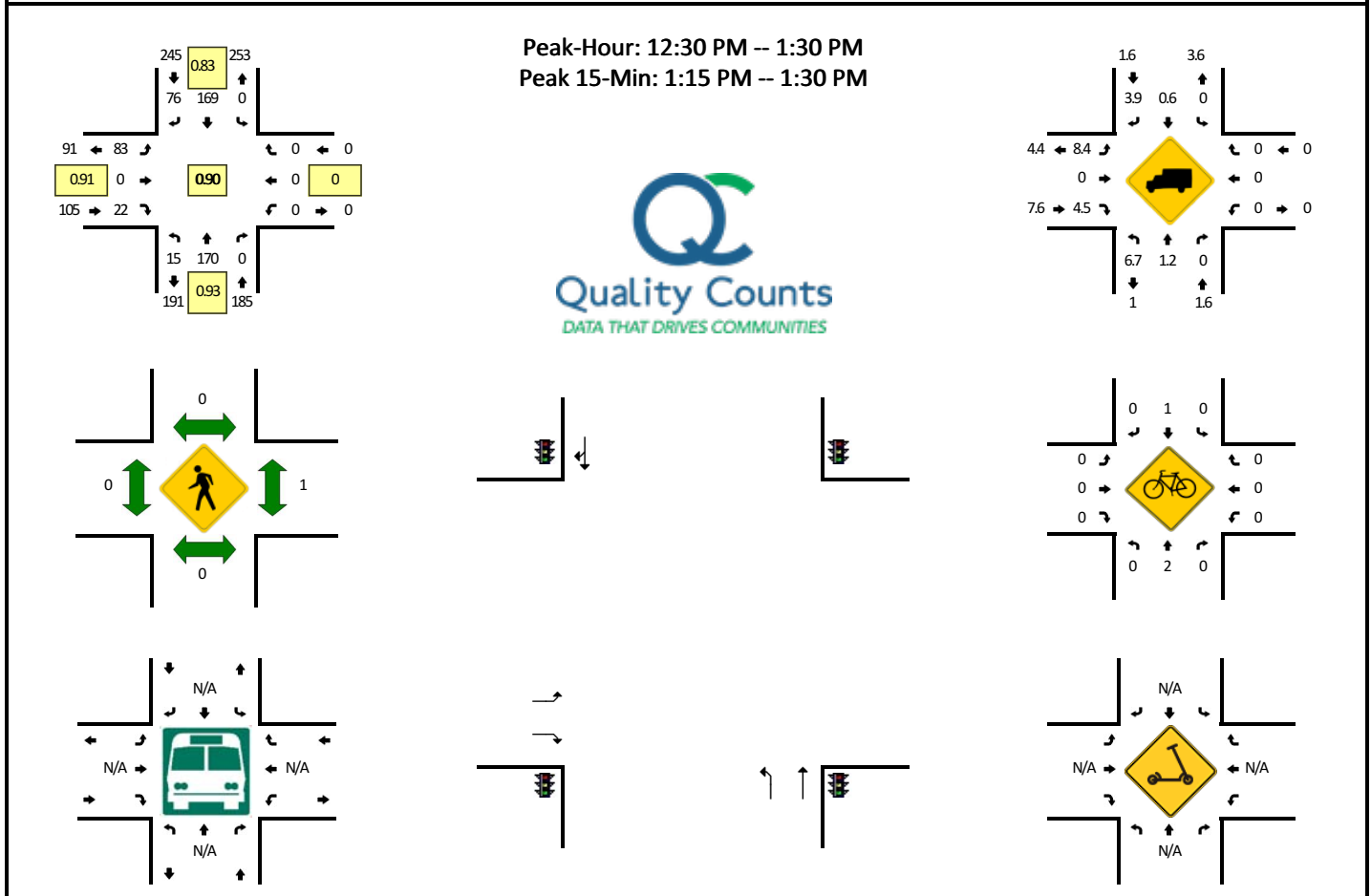


15-Min Count Period Beginning At	Alii Hwy (Northbound)				Alii Hwy (Southbound)				Kaleiopapa St (Eastbound)				Kaleiopapa St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:30 PM	1	62	0	0	0	65	18	0	18	0	7	0	0	0	0	0	171	
3:45 PM	8	64	0	0	0	66	38	0	25	0	11	0	0	0	0	0	212	
4:00 PM	10	45	0	0	0	90	19	0	25	0	10	0	0	0	0	0	199	
4:15 PM	5	55	0	0	0	91	21	0	14	0	3	0	0	0	0	0	189	771
4:30 PM	4	49	0	0	0	115	19	0	19	0	11	0	0	0	0	0	217	817
4:45 PM	5	50	0	0	0	85	25	0	13	0	7	0	0	0	0	0	185	790
5:00 PM	7	37	0	0	0	85	28	0	18	0	8	0	0	0	0	0	183	774
5:15 PM	10	32	0	0	0	85	26	0	29	0	9	0	0	0	0	0	191	776
5:30 PM	7	34	0	0	0	71	33	0	20	0	3	0	0	0	0	0	168	727
5:45 PM	3	18	0	0	0	69	26	0	22	0	6	0	0	0	0	0	144	686
6:00 PM	7	32	0	0	0	53	33	0	25	0	7	0	0	0	0	0	157	660
6:15 PM	4	29	0	0	0	50	22	0	19	0	7	0	0	0	0	0	131	600
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	16	196	0	0	0	460	76	0	76	0	44	0	0	0	0	0	868	
Heavy Trucks	0	4	0	0	0	20	8	0	12	0	8	0	0	0	0	0	52	
Buses																		
Pedestrians	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	4	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scoters																		

Comments:

LOCATION: Alii Hwy -- Kaleiopapa St
CITY/STATE: Kahaluu-Keauhou, HI

QC JOB #: 15561803
DATE: Sat, Sep 18 2021



15-Min Count Period Beginning At	Alii Hwy (Northbound)				Alii Hwy (Southbound)				Kaleiopapa St (Eastbound)				Kaleiopapa St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
10:30 AM	2	38	0	0	0	40	10	0	20	0	1	0	0	0	0	0	111	
10:45 AM	3	37	0	0	0	42	19	0	23	0	5	1	0	0	0	0	130	
11:00 AM	2	32	0	0	0	50	17	0	26	0	6	0	0	0	0	0	133	
11:15 AM	2	58	0	0	0	47	12	0	13	0	2	0	0	0	0	0	134	508
11:30 AM	2	37	0	0	0	52	11	0	17	0	3	0	0	0	0	0	122	519
11:45 AM	4	47	0	0	0	46	20	0	12	0	5	0	0	0	0	0	134	523
12:00 PM	3	52	0	0	0	54	12	0	15	0	3	0	0	0	0	0	139	529
12:15 PM	7	44	0	0	0	49	15	0	18	0	3	0	0	0	0	0	136	531
12:30 PM	6	34	0	0	0	26	22	0	20	0	4	0	0	0	0	0	112	521
12:45 PM	4	42	0	0	0	42	16	0	20	0	6	0	0	0	0	0	130	517
1:00 PM	3	47	0	0	0	51	14	0	20	0	9	0	0	0	0	0	144	522
1:15 PM	2	47	0	0	0	50	24	0	23	0	3	0	0	0	0	0	149	535
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	8	188	0	0	0	200	96	0	92	0	12	0	0	0	0	0	596	
Heavy Trucks	0	4	0	0	0	4	4	0	4	0	0	0	0	0	0	0	16	
Buses																		
Pedestrians		0				0				0				4			4	
Bicycles	0	8	0		0	0	0		0	0	0		0	0	0		8	
Scooters																		

Comments:

Type of report: Tube Count - Volume Data

LOCATION: Kaleiopapa St just N of Ehukai St SPECIFIC LOCATION: CITY/STATE: Kahaluu-Keauhou, HI										QC JOB #: 15561807 DIRECTION: SB DATE: Sep 30 2021 - Oct 2 2021
Start Time	Mon	Tue	Wed	Thu 30 Sep 21	Fri 1 Oct 21	Average Weekday 15-min Traffic	Sat 2 Oct 21	Sun	Average Week 15-min Traffic	Average Week Profile
12:00 AM				2	2	2	0		1	
12:15 AM				0	0	0	0		0	
12:30 AM				0	2	1	1		1	
12:45 AM				1	0	1	0		0	
01:00 AM				0	1	1	1		1	
01:15 AM				1	2	2	3		2	
01:30 AM				1	0	1	1		1	
01:45 AM				0	0	0	0		0	
02:00 AM				0	0	0	0		0	
02:15 AM				2	0	1	0		1	
02:30 AM				0	0	0	1		0	
02:45 AM				0	0	0	1		0	
03:00 AM				1	2	2	0		1	
03:15 AM				2	0	1	0		1	
03:30 AM				0	0	0	3		1	
03:45 AM				6	2	4	0		3	
04:00 AM				0	0	0	2		1	
04:15 AM				0	3	2	2		2	
04:30 AM				2	4	3	1		2	
04:45 AM				4	2	3	4		3	
05:00 AM				2	2	2	3		2	
05:15 AM				8	12	10	12		11	
05:30 AM				3	9	6	8		7	
05:45 AM				4	0	2	2		2	
Day Total										
% Weekday Average										
% Week Average										
AM Peak 15-min Vol										
PM Peak 15-min Vol										
Comments:										

Report generated on 10/5/2021 8:48 AM

SOURCE: Quality Counts, LLC (<http://www.qualitycounts.net>)

LOCATION: Kaleiopapa St just N of Ehukai St							QC JOB #: 15561807			
SPECIFIC LOCATION:							DIRECTION: SB			
CITY/STATE: Kahaluu-Keauhou, HI							DATE: Sep 30 2021 - Oct 2 2021			
Start Time	Mon	Tue	Wed	Thu 30 Sep 21	Fri 1 Oct 21	Average Weekday 15-min Traffic	Sat 2 Oct 21	Sun	Average Week 15-min Traffic	Average Week Profile
06:00 AM				2	0	1	0		1	
06:15 AM				4	5	5	4		4	
06:30 AM				4	5	5	4		4	
06:45 AM				4	10	7	3		6	
07:00 AM				6	10	8	6		7	
07:15 AM				4	9	7	8		7	
07:30 AM				8	7	8	13		9	
07:45 AM				2	14	8	19		12	
08:00 AM				5	18	12	28		17	
08:15 AM				4	8	6	22		11	
08:30 AM				10	10	10	10		10	
08:45 AM				12	18	15	6		12	
09:00 AM				12	6	9	5		8	
09:15 AM				16	12	14	9		12	
09:30 AM				12	10	11	12		11	
09:45 AM				6	4	5	12		7	
10:00 AM				13	12	13	10		12	
10:15 AM				18	16	17	16		17	
10:30 AM				10	8	9	16		11	
10:45 AM				13	11	12	18		14	
11:00 AM				8	3	6	20		10	
11:15 AM				8	15	12	14		12	
11:30 AM				12	8	10	16		12	
11:45 AM				12	11	12	15		13	
Day Total										
% Weekday Average										
% Week Average										
AM Peak 15-min Vol										
PM Peak 15-min Vol										
Comments:										

LOCATION: Kaleiopapa St just N of Ehukai St							QC JOB #: 15561807			
SPECIFIC LOCATION:							DIRECTION: SB			
CITY/STATE: Kahaluu-Keauhou, HI							DATE: Sep 30 2021 - Oct 2 2021			
Start Time	Mon	Tue	Wed	Thu 30 Sep 21	Fri 1 Oct 21	Average Weekday 15-min Traffic	Sat 2 Oct 21	Sun	Average Week 15-min Traffic	Average Week Profile
12:00 PM				22	11	17	23		19	<div></div>
12:15 PM				14	20	17	14		16	<div></div>
12:30 PM				14	14	14	9		12	<div></div>
12:45 PM				12	13	13	22		16	<div></div>
01:00 PM				12	20	16	26		19	<div></div>
01:15 PM				20	26	23	36		27	<div></div>
01:30 PM				18	18	18	26		21	<div></div>
01:45 PM				10	26	18	15		17	<div></div>
02:00 PM				12	12	12	13		12	<div></div>
02:15 PM				9	16	13	12		12	<div></div>
02:30 PM				14	19	17	21		18	<div></div>
02:45 PM				12	12	12	24		16	<div></div>
03:00 PM				9	17	13	15		14	<div></div>
03:15 PM				14	14	14	16		15	<div></div>
03:30 PM				10	14	12	9		11	<div></div>
03:45 PM				6	7	7	15		9	<div></div>
04:00 PM				12	10	11	13		12	<div></div>
04:15 PM				10	8	9	16		11	<div></div>
04:30 PM				10	8	9	22		13	<div></div>
04:45 PM				16	16	16	20		17	<div></div>
05:00 PM				14	14	14	24		17	<div></div>
05:15 PM				30	30	30	20		27	<div></div>
05:30 PM				20	48	34	50		39	<div></div>
05:45 PM				13	38	26	22		24	<div></div>
Day Total										
% Weekday Average										
% Week Average										
AM Peak 15-min Vol										
PM Peak 15-min Vol										
Comments:										

LOCATION: Kaleiopapa St just N of Ehukai St							QC JOB #: 15561807			
SPECIFIC LOCATION:							DIRECTION: SB			
CITY/STATE: Kahaluu-Keauhou, HI							DATE: Sep 30 2021 - Oct 2 2021			
Start Time	Mon	Tue	Wed	Thu 30 Sep 21	Fri 1 Oct 21	Average Weekday 15-min Traffic	Sat 2 Oct 21	Sun	Average Week 15-min Traffic	Average Week Profile
06:00 PM				32	30	31	19		27	
06:15 PM				38	26	32	26		30	
06:30 PM				19	26	23	16		20	
06:45 PM				9	23	16	17		16	
07:00 PM				8	10	9	7		8	
07:15 PM				12	18	15	6		12	
07:30 PM				14	14	14	19		16	
07:45 PM				14	23	19	6		14	
08:00 PM				15	24	20	4		14	
08:15 PM				13	14	14	12		13	
08:30 PM				15	18	17	12		15	
08:45 PM				6	12	9	9		9	
09:00 PM				12	10	11	2		8	
09:15 PM				11	6	9	2		6	
09:30 PM				4	8	6	4		5	
09:45 PM				5	8	7	10		8	
10:00 PM				7	4	6	7		6	
10:15 PM				6	6	6	8		7	
10:30 PM				4	12	8	1		6	
10:45 PM				1	1	1	4		2	
11:00 PM				4	2	3	1		2	
11:15 PM				1	6	4	4		4	
11:30 PM				3	1	2	10		5	
11:45 PM				4	2	3	2		3	
Day Total				834	1008	936	1022		952	
% Weekday Average				89.1%	107.7%					
% Week Average				87.6%	105.9%	98.3%	107.4%			
AM Peak 15-min Vol				10:15 AM 18	8:00 AM 18	10:15 AM 17	8:00 AM 28		8:00 AM 17	
PM Peak 15-min Vol				6:15 PM 38	5:30 PM 48	5:30 PM 34	5:30 PM 50		5:30 PM 39	
Comments:										

Type of report: Tube Count - Volume Data

LOCATION: Kaleiopapa St just N of Ehukai St							QC JOB #: 15561807			
SPECIFIC LOCATION:							DIRECTION: NB			
CITY/STATE: Kahaluu-Keauhou, HI							DATE: Sep 30 2021 - Oct 2 2021			
Start Time	Mon	Tue	Wed	Thu 30 Sep 21	Fri 1 Oct 21	Average Weekday 15-min Traffic	Sat 2 Oct 21	Sun	Average Week 15-min Traffic	Average Week Profile
12:00 AM				2	2	2	0		1	
12:15 AM				0	0	0	0		0	
12:30 AM				0	2	1	1		1	
12:45 AM				1	0	1	0		0	
01:00 AM				1	1	1	1		1	
01:15 AM				0	0	0	2		1	
01:30 AM				1	0	1	3		1	
01:45 AM				0	0	0	0		0	
02:00 AM				0	0	0	0		0	
02:15 AM				2	0	1	0		1	
02:30 AM				0	0	0	1		0	
02:45 AM				2	0	1	2		1	
03:00 AM				1	2	2	0		1	
03:15 AM				3	0	2	0		1	
03:30 AM				0	0	0	4		1	
03:45 AM				6	2	4	0		3	
04:00 AM				0	0	0	2		1	
04:15 AM				1	2	2	2		2	
04:30 AM				1	4	3	2		2	
04:45 AM				3	2	3	4		3	
05:00 AM				2	3	3	3		3	
05:15 AM				7	11	9	10		9	
05:30 AM				4	9	7	6		6	
05:45 AM				8	0	4	0		3	
Day Total										
% Weekday Average										
% Week Average										
AM Peak 15-min Vol										
PM Peak 15-min Vol										
Comments:										

Report generated on 10/5/2021 8:48 AM

SOURCE: Quality Counts, LLC (<http://www.qualitycounts.net>)

LOCATION: Kaleiopapa St just N of Ehukai St							QC JOB #: 15561807			
SPECIFIC LOCATION:							DIRECTION: NB			
CITY/STATE: Kahaluu-Keauhou, HI							DATE: Sep 30 2021 - Oct 2 2021			
Start Time	Mon	Tue	Wed	Thu 30 Sep 21	Fri 1 Oct 21	Average Weekday 15-min Traffic	Sat 2 Oct 21	Sun	Average Week 15-min Traffic	Average Week Profile
06:00 AM				3	1	2	1		2	
06:15 AM				4	4	4	3		4	
06:30 AM				6	6	6	8		7	
06:45 AM				6	10	8	3		6	
07:00 AM				8	14	11	9		10	
07:15 AM				6	15	11	12		11	
07:30 AM				10	9	10	14		11	
07:45 AM				8	20	14	26		18	
08:00 AM				14	23	19	28		22	
08:15 AM				10	11	11	26		16	
08:30 AM				16	13	15	10		13	
08:45 AM				15	22	19	5		14	
09:00 AM				12	8	10	6		9	
09:15 AM				13	7	10	9		10	
09:30 AM				14	12	13	12		13	
09:45 AM				6	6	6	10		7	
10:00 AM				15	14	15	12		14	
10:15 AM				16	14	15	14		15	
10:30 AM				8	8	8	15		10	
10:45 AM				18	10	14	19		16	
11:00 AM				6	4	5	20		10	
11:15 AM				10	16	13	12		13	
11:30 AM				16	8	12	18		14	
11:45 AM				13	10	12	18		14	
Day Total										
% Weekday Average										
% Week Average										
AM Peak 15-min Vol										
PM Peak 15-min Vol										
Comments:										

LOCATION: Kaleiopapa St just N of Ehukai St							QC JOB #: 15561807			
SPECIFIC LOCATION:							DIRECTION: NB			
CITY/STATE: Kahaluu-Keauhou, HI							DATE: Sep 30 2021 - Oct 2 2021			
Start Time	Mon	Tue	Wed	Thu 30 Sep 21	Fri 1 Oct 21	Average Weekday 15-min Traffic	Sat 2 Oct 21	Sun	Average Week 15-min Traffic	Average Week Profile
12:00 PM				22	12	17	22		19	<div></div>
12:15 PM				14	18	16	14		15	<div></div>
12:30 PM				20	12	16	11		14	<div></div>
12:45 PM				11	12	12	24		16	<div></div>
01:00 PM				10	19	15	26		18	<div></div>
01:15 PM				22	28	25	32		27	<div></div>
01:30 PM				22	22	22	26		23	<div></div>
01:45 PM				6	22	14	15		14	<div></div>
02:00 PM				14	14	14	17		15	<div></div>
02:15 PM				10	14	12	12		12	<div></div>
02:30 PM				10	19	15	20		16	<div></div>
02:45 PM				14	12	13	28		18	<div></div>
03:00 PM				7	11	9	14		11	<div></div>
03:15 PM				16	8	12	15		13	<div></div>
03:30 PM				10	17	14	7		11	<div></div>
03:45 PM				8	7	8	12		9	<div></div>
04:00 PM				13	12	13	13		13	<div></div>
04:15 PM				13	8	11	14		12	<div></div>
04:30 PM				10	6	8	20		12	<div></div>
04:45 PM				18	19	19	21		19	<div></div>
05:00 PM				22	18	20	28		23	<div></div>
05:15 PM				30	31	31	18		26	<div></div>
05:30 PM				24	47	36	52		41	<div></div>
05:45 PM				20	38	29	23		27	<div></div>
Day Total										
% Weekday Average										
% Week Average										
AM Peak 15-min Vol										
PM Peak 15-min Vol										
Comments:										

Type of report: Tube Count - Volume Data

LOCATION: Kaleiopapa St just N of Ehukai St							QC JOB #: 15561807			
SPECIFIC LOCATION:							DIRECTION: NB			
CITY/STATE: Kahaluu-Keauhou, HI							DATE: Sep 30 2021 - Oct 2 2021			
Start Time	Mon	Tue	Wed	Thu 30 Sep 21	Fri 1 Oct 21	Average Weekday 15-min Traffic	Sat 2 Oct 21	Sun	Average Week 15-min Traffic	Average Week Profile
06:00 PM				38	28	33	18		28	
06:15 PM				38	24	31	24		29	
06:30 PM				23	28	26	15		22	
06:45 PM				9	22	16	18		16	
07:00 PM				10	12	11	10		11	
07:15 PM				14	18	16	7		13	
07:30 PM				14	14	14	20		16	
07:45 PM				18	25	22	7		17	
08:00 PM				17	24	21	5		15	
08:15 PM				16	12	14	11		13	
08:30 PM				12	14	13	14		13	
08:45 PM				8	10	9	6		8	
09:00 PM				12	7	10	2		7	
09:15 PM				7	6	7	2		5	
09:30 PM				4	7	6	5		5	
09:45 PM				5	6	6	9		7	
10:00 PM				5	4	5	6		5	
10:15 PM				5	7	6	4		5	
10:30 PM				4	9	7	2		5	
10:45 PM				2	1	2	4		2	
11:00 PM				3	2	3	2		2	
11:15 PM				1	6	4	4		4	
11:30 PM				2	1	2	6		3	
11:45 PM				3	2	3	4		3	
Day Total				934	1020	998	1042		999	
% Weekday Average				93.6%	102.2%					
% Week Average				93.5%	102.1%	99.9%	104.3%			
AM Peak 15-min Vol				10:45 AM 18	8:00 AM 23	8:00 AM 19	8:00 AM 28		8:00 AM 22	
PM Peak 15-min Vol				6:00 PM 38	5:30 PM 47	5:30 PM 36	5:30 PM 52		5:30 PM 41	
Comments:										

Report generated on 10/5/2021 8:48 AM

SOURCE: Quality Counts, LLC (<http://www.qualitycounts.net>)

Type of report: Tube Count - Volume Data

LOCATION: Kamehameha III Rd btwn Holua Rd & Boat Parking Entrance							QC JOB #: 15561808			
SPECIFIC LOCATION:							DIRECTION: SB			
CITY/STATE: Kahaluu-Keauhou, HI							DATE: Sep 16 2021 - Sep 18 2021			
Start Time	Mon	Tue	Wed	Thu 16 Sep 21	Fri 17 Sep 21	Average Weekday 15-min Traffic	Sat 18 Sep 21	Sun	Average Week 15-min Traffic	Average Week Profile
12:00 AM				0	0	0	0		0	
12:15 AM				0	2	1	2		1	<div></div>
12:30 AM				0	1	1	0		0	
12:45 AM				0	1	1	0		0	
01:00 AM				0	1	1	2		1	<div></div>
01:15 AM				0	1	1	1		1	<div></div>
01:30 AM				0	0	0	0		0	
01:45 AM				0	0	0	0		0	
02:00 AM				1	2	2	0		1	<div></div>
02:15 AM				3	1	2	0		1	<div></div>
02:30 AM				0	0	0	0		0	
02:45 AM				2	0	1	0		1	<div></div>
03:00 AM				0	0	0	1		0	
03:15 AM				1	0	1	0		0	
03:30 AM				0	0	0	1		0	
03:45 AM				0	0	0	1		0	
04:00 AM				1	0	1	0		0	
04:15 AM				0	0	0	0		0	
04:30 AM				0	1	1	0		0	
04:45 AM				0	2	1	0		1	<div></div>
05:00 AM				1	2	2	1		1	<div></div>
05:15 AM				0	0	0	0		0	
05:30 AM				0	0	0	1		0	
05:45 AM				0	4	2	4		3	<div></div>
Day Total										
% Weekday Average										
% Week Average										
AM Peak 15-min Vol										
PM Peak 15-min Vol										
Comments:										

LOCATION: Kamehameha III Rd btwn Holua Rd & Boat Parking Entrance										QC JOB #: 15561808	
SPECIFIC LOCATION:										DIRECTION: SB	
CITY/STATE: Kahaluu-Keauhou, HI										DATE: Sep 16 2021 - Sep 18 2021	
Start Time	Mon	Tue	Wed	Thu 16 Sep 21	Fri 17 Sep 21	Average Weekday 15-min Traffic	Sat 18 Sep 21	Sun	Average Week 15-min Traffic	Average Week Profile	
06:00 AM				1	7	4	9		6	<div></div>	
06:15 AM				0	6	3	2		3	<div></div>	
06:30 AM				1	3	2	0		1	<div></div>	
06:45 AM				5	9	7	3		6	<div></div>	
07:00 AM				4	12	8	5		7	<div></div>	
07:15 AM				10	10	10	8		9	<div></div>	
07:30 AM				16	14	15	14		15	<div></div>	
07:45 AM				3	8	6	12		8	<div></div>	
08:00 AM				4	6	5	14		8	<div></div>	
08:15 AM				0	10	5	3		4	<div></div>	
08:30 AM				12	8	10	3		8	<div></div>	
08:45 AM				2	9	6	13		8	<div></div>	
09:00 AM				5	3	4	7		5	<div></div>	
09:15 AM				12	1	7	10		8	<div></div>	
09:30 AM				4	11	8	10		8	<div></div>	
09:45 AM				6	10	8	9		8	<div></div>	
10:00 AM				10	8	9	4		7	<div></div>	
10:15 AM				4	8	6	7		6	<div></div>	
10:30 AM				0	5	3	9		5	<div></div>	
10:45 AM				2	10	6	7		6	<div></div>	
11:00 AM				7	4	6	4		5	<div></div>	
11:15 AM				6	5	6	4		5	<div></div>	
11:30 AM				6	8	7	2		5	<div></div>	
11:45 AM				6	10	8	8		8	<div></div>	
Day Total											
% Weekday Average											
% Week Average											
AM Peak 15-min Vol											
PM Peak 15-min Vol											
Comments:											

LOCATION: Kamehameha III Rd btwn Holua Rd & Boat Parking Entrance										QC JOB #: 15561808	
SPECIFIC LOCATION:										DIRECTION: SB	
CITY/STATE: Kahaluu-Keauhou, HI										DATE: Sep 16 2021 - Sep 18 2021	
Start Time	Mon	Tue	Wed	Thu 16 Sep 21	Fri 17 Sep 21	Average Weekday 15-min Traffic	Sat 18 Sep 21	Sun	Average Week 15-min Traffic	Average Week Profile	
12:00 PM				6	7	7	7		7	<div></div>	
12:15 PM				5	6	6	5		5	<div></div>	
12:30 PM				5	3	4	9		6	<div></div>	
12:45 PM				14	9	12	11		11	<div></div>	
01:00 PM				6	10	8	8		8	<div></div>	
01:15 PM				8	8	8	8		8	<div></div>	
01:30 PM				4	10	7	4		6	<div></div>	
01:45 PM				3	9	6	10		7	<div></div>	
02:00 PM				8	4	6	2		5	<div></div>	
02:15 PM				12	2	7	7		7	<div></div>	
02:30 PM				5	9	7	5		6	<div></div>	
02:45 PM				2	7	5	6		5	<div></div>	
03:00 PM				7	5	6	6		6	<div></div>	
03:15 PM				13	3	8	10		9	<div></div>	
03:30 PM				6	6	6	6		6	<div></div>	
03:45 PM				6	6	6	8		7	<div></div>	
04:00 PM				6	10	8	8		8	<div></div>	
04:15 PM				4	6	5	4		5	<div></div>	
04:30 PM				5	11	8	3		6	<div></div>	
04:45 PM				9	8	9	6		8	<div></div>	
05:00 PM				7	3	5	4		5	<div></div>	
05:15 PM				4	4	4	5		4	<div></div>	
05:30 PM				11	4	8	9		8	<div></div>	
05:45 PM				10	7	9	2		6	<div></div>	
Day Total											
% Weekday Average											
% Week Average											
AM Peak 15-min Vol											
PM Peak 15-min Vol											
Comments:											

LOCATION: Kamehameha III Rd btwn Holua Rd & Boat Parking Entrance										QC JOB #: 15561808
SPECIFIC LOCATION:										DIRECTION: SB
CITY/STATE: Kahaluu-Keauhou, HI										DATE: Sep 16 2021 - Sep 18 2021
Start Time	Mon	Tue	Wed	Thu 16 Sep 21	Fri 17 Sep 21	Average Weekday 15-min Traffic	Sat 18 Sep 21	Sun	Average Week 15-min Traffic	Average Week Profile
06:00 PM				8	3	6	3		5	<div></div>
06:15 PM				6	7	7	5		6	<div></div>
06:30 PM				3	5	4	16		8	<div></div>
06:45 PM				0	0	0	6		2	<div></div>
07:00 PM				4	0	2	4		3	<div></div>
07:15 PM				3	3	3	5		4	<div></div>
07:30 PM				2	2	2	4		3	<div></div>
07:45 PM				1	0	1	7		3	<div></div>
08:00 PM				6	3	5	2		4	<div></div>
08:15 PM				0	4	2	0		1	<div></div>
08:30 PM				2	1	2	0		1	<div></div>
08:45 PM				0	3	2	1		1	<div></div>
09:00 PM				0	0	0	0		0	<div></div>
09:15 PM				2	7	5	0		3	<div></div>
09:30 PM				0	2	1	0		1	<div></div>
09:45 PM				1	0	1	1		1	<div></div>
10:00 PM				1	2	2	1		1	<div></div>
10:15 PM				2	2	2	1		2	<div></div>
10:30 PM				0	2	1	2		1	<div></div>
10:45 PM				0	2	1	0		1	<div></div>
11:00 PM				0	2	1	4		2	<div></div>
11:15 PM				1	0	1	0		0	<div></div>
11:30 PM				0	0	0	0		0	<div></div>
11:45 PM				0	0	0	3		1	<div></div>
Day Total				343	410	393	399		383	
% Weekday Average				87.3%	104.3%					
% Week Average				89.6%	107%	102.6%	104.2%			
AM Peak 15-min Vol				7:30 AM 16	7:30 AM 14	7:30 AM 15	7:30 AM 14		7:30 AM 15	
PM Peak 15-min Vol				12:45 PM 14	4:30 PM 11	12:45 PM 12	6:30 PM 16		12:45 PM 11	
Comments:										

Type of report: Tube Count - Volume Data

LOCATION: Kamehameha III Rd btwn Holua Rd & Boat Parking Entrance										QC JOB #: 15561808
SPECIFIC LOCATION:										DIRECTION: NB
CITY/STATE: Kahaluu-Keauhou, HI										DATE: Sep 16 2021 - Sep 18 2021
Start Time	Mon	Tue	Wed	Thu 16 Sep 21	Fri 17 Sep 21	Average Weekday 15-min Traffic	Sat 18 Sep 21	Sun	Average Week 15-min Traffic	Average Week Profile
12:00 AM				0	0	0	0		0	
12:15 AM				0	1	1	2		1	<div></div>
12:30 AM				0	0	0	0		0	
12:45 AM				0	1	1	0		0	
01:00 AM				0	1	1	2		1	<div></div>
01:15 AM				0	1	1	1		1	<div></div>
01:30 AM				0	0	0	0		0	
01:45 AM				0	0	0	0		0	
02:00 AM				1	2	2	0		1	<div></div>
02:15 AM				3	1	2	0		1	<div></div>
02:30 AM				0	0	0	0		0	
02:45 AM				2	0	1	0		1	<div></div>
03:00 AM				0	0	0	1		0	
03:15 AM				2	0	1	0		1	<div></div>
03:30 AM				0	0	0	1		0	
03:45 AM				0	0	0	1		0	
04:00 AM				1	0	1	0		0	
04:15 AM				0	0	0	0		0	
04:30 AM				0	1	1	0		0	
04:45 AM				0	0	0	0		0	
05:00 AM				1	2	2	1		1	<div></div>
05:15 AM				0	0	0	0		0	
05:30 AM				0	1	1	1		1	<div></div>
05:45 AM				0	3	2	2		2	<div></div>
Day Total										
% Weekday Average										
% Week Average										
AM Peak 15-min Vol										
PM Peak 15-min Vol										
Comments:										

LOCATION: Kamehameha III Rd btwn Holua Rd & Boat Parking Entrance										QC JOB #: 15561808	
SPECIFIC LOCATION:										DIRECTION: NB	
CITY/STATE: Kahaluu-Keauhou, HI										DATE: Sep 16 2021 - Sep 18 2021	
Start Time	Mon	Tue	Wed	Thu 16 Sep 21	Fri 17 Sep 21	Average Weekday 15-min Traffic	Sat 18 Sep 21	Sun	Average Week 15-min Traffic	Average Week Profile	
06:00 AM				2	4	3	2		3	<div></div>	
06:15 AM				0	4	2	2		2	<div></div>	
06:30 AM				3	4	4	0		2	<div></div>	
06:45 AM				2	8	5	4		5	<div></div>	
07:00 AM				2	14	8	5		7	<div></div>	
07:15 AM				4	12	8	7		8	<div></div>	
07:30 AM				12	16	14	10		13	<div></div>	
07:45 AM				4	9	7	8		7	<div></div>	
08:00 AM				4	10	7	18		11	<div></div>	
08:15 AM				0	12	6	3		5	<div></div>	
08:30 AM				11	8	10	4		8	<div></div>	
08:45 AM				1	7	4	13		7	<div></div>	
09:00 AM				5	4	5	6		5	<div></div>	
09:15 AM				15	1	8	13		10	<div></div>	
09:30 AM				3	11	7	12		9	<div></div>	
09:45 AM				8	6	7	10		8	<div></div>	
10:00 AM				12	8	10	9		10	<div></div>	
10:15 AM				4	12	8	6		7	<div></div>	
10:30 AM				0	5	3	9		5	<div></div>	
10:45 AM				2	13	8	6		7	<div></div>	
11:00 AM				6	4	5	4		5	<div></div>	
11:15 AM				7	6	7	3		5	<div></div>	
11:30 AM				6	8	7	3		6	<div></div>	
11:45 AM				6	12	9	8		9	<div></div>	
Day Total											
% Weekday Average											
% Week Average											
AM Peak 15-min Vol											
PM Peak 15-min Vol											
Comments:											

LOCATION: Kamehameha III Rd btwn Holua Rd & Boat Parking Entrance										QC JOB #: 15561808	
SPECIFIC LOCATION:										DIRECTION: NB	
CITY/STATE: Kahaluu-Keauhou, HI										DATE: Sep 16 2021 - Sep 18 2021	
Start Time	Mon	Tue	Wed	Thu 16 Sep 21	Fri 17 Sep 21	Average Weekday 15-min Traffic	Sat 18 Sep 21	Sun	Average Week 15-min Traffic	Average Week Profile	
12:00 PM				8	7	8	5		7	<div></div>	
12:15 PM				5	6	6	4		5	<div></div>	
12:30 PM				4	3	4	10		6	<div></div>	
12:45 PM				15	7	11	13		12	<div></div>	
01:00 PM				6	9	8	8		8	<div></div>	
01:15 PM				10	8	9	10		9	<div></div>	
01:30 PM				3	6	5	5		5	<div></div>	
01:45 PM				0	6	3	15		7	<div></div>	
02:00 PM				9	5	7	3		6	<div></div>	
02:15 PM				11	2	7	7		7	<div></div>	
02:30 PM				6	9	8	5		7	<div></div>	
02:45 PM				2	8	5	6		5	<div></div>	
03:00 PM				9	6	8	5		7	<div></div>	
03:15 PM				14	7	11	14		12	<div></div>	
03:30 PM				4	8	6	6		6	<div></div>	
03:45 PM				9	8	9	6		8	<div></div>	
04:00 PM				5	11	8	10		9	<div></div>	
04:15 PM				4	4	4	2		3	<div></div>	
04:30 PM				8	9	9	3		7	<div></div>	
04:45 PM				4	7	6	6		6	<div></div>	
05:00 PM				4	5	5	3		4	<div></div>	
05:15 PM				3	3	3	4		3	<div></div>	
05:30 PM				6	3	5	8		6	<div></div>	
05:45 PM				8	8	8	4		7	<div></div>	
Day Total											
% Weekday Average											
% Week Average											
AM Peak 15-min Vol											
PM Peak 15-min Vol											
Comments:											




















LOCATION: Kamehameha III Rd btwn Holua Rd & Boat Parking Entrance									QC JOB #: 15561808	
SPECIFIC LOCATION:									DIRECTION: NB	
CITY/STATE: Kahaluu-Keauhou, HI									DATE: Sep 16 2021 - Sep 18 2021	
Start Time	Mon	Tue	Wed	Thu 16 Sep 21	Fri 17 Sep 21	Average Weekday 15-min Traffic	Sat 18 Sep 21	Sun	Average Week 15-min Traffic	Average Week Profile
06:00 PM				10	3	7	2		5	<div></div>
06:15 PM				6	5	6	4		5	<div></div>
06:30 PM				1	4	3	18		8	<div></div>
06:45 PM				0	0	0	8		3	<div></div>
07:00 PM				4	0	2	4		3	<div></div>
07:15 PM				1	2	2	3		2	<div></div>
07:30 PM				4	5	5	4		4	<div></div>
07:45 PM				2	0	1	10		4	<div></div>
08:00 PM				6	2	4	3		4	<div></div>
08:15 PM				1	3	2	0		1	<div></div>
08:30 PM				2	1	2	0		1	<div></div>
08:45 PM				0	2	1	1		1	<div></div>
09:00 PM				0	0	0	0		0	<div></div>
09:15 PM				1	6	4	0		2	<div></div>
09:30 PM				0	1	1	0		0	<div></div>
09:45 PM				3	0	2	0		1	<div></div>
10:00 PM				1	2	2	1		1	<div></div>
10:15 PM				1	0	1	1		1	<div></div>
10:30 PM				0	3	2	2		2	<div></div>
10:45 PM				1	2	2	0		1	<div></div>
11:00 PM				0	1	1	3		1	<div></div>
11:15 PM				0	0	0	0		0	<div></div>
11:30 PM				1	0	1	0		0	<div></div>
11:45 PM				1	0	1	1		1	<div></div>
Day Total				332	409	394	404		388	
% Weekday Average				84.3%	103.8%					
% Week Average				85.6%	105.4%	101.5%	104.1%			
AM Peak 15-min Vol				9:15 AM 15	7:30 AM 16	7:30 AM 14	8:00 AM 18		7:30 AM 13	
PM Peak 15-min Vol				12:45 PM 15	4:00 PM 11	12:45 PM 11	6:30 PM 18		12:45 PM 12	
Comments:										

Appendix B: Existing Conditions LOS Worksheets

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Existing Conditions
AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	19	19	8	138	34	53	9	284	113	33	157	23
Future Volume (veh/h)	19	19	8	138	34	53	9	284	113	33	157	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.98		1.00	0.99		1.00	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1811	1870	1841	1870	1870	1856	1870	1856	1870
Adj Flow Rate, veh/h	21	21	1	150	37	0	10	309	0	36	171	21
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	6	2	4	2	2	3	2	3	2
Cap, veh/h	272	203	7	420	52		516	511		447	488	60
Arrive On Green	0.18	0.18	0.18	0.18	0.18	0.00	0.01	0.27	0.00	0.04	0.30	0.30
Sat Flow, veh/h	562	1146	41	1188	293	1560	1781	1870	0	1781	1611	198
Grp Volume(v), veh/h	43	0	0	187	0	0	10	309	0	36	0	192
Grp Sat Flow(s),veh/h/ln	1748	0	0	1481	0	1560	1781	1870	0	1781	0	1809
Q Serve(g_s), s	0.0	0.0	0.0	3.0	0.0	0.0	0.1	4.5	0.0	0.4	0.0	2.6
Cycle Q Clear(g_c), s	0.6	0.0	0.0	3.6	0.0	0.0	0.1	4.5	0.0	0.4	0.0	2.6
Prop In Lane	0.49		0.02	0.80		1.00	1.00		0.00	1.00		0.11
Lane Grp Cap(c), veh/h	482	0	0	472	0		516	511		447	0	548
V/C Ratio(X)	0.09	0.00	0.00	0.40	0.00		0.02	0.60		0.08	0.00	0.35
Avail Cap(c_a), veh/h	1726	0	0	1600	0		2216	2691		1233	0	1727
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.7	0.0	0.0	11.9	0.0	0.0	8.0	9.8	0.0	7.7	0.0	8.4
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.4	0.0	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.9	0.0	0.0	0.0	1.3	0.0	0.1	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	10.8	0.0	0.0	12.1	0.0	0.0	8.0	10.2	0.0	7.8	0.0	8.6
LnGrp LOS	B	A	A	B	A		A	B		A	A	A
Approach Vol, veh/h		43			187	A		319	A		228	
Approach Delay, s/veh		10.8			12.1			10.2			8.4	
Approach LOS		B			B			B			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.1	13.9		11.0	5.2	14.8		11.0				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	2.4	6.5		2.6	2.1	4.6		5.6				
Green Ext Time (p_c), s	0.0	0.9		0.1	0.0	0.5		0.5				

Intersection Summary

HCM 6th Ctrl Delay	10.2
HCM 6th LOS	B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary

2: Alii Dr & Kaleiopapa St

Existing Conditions
AM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	34	15	30	353	211	72
Future Volume (veh/h)	34	15	30	353	211	72
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1796	1856	1870	1826	1796
Adj Flow Rate, veh/h	35	1	31	360	215	62
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	6	7	3	2	5	7
Cap, veh/h	76	67	550	1041	439	126
Arrive On Green	0.04	0.04	0.04	0.56	0.33	0.33
Sat Flow, veh/h	1725	1522	1767	1870	1346	388
Grp Volume(v), veh/h	35	1	31	360	0	277
Grp Sat Flow(s), veh/h/ln	1725	1522	1767	1870	0	1734
Q Serve(g_s), s	0.5	0.0	0.3	2.9	0.0	3.5
Cycle Q Clear(g_c), s	0.5	0.0	0.3	2.9	0.0	3.5
Prop In Lane	1.00	1.00	1.00			0.22
Lane Grp Cap(c), veh/h	76	67	550	1041	0	565
V/C Ratio(X)	0.46	0.01	0.06	0.35	0.00	0.49
Avail Cap(c_a), veh/h	1276	1126	1462	4207	0	2566
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.6	12.4	4.9	3.3	0.0	7.3
Incr Delay (d2), s/veh	1.6	0.0	0.0	0.1	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.0	0.1	0.0	0.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	14.2	12.4	4.9	3.4	0.0	7.6
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	36			391	277	
Approach Delay, s/veh	14.2			3.5	7.6	
Approach LOS	B			A	A	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	6.2	14.6		6.2		20.8
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	15	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.3	5.5		2.5		4.9
Green Ext Time (p_c), s	0.0	0.8		0.0		1.0

Intersection Summary

HCM 6th Ctrl Delay 5.6
HCM 6th LOS A

Notes




* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC
3: Kamehameha III Rd & Holua Rd

Existing Conditions
AM Peak Hour

Intersection

Int Delay, s/veh 0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	3	1	1	20	29	4
Future Vol, veh/h	3	1	1	20	29	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	1	1	22	32	4




Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	58	34	36
Stage 1	34	-	-
Stage 2	24	-	-
Critical Hdwy	6.42	6.22	4.12
Critical Hdwy Stg 1	5.42	-	-
Critical Hdwy Stg 2	5.42	-	-
Follow-up Hdwy	3.518	3.318	2.218
Pot Cap-1 Maneuver	949	1039	1575
Stage 1	988	-	-
Stage 2	999	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	948	1039	1575
Mov Cap-2 Maneuver	948	-	-
Stage 1	987	-	-
Stage 2	999	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.7	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1575	-	969	-	-
HCM Lane V/C Ratio	0.001	-	0.004	-	-
HCM Control Delay (s)	7.3	0	8.7	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

HCM 6th TWSC
4: Kaleiopapa St & Ehukai St




















Existing Conditions
AM Peak Hour

Intersection						
Int Delay, s/veh	1.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	5	11	40	19	2
Future Vol, veh/h	2	5	11	40	19	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	5	12	43	21	2
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	89	22	23	0	-	0
Stage 1	22	-	-	-	-	-
Stage 2	67	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	912	1055	1592	-	-	-
Stage 1	1001	-	-	-	-	-
Stage 2	956	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	905	1055	1592	-	-	-
Mov Cap-2 Maneuver	905	-	-	-	-	-
Stage 1	993	-	-	-	-	-
Stage 2	956	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	8.6	1.6		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1592	-	1007	-	-	
HCM Lane V/C Ratio	0.008	-	0.008	-	-	
HCM Control Delay (s)	7.3	0	8.6	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0	-	-	

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Existing Conditions
PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	24	24	14	158	27	40	10	196	105	60	329	30
Future Volume (veh/h)	24	24	14	158	27	40	10	196	105	60	329	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.98	0.98		1.00	1.00		1.00	1.00		0.99
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1693	1856	1841	1870	1752	1870	1796	1870	1870	1856
Adj Flow Rate, veh/h	25	25	4	166	28	0	11	206	0	63	346	30
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	14	3	4	2	10	2	7	2	2	3
Cap, veh/h	263	204	24	439	39		373	482		537	526	46
Arrive On Green	0.19	0.19	0.19	0.19	0.19	0.00	0.01	0.26	0.00	0.07	0.31	0.31
Sat Flow, veh/h	531	1084	129	1229	207	1585	1668	1870	0	1781	1695	147
Grp Volume(v), veh/h	54	0	0	194	0	0	11	206	0	63	0	376
Grp Sat Flow(s),veh/h/ln	1744	0	0	1437	0	1585	1668	1870	0	1781	0	1842
Q Serve(g_s), s	0.0	0.0	0.0	3.2	0.0	0.0	0.2	3.0	0.0	0.8	0.0	5.7
Cycle Q Clear(g_c), s	0.8	0.0	0.0	4.0	0.0	0.0	0.2	3.0	0.0	0.8	0.0	5.7
Prop In Lane	0.46		0.07	0.86		1.00	1.00		0.00	1.00		0.08
Lane Grp Cap(c), veh/h	492	0	0	478	0		373	482		537	0	571
V/C Ratio(X)	0.11	0.00	0.00	0.41	0.00		0.03	0.43		0.12	0.00	0.66
Avail Cap(c_a), veh/h	1662	0	0	1497	0		1901	2587		1246	0	1691
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	10.9	0.0	0.0	12.2	0.0	0.0	8.8	10.0	0.0	7.8	0.0	9.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.9	0.0	0.0	0.0	0.9	0.0	0.2	0.0	1.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.0	0.0	0.0	12.4	0.0	0.0	8.9	10.2	0.0	7.8	0.0	10.1
LnGrp LOS	B	A	A	B	A		A	B		A	A	B
Approach Vol, veh/h		54			194	A		217	A		439	
Approach Delay, s/veh		11.0			12.4			10.1			9.8	
Approach LOS		B			B			B			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.0	13.7		11.6	5.3	15.4		11.6				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	2.8	5.0		2.8	2.2	7.7		6.0				
Green Ext Time (p_c), s	0.0	0.6		0.1	0.0	1.1		0.5				

Intersection Summary

HCM 6th Ctrl Delay	10.5
HCM 6th LOS	B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary

2: Alii Dr & Kaleiopapa St

Existing Conditions
PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	83	35	27	213	362	97
Future Volume (veh/h)	83	35	27	213	362	97
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1811	1841	1870	1870	1870
Adj Flow Rate, veh/h	88	2	29	227	385	92
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	6	6	4	2	2	2
Cap, veh/h	151	134	406	1043	512	122
Arrive On Green	0.09	0.09	0.04	0.56	0.35	0.35
Sat Flow, veh/h	1725	1535	1753	1870	1459	349
Grp Volume(v), veh/h	88	2	29	227	0	477
Grp Sat Flow(s), veh/h/ln	1725	1535	1753	1870	0	1807
Q Serve(g_s), s	1.5	0.0	0.3	1.9	0.0	7.1
Cycle Q Clear(g_c), s	1.5	0.0	0.3	1.9	0.0	7.1
Prop In Lane	1.00	1.00	1.00			0.19
Lane Grp Cap(c), veh/h	151	134	406	1043	0	634
V/C Ratio(X)	0.58	0.01	0.07	0.22	0.00	0.75
Avail Cap(c_a), veh/h	1134	1009	1207	3738	0	2376
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.3	12.7	6.0	3.4	0.0	8.7
Incr Delay (d2), s/veh	1.3	0.0	0.0	0.0	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	0.2	0.0	1.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	14.7	12.7	6.1	3.4	0.0	9.4
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	90			256	477	
Approach Delay, s/veh	14.6			3.7	9.4	
Approach LOS	B			A	A	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	6.3	16.5		7.7		22.8
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	15	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.3	9.1		3.5		3.9
Green Ext Time (p_c), s	0.0	1.5		0.1		0.6

Intersection Summary

HCM 6th Ctrl Delay	8.2
HCM 6th LOS	A




Notes

User approved volume balancing among the lanes for turning movement.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC
3: Kamehameha III Rd & Holua Rd

Existing Conditions
PM Peak Hour

Intersection						
Int Delay, s/veh	0.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	1	1	27	29	4
Future Vol, veh/h	4	1	1	27	29	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	1	1	29	32	4




Major/Minor	Minor2	Major1	Major2			
Conflicting Flow All	65	34	36	0	-	0
Stage 1	34	-	-	-	-	-
Stage 2	31	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	941	1039	1575	-	-	-
Stage 1	988	-	-	-	-	-
Stage 2	992	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	940	1039	1575	-	-	-
Mov Cap-2 Maneuver	940	-	-	-	-	-
Stage 1	987	-	-	-	-	-
Stage 2	992	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.8	0.3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1575	-	958	-	-
HCM Lane V/C Ratio	0.001	-	0.006	-	-
HCM Control Delay (s)	7.3	0	8.8	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

HCM 6th TWSC
4: Kaleiopapa St & Ehukai St




















Existing Conditions
PM Peak Hour

Intersection						
Int Delay, s/veh	1.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	12	13	49	47	2
Future Vol, veh/h	2	12	13	49	47	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	13	14	53	51	2
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	133	52	53	0	-	0
Stage 1	52	-	-	-	-	-
Stage 2	81	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	861	1016	1553	-	-	-
Stage 1	970	-	-	-	-	-
Stage 2	942	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	853	1016	1553	-	-	-
Mov Cap-2 Maneuver	853	-	-	-	-	-
Stage 1	961	-	-	-	-	-
Stage 2	942	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	8.7	1.5		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1553	-	989	-	-	
HCM Lane V/C Ratio	0.009	-	0.015	-	-	
HCM Control Delay (s)	7.3	0	8.7	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0	-	-	

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Existing Conditions
Saturday Midday Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	31	22	14	96	23	41	14	170	96	48	163	31
Future Volume (veh/h)	31	22	14	96	23	41	14	170	96	48	163	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.99	0.99		1.00	1.00		1.00	1.00		0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1693	1870	1826	1870	1870	1870
Adj Flow Rate, veh/h	35	25	5	108	26	0	16	191	0	54	183	29
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	14	2	5	2	2	2
Cap, veh/h	289	98	16	375	37		521	522		589	501	79
Arrive On Green	0.12	0.12	0.12	0.12	0.12	0.00	0.02	0.28	0.00	0.06	0.32	0.32
Sat Flow, veh/h	805	788	133	1233	297	1585	1612	1870	0	1781	1569	249
Grp Volume(v), veh/h	65	0	0	134	0	0	16	191	0	54	0	212
Grp Sat Flow(s),veh/h/ln	1726	0	0	1530	0	1585	1612	1870	0	1781	0	1818
Q Serve(g_s), s	0.0	0.0	0.0	1.4	0.0	0.0	0.2	2.4	0.0	0.6	0.0	2.6
Cycle Q Clear(g_c), s	0.9	0.0	0.0	2.4	0.0	0.0	0.2	2.4	0.0	0.6	0.0	2.6
Prop In Lane	0.54		0.08	0.81		1.00	1.00		0.00	1.00		0.14
Lane Grp Cap(c), veh/h	403	0	0	412	0		521	522		589	0	580
V/C Ratio(X)	0.16	0.00	0.00	0.33	0.00		0.03	0.37		0.09	0.00	0.37
Avail Cap(c_a), veh/h	1796	0	0	1695	0		2140	2850		1393	0	1838
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.6	0.0	0.0	12.2	0.0	0.0	7.3	8.5	0.0	6.7	0.0	7.7
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.6	0.0	0.0	0.0	0.7	0.0	0.1	0.0	0.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.7	0.0	0.0	12.4	0.0	0.0	7.3	8.6	0.0	6.7	0.0	7.8
LnGrp LOS	B	A	A	B	A		A	A		A	A	A
Approach Vol, veh/h		65			134	A		207	A		266	
Approach Delay, s/veh		11.7			12.4			8.5			7.6	
Approach LOS		B			B			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.6	13.6		9.1	5.4	14.7		9.1				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	2.6	4.4		2.9	2.2	4.6		4.4				
Green Ext Time (p_c), s	0.0	0.5		0.2	0.0	0.6		0.3				

Intersection Summary

HCM 6th Ctrl Delay	9.2
HCM 6th LOS	A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary

2: Alii Dr & Kaleiopapa St

Existing Conditions
Saturday Midday Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	83	22	15	170	169	76
Future Volume (veh/h)	83	22	15	170	169	76
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			0.98
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1841	1796	1870	1870	1841
Adj Flow Rate, veh/h	92	1	17	189	188	64
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	8	4	7	2	2	4
Cap, veh/h	157	145	498	954	393	134
Arrive On Green	0.09	0.09	0.02	0.51	0.30	0.30
Sat Flow, veh/h	1697	1560	1711	1870	1325	451
Grp Volume(v), veh/h	92	1	17	189	0	252
Grp Sat Flow(s), veh/h/ln	1697	1560	1711	1870	0	1777
Q Serve(g_s), s	1.4	0.0	0.2	1.5	0.0	3.2
Cycle Q Clear(g_c), s	1.4	0.0	0.2	1.5	0.0	3.2
Prop In Lane	1.00	1.00	1.00			0.25
Lane Grp Cap(c), veh/h	157	145	498	954	0	527
V/C Ratio(X)	0.58	0.01	0.03	0.20	0.00	0.48
Avail Cap(c_a), veh/h	1248	1147	1404	4182	0	2613
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.8	11.2	5.6	3.6	0.0	7.8
Incr Delay (d2), s/veh	1.3	0.0	0.0	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	0.1	0.0	0.7
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	13.1	11.2	5.6	3.7	0.0	8.1
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	93			206	252	
Approach Delay, s/veh	13.1			3.8	8.1	
Approach LOS	B			A	A	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	5.8	13.9		7.5		19.7
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	15	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.2	5.2		3.4		3.5
Green Ext Time (p_c), s	0.0	0.7		0.1		0.5

Intersection Summary

HCM 6th Ctrl Delay	7.3
HCM 6th LOS	A

Notes

User approved volume balancing among the lanes for turning movement.




* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

HCM 6th TWSC
3: Kamehameha III Rd & Holua Rd

Existing Conditions
Saturday Midday Peak Hour

Intersection

Int Delay, s/veh 0.7

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	1	1	29	30	4
Future Vol, veh/h	4	1	1	29	30	4
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	1	1	32	33	4




Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	69	35	37
Stage 1	35	-	-
Stage 2	34	-	-
Critical Hdwy	6.42	6.22	4.12
Critical Hdwy Stg 1	5.42	-	-
Critical Hdwy Stg 2	5.42	-	-
Follow-up Hdwy	3.518	3.318	2.218
Pot Cap-1 Maneuver	936	1038	1574
Stage 1	987	-	-
Stage 2	988	-	-
Platoon blocked, %			
Mov Cap-1 Maneuver	935	1038	1574
Mov Cap-2 Maneuver	935	-	-
Stage 1	986	-	-
Stage 2	988	-	-

Approach	EB	NB	SB
HCM Control Delay, s	8.8	0.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1574	-	954	-	-
HCM Lane V/C Ratio	0.001	-	0.006	-	-
HCM Control Delay (s)	7.3	0	8.8	-	-
HCM Lane LOS	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	-	-

HCM 6th TWSC
4: Kaleiopapa St & Ehukai St

Existing Conditions
Saturday Midday Peak Hour

Intersection						
Int Delay, s/veh	1.8					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	2	11	10	35	41	2
Future Vol, veh/h	2	11	10	35	41	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	12	11	38	45	2
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	106	46	47	0	-	0
Stage 1	46	-	-	-	-	-
Stage 2	60	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	892	1023	1560	-	-	-
Stage 1	976	-	-	-	-	-
Stage 2	963	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	886	1023	1560	-	-	-
Mov Cap-2 Maneuver	886	-	-	-	-	-
Stage 1	969	-	-	-	-	-
Stage 2	963	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	8.7	1.6		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1560	-	999	-	-	
HCM Lane V/C Ratio	0.007	-	0.014	-	-	
HCM Control Delay (s)	7.3	0	8.7	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0	-	-	

Appendix C: Baseline Conditions LOS Worksheets

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Baseline (2035) No Project Conditions

AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Traffic Volume (veh/h)	30	30	10	160	40	70	20	330	130	40	190	30
Future Volume (veh/h)	30	30	10	160	40	70	20	330	130	40	190	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.95	0.98		1.00	0.99		1.00	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1811	1870	1841	1870	1870	1856	1870	1856	1870
Adj Flow Rate, veh/h	33	33	4	174	43	0	22	359	0	43	207	28
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	6	2	4	2	2	3	2	3	2
Cap, veh/h	276	224	21	439	64		481	521		408	477	64
Arrive On Green	0.21	0.21	0.21	0.21	0.21	0.00	0.03	0.28	0.00	0.05	0.30	0.30
Sat Flow, veh/h	571	1058	99	1172	301	1560	1781	1870	0	1781	1589	215
Grp Volume(v), veh/h	70	0	0	217	0	0	22	359	0	43	0	235
Grp Sat Flow(s),veh/h/ln	1728	0	0	1473	0	1560	1781	1870	0	1781	0	1804
Q Serve(g_s), s	0.0	0.0	0.0	3.5	0.0	0.0	0.3	5.8	0.0	0.6	0.0	3.6
Cycle Q Clear(g_c), s	1.1	0.0	0.0	4.5	0.0	0.0	0.3	5.8	0.0	0.6	0.0	3.6
Prop In Lane	0.47		0.06	0.80		1.00	1.00		0.00	1.00		0.12
Lane Grp Cap(c), veh/h	521	0	0	502	0		481	521		408	0	541
V/C Ratio(X)	0.13	0.00	0.00	0.43	0.00		0.05	0.69		0.11	0.00	0.43
Avail Cap(c_a), veh/h	1564	0	0	1440	0		2000	2448		1104	0	1566
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.0	0.0	0.0	12.3	0.0	0.0	8.4	11.0	0.0	8.4	0.0	9.6
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	1.1	0.0	0.0	0.1	1.8	0.0	0.2	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.0	0.0	0.0	12.5	0.0	0.0	8.4	11.6	0.0	8.5	0.0	9.8
LnGrp LOS	B	A	A	B	A		A	B		A	A	A
Approach Vol, veh/h		70			217	A		381	A		278	
Approach Delay, s/veh		11.0			12.5			11.4			9.6	
Approach LOS		B			B			B			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.5	14.9		12.7	5.7	15.6		12.7				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	2.6	7.8		3.1	2.3	5.6		6.5				
Green Ext Time (p_c), s	0.0	1.1		0.2	0.0	0.7		0.6				

Intersection Summary

HCM 6th Ctrl Delay 11.1

HCM 6th LOS B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary 2: Alii Dr & Kaleiopapa St

Baseline (2035) No Project Conditions
AM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	40	20	40	410	250	90
Future Volume (veh/h)	40	20	40	410	250	90
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	0.99			0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1796	1856	1870	1826	1796
Adj Flow Rate, veh/h	41	2	41	418	255	80
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	6	7	3	2	5	7
Cap, veh/h	88	78	506	1039	416	130
Arrive On Green	0.05	0.05	0.05	0.56	0.32	0.32
Sat Flow, veh/h	1725	1522	1767	1870	1313	412
Grp Volume(v), veh/h	41	2	41	418	0	335
Grp Sat Flow(s), veh/h/ln	1725	1522	1767	1870	0	1725
Q Serve(g_s), s	0.6	0.0	0.4	3.5	0.0	4.5
Cycle Q Clear(g_c), s	0.6	0.0	0.4	3.5	0.0	4.5
Prop In Lane	1.00	1.00	1.00			0.24
Lane Grp Cap(c), veh/h	88	78	506	1039	0	546
V/C Ratio(X)	0.47	0.03	0.08	0.40	0.00	0.61
Avail Cap(c_a), veh/h	1258	1110	1386	4147	0	2516
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.7	12.4	5.2	3.5	0.0	7.9
Incr Delay (d2), s/veh	1.4	0.0	0.0	0.1	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.2	0.0	0.1	0.2	0.0	0.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	14.1	12.4	5.3	3.6	0.0	8.4
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	43			459	335	
Approach Delay, s/veh	14.0			3.7	8.4	
Approach LOS	B			A	A	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	6.5	14.5		6.4		21.0
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	15	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.4	6.5		2.6		5.5
Green Ext Time (p_c), s	0.0	1.0		0.0		1.2




Intersection Summary




HCM 6th Ctrl Delay	6.1
HCM 6th LOS	A

Notes

User approved volume balancing among the lanes for turning movement.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection						
Int Delay, s/veh	2.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	10	10	30	40	10
Future Vol, veh/h	10	10	10	30	40	10
Conflicting Peds, #/hr	20	20	20	0	0	20
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	11	11	33	43	11
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	144	89	74	0	-	0
Stage 1	69	-	-	-	-	-
Stage 2	75	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	849	969	1526	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	948	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	812	932	1497	-	-	-
Mov Cap-2 Maneuver	812	-	-	-	-	-
Stage 1	929	-	-	-	-	-
Stage 2	930	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	9.3	1.9		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1497	-	868	-	-	
HCM Lane V/C Ratio	0.007	-	0.025	-	-	
HCM Control Delay (s)	7.4	0	9.3	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0.1	-	-	

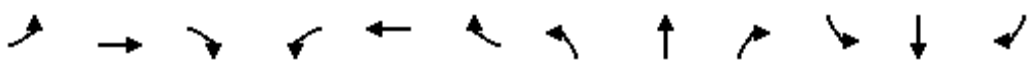
Intersection						
Int Delay, s/veh	2.6					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	10	20	50	30	10
Future Vol, veh/h	10	10	20	50	30	10
Conflicting Peds, #/hr	20	20	20	0	0	20
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	11	22	54	33	11
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	177	79	64	0	-	0
Stage 1	59	-	-	-	-	-
Stage 2	118	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	813	981	1538	-	-	-
Stage 1	964	-	-	-	-	-
Stage 2	907	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	771	944	1509	-	-	-
Mov Cap-2 Maneuver	771	-	-	-	-	-
Stage 1	931	-	-	-	-	-
Stage 2	890	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	9.4	2.1		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1509	-	849	-	-	
HCM Lane V/C Ratio	0.014	-	0.026	-	-	
HCM Control Delay (s)	7.4	0	9.4	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0.1	-	-	

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Baseline (2035) No Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Traffic Volume (veh/h)	30	30	20	190	40	50	20	230	130	70	380	40
Future Volume (veh/h)	30	30	20	190	40	50	20	230	130	70	380	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.96	0.98		1.00	0.99		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1693	1856	1841	1870	1752	1870	1796	1870	1870	1856
Adj Flow Rate, veh/h	32	32	9	200	42	0	21	242	0	74	400	39
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	14	3	4	2	10	2	7	2	2	3
Cap, veh/h	264	226	50	450	58		335	525		514	545	53
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.00	0.03	0.28	0.00	0.07	0.33	0.33
Sat Flow, veh/h	544	972	213	1187	249	1585	1668	1870	0	1781	1671	163
Grp Volume(v), veh/h	73	0	0	242	0	0	21	242	0	74	0	439
Grp Sat Flow(s),veh/h/ln	1729	0	0	1436	0	1585	1668	1870	0	1781	0	1834
Q Serve(g_s), s	0.0	0.0	0.0	4.5	0.0	0.0	0.3	4.0	0.0	1.1	0.0	8.0
Cycle Q Clear(g_c), s	1.2	0.0	0.0	5.8	0.0	0.0	0.3	4.0	0.0	1.1	0.0	8.0
Prop In Lane	0.44		0.12	0.83		1.00	1.00		0.00	1.00		0.09
Lane Grp Cap(c), veh/h	539	0	0	508	0		335	525		514	0	598
V/C Ratio(X)	0.14	0.00	0.00	0.48	0.00		0.06	0.46		0.14	0.00	0.73
Avail Cap(c_a), veh/h	1413	0	0	1275	0		1614	2206		1093	0	1435
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(l)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.6	0.0	0.0	13.2	0.0	0.0	9.7	11.2	0.0	8.5	0.0	11.3
Incr Delay (d2), s/veh	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	1.5	0.0	0.0	0.1	1.3	0.0	0.3	0.0	2.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.6	0.0	0.0	13.5	0.0	0.0	9.8	11.5	0.0	8.6	0.0	12.0
LnGrp LOS	B	A	A	B	A		A	B		A	A	B
Approach Vol, veh/h		73			242	A		263	A		513	
Approach Delay, s/veh		11.6			13.5			11.3			11.5	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.5	16.0		14.3	5.8	17.7		14.3				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	3.1	6.0		3.2	2.3	10.0		7.8				
Green Ext Time (p_c), s	0.0	0.7		0.2	0.0	1.3		0.6				

Intersection Summary

HCM 6th Ctrl Delay 11.9

HCM 6th LOS B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary 2: Alii Dr & Kaleiopapa St

Baseline (2035) No Project Conditions
PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	100	50	40	250	420	120
Future Volume (veh/h)	100	50	40	250	420	120
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1811	1841	1870	1870	1870
Adj Flow Rate, veh/h	106	4	43	266	447	117
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	6	6	4	2	2	2
Cap, veh/h	162	144	395	1120	569	149
Arrive On Green	0.09	0.09	0.05	0.60	0.40	0.40
Sat Flow, veh/h	1725	1535	1753	1870	1417	371
Grp Volume(v), veh/h	106	4	43	266	0	564
Grp Sat Flow(s), veh/h/ln	1725	1535	1753	1870	0	1788
Q Serve(g_s), s	2.1	0.1	0.4	2.3	0.0	9.7
Cycle Q Clear(g_c), s	2.1	0.1	0.4	2.3	0.0	9.7
Prop In Lane	1.00	1.00	1.00			0.21
Lane Grp Cap(c), veh/h	162	144	395	1120	0	718
V/C Ratio(X)	0.66	0.03	0.11	0.24	0.00	0.79
Avail Cap(c_a), veh/h	983	874	1059	3240	0	2038
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	15.4	14.5	6.4	3.3	0.0	9.2
Incr Delay (d2), s/veh	1.7	0.0	0.0	0.0	0.0	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.8	0.0	0.1	0.3	0.0	2.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	17.0	14.5	6.5	3.3	0.0	9.9
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	110			309	564	
Approach Delay, s/veh	16.9			3.8	9.9	
Approach LOS	B			A	A	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	6.9	19.9		8.3		26.8
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	15	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.4	11.7		4.1		4.3
Green Ext Time (p_c), s	0.0	1.8		0.1		0.7




Intersection Summary

HCM 6th Ctrl Delay	8.8
HCM 6th LOS	A

Notes




User approved volume balancing among the lanes for turning movement.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection						
Int Delay, s/veh	2.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	10	10	40	40	10
Future Vol, veh/h	10	10	10	40	40	10
Conflicting Peds, #/hr	20	20	20	0	0	20
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	11	11	43	43	11
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	154	89	74	0	-	0
Stage 1	69	-	-	-	-	-
Stage 2	85	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	838	969	1526	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	938	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	800	932	1497	-	-	-
Mov Cap-2 Maneuver	800	-	-	-	-	-
Stage 1	928	-	-	-	-	-
Stage 2	920	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	9.3	1.5		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1497	-	861	-	-	
HCM Lane V/C Ratio	0.007	-	0.025	-	-	
HCM Control Delay (s)	7.4	0	9.3	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0.1	-	-	

HCM 6th TWSC
4: Kaleiopapa St & Ehukai St

Baseline (2035) No Project Conditions
PM Peak Hour

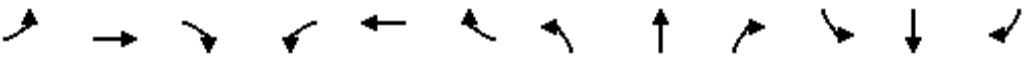
Intersection						
Int Delay, s/veh	2.4					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	20	20	60	60	10
Future Vol, veh/h	10	20	20	60	60	10
Conflicting Peds, #/hr	20	20	20	0	0	20
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	22	22	65	65	11
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	220	111	96	0	-	0
Stage 1	91	-	-	-	-	-
Stage 2	129	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	768	942	1498	-	-	-
Stage 1	933	-	-	-	-	-
Stage 2	897	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	727	906	1469	-	-	-
Mov Cap-2 Maneuver	727	-	-	-	-	-
Stage 1	900	-	-	-	-	-
Stage 2	880	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	9.5	1.9		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1469	-	837	-	-	
HCM Lane V/C Ratio	0.015	-	0.039	-	-	
HCM Control Delay (s)	7.5	0	9.5	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0.1	-	-	

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Baseline (2035) No Project Conditions

Saturday Midday Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Traffic Volume (veh/h)	40	30	20	120	30	50	20	200	120	60	190	40
Future Volume (veh/h)	40	30	20	120	30	50	20	200	120	60	190	40
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.95	0.98		1.00	0.99		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1693	1870	1826	1870	1870	1870
Adj Flow Rate, veh/h	45	34	11	135	34	0	22	225	0	67	213	39
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	14	2	5	2	2	2
Cap, veh/h	274	147	35	406	51		471	503		544	476	87
Arrive On Green	0.17	0.17	0.17	0.17	0.17	0.00	0.03	0.27	0.00	0.07	0.31	0.31
Sat Flow, veh/h	621	867	207	1198	302	1585	1612	1870	0	1781	1527	280
Grp Volume(v), veh/h	90	0	0	169	0	0	22	225	0	67	0	252
Grp Sat Flow(s),veh/h/ln	1695	0	0	1500	0	1585	1612	1870	0	1781	0	1807
Q Serve(g_s), s	0.0	0.0	0.0	1.8	0.0	0.0	0.3	3.2	0.0	0.8	0.0	3.6
Cycle Q Clear(g_c), s	1.4	0.0	0.0	3.2	0.0	0.0	0.3	3.2	0.0	0.8	0.0	3.6
Prop In Lane	0.50		0.12	0.80		1.00	1.00		0.00	1.00		0.15
Lane Grp Cap(c), veh/h	457	0	0	458	0		471	503		544	0	563
V/C Ratio(X)	0.20	0.00	0.00	0.37	0.00		0.05	0.45		0.12	0.00	0.45
Avail Cap(c_a), veh/h	1630	0	0	1527	0		1938	2607		1254	0	1672
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.6	0.0	0.0	12.3	0.0	0.0	8.1	9.7	0.0	7.4	0.0	8.8
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.5	0.0	0.0	0.8	0.0	0.0	0.1	1.0	0.0	0.2	0.0	1.0
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.7	0.0	0.0	12.5	0.0	0.0	8.1	9.9	0.0	7.5	0.0	9.0
LnGrp LOS	B	A	A	B	A		A	A		A	A	A
Approach Vol, veh/h		90			169	A		247	A		319	
Approach Delay, s/veh		11.7			12.5			9.8			8.7	
Approach LOS		B			B			A			A	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.0	14.0		10.9	5.7	15.4		10.9				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	2.8	5.2		3.4	2.3	5.6		5.2				
Green Ext Time (p_c), s	0.0	0.6		0.2	0.0	0.7		0.4				

Intersection Summary

HCM 6th Ctrl Delay 10.1

HCM 6th LOS B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary 2: Alii Dr & Kaleiopapa St

Baseline (2035) No Project Conditions
Saturday Midday Peak Hour






Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	100	30	20	200	200	90
Future Volume (veh/h)	100	30	20	200	200	90
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	0.99			0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1841	1796	1870	1870	1841
Adj Flow Rate, veh/h	111	0	22	222	222	80
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	8	4	7	2	2	4
Cap, veh/h	172	159	482	989	419	151
Arrive On Green	0.10	0.00	0.03	0.53	0.32	0.32
Sat Flow, veh/h	1697	1560	1711	1870	1297	467
Grp Volume(v), veh/h	111	0	22	222	0	302
Grp Sat Flow(s), veh/h/ln	1697	1560	1711	1870	0	1765
Q Serve(g_s), s	1.8	0.0	0.2	1.9	0.0	4.1
Cycle Q Clear(g_c), s	1.8	0.0	0.2	1.9	0.0	4.1
Prop In Lane	1.00	1.00	1.00			0.26
Lane Grp Cap(c), veh/h	172	159	482	989	0	570
V/C Ratio(X)	0.64	0.00	0.05	0.22	0.00	0.53
Avail Cap(c_a), veh/h	1161	1068	1313	3892	0	2416
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.6	0.0	5.6	3.7	0.0	8.1
Incr Delay (d2), s/veh	1.5	0.0	0.0	0.0	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	0.2	0.0	0.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	14.1	0.0	5.7	3.7	0.0	8.4
LnGrp LOS	B	A	A	A	A	A
Approach Vol, veh/h	111			244	302	
Approach Delay, s/veh	14.1			3.9	8.4	
Approach LOS	B			A	A	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	6.0	15.2		8.0		21.2
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	15	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.2	6.1		3.8		3.9
Green Ext Time (p_c), s	0.0	0.9		0.1		0.6




Intersection Summary

HCM 6th Ctrl Delay	7.7
HCM 6th LOS	A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection						
Int Delay, s/veh	2.2					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	10	10	40	40	10
Future Vol, veh/h	10	10	10	40	40	10
Conflicting Peds, #/hr	20	20	20	0	0	20
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	11	11	43	43	11
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	154	89	74	0	-	0
Stage 1	69	-	-	-	-	-
Stage 2	85	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	838	969	1526	-	-	-
Stage 1	954	-	-	-	-	-
Stage 2	938	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	800	932	1497	-	-	-
Mov Cap-2 Maneuver	800	-	-	-	-	-
Stage 1	928	-	-	-	-	-
Stage 2	920	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	9.3	1.5		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1497	-	861	-	-	
HCM Lane V/C Ratio	0.007	-	0.025	-	-	
HCM Control Delay (s)	7.4	0	9.3	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0.1	-	-	

Intersection						
Int Delay, s/veh	2.7					
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	10	20	20	50	50	10
Future Vol, veh/h	10	20	20	50	50	10
Conflicting Peds, #/hr	20	20	20	0	0	20
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	11	22	22	54	54	11
Major/Minor	Minor2	Major1		Major2		
Conflicting Flow All	198	100	85	0	-	0
Stage 1	80	-	-	-	-	-
Stage 2	118	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	791	956	1512	-	-	-
Stage 1	943	-	-	-	-	-
Stage 2	907	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	750	920	1483	-	-	-
Mov Cap-2 Maneuver	750	-	-	-	-	-
Stage 1	911	-	-	-	-	-
Stage 2	890	-	-	-	-	-
Approach	EB	NB		SB		
HCM Control Delay, s	9.4	2.1		0		
HCM LOS	A					
Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR	
Capacity (veh/h)	1483	-	855	-	-	
HCM Lane V/C Ratio	0.015	-	0.038	-	-	
HCM Control Delay (s)	7.5	0	9.4	-	-	
HCM Lane LOS	A	A	A	-	-	
HCM 95th %tile Q(veh)	0	-	0.1	-	-	

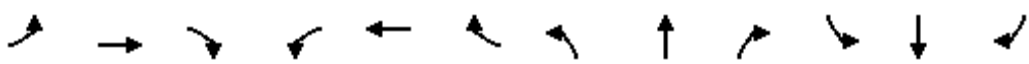
Appendix D: Baseline Plus Project Conditions LOS Worksheets

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Baseline (2035) Plus Project Conditions

AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Traffic Volume (veh/h)	53	38	16	160	53	70	30	342	130	40	210	70
Future Volume (veh/h)	53	38	16	160	53	70	30	342	130	40	210	70
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.95	0.98		1.00	0.99		1.00	1.00		0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1811	1870	1841	1870	1870	1856	1870	1856	1870
Adj Flow Rate, veh/h	58	41	10	174	58	0	33	372	0	43	228	66
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	6	2	4	2	2	3	2	3	2
Cap, veh/h	309	186	34	424	87		438	529		399	399	116
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.00	0.04	0.28	0.00	0.05	0.29	0.29
Sat Flow, veh/h	693	851	156	1112	399	1560	1781	1870	0	1781	1365	395
Grp Volume(v), veh/h	109	0	0	232	0	0	33	372	0	43	0	294
Grp Sat Flow(s),veh/h/ln	1700	0	0	1511	0	1560	1781	1870	0	1781	0	1760
Q Serve(g_s), s	0.0	0.0	0.0	3.0	0.0	0.0	0.4	6.2	0.0	0.6	0.0	5.0
Cycle Q Clear(g_c), s	1.7	0.0	0.0	4.8	0.0	0.0	0.4	6.2	0.0	0.6	0.0	5.0
Prop In Lane	0.53		0.09	0.75		1.00	1.00		0.00	1.00		0.22
Lane Grp Cap(c), veh/h	530	0	0	511	0		438	529		399	0	515
V/C Ratio(X)	0.21	0.00	0.00	0.45	0.00		0.08	0.70		0.11	0.00	0.57
Avail Cap(c_a), veh/h	1494	0	0	1415	0		1897	2387		1076	0	1491
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	11.3	0.0	0.0	12.4	0.0	0.0	8.5	11.2	0.0	8.6	0.0	10.5
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.2	0.0	0.0	0.0	0.6	0.0	0.0	0.0	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.6	0.0	0.0	1.2	0.0	0.0	0.1	2.0	0.0	0.2	0.0	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	11.4	0.0	0.0	12.6	0.0	0.0	8.5	11.9	0.0	8.6	0.0	10.9
LnGrp LOS	B	A	A	B	A		A	B		A	A	B
Approach Vol, veh/h		109			232	A		405	A		337	
Approach Delay, s/veh		11.4			12.6			11.6			10.6	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	6.5	15.3		13.1	6.2	15.6		13.1				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	2.6	8.2		3.7	2.4	7.0		6.8				
Green Ext Time (p_c), s	0.0	1.1		0.3	0.0	0.9		0.6				

Intersection Summary

HCM 6th Ctrl Delay 11.5

HCM 6th LOS B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary 2: Alii Dr & Kaleiopapa St

Baseline (2035) Plus Project Conditions
AM Peak Hour







Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	52	28	55	420	256	110
Future Volume (veh/h)	52	28	55	420	256	110
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	0.99			0.95
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1796	1856	1870	1826	1796
Adj Flow Rate, veh/h	53	2	56	429	261	97
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98
Percent Heavy Veh, %	6	7	3	2	5	7
Cap, veh/h	107	94	498	1046	392	146
Arrive On Green	0.06	0.06	0.06	0.56	0.31	0.31
Sat Flow, veh/h	1725	1522	1767	1870	1248	464
Grp Volume(v), veh/h	53	2	56	429	0	358
Grp Sat Flow(s), veh/h/ln	1725	1522	1767	1870	0	1712
Q Serve(g_s), s	0.8	0.0	0.5	3.7	0.0	5.2
Cycle Q Clear(g_c), s	0.8	0.0	0.5	3.7	0.0	5.2
Prop In Lane	1.00	1.00	1.00			0.27
Lane Grp Cap(c), veh/h	107	94	498	1046	0	538
V/C Ratio(X)	0.50	0.02	0.11	0.41	0.00	0.67
Avail Cap(c_a), veh/h	1210	1067	1316	3987	0	2401
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.9	12.6	5.5	3.6	0.0	8.5
Incr Delay (d2), s/veh	1.3	0.0	0.0	0.1	0.0	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.1	0.2	0.0	1.1
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	14.3	12.6	5.5	3.7	0.0	9.0
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	55			485	358	
Approach Delay, s/veh	14.2			3.9	9.0	
Approach LOS	B			A	A	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	7.0	14.8		6.8		21.8
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	15	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.5	7.2		2.8		5.7
Green Ext Time (p_c), s	0.0	1.1		0.0		1.2

Intersection Summary

HCM 6th Ctrl Delay 6.6
HCM 6th LOS A

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection												
Int Delay, s/veh	7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	10	5	5	0	0	55	10	12	0	90	13	10
Future Vol, veh/h	10	5	5	0	0	55	10	12	0	90	13	10
Conflicting Peds, #/hr	20	0	20	20	0	20	20	0	20	20	0	20
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	5	5	0	0	60	11	13	0	98	14	11
Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	321	291	60	296	296	53	45	0	0	33	0	0
Stage 1	236	236	-	55	55	-	-	-	-	-	-	-
Stage 2	85	55	-	241	241	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	632	619	1005	656	616	1014	1563	-	-	1579	-	-
Stage 1	767	710	-	957	849	-	-	-	-	-	-	-
Stage 2	923	849	-	762	706	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	540	553	967	590	551	976	1533	-	-	1549	-	-
Mov Cap-2 Maneuver	540	553	-	590	551	-	-	-	-	-	-	-
Stage 1	747	652	-	932	827	-	-	-	-	-	-	-
Stage 2	844	827	-	690	648	-	-	-	-	-	-	-
Approach	EB		WB		NB		SB					
HCM Control Delay, s	11.1		8.9		3.3		6					
HCM LOS	B		A									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1533	-	-	611	976	1549	-	-				
HCM Lane V/C Ratio	0.007	-	-	0.036	0.061	0.063	-	-				
HCM Control Delay (s)	7.4	0	-	11.1	8.9	7.5	0	-				
HCM Lane LOS	A	A	-	B	A	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	0.1	0.2	0.2	-	-				

HCM 6th TWSC
4: Kaleiopapa St & Ehukai St

Baseline (2035) Plus Project Conditions
AM Peak Hour

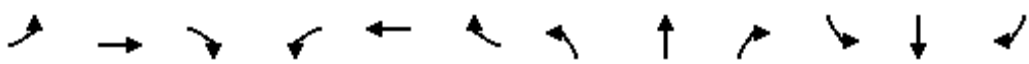
Intersection												
Int Delay, s/veh	5											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	18	30	0	0	45	13	47	0	12	10
Future Vol, veh/h	5	5	18	30	0	0	45	13	47	0	12	10
Conflicting Peds, #/hr	20	0	20	20	0	20	20	0	20	20	0	20
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	20	33	0	0	49	14	51	0	13	11
Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	197	222	59	209	202	80	44	0	0	85	0	0
Stage 1	39	39	-	158	158	-	-	-	-	-	-	-
Stage 2	158	183	-	51	44	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	762	677	1007	748	694	980	1564	-	-	1512	-	-
Stage 1	976	862	-	844	767	-	-	-	-	-	-	-
Stage 2	844	748	-	962	858	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	715	630	969	683	646	943	1534	-	-	1483	-	-
Mov Cap-2 Maneuver	715	630	-	683	646	-	-	-	-	-	-	-
Stage 1	926	846	-	801	728	-	-	-	-	-	-	-
Stage 2	801	710	-	919	842	-	-	-	-	-	-	-
Approach	EB		WB		NB		SB					
HCM Control Delay, s	9.5		10.5		3.2		0					
HCM LOS	A		B									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR				
Capacity (veh/h)	1534	-	-	836	683	1483	-	-				
HCM Lane V/C Ratio	0.032	-	-	0.036	0.048	-	-	-				
HCM Control Delay (s)	7.4	0	-	9.5	10.5	0	-	-				
HCM Lane LOS	A	A	-	A	B	A	-	-				
HCM 95th %tile Q(veh)	0.1	-	-	0.1	0.1	0	-	-				

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Baseline (2035) Plus Project Conditions

PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Traffic Volume (veh/h)	79	47	33	190	56	50	31	255	130	70	402	84
Future Volume (veh/h)	79	47	33	190	56	50	31	255	130	70	402	84
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.99		0.96	0.98		1.00	0.99		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1693	1856	1841	1870	1752	1870	1796	1870	1870	1856
Adj Flow Rate, veh/h	83	49	26	200	59	0	33	268	0	74	423	82
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Percent Heavy Veh, %	2	2	14	3	4	2	10	2	7	2	2	3
Cap, veh/h	297	161	64	422	80		321	605		527	535	104
Arrive On Green	0.23	0.23	0.23	0.23	0.23	0.00	0.04	0.32	0.00	0.07	0.35	0.35
Sat Flow, veh/h	710	690	276	1156	341	1585	1668	1870	0	1781	1512	293
Grp Volume(v), veh/h	158	0	0	259	0	0	33	268	0	74	0	505
Grp Sat Flow(s),veh/h/ln	1675	0	0	1496	0	1585	1668	1870	0	1781	0	1805
Q Serve(g_s), s	0.0	0.0	0.0	3.3	0.0	0.0	0.5	4.7	0.0	1.1	0.0	10.5
Cycle Q Clear(g_c), s	3.1	0.0	0.0	6.4	0.0	0.0	0.5	4.7	0.0	1.1	0.0	10.5
Prop In Lane	0.53		0.16	0.77		1.00	1.00		0.00	1.00		0.16
Lane Grp Cap(c), veh/h	522	0	0	501	0		321	605		527	0	639
V/C Ratio(X)	0.30	0.00	0.00	0.52	0.00		0.10	0.44		0.14	0.00	0.79
Avail Cap(c_a), veh/h	1241	0	0	1155	0		1451	1989		1041	0	1274
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.5	0.0	0.0	14.6	0.0	0.0	9.8	11.2	0.0	8.4	0.0	12.1
Incr Delay (d2), s/veh	0.1	0.0	0.0	0.3	0.0	0.0	0.1	0.2	0.0	0.0	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	0.0	1.8	0.0	0.0	0.2	1.6	0.0	0.3	0.0	3.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.6	0.0	0.0	14.9	0.0	0.0	9.8	11.4	0.0	8.4	0.0	13.0
LnGrp LOS	B	A	A	B	A		A	B		A	A	B
Approach Vol, veh/h		158			259	A		301	A		579	
Approach Delay, s/veh		13.6			14.9			11.2			12.4	
Approach LOS		B			B			B			B	
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.7	19.0		15.3	6.4	20.3		15.3				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	3.1	6.7		5.1	2.5	12.5		8.4				
Green Ext Time (p_c), s	0.0	0.8		0.5	0.0	1.6		0.7				

Intersection Summary

HCM 6th Ctrl Delay 12.8

HCM 6th LOS B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary

2: Alii Dr & Kaleiopapa St

Baseline (2035) Plus Project Conditions
PM Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	125	67	56	261	433	142
Future Volume (veh/h)	125	67	56	261	433	142
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	1.00			0.97
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1811	1811	1841	1870	1870	1870
Adj Flow Rate, veh/h	133	6	60	278	461	139
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Percent Heavy Veh, %	6	6	4	2	2	2
Cap, veh/h	175	155	393	1150	569	172
Arrive On Green	0.10	0.10	0.06	0.61	0.42	0.42
Sat Flow, veh/h	1725	1535	1753	1870	1367	412
Grp Volume(v), veh/h	133	6	60	278	0	600
Grp Sat Flow(s), veh/h/ln	1725	1535	1753	1870	0	1779
Q Serve(g_s), s	2.9	0.1	0.6	2.6	0.0	11.3
Cycle Q Clear(g_c), s	2.9	0.1	0.6	2.6	0.0	11.3
Prop In Lane	1.00	1.00	1.00			0.23
Lane Grp Cap(c), veh/h	175	155	393	1150	0	741
V/C Ratio(X)	0.76	0.04	0.15	0.24	0.00	0.81
Avail Cap(c_a), veh/h	907	807	977	2991	0	1872
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	16.6	15.4	6.8	3.3	0.0	9.8
Incr Delay (d2), s/veh	2.6	0.0	0.1	0.0	0.0	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.1	0.0	0.1	0.3	0.0	2.9
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	19.2	15.5	6.9	3.4	0.0	10.6
LnGrp LOS	B	B	A	A	A	B
Approach Vol, veh/h	139			338	600	
Approach Delay, s/veh	19.1			4.0	10.6	
Approach LOS	B			A	B	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	7.5	21.6		8.8		29.2
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	45	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.6	13.3		4.9		4.6
Green Ext Time (p_c), s	0.0	2.0		0.1		0.8

Intersection Summary

HCM 6th Ctrl Delay 9.6
HCM 6th LOS A

Notes

User approved volume balancing among the lanes for turning movement.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection												
Int Delay, s/veh	7.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	5	5	0	0	105	10	14	0	97	14	10
Future Vol, veh/h	10	5	5	0	0	105	10	14	0	97	14	10
Conflicting Peds, #/hr	20	0	20	20	0	20	20	0	20	20	0	20
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	5	5	0	0	114	11	15	0	105	15	11
Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	365	308	61	313	313	55	46	0	0	35	0	0
Stage 1	251	251	-	57	57	-	-	-	-	-	-	-
Stage 2	114	57	-	256	256	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	591	606	1004	640	602	1012	1562	-	-	1576	-	-
Stage 1	753	699	-	955	847	-	-	-	-	-	-	-
Stage 2	891	847	-	749	696	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	473	539	966	573	536	974	1532	-	-	1546	-	-
Mov Cap-2 Maneuver	473	539	-	573	536	-	-	-	-	-	-	-
Stage 1	733	638	-	930	825	-	-	-	-	-	-	-
Stage 2	766	825	-	674	635	-	-	-	-	-	-	-
Approach	EB		WB		NB		SB					
HCM Control Delay, s	11.7		9.2		3.1		6					
HCM LOS	B		A									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1532	-	-	562	974	1546	-	-				
HCM Lane V/C Ratio	0.007	-	-	0.039	0.117	0.068	-	-				
HCM Control Delay (s)	7.4	0	-	11.7	9.2	7.5	0	-				
HCM Lane LOS	A	A	-	B	A	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	0.1	0.4	0.2	-	-				

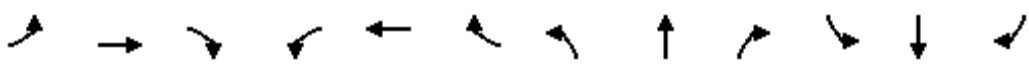
Intersection												
Int Delay, s/veh	6.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	38	70	0	0	51	14	53	0	14	10
Future Vol, veh/h	5	5	38	70	0	0	51	14	53	0	14	10
Conflicting Peds, #/hr	20	0	20	20	0	20	20	0	20	20	0	20
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	41	76	0	0	55	15	58	0	15	11
Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	215	244	61	238	220	84	46	0	0	93	0	0
Stage 1	41	41	-	174	174	-	-	-	-	-	-	-
Stage 2	174	203	-	64	46	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	742	658	1004	716	678	975	1562	-	-	1501	-	-
Stage 1	974	861	-	828	755	-	-	-	-	-	-	-
Stage 2	828	733	-	947	857	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	693	609	966	636	628	938	1532	-	-	1472	-	-
Mov Cap-2 Maneuver	693	609	-	636	628	-	-	-	-	-	-	-
Stage 1	919	845	-	782	713	-	-	-	-	-	-	-
Stage 2	781	692	-	884	841	-	-	-	-	-	-	-
Approach	EB		WB		NB		SB					
HCM Control Delay, s	9.4		11.4		3.2		0					
HCM LOS	A		B									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1532	-	-	877	636	1472	-	-				
HCM Lane V/C Ratio	0.036	-	-	0.059	0.12	-	-	-				
HCM Control Delay (s)	7.4	0	-	9.4	11.4	0	-	-				
HCM Lane LOS	A	A	-	A	B	A	-	-				
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.4	0	-	-				

HCM 6th Signalized Intersection Summary

1: Alii Dr & Kamehameha III Rd

Baseline (2035) Plus Project Conditions

Saturday Midday Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔	↔	↔		↔	↔	
Traffic Volume (veh/h)	112	57	38	120	56	50	39	236	120	60	227	113
Future Volume (veh/h)	112	57	38	120	56	50	39	236	120	60	227	113
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	0.98		0.95	0.98		1.00	0.99		1.00	0.99		0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No			No			No		
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1693	1870	1826	1870	1870	1870
Adj Flow Rate, veh/h	126	64	34	135	63	0	44	265	0	67	255	109
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Percent Heavy Veh, %	2	2	2	2	2	2	14	2	5	2	2	2
Cap, veh/h	325	108	49	381	115		397	533		514	372	159
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.00	0.05	0.28	0.00	0.07	0.30	0.30
Sat Flow, veh/h	836	554	249	1058	588	1585	1612	1870	0	1781	1227	524
Grp Volume(v), veh/h	224	0	0	198	0	0	44	265	0	67	0	364
Grp Sat Flow(s),veh/h/ln	1638	0	0	1647	0	1585	1612	1870	0	1781	0	1751
Q Serve(g_s), s	0.6	0.0	0.0	0.0	0.0	0.0	0.7	4.1	0.0	0.9	0.0	6.4
Cycle Q Clear(g_c), s	4.1	0.0	0.0	3.5	0.0	0.0	0.7	4.1	0.0	0.9	0.0	6.4
Prop In Lane	0.56		0.15	0.68		1.00	1.00		0.00	1.00		0.30
Lane Grp Cap(c), veh/h	482	0	0	496	0		397	533		514	0	532
V/C Ratio(X)	0.46	0.00	0.00	0.40	0.00		0.11	0.50		0.13	0.00	0.68
Avail Cap(c_a), veh/h	1460	0	0	1429	0		1706	2395		1159	0	1488
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	12.9	0.0	0.0	12.6	0.0	0.0	8.4	10.4	0.0	7.8	0.0	10.7
Incr Delay (d2), s/veh	0.3	0.0	0.0	0.2	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.3	0.0	0.0	1.1	0.0	0.0	0.2	1.3	0.0	0.2	0.0	1.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	13.1	0.0	0.0	12.8	0.0	0.0	8.5	10.6	0.0	7.9	0.0	11.2
LnGrp LOS	B	A	A	B	A		A	B		A	A	B
Approach Vol, veh/h	224			198			309			431		
Approach Delay, s/veh	13.1			12.8			10.3			10.7		
Approach LOS	B			B			B			B		
Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	7.2	15.3		12.3	6.5	16.0		12.3				
Change Period (Y+Rc), s	* 4.8	* 5.4		* 5.5	* 4.8	* 5.4		* 5.5				
Max Green Setting (Gmax), s	* 15	* 45		* 30	* 30	* 30		* 30				
Max Q Clear Time (g_c+I1), s	2.9	6.1		6.1	2.7	8.4		5.5				
Green Ext Time (p_c), s	0.0	0.8		0.7	0.0	1.1		0.5				

Intersection Summary

HCM 6th Ctrl Delay 11.4

HCM 6th LOS B

Notes

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Unsignalized Delay for [NBR, WBR] is excluded from calculations of the approach delay and intersection delay.

HCM 6th Signalized Intersection Summary

2: Alii Dr & Kaleiopapa St

Baseline (2035) Plus Project Conditions
Saturday Midday Peak Hour



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	136	57	46	219	218	127
Future Volume (veh/h)	136	57	46	219	218	127
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00	1.00	0.99			0.96
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach	No			No	No	
Adj Sat Flow, veh/h/ln	1781	1841	1796	1870	1870	1841
Adj Flow Rate, veh/h	151	5	51	243	242	114
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	8	4	7	2	2	4
Cap, veh/h	203	187	454	990	359	169
Arrive On Green	0.12	0.12	0.06	0.53	0.30	0.30
Sat Flow, veh/h	1697	1560	1711	1870	1185	558
Grp Volume(v), veh/h	151	5	51	243	0	356
Grp Sat Flow(s), veh/h/ln	1697	1560	1711	1870	0	1743
Q Serve(g_s), s	2.6	0.1	0.5	2.2	0.0	5.5
Cycle Q Clear(g_c), s	2.6	0.1	0.5	2.2	0.0	5.5
Prop In Lane	1.00	1.00	1.00			0.32
Lane Grp Cap(c), veh/h	203	187	454	990	0	528
V/C Ratio(X)	0.74	0.03	0.11	0.25	0.00	0.67
Avail Cap(c_a), veh/h	1102	1014	1189	3695	0	2266
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	13.1	12.0	6.2	3.9	0.0	9.4
Incr Delay (d2), s/veh	2.0	0.0	0.0	0.0	0.0	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.9	0.0	0.1	0.3	0.0	1.4
Unsig. Movement Delay, s/veh						
LnGrp Delay(d),s/veh	15.1	12.0	6.2	4.0	0.0	10.0
LnGrp LOS	B	B	A	A	A	A
Approach Vol, veh/h	156			294	356	
Approach Delay, s/veh	15.0			4.4	10.0	
Approach LOS	B			A	A	
Timer - Assigned Phs	1	2		4		6
Phs Duration (G+Y+Rc), s	7.0	15.1		8.7		22.1
Change Period (Y+Rc), s	5.2	* 5.8		5.0		* 5.8
Max Green Setting (Gmax), s	15	* 40		20.0		* 61
Max Q Clear Time (g_c+I), s	12.5	7.5		4.6		4.2
Green Ext Time (p_c), s	0.0	1.1		0.1		0.7

Intersection Summary

HCM 6th Ctrl Delay 8.9
HCM 6th LOS A

Notes

User approved volume balancing among the lanes for turning movement.

* HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Intersection												
Int Delay, s/veh	7.7											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	10	5	5	0	0	141	10	16	0	142	16	10
Future Vol, veh/h	10	5	5	0	0	141	10	16	0	142	16	10
Conflicting Peds, #/hr	20	0	20	20	0	20	20	0	20	20	0	20
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	11	5	5	0	0	153	11	17	0	154	17	11
Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	487	410	63	415	415	57	48	0	0	37	0	0
Stage 1	351	351	-	59	59	-	-	-	-	-	-	-
Stage 2	136	59	-	356	356	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	491	531	1002	548	528	1009	1559	-	-	1574	-	-
Stage 1	666	632	-	953	846	-	-	-	-	-	-	-
Stage 2	867	846	-	661	629	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	365	456	964	477	454	971	1529	-	-	1544	-	-
Mov Cap-2 Maneuver	365	456	-	477	454	-	-	-	-	-	-	-
Stage 1	649	557	-	928	824	-	-	-	-	-	-	-
Stage 2	711	824	-	574	555	-	-	-	-	-	-	-
Approach	EB		WB		NB		SB					
HCM Control Delay, s	13.2		9.4		2.8		6.4					
HCM LOS	B		A									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1529	-	-	459	971	1544	-	-				
HCM Lane V/C Ratio	0.007	-	-	0.047	0.158	0.1	-	-				
HCM Control Delay (s)	7.4	0	-	13.2	9.4	7.6	0	-				
HCM Lane LOS	A	A	-	B	A	A	A	-				
HCM 95th %tile Q(veh)	0	-	-	0.1	0.6	0.3	-	-				

Intersection												
Int Delay, s/veh	6.3											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	5	5	46	71	0	0	57	16	60	0	16	10
Future Vol, veh/h	5	5	46	71	0	0	57	16	60	0	16	10
Conflicting Peds, #/hr	20	0	20	20	0	20	20	0	20	20	0	20
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	5	5	50	77	0	0	62	17	65	0	17	11
Major/Minor	Minor2		Minor1		Major1		Major2					
Conflicting Flow All	237	269	63	264	242	90	48	0	0	102	0	0
Stage 1	43	43	-	194	194	-	-	-	-	-	-	-
Stage 2	194	226	-	70	48	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	717	637	1002	689	660	968	1559	-	-	1490	-	-
Stage 1	971	859	-	808	740	-	-	-	-	-	-	-
Stage 2	808	717	-	940	855	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	668	587	964	604	608	931	1529	-	-	1462	-	-
Mov Cap-2 Maneuver	668	587	-	604	608	-	-	-	-	-	-	-
Stage 1	912	843	-	759	695	-	-	-	-	-	-	-
Stage 2	759	673	-	869	839	-	-	-	-	-	-	-
Approach	EB		WB		NB		SB					
HCM Control Delay, s	9.4		11.8		3.2		0					
HCM LOS	A		B									
Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1WBLn1	SBL	SBT	SBR					
Capacity (veh/h)	1529	-	-	879	604	1462	-	-				
HCM Lane V/C Ratio	0.041	-	-	0.069	0.128	-	-	-				
HCM Control Delay (s)	7.5	0	-	9.4	11.8	0	-	-				
HCM Lane LOS	A	A	-	A	B	A	-	-				
HCM 95th %tile Q(veh)	0.1	-	-	0.2	0.4	0	-	-				

Appendix N

Preliminary Engineering Report

Keauhou Bay Improvements

TMK: 7-8-010: 053, 044, 049, 059, 039, 038
7-8-012:058, 061, 098, 004, 007, 065, 048, 103, 013, 014, 027, 054, 101, 091
Keauhou Bay, Kahalu'u Ahupua'a
North Kona District, Island of Hawai'i

Preliminary Engineering Report

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DATED: April 29, 2022

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1 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Keauhou Bay Improvements Project is located on the Big Island of Hawai'i in the North Kona District (see Figure 1, Location Map). The project encompasses multiple TMKs (7-8-010:044 & 049, 7-8-012:004, 013, 014, 065, 098; see **Figure 1 – TMK Map**) totaling approximately 30 acres. The properties are bounded by the Hōlua Resort at Mauna Loa Village to the South, Keauhou Resort Condominiums at the North, Kona Country Club to the east and the Pacific Ocean to the west. The Keauhou Bay region is rich with Hawaiian History. The Kauikeaouli birth stone and the Kāneaka Hōlua Slide are just two of the many important historic sites located within the project boundaries.

1.1.1 EXISTING USES

Historically, the Keauhou Bay area was known as a gathering place for Hawaiian Royalty. As time elapsed, the use of the bay shifted away from a center for cultural practices to homesteading and eventually to its present-day use of a tourism hub. To this day, the Keauhou Bay area still contain remnants of the cultural practices that took place in the bay centuries ago. Its current use includes commercial, community recreation, resort, residential dedicated heritage sites, and open space. The existing parcels included in the Keauhou Bay Improvements Project have largely been developed except for the largest of the properties, parcel 044 (TMK 7-8-010:044).

At the north end of the project there is an existing boat storage lot and visitor parking lot. Both lots are unpaved and lack any supporting infrastructure typical to a vehicular parking lot and as required by County standards. The boat storage lot known as “Keauhou Bay Boat Park” currently houses around 35 boats ranging in size from a small personal watercraft to 30-foot-long tour boat vessels. The visitor parking lot is currently used by the Fair Winds and Hula Kai tours that operate out of Keauhou Bay. The capacity of the 0.3-acre lot is unknown as it is rarely full and does not have any delineated stalls.

At the center of the bay is the Keauhou Bay Beach Park. This public space is shared by the Keauhou Canoe club and used as a gathering space and ocean access point for the users of the bay.

Further south of the beach park is a commercial center where the recreational tours operate their businesses. These businesses depend on the State of Hawai'i Department of Boating and Recreation (DOBAR) facilities which consist of a small vehicle parking lot, boat ramp and boat trailer parking lot. Also in this area is a sewer pump station which collects wastewater from the south side of the bay and pumps wastewater to the treatment plant on the north side of the bay.

1.1.2 PROPOSED USE

The Keauhou Bay Improvements project will include a variety of land uses including resort, commercial, mixed use, visitor accommodations, park, conservation, and cultural education. The project is comprised of five different project groups. Each of these project groups are broken down further into individual project numbers.

Project Group A

Project Group A encompasses improvements to the existing vehicle parking facilities within Keauhou Bay including Projects #1 and #10. Project #1 involves improving the existing boat storage and visitor parking lots within TMK: 7-8-010:044 located adjacent to each other at the north end of the bay. These two facilities have been neglected over the years and do not meet the County standards and do not provide

amenities and infrastructure in comparisons to similar facilities in the West Hawai'i area. The boat storage facility is proposed to accommodate at a minimum 18 boat storage parking stalls. The visitor parking lot will target to accommodate visitor 140 parking stalls (see **Figure 2 –Parking and Boat Storage Lot Site and Grading Plan**). Project #10 looks to add to the current DOBAR boat trailer parking to the south end of TMK: 7-8-010:044. This relocation of the boat parking will be funded by DOBAR. Eight 15' x 55' stalls will be provided to meet the recreation boating demand of Keauhou Bay (see **Figure 3 – New Boat Trailer Parking Site and Grading Plan**).

Project Group B

Project Group B is broken down into five sub-projects that all focus on redirecting the use of the bay towards becoming a cultural education center of West Hawai'i. Project #8A involves restoring the cultural landscape on the mauka side of Mo'ikeha to 'Ahu'ula. (see **Figure 4 – Landscape Master Plan**). This project will focus on improving the Mo'ikeha to 'Ahu'ula landscape from its current overgrown state into an area that is usable and attractive. A pedestrian trail with small shelters, benches, and trash receptacles will weave through a landscaped zone. This project will serve as a catalyst for Project Group B.

Following the completion of Project #8A, Projects #8B, #4 and #5 will be developed to further restore and improve the landscape of the bay. Project #8B will restore the cultural landscape makai of the 'Ahu'ula cliff area. The focal point of this restoration will be the birthplace of Kauikeaouli. Project #4 will involve the reorganization of the Keauhou Canoe Club space. Over the years, the Keauhou Canoe Club has expanded its footprint and is now encroaching on other parts of the bay. Project #5 will involve the development of the mauka-makai corridor and shoreline park. The goal of this project is to establish a community zone to improve public accessibility to and from the bay.

After these three projects are completed, Project #3 will finalize completion of Project Group B by developing local vendor kiosks to complement the restoration of the bay. These 200-square foot pop up kiosks will depend on the other Projects in Group B to increase the pedestrian traffic and allow for commercial activity to be feasible.

Project Group C

Project Group C is a resort and infrastructure development project that will provide a large increase in usage of the Keauhou Bay region. This project group includes two projects, Project #6 and #7. Project #6 will look to develop approximately 7.5 acres of the hillside land into a boutique resort (see **Figure 5 – Boutique Resort Site Plan**). This resort will revolve around a bungalow approach to minimize the need for extensive mass grading. A total of 80 bungalows (150 keys) is programmed with the public back of house of 13,000 square feet. This resort will take a low-density and low impact approach to development and will look to capitalize on the growing interest in lifestyle centric resorts while incorporating the rich historical significance of Keauhou Bay.

In conjunction with the development of the resort, Project #7 looks to restore existing Old Kona Road (see **Figure 6 – Old Kona Road Overview Plan**). Adding an accessway to provide circulation from one side of the bay to the other will be crucial to the development of the boutique resort. Old Kona Road will be a private roadway owned and maintained by the Kamehameha Schools. All utilities that will be needed for the large resort development will be installed along this roadway corridor.

Project Group D

Project Group D will look to repurpose the existing bayfront facilities in Project #9 (see **Figure 7 – Repurpose Existing Bay Front Facilities Plan**). These facilities currently include the Fairwinds Tours operating center, a cultural/education center and lawn terrace. The proposed renovations will look to divert the use of these buildings away from commercial towards a culture education center.

Project Group E

Project Group E will involve the group of TMK parcels (TMK: 7-8-010:049, 7-8-012:004, 065, 098) at the intersection of Kaleiopapa Street and 'Ehukai Street. The project will look to incorporate the history and legacy of the bay into a modern-day commercial development. (see **Figure 8 – Keauhou Bay Commercial Development Project**).

2 SITE ACCESS

2.1 EXISTING CONDITIONS

Keauhou Bay is accessed off of Ali'i Drive mauka of the project area. Ali'i Drive is under the jurisdiction of the County of Hawai'i and has a 40-foot ROW with one lane headed in each direction. Shoulder lanes are present on both sides.

From Ali'i Drive, the north side of Keauhou Bay is accessed through Kamehameha III Road. Kamehameha III Road is a two-lane 50-foot-wide right-of-way (ROW) with a 10-foot lane in each direction and 8-foot on-street parking. This road has curb and gutters and sidewalks on both sides along some lengths of the roadway. The posted speed limit is 25 mph. Kamehameha III Road ends with a cul-de-sac at the north end of the bay.

Access off of Ali'i Drive from the south side of Keauhou Bay is through Kaleiopapa Street. It is a two-lane 40-foot-wide ROW with a 12-foot lane in each direction. An eight-foot shoulder on each side provides parking and a pedestrian walkway for the public. The posted speed limit is 25 mph. This road splits to a boat ramp and a parking lot owned by the State of Hawai'i (TMK 7-8-012:055).

Currently there is no vehicular access between Kamehameha III Road and Kaleiopapa Street. Property and survey records indicate that these two roadways are connected by a Government Road Right of Way (ROW) and may have been accessible by vehicle in the past. However, in the existing condition, there isn't any existing road as the ROW crosses through the beach area.

The existing gravel road in parcel 7-8-010:044 is what remains of what is believed to be a former emergency evacuation route known as Old Kona Road. Despite that belief, the County of Hawai'i Department of Public Works Engineering Division does not have any record of this route being designated as an emergency evacuation route. The width of the path varies from 34-feet at its widest point to 12-feet at its narrowest. In its present condition, much of this road is passable by foot or vehicle but needs to be cleared.

The north end of Old Kona Road is currently used as a vehicle access way, primarily by the Keauhou Canoe Club, to the center of the bay. Access to the south end of the road is prohibited by cattle gates at the center of the parcel and at Kaleiopapa Street. This section of Old Kona Road is overgrown with vegetation. The entire Old Kona Road lies within the property, which is owned by Kamehameha Schools.

2.2 PROPOSED ACCESS INFRASTRUCTURE

2.2.1 ONSITE ROADWAYS

All roadways within the property will be privately owned and maintained by Kamehameha Schools or its lessees. The roadways will be designed in conformance with County standards. The road will be public accessible and connect the two ends of Keauhou Bay. Pavement design and recommendations will conform to the geotechnical recommendations that will be given during the design phase.

The main roadway that is planned within the project will be the improvement of Old Kona Road in Project Group C. The approximately 1,800-foot roadway is planned to have a 40-foot right-of-way with 12-foot lanes in each direction. The alignment of Old Kona Road will generally follow the existing alignment deviating only when necessary to accommodate the other project improvements. The road will be asphalt paved with a sidewalk on the makai side of the roadway. A drainage swale will be constructed on the mauka edge of the road to catch and divert upstream runoff.

A system of concrete and gravel pedestrian walkways are planned throughout the project. Paths will connect the parking areas with the cultural landscaped areas and education center, the boutique resort, and the commercial development.

3 GRADING AND EROSION CONTROL

3.1 EXISTING CONDITIONS

3.1.1 CLIMATE

The project site is located on the leeward side of Mauna Loa along the Kona coast. The predominant trade winds of Hawai'i Island originate from the east. Keauhou Bay is largely sheltered from the trades by Mauna Loa. Most wind in the area come from the South with onshore breezes during the nighttime hours. As a result, the rainfall pattern is relatively dry with the chance of rainfall increasing in the summertime. The average annual rainfall in the Keauhou area is approximately 20 to 50 inches.

3.1.2 TOPOGRAPHY AND GEOLOGY

The Keauhou bay parcels generally slope in the makai direction from Ali'i Drive down to the center of the bay. The slope of the site varies from 2% to 33% at its steepest. Near the bottom of the bay is a steep drop off known as 'Ahu'ula cliffs.

Since Mauna Loa is considered an active volcano, much of the site is covered in volcanic soils. The Keauhou bay area is not within any recorded historic lava flow paths and is classified by USGS as Lava Hazard Zone 4. With Zone 1 being the highest hazard and zone 9 being the lowest, Zone 4 falls near the middle where lava coverage is proportionally smaller (about 5 percent since 1800) and less than 15 percent within the past 750 years.

3.1.3 SOILS

The NRCS Soil Survey shows that the project site consists primarily of three different types of soil. Starting from the north end of the site, 'a'ā rock, Wai'aha medial silt, and Punalu'u lava flows make up this portion of the Keauhou area. These are all soils that are typically found at the lower elevations of Mauna Loa (see **Figure 9 – USGS Soil Survey Map**).

Lava Flows, 'a'ā – This soil is rough and broken, consisting of a mass of clinkery, hard, glassy, sharp pieces piled in tumbled heaps. There is practically no soil covering and it is typically bare of vegetation, except for mosses, lichens, ferns and a few small 'ōhi'a trees. In areas of high rainfall, it contributes substantially to the underground water supply and is used for watershed. The capability classification is VIII, non-irrigated. Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife or water supply or aesthetic purposes. The subclass is "s," meaning the soil is limited because it is shallow, droughty, or stony.

Medial Silt, Wai'aha – Wai'aha silt loam is derived from volcanic ash over pahoe-hoe lava. This soil is well drained with the depth to water supply being very low (about 1.6 inches). The typical profile consists of around 8 inches of medial silt loam, 7 inches of extremely cobbly medial fine sandy loam and bedrock thereafter. The Wai'aha family of soil is not considered prime farmland with the primary vegetation being of a grass type.

Lava Flows, Punalu'u – The Punalu'u soil class consists of a combination of organic material and volcanic ash over pahoe-hoe lava. Like the other soils on site, it is well drained with rock fragments ranging in size from gravel to cobble sized lava rocks. This soil is not a considered prime farmland with its main vegetation being guinea grass and haole.

3.1.4 GRADING

The existing ground surface within the project site is primarily covered by 'a'ā rock, Wai'aha medial silt, and Punalu'u lava flows. In the areas that have not been developed, the rock surface is rough and uneven. Due to the minimal rainfall and permeability of the lava rock, the existing ground surface is not eroded and there are no visible existing drainage ways throughout the property.

The proposed development will generally follow the existing topography to minimize earthwork activities. Due to the steep topography of the site, retaining walls will be needed meet proposed grades. Earthwork activities will include excavation and embankment for roadways, rough grading and landscaping of the cultural landscaped areas, utility installation, and site grading for the proposed developments.

Due to the predominance of volcanic soils and historic lava flows on site, the earthwork activities may include blasting, rock crushing, and pneumatic hammering to excavate lava rock. The import of soil may be required for areas that that will be landscaped due to the shallow depth of the topsoil on site.

3.1.5 EROSION CONTROL

The nearshore waters off the Property are classified as "AA" by the State DOH. According to DOH Water Quality Standards, "It is the objective of class AA waters that these waters remain in their natural pristine state as nearly as possible with an absolute minimum of pollution or alteration of water quality from any human-caused source or actions" (HAR §11-54-03(c)(1)). To the extent practicable the wilderness character of these areas shall be protected. Therefore, storm runoff from the improvements of Keauhou Bay will be contained within project site to a reasonable extent that is possible. Total maximum daily load of discharge must not exceed the amount specified in HAR §11-54-06.

Soil erosion and sediment control BMPs will be implemented to minimize and control erosion of soils and dust during construction. BMPs are pollution control measures, applied to nonpoint sources, on-site or off-site, to control erosion and the transport of sediments and other pollutants which have an adverse impact on waters of the State. Construction BMPs are temporary measures installed before construction commences and removed after construction completion. Potential construction BMPs include but are not limited to gravel entrance, water trucks, dust screen, silt fence, sedimentation basins, diversion

berm/ditches, and grading procedures that follow Hawai'i County Code Chapter 10 – Erosion and Sediment Control.

Unlike construction BMPs, permanent BMPs are designed to remain part of the project features after the site grading operation is complete. The permanent BMPs are intended to reduce storm water pollution typically associated with the increased impervious surfaces. Permanent BMPs will consist of the lava swales and infiltration trenches, grass swales, vegetated buffers, and rain gardens along with the general development of landscaped areas. Increase in runoff rates resulting from the development will be mitigated by infiltrating excess runoff into the ground and the implementation of BMPs. As a result, the proposed project will not create an adverse impact to the near shore waters.

4 DRAINAGE

4.1 EXISTING CONDITIONS

4.1.1 FLOODING AND TSUNAMI HAZARDS

The Federal Emergency Management Agency's (FEMA) Flood Rate Insurance Maps (FIRM) indicate that the project area is within the Flood Zones VE, AE and X, with established base flood elevations at 14 ft msl. Flood zone VE is designated as a coastal hazard zone with a 1% annual change of flooding. Flood zone AE designated as a 1% chance of flooding with a defined base flood elevation. Most of the project area is within Flood zone X. Zone X is defined as an area outside the 500-year flood limits. Any development that occurs within the Flood Zone AE and VE are subject to regulation through the County flood hazard ordinance and FEMA regulations (see **Figure 10 – FEMA Flood Map**).

4.1.2 EXISTING DRAINAGE INFRASTRUCTURE

Currently, there is no existing drainage infrastructure or visible drainage ways on the Keauhou Bay project parcels. It is expected that most of the rainfall infiltrates due to the high permeability of the ground. Offsite, existing drainage infrastructure is limited to gutters, swales, and inlets to dry wells along Kaleiopapa and Kamehameha Road.

There are no drainage reports or calculations on file with the County of Hawai'i or State of Hawai'i, Department of Transportation for the adjacent public roadways or surrounding developed properties.

4.1.3 EXISTING HYDROLOGY

The West Hawai'i region consistently slopes from the top of Mauna Loa down to the ocean. The Keauhou area does not differ from this generalization and consists of moderate to steep slopes of highly permeable volcanic soils consisting of primarily 'a'ā lava rock. Due to the low frequency of substantial rainfall and high permeability of the soils throughout the project area, surface runoff generally does not occur in the typical rainfall occurrence. The runoff either percolates into the underlying groundwater or is evaporated into the atmosphere. As a result, there is no visible natural gulches or waterways on the property. It can also be assumed that any stormwater run on from uphill properties is negligible as the water infiltrates soon after entering the project boundary. (see **Appendix C, NOAA Precipitation Frequency Estimates**).

TABLE 4.1 – EXISTING STORMWATER RUNOFF PEAK FLOW ESTIMATES

Intensity of 1 hr Rainfall (Tm=10 years) $i(10) = 1.86$ in/hr NOAA Atlas 14 Volume 4 Version 2.1
 Intensity of 1 hr Rainfall (Tm=50 years) $i(50) = 2.78$ in/hr NOAA Atlas 14 Volume 4 Version 2.1

Project Group	Area (Acres)	C	Tc (Min)	I	Q ₁₀ /Acre (cfs)	Total Q ₁₀ (cfs)
Project Groups A,B,C	25.24	0.60	14.00	1.86	1.90	57.70
Project Group D	0.61	0.85	7.25	1.86	3.97	2.42
Project Group E	2.71	0.60	16.00	1.86	1.82	5.93

4.2 PROPOSED CONDITIONS

4.2.1 COUNTY OF HAWAII DRAINAGE STANDARDS

The proposed drainage systems hydrologic criteria will be developed in accordance with County of Hawai'i Standards with the exception of applying NOAA Atlas 14 Volume 4 Version 2.1 in lieu of Plates 1 and 2 (Intensity of 1-hr Rainfall for 10- and 50-year Return Periods). Plates 1 and 2 of the County Drainage Standards are based on the U.S. Department of Commerce Technical Paper 43, Rainfall Frequency Atlas of the Hawaiian Islands (TP-43) published in 1962. The isopluvial (rainfall intensity) maps in NOAA Atlas 14 Volume 4 Version 2.1 are the result of interpolation of frequency estimates of a larger sample of rain stations with longer years of record than TP-43. Hence NOAA Atlas 14 Volume 4 Version 2.1 portrays a more accurate representation of the rainfall intensity than the current County of Hawai'i Drainage Standards.

For drainage areas of 100 acres or less, the County of Hawai'i Drainage Standards stipulates that the drainage system be designed for a return period of 10-years. To determine the runoff quantity for these areas, the rational method will be used. The rational method is based on the drainage area, runoff coefficient (ground cover conditions) and the rainfall intensity for duration equal to the time of concentration. For drainage areas greater than 100 acres, the County of Hawai'i uses Plates 6 and 6A in the Drainage Standards where peak discharge is a function of the drainage area and the location of the drainage area (runoff zone).

4.2.2 PROPOSED DRAINAGE INFRASTRUCTURE

In the post-developed condition, stormwater runoff will be generated from the replacement of porous lava with top spoil, vegetation, and impervious surfaces. Strategies to mitigate the increase in runoff will be implemented. Those strategies include but are not limited to detaining, retaining and infiltrating runoff into the ground. Since it is assumed that there is no pre-developed runoff, the drainage system sizing will be based solely on the pre-developed runoff.

Due to the site characteristics, the location of the property and the proposed masterplan, the project is well suited to implementation of Low Impact Development (LID) strategies. LID is a stormwater management strategy that promotes conservation of existing natural features and use of localized small-scale stormwater systems to mimic the natural hydrologic patterns while minimizing stormwater infrastructure. LID practices and stormwater systems that can be incorporated into the project include:

- Minimize impervious area, use permeable surfaces where possible including permeable sidewalk and roadway/driveway paving
- Plan site around existing site features – retain and incorporate natural topography
- Minimize grading and disturbed area – maximize existing undisturbed lava fields

- Narrow roads and minimize driveway lengths/widths, use wheel strips and shared driveways
- Provided connected bike and pedestrian pathways
- Sidewalks on one side of street
- Plant trees – especially large canopy, plant in well thought out locations
- Use source control of stormwater for pollutant control and groundwater recharge
- Minimize conventional infrastructure including curb and gutter, piping and drain inlets
- Utilize the lava rock onsite – lava sumps, lava swales, lava trenches, shallow drywells, drainage injection wells, detention, and retention basins.

In areas with high density such as “*Project #11 Commercial and Dining Area*”, conventional stormwater infrastructure will be implemented including curb, gutter, drain inlets and drainpipes. The piped drainage system will be conveyed into an existing drainage injection well or retention/detention basin or another type of detention/infiltration system.

Outside of the high-density development areas, minimal stormwater management is anticipated due to the high infiltration rates of the lava-based soils. Should mitigation strategies be needed, the stormwater runoff will be conveyed using natural lava swales or grass swales through localized infiltration structures such as lava sumps or lava trenches. Other infiltration practices using shallow drywells, drainage injection wells and detention/retention basins will be utilized where necessary.

During the design phase of the project, a drainage masterplan will be developed that incorporates the stormwater management strategies listed above to establish the project drainage concept and to provide design criteria for each project group. The Drainage master plan will be based on detailed topographic survey and proposed mass grading of the project and will include LID stormwater strategies, infiltration and stormwater system sizing criteria, detention/retention analysis, flood analysis, and drainage system schematics and plans.

Though not required by the County of Hawai‘i Drainage Standards, the implementation of LID stormwater strategies will allow management of runoff at the source and sizing of stormwater facilities will be dependent on the individual site and its specified use. Increase in runoff rates resulting from the development will be mitigated by infiltrating excess runoff into the ground and the implementation of Permanent BMPs. As a result, the proposed project will not create an adverse impact due to increases in peak flow rates downstream of the project site. The table below shows the estimated stormwater runoff peak flows per acre of land to provide a generalized estimate of total peak flow for the project.

TABLE 4.2 – PROPOSED STORMWATER RUNOFF PEAK FLOW ESTIMATES

Intensity of 1 hr Rainfall (Tm=10 years) $i(10) = 1.86$ in/hr NOAA Atlas 14 Volume 4 Version 2.1

Intensity of 1 hr Rainfall (Tm=50 years) $i(50) = 2.78$ in/hr NOAA Atlas 14 Volume 4 Version 2.1

Project Group	Area (Acres)	C	Tc (Min)	I	Q ₁₀ /Acre (cfs)	Total Q ₁₀ (cfs)
Project Groups A,B,C	25.24	0.70	10.75	1.86	2.90	75.11
Project Group D	0.61	0.85	7.25	1.86	3.97	2.42
Project Group E	2.71	0.70	12.00	1.86	2.81	8.70

5 WATER

5.1 EXISTING CONDITIONS

The project site is in the Keauhou Aquifer System Area, which is within the Hualalai Aquifer Sector Area on the western slope of Mauna Loa which spans from Keauhou to Kukio (Hawai'i Water Plan, July 2019). The properties around Keauhou Bay are served by the County of Hawai'i Department of Water Supply's (DWS) North Kona Water System which is sourced from the Kahalu'u Shaft Wells. The wells feed the Kahalu'u tanks No.4 and 4a at an elevation of 310 feet msl. These tanks provide water service to the DWS distribution mains in the Keauhou Bay region.

The Keauhou Bay area is serviced by a water main loop that starts and ends in Ali'i Drive from the Kamehameha III Road intersection to the north and Kaleiopapa Street. intersection to the south. Both ends are connected to the same 12" water main in Ali'i Drive. The loop begins as an 8" water main and transitions to a 12" somewhere near the intersection of Kamehameha III Road and Hōlua Road. This main travels through the project site at the bottom of the bay and back up through Kaleiopapa Street; ultimately connecting back to the 12" water main at the intersection of Kaleiopapa Street and Ali'i Drive.

5.2 PROPOSED WATER SUPPLY SYSTEM

The proposed water supply system that will serve the improvements will connect to the existing infrastructure currently owned and operated by the DWS. The project groups that will require potable water are Project Groups B, C, D, and E.

Project Group B will require potable water for the reorientation of the canoe club and the planned small-scale commercial kiosks. A domestic lateral will be connected to the existing water main located within Kamehameha III Road. The demand of the group of projects is not anticipated to exceed 300 GPD daily average.

Project Group C's boutique resort is projected to have the largest potable water demand of the proposed developments. A 4" domestic lateral will connect to the existing water main located within Kaleiopapa Street and run under Old Kona Road. Fire protection for the resort will be provided by an 8" lateral that will run adjacent to the 4" domestic lateral in Old Kona Road. Fire hydrants will be spaced per DWS requirements.

Project Group D is not expected to generate a large increase in water demand since the use of the facility will remain relatively similar. Improvements to the water system is not anticipated in the bayfront facilities.

Project Group E will generate the second largest demand for potable water out of the project groups. The commercial development will require at a minimum 1 ½" water lateral from Kaleiopapa Street to serve its domestic water demand. There are fire hydrants along 'Ehukai Street and Kaleiopapa Street. If the commercial buildings are equipped with automatic fire sprinklers, a separate fire protection system will need to be designed.

The proposed water system outside of the water mains will be privately owned and maintained. Use of the water system will be metered to the individual users. The proposed water and irrigation systems are shown on **Figure 6 – Old Kona Road Overview**.

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5.2.1 WATER DEMAND

In total, the proposed projects will result in an average water demand of approximately 95,879 gpd, which is equivalent to 240 water credits from DWS (see **Appendix A – Water Demand Calculations**). DWS will need to determine whether the system in the Keauhou region has enough capacity to honor the credits or if alternative sources of water are required. There is an understanding in place between DWS and KS to develop additional water wells for the West Hawai'i Region. The water demand estimates for potable uses were performed using domestic and irrigation usage rates from the Board of Water Supply Water System Standards (2002); Table 100-18. See Table 5.1 below for cumulative demand estimates. Detailed demand calculations are included in the appendix. Potable water will be used for domestic and irrigation purposes.

TABLE 5.2 – POTABLE WATER AVERAGE DAILY DEMAND ESTIMATE

Project Group	Unit of Measurements	# of Units	GPD/Unit	GPD Average
Project Group A - Irrigation Demand	-	-	-	350.8
Project #3 - Small scale commercial and Beyond - Dry Retail*	Per acre	0.05	3,000	150.0
Project #4 - Reorient Canoe Club - Canoe Halau ^{1*}	Per acre	0.05	3,000	150.0
Project #3 - Small Scale Commercial and Beyond - Irrigation Demand	-	-	-	544.3
Project #4, 5 - Open Lawn - Irrigation Demand	-	-	-	1,111.6
Project #6 - Boutique Resort - Guest Rooms	Per bedroom	172	400	68,800.0
Project #6 - Boutique Resort - Irrigation Demand	-	-	-	2,033.6
Project #7 - Old Kona Road - Irrigation Demand	-	-	-	555.9
Project #9 - Repurpose Existing Bayfront Facilities ³	Existing Information	-	1,373	1,373.0
Project #11 - Commercial and Dining - Dry Retail	Per acre	0.04	3,000	120.0
Project #11 - Commercial and Dining - F&B Retail	Per seat	135	60	8,100.0
Project #11 - Commercial and Dining - Retail Outdoor	Per acre	0.06	3,000	180.0
Project #11 - Commercial and Dining - Employees	Per capita	32	25	800.0
Project #11 - Commercial and Dining - Pavilion/Restrooms	Per capita	400	6	2,400.0
Project #11 - Commercial and Dining - Restaurant	Per seat	150	60	9,000.0
Project #11 - Commercial and Dining - Microfarm	Per acre	0.06	3,500	210.0
TOTAL MAX DAILY DEMAND (Avg. * 1.5)				143,818.8
TOTAL PEAK HOUR DEMAND (IN GPD) (Avg. * 5.0)				479,396.0
TOTAL AVERAGE DAILY DEMAND				95,879.2

6 WASTEWATER

6.1 EXISTING CONDITIONS

The Keauhou Bay area is served by the He'eia Waste Water Reclamation Facility (WWRF). The facility is privately owned and operated by Keauhou Community Services Inc. (KCS), a subsidiary of Kamehameha Schools/Kamehameha Investment Corporation (KS/KIC) and is operated by Aqua Engineers, Inc. This facility is currently undergoing a change in ownership from the current KCS owners to Hawai'i Water Service, a subsidiary of California Water Service. Hawai'i Water Service is certified by the Hawaii Public Utilities Commission (HPUC) to provide sewer service to the Keauhou area.

The He'eia WWRF has a stated 1.8 MGD capacity. Of that capacity, only 1.35 MGD of the system capacity is in use as of 2016. It is expected that the He'eia WWRF treatment plant has capacity to serve additional development. Further study is needed to determine the capacity of the individual components of the existing Keauhou sewer system. Hawaii Water Service, as the operator, will review and determine the need for any improvements or expansions to the existing system to ensure adequate capacity and compliance with regulatory requirements. However, this evaluation typically occurs during the County permitting process, when more detailed project designs are submitted for review and approval.

The wastewater from the Keauhou Bay area is collected and conveyed to the Keauhou Pump Station located within the project area at the bottom of the bay. From the pump station wastewater is pumped to the He'eia WWRF for treatment. The resulting treated effluent is disposed of through irrigation of the Kona Country Club golf course.

The property is also subject to the State DOH Underground Injection Control (UIC) regulations (HAR Chapter 11-23) which govern the location, construction, and operation of injection wells with the intention of protecting the quality of Underground Sources of Drinking Water (USDW). The project site is located on the makai side of the UIC line and is within an exempted aquifer. No cesspools are programmed to be constructed regardless of the UIC status.

6.2 Proposed Sewer System

The proposed sewer system that will serve the improvements will connect to the existing infrastructure currently owned and operated by the Hawai'i Water Service; a subsidiary of California Water Service. The project groups that will require sewer service are Project Groups C, D, and E.

Project Group C's boutique resort is projected to produce the largest amount of wastewater flow in the improvements. The proposed sewer main for the boutique resort will be located within Old Kona Road. This sewer main will gravity flow and connect to the existing sewer main in Kaleiopapa Street. The flow generated from the resort project will require the a 6-inch pipe to meet the design requirements. Sewer laterals the commercial development project and the cultural resource center will also gravity flow and connect into the sewer main in Kaleiopapa Street.

Project Group D is not expected to generate a large increase in wastewater flow since the use of the facility will remain relatively similar. Improvements to the current lateral will not be required.

Project Group E will generate another large increase in wastewater flow. The commercial development will use a 6" lateral that will connect to the existing gravity main in Kaleiopapa Street.

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These proposed sewer utilities will connect to the Keauhou Pump station where it will be sent via force main to the He'eia WWRF. The He'eia WWRF will treat to R-1 quality and utilize it as irrigation for the Kona Country Club Golf Course.

6.2.1 WASTEWATER FLOW PROJECTIONS

The wastewater flow projections for the projects are based on land use areas, unit counts and estimated population using demand rates from the State HAR Chapter 11-62, Appendix D.

TABLE 6.2 – WASTEWATER FLOW PROJECTIONS

Project Group	Unit of Measurements	# of Units	GPD/Unit	GPD Average
Project #6 - Boutique Resort - Guest Rooms	Room	172	200 gpd/Per Bedroom	34,400
Project #9 - Repurpose Existing Bayfront Facilities ¹	Existing Information	-	-	1098
Project #11 - Commercial and Dining - Dry Retail ³	1000 sf	1800 sf	100 gpd/Per 1000 sf	108
Project #11 - Commercial and Dining - F&B Retail ⁴	Seat	135	50 gpd/Per Seat	6,750
Project #11 - Commercial and Dining - Retail Outdoor	1000 sf	2400 sf	60 gpd/Per 1000 sf	144
Project #11 - Commercial and Dining - Employees	Capita	37	25 gpd/Per Capita	925
Project #11 - Commercial and Dining - Restaurant	Seat	150	50 gpd/Per Seat	7,500
TOTAL DESIGN AVERAGE DAILY FLOW				50,925

Hawaii Water Service Company Inc. is certified by the Hawaii Public Utilities Commission (HPUC) to provide sewer service to the Keauhou area. A sewer service request was submitted for the improvements project for the estimated wastewater flow projection of 50,925 gpd. Hawaii Water Service Company Inc. confirmed that the Project will be served. Sewer services will be provided in accordance with the Rules and Regulations and at rates approved by the HPUC (see **Appendix B – Sewer Demand Calculations**)

As previously stated, it is expected that the He'eia WWRF will have capacity to accommodate the increase in wastewater flows based on the information from 2016. Further study by the utilities operator will be needed to determine if any capital improvements of the existing WWRF and facilities leading up to ensure adequate capacity and compliance with regulatory requirements.

7 SOLID WASTE

7.1 EXISTING CONDITIONS

The County of Hawai'i operates a network of 22 recycling and transfer stations and two landfills. The West Hawai'i Sanitary Landfill in Pu'u'anahulu will receive the solid waste from the Keauhou area. The County of Hawai'i does not have a curbside pickup system and instead depends on private waste collection companies to transport waste to the nearest transfer station. The Keauhou transfer station is approximately 7 miles mauka of the project site.

7.2 WASTE GENERATION

The 2019 IRSWMP update includes a waste stream assessment and historic waste generation rates for the County on a per capita basis. For the fiscal year 16-17, the County of Hawai'i waste generation rate was 7.1 pounds/capita/day using resident population. When transient population is added using the State of Hawai'i de facto population, the waste generation rate drops to 6.4 pounds/capita/day. Due to the transient nature of the development, the diversity of land use types, and the 20-year projection, the County waste generation rate is probably conservative. Additionally, the County anticipates a diversion rate of 8% due to existing and new programs and investment in new technologies.

Solid waste from the project is anticipated to generate 0.457 tons per day, as shown in the table below. The increase in waste generation will not have a significant impact on the County's waste stream and disposal. The project anticipates recycling food waste, cardboard, glass, and plastics, which will be coordinated with private entities.

TABLE 7.2 – SOLID WASTE GENERATION PROJECTIONS

Project Group	Unit of Measurements	# of Units	Use Rate	Expected Usage (lbs/day)
Project #3 – Vendor Kiosk	Square foot	2,000	0.026 lbs/sf/day	52
Project #6 - Boutique Resort	Room	172	2.5 lbs/room/day	430
Project #9 - Repurpose Existing Bayfront Facilities	Square foot	2,000	0.026 lbs/sf/day	52
Project #11 - Commercial Retail and Dining	Square foot	14,620	0.026 lbs/sf/day	380
TOTAL				914
				0.457 tons/day

8 POWER AND COMMUNICATIONS

8.1 EXISTING CONDITIONS

The multiple parcels being master planned for improvement and development as part of the Keauhou Master Plan are connected to HELCO's Kahalu'u substation, which is located near the intersection of Kamehameha III Road and Keali'i Street. According to available record drawings, power runs from the Kahalu'u substation via 3-5" HELCO underground conduits down Keali'i Street onto Kaluna Street. Where Kaluna Street meets Ali'i Highway, the 3-5" underground conduits continue north and south along Ali'i Highway. North at the intersection of Ali'i Highway and Kamehameha III Road, the 3-5" underground conduits branch and continue onto Kamehameha III Road. Similarly, south at the intersection of Kaleiopapa Street and Ali'i Highway, the 3-5" underground conduits branch and continue onto Kaleiopapa Street. The 3-5" underground conduits run south along Kamehameha III Road and north along Kaleiopapa Street until they connect with each other. HELCO has four pad-mounted switches in the project area, two located on the mauka side of the street at the intersection of Maukai Street and Kamehameha III Road and two located on the mauka side of the street at the intersection of Ehukai Street and Kaleiopapa Street. These switches are used to control the various underground circuits throughout the area and serve as a means of protection for HELCO's distribution network. Currently there are no existing underground electrical ducts along Old Kona Road.

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Both Hawaiian Telecom (HTCO) and Charter Communications (Spectrum) have underground ducts along Kaleiopapa Street and Kamehameha III Road, which connect underneath Keauhou Beach Park. According to available record drawings, HTCO has 4-4" underground conduits and Spectrum has 1-3" underground conduit. Charter also has two trunk line amplifiers (used to boost the signal power in their cables) in the area, one at the intersection of Manukai Street and Kamehameha III Road, and the other at the intersection of Ehukai Street and Kaleiopapa Street. These Charter trunk line amplifiers will be the points of interconnection to the Charter system if they are chosen as the future telecommunications provider. The closest Hawaiian Telecom boxes are located on Ali'i Highway just south of the Ali'i Highway and Kaluna Street intersection. The HTCO boxes located there will be the point of connection to the HTCO system. HTCO will run additional cabling in their underground duct system if they are chosen as the future telecommunications provider.

8.2 ELECTRICAL AND TELECOMMUNICATIONS DEMAND

The projected electrical demand and telecommunications requirements for each project in the Keauhou Master Plan are summarized in Table 8.2 below.

TABLE 8.2 – ELECTRICAL DEMAND AND TELEPHONE LINE REQUIREMENTS

Electric and Comm. Master Plan	Electric Demand (kiloVolt-Amperes kVA)	Telecommunication Requirement
Project 1: Improve Parking / Boat Trailer Storage	8.52	N/A
Project 3: Small Scale Commercial (Kiosks)	32.4	Internet / Phone
Project 4: Reorient Canoe Club	11.58	N/A
Project 5: Mauka-Makai Corridor and Shoreline Park	18.3	N/A
Project 6: Boutique Resort	2,582.7	Internet / Phone / TV
Project 7: Old Kona Road Improvements	4.38	N/A
Project 8A & 8B: Restore Cultural Landscape – Moikehua to Ahu'ula	36.12	N/A
Project 10: New Boat Trailer Parking	8.52	N/A
Project 11: Commercial Dining and Retail	479.34	Internet / Phone / TV

The electrical demand figures for commercial and other land uses are baseline planning figures used by HELCO planning personnel for system capacity planning. For commercial, resort, and other land uses, the acreage assigned to that land use is multiplied by an electrical demand rate per acre characteristic of that land use. The telecommunication requirements were based on whether the individual project guidelines indicated that a data connection was needed for future operational use.

8.3 PROPOSED ELECTRICAL AND TELECOMMUNICATIONS SYSTEMS

8.3.1 HELCO ELECTRICAL

HELCO's electrical distribution system within the development area will be required for each specific project described above. As part of this Master Plan, HELCO completed a preliminary engineering analysis of their system to determine if any improvements will be needed. To begin, HELCO conducted an analysis of the capacity of their Kahalu'u substation. HELCO reported that the capacity of their Kahalu'u substation is adequate to serve all of the proposed projects, and no substation upgrades are required. Upgrades to HELCO's existing underground distribution system are needed to provide power to all proposed projects. The upgrades include:

- New underground concrete encased electrical ducts along the entirety of Kamehameha III Road and Kaleiopapa Street. Minimum duct improvements of 2-5" conduits with 2 sets of 1000 kcmil PEICN 15kv conductors and 2-4" conduits with 2 sets of #4/0 AWG AL PEICN 15kv conductors.
- New 6' by 11' manholes along the new underground electrical ducts.
- Installation of new pad mounted switches to support the new distribution system in the area. The location and quantity of switches cannot be determined at this time. The design of the new distribution system will determine the best locations and number of switches required, which will be a future project for Kamehameha or the developer to undertake.

These upgrades are based on HELCO's current system conditions (as of April 2022). If other significant development or changes occur in the area served by the Kahalu'u substation, the electrical upgrades required may change and may need to be reevaluated.

Along with the above HELCO distribution system upgrades, the HELCO distribution system will have to be extended onto Old Kona Road. We recommend that the 2-5" conduits and 2-4" conduits that HELCO has proposed as an upgrade to their electrical distribution system connecting Kamehameha III Road and Kaleiopapa Street, is branched off to include 2-5" conduits and 2-4" conduits along the entirety of Old Kona Road. This will allow HELCO's distribution system to be accessible along the entirety of Old Kona Road. Figure 12 and 13 show the proposed electrical site distribution system.

8.3.2 PROJECT SPECIFIC SITE ELECTRICAL

Electrical distribution system within each project area will be required to meet the specific electrical needs of each project. Our proposed layout can be found in Figure 13. Projects 1, 3, 4, 5, 7, and 8 will connect to a shared service equipment located adjacent to projects 1 and 3. The service equipment will be comprised of a transformer to step down HELCO's 12.47 kV distribution network power to 480Y/277V power, a HELCO meter, and a distribution panel. Projects 1, 4, 5, 7, and 8 will require only site/landscape lighting which can be served by 277V light fixtures and power to the irrigation system controllers regulating the various areas. Project 3 (small scale commercial kiosks) will require an additional transformer to step down the 480V power to 208Y/120V or 240/120V power and a distribution panel to provide usable 120V power to each kiosk.

Project 6 will require a dedicated service equipment because of the large electrical demand of the project. The service equipment will include a transformer to step down HELCO's 12.47 kV distribution network power to 480Y/277V power, a HELCO meter, and a switchboard. The switchboard will provide 480Y/277V power to separate panels for the HVAC equipment, pool equipment, laundry equipment, and restaurant equipment. The switchboard will also distribute 480V power across the site to stepdown transformers and distribution panels housed in the BOH buildings. Each BOH building will house a transformer to step down the 480V power to either 208Y/120V or 240/120V power via a distribution panel. The distribution panel will then feed a panel located in the BOH building and a panel in each bungalow building served by that specific BOH building. In all there will be 6 transformer/distribution panel combinations like this housed in the BOH buildings. Figure 14 shows the proposed electrical one-line diagram for project 6.

Project 10 will be provided with a dedicated service equipment for the new boat trailer parking area. The service equipment will consist of a transformer to step down HELCO's 12.47 kV distribution network power to 3-phase 208Y/120V power, a HELCO meter, and a distribution panel. Project 10 only requires site/landscape lighting which can be served by 120V light fixtures and power to the irrigation system controller serving the area.

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Project 11 will also require a dedicated service equipment because of the large electrical demand of the project. The service equipment will include a transformer to step down HELCO's 12.47 kV distribution network power to 208Y/120V power and a switchboard. The switchboard will house fourteen (14) HELCO meters; one for each retail space, one for the restaurant, and one for the common spaces. Each of the fourteen HELCO meters will be connected to a panel to house the circuits for that space. Part of the area for project 11 is designated as Flood Zone AE. The installation of electrical service equipment (i.e. electrical panels, transformers, switchboards, etc.) in areas inside the Flood Zone AE will be very expensive because the equipment will need to be installed on elevated platforms. The platform height will be dependent on what the expected mean sea level rise and storm surge predictions are for the area. Figure 15 shows the proposed electrical one-line diagram for project 11.

8.3.3 TELECOMMUNICATIONS

Telecommunications service is required for projects 3, 6 and 10. Both Hawaiian Telecom and Spectrum Charter have underground telecommunications ducts along Kaleiopapa Street and Kamehameha III Road. Whichever service provider is chosen will install new underground conduits along Old Kona Road. This installation will be within a multi conduit duct system with conduits carrying both telecommunications and power cables. The proposed installation along Old Kona Road is 3-4" conduits for use by either Hawaiian Telecom or Spectrum depending on the preferred service provider. Project 3, 6, and 10 will each require a main telecom box to be installed by the preferred service provider. From the telecom boxes, separate telecom service cables can be run to the required areas across each site.

8.3.4 ROADWAY LIGHTING

Depending on the road type designation Old Kona Road is developed as (i.e. private, dedicable, ag or resort), that will determine the exact requirements the roadway lighting will need to conform to. Dedicable roads would have the strictest lighting requirements followed by ag, private and finally resort roads. Resort roads allow for light installation at the discretion of the resort developer. As of June 2021, the Hawai'i County Street Light Standards has a list of approved Light Emitting Diode (LED) roadway luminaires that are acceptable for installation within Hawai'i County. Any roadway lighting system would be energized through metered electrical connections to HELCO secondary power sources situated along Old Kona Road. All roadway lighting will consist of fully shielded light fixtures and comply with Hawai'i's Outdoor Lighting Ordinances and Dark-Sky regulations.

9 ORDER OF MAGNITUDE COSTS

Construction costs for the proposed civil infrastructure have been estimate and order of magnitude budgets are shown in the table below.

TABLE 9.1 – ORDER OF MAGNITUDE COSTS

Project Number	QTY	UNIT	TOTAL
Project #1 – Parking and Boat Storage	1	LS	\$3,210,000
Project #3 – Vendor Kiosks	1	LS	\$1,937,000
Project #4 – Canoe Club	1	LS	\$528,000
Project #5 – Mauka Makai Open Space	1	LS	\$2,736,000
Project #6 – Boutique Resort Hotel	1	LS	\$87,922,000
Project #7 – Old Kona Road	1	LS	\$9,299,000
Project #8A – Kamauae	1	LS	\$998,000
Project #8B – Ahu'ula	1	LS	\$2,474,000

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Project #9 – Repurpose Exist. Bayfront Facilities	1	LS	\$481,000
Project #10 – New Boat Trailer Parking	1	LS	\$1,748,000
Project #11 – Commercial/Dining Venue Site and Bldg	1	LS	\$10,453,000
Project #11 – Commercial/Dining Venue Lanais	1	LS	\$920,000
Project #11 – Commercial/Dining Venue Tenant Improvements	1	LS	\$1,071,000
Project #11 – Commercial/Dining Venue Common Elements	1	LS	\$448,000
TOTAL			\$124,225,000

Note – cost estimate provided by **J.Uno and SJ Consulting**

10 REFERENCES

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Appendix O

Acoustic Study

**FINAL ACOUSTIC STUDY FOR THE
KEAUHOU BAY MANAGEMENT PLAN
KAILUA-KONA, HAWAII, HAWAII**

Prepared for:

G70

Prepared by:

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JUNE 2022

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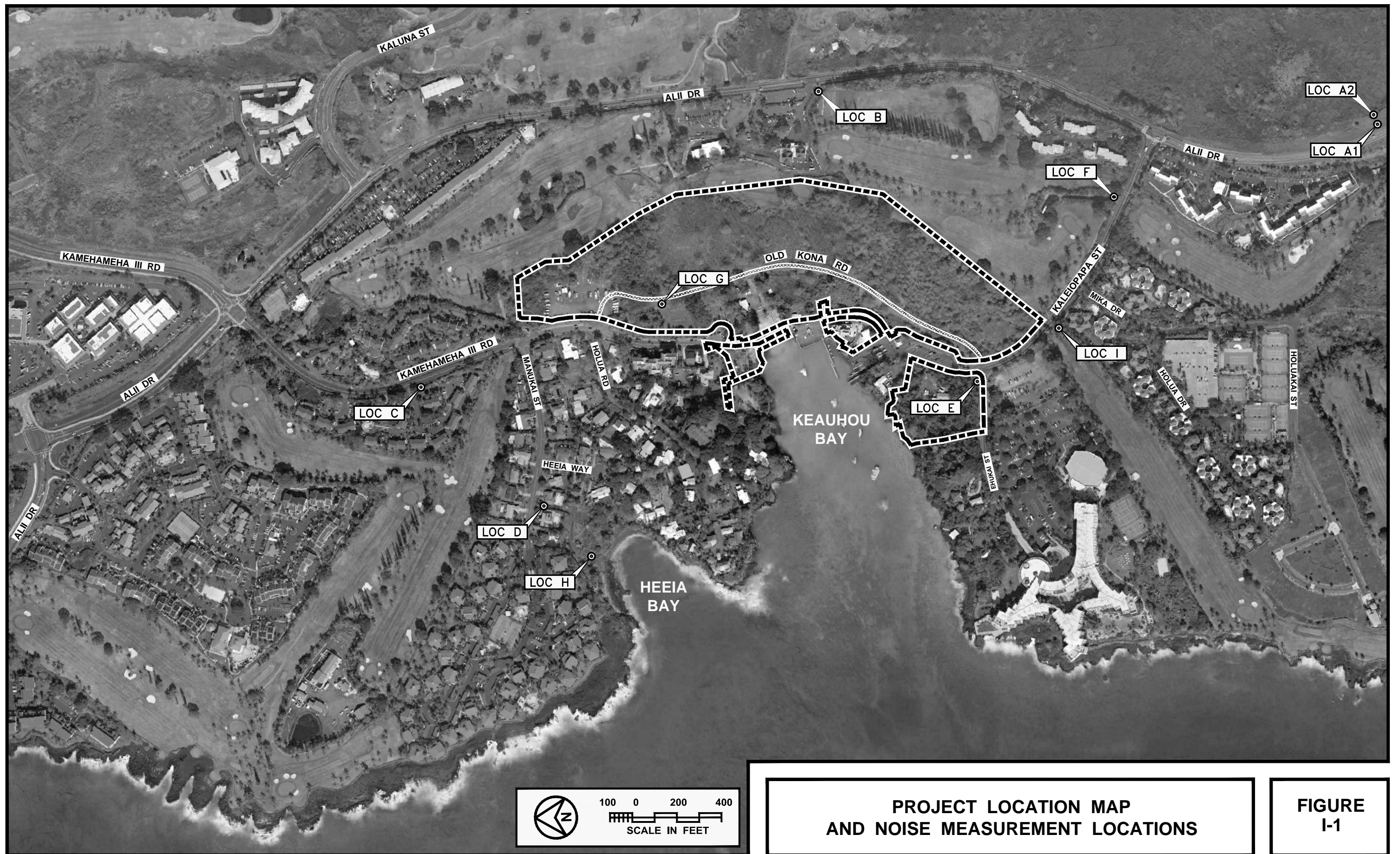
CHAPTER 1. SUMMARY

The existing and future traffic noise levels in the vicinity of the proposed Keauhou Bay Management Plan Projects were evaluated for their potential impact on present and future noise sensitive areas. Figure I-1 depicts the location of the project site. The future traffic noise levels along the primary access roadways to the project were calculated for the year 2035.

Along the existing Alii Drive, traffic noise levels were expected to increase by 1.1 to 1.4 DNL (Day-Night Average Sound Level) between CY (Calendar Year) 2021 and CY 2035 as a result of both project and non-project traffic. Traffic noise increases due to project traffic were predicted to range from 0.3 to 0.9 DNL which was greater than the range of the noise increases caused by non-project traffic (0.5 to 0.8 DNL) on Alii Drive. These increases in traffic noise levels associated with project traffic were considered to be low.

Future traffic noise levels at existing and planned noise sensitive locations along Alii Drive in the project environs are not expected to exceed 65 DNL. Existing residences between Alii Drive and mauka of Keauhou Bay and Heeia Bay were also predicted to experience future traffic noise levels less than 65 DNL. Existing residents located along Kamehameha III Road and Kaleiopapa Street were also predicted to experience future traffic noise levels less than 65 DNL. The planned improvement to Old Kona Road is not expected to exceed 65 DNL or increase background noise levels by 15 dBA (A-Weighted Decibels) at existing residences or noise sensitive properties.

Unavoidable, but temporary, noise impacts may occur during the construction of the proposed project. Because construction activities may be audible at existing and planned developed properties within the project environs (or area), the acoustic environment may be degraded during periods of construction. Mitigation measures to reduce construction noise to inaudible levels will not be practical in all cases. For this reason, the use of quiet equipment and construction curfew periods as required under the State Department of Health noise regulations are recommended to minimize construction noise impacts.



PROJECT LOCATION MAP
AND NOISE MEASUREMENT LOCATIONS

FIGURE
I-1

CHAPTER II. PURPOSE

The objectives of this study were to describe the existing and future noise environment in the environs of the proposed Keauhou Bay Management Plan Projects at Keauhou Bay on the island of Hawaii. Traffic noise level increases and impacts associated with the proposed plans were to be determined within the project site as well as along the public roadways expected to service the project traffic. A specific objective was to determine the future traffic noise level increases associated with both project and non-project traffic, and the potential noise impacts associated with these increases. Assessments of possible impacts from short term construction noise at the project site were also included in the noise study objectives. Recommendations for minimizing these noise impacts were also to be provided as required.

CHAPTER III. NOISE DESCRIPTORS AND THEIR RELATIONSHIP TO LAND USE COMPATIBILITY

The noise descriptor currently used by federal agencies to assess environmental noise is the Day-Night Average Sound Level (DNL or Ldn). This descriptor incorporates a 24-hour average of instantaneous A-Weighted sound levels as read on a standard Sound Level Meter. The maximum A-Weighted sound level occurring while a noise source such as a heavy truck or aircraft is moving past a listener (i.e., the maximum sound level from a "single event") is referred to as the "Lmax value". The mathematical product (or integral) of the instantaneous sound level times the duration of the event is known as the "Sound Exposure Level", or Lse, which is analogous to the energy of the time-varying sound levels associated with a single event.

The DNL values represent the average noise during a typical day of the year. DNL exposure levels of 55 or less are typical of quiet rural or suburban areas. DNL exposure levels of 55 to 65 are typical of urbanized areas with medium to high levels of activity and street traffic. DNL exposure levels above 65 are representative of densely developed urban areas and areas fronting high volume roadways.

By definition, the minimum averaging period for the DNL descriptor is 24 hours. Additionally, sound levels which occur during the nighttime hours of 10:00 PM to 7:00 AM are increased by 10 decibels (dB) prior to computing the 24-hour average by the DNL descriptor. Because of the averaging used, DNL values in urbanized areas typically range between 50 and 75 DNL. In comparison, the typical range of intermittent noise events may have maximum Sound Level Meter readings between 75 and 105 dBA. A more complete list of noise descriptors is provided in Appendix B to this report. In Appendix B, the Ldn descriptor symbol is used in place of the DNL descriptor symbol.

Table III-1, extracted from Reference 1, categorizes the various DNL levels of outdoor noise exposure with severity classifications. Figure III-1, extracted from Reference 2, presents suggested land use compatibility guidelines for residential and nonresidential land uses. A general consensus among federal agencies has developed whereby residential housing development is considered acceptable in areas where exterior noise does not exceed 65 DNL. This value of 65 DNL is used as a federal regulatory threshold for determining the necessity for special noise abatement measures when applications for federal funding assistance are made.

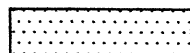
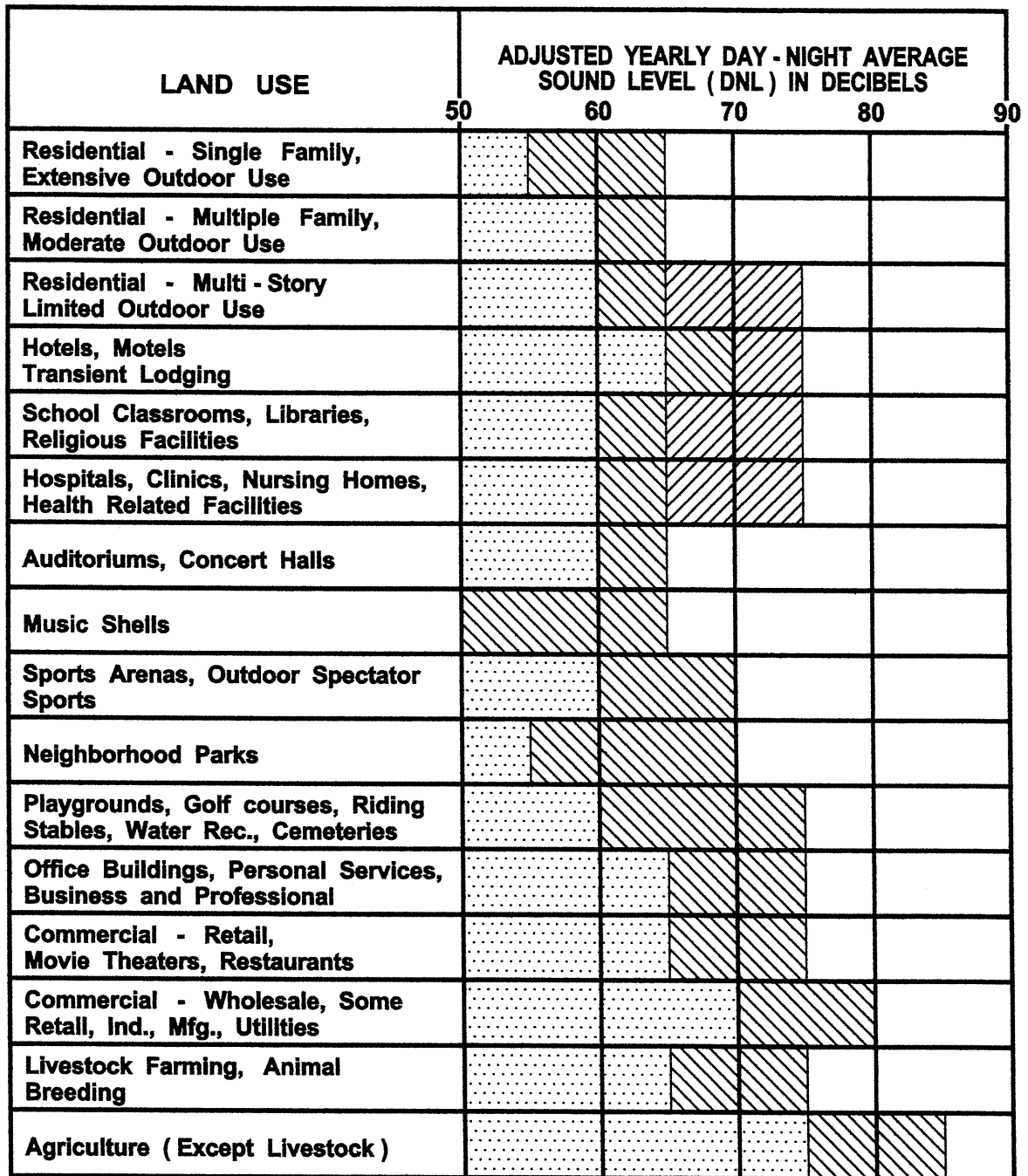
As a general rule, noise levels of 55 DNL or less occur in rural areas, or in areas which are removed from high volume roadways. In urbanized areas which are shielded from high volume streets, DNL levels generally range from 55 to 65 DNL, and are usually controlled by motor vehicle traffic noise. Residences which front major roadways are generally exposed to levels of 65 DNL, and as high as 75 DNL when the roadway is a high speed freeway. Due to noise shielding effects from intervening structures, interior lots are usually exposed to 3 to 10 DNL lower noise levels than the

TABLE III-1**EXTERIOR NOISE EXPOSURE CLASSIFICATION
(RESIDENTIAL LAND USE)**

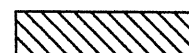
NOISE EXPOSURE CLASS	DAY-NIGHT SOUND LEVEL	EQUIVALENT SOUND LEVEL	FEDERAL (1) STANDARD
Minimal Exposure	Not Exceeding 55 DNL	Not Exceeding 55 Leq	Unconditionally Acceptable
Moderate Exposure	Above 55 DNL But Not Above 65 DNL	Above 55 Leq But Not Above 65 Leq	Acceptable(2)
Significant Exposure	Above 65 DNL But Not Above 75 DNL	Above 65 Leq But Not Above 75 Leq	Normally Unacceptable
Severe Exposure	Above 75 DNL	Above 75 Leq	Unacceptable

Notes: (1) Federal Housing Administration, Veterans Administration, Department of Defense, and Department of Transportation.

(2) FHWA uses the Leq instead of the Ldn descriptor. For planning purposes, both are equivalent if: (a) heavy trucks do not exceed 10 percent of total traffic flow in vehicles per 24 hours, and (b) traffic between 10:00 PM and 7:00 AM does not exceed 15 percent of average daily traffic flow in vehicles per 24 hours. The noise mitigation threshold used by FHWA for residences is 67 Leq.



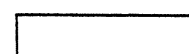
Compatible



Marginally
Compatible



With Insulation
per Section A.4



Incompatible

**LAND USE COMPATIBILITY WITH YEARLY AVERAGE DAY - NIGHT
SOUND LEVEL (DNL) AT A SITE FOR BUILDINGS AS COMMONLY
CONSTRUCTED.**

(Source: American National Standards Institute S12.9 - 1988/Part 5)

**FIGURE
III-1**

front lots which are not shielded from the traffic noise.

For the purposes of determining noise acceptability for funding assistance from federal agencies, an exterior noise level of 65 DNL or lower is considered acceptable. These federal agencies include the Federal Aviation Administration (FAA), Department of Defense (DOD); Federal Housing Administration, Housing and Urban Development (FHA/HUD), and Veterans Administration (VA). This standard is applied nationally (see Reference 3), including Hawaii.

Because of our open-living conditions, the predominant use of naturally ventilated dwellings, and the relatively low exterior-to-interior sound attenuation afforded by these naturally ventilated structures, an exterior noise level of 65 DNL does not eliminate all risks of noise impacts. Because of these factors, a lower level of 55 DNL is considered as the "Unconditionally Acceptable" (or "Near-Zero Risk") level of exterior noise (see Reference 4). For typical, naturally ventilated structures in Hawaii, an exterior noise level of 55 DNL results in an interior level of approximately 45 DNL, which is considered to be the "Unconditionally Acceptable" (or "Near-Zero Risk") level of interior noise. However, after considering the cost and feasibility of applying the lower level of 55 DNL, government agencies such as FHA/HUD and VA have selected 65 DNL as a more appropriate regulatory standard.

For commercial, industrial, and other non-noise sensitive land uses, exterior noise levels as high as 75 DNL are generally considered acceptable. Exceptions to this occur when naturally ventilated office and other commercial establishments are exposed to exterior levels which exceed 65 DNL.

In the State of Hawaii, the State Department of Health (DOH) regulates noise from on-site activities. State DOH noise regulations are expressed in maximum allowable property line noise limits rather than DNL (see Reference 5). The noise limits apply on all islands of the State, including the island of Hawaii. Although they are not directly comparable to noise criteria expressed in DNL, State DOH noise limits for preservation/residential, apartment/commercial, and agricultural/industrial lands equate to approximately 55, 60, and 76 DNL, respectively.

Because the proposed project site is located on lands primarily designated for resort uses, DOH noise limits would be applicable along the lot boundary lines or at receptor locations for any stationary machinery, or equipment related to resort, commercial, or construction activities. These property line limits are 60 dBA and 50 dBA during the daytime and nighttime periods, respectively, for resort and commercial lots or receptors. These noise limits cannot be exceeded for more than 2 minutes in any 20-minute time period under the State DOH noise regulations. The State DOH noise regulations do not apply to aircraft or motor vehicles.

CHAPTER IV. GENERAL STUDY METHODOLOGY

Existing traffic and background ambient noise levels were measured at ten locations in the project environs to provide a basis for developing the existing and future traffic noise levels along Alii Drive; Kaleiopapa Street, Ehukai Street, Kamehameha III Road, Old Kona Road, Holua Road, and Manukai Street, and for determining the existing background ambient noise levels in the project area. The locations of the noise measurement sites are shown in Figure I-1. Noise measurements were performed during February 2022. The traffic noise measurement results, and their comparisons with computer model predictions of existing traffic noise levels are summarized in Table IV-1. The results of the traffic noise measurements were compared with calculations of existing traffic noise levels to validate the computer model used. Where only background noise measurements were obtained, such as at Locations G and H, which were removed from existing roadways, traffic volumes and predicted noise levels were not shown in Table IV-1.

Traffic noise calculations for the existing conditions as well as noise predictions for the future conditions with and without the project were performed using the Federal Highway Administration (FHWA) Noise Prediction Model, Version 2.5 (Reference 6). Traffic data entered into the noise prediction model were: hourly traffic volumes, average vehicle speeds, estimates of traffic mix, and hard soil propagation loss factor. The traffic assignments for the project (Reference 7) and Hawaii State Department of Transportation counts on Alii Drive (Reference 8) were the primary sources of data inputs to the model. Appendix C summarizes the existing and future projections of AM and PM peak hour traffic volumes which were available from Reference 7.

For existing and future traffic, it was assumed that the average noise levels, or $Leq(h)$, during the weekday PM peak hour were 0.8 dB greater than the weekday 24-hour DNL along any roadway segment in the project environs. This assumption was based on computations of the weekday hourly Leq 's and the 24-hour DNL's of traffic noise on Alii Drive from the HDOT traffic counts in February 2019 prior to the COVID-19 crisis (see Figures IV-1 and IV-2).

Traffic noise calculations for both the existing and future conditions in the project environs were developed for ground level receptors without the benefit of noise shielding effects from buildings or natural terrain features. Traffic assignments with and without the project were obtained from the project's traffic turning movements (Reference 7). The forecasted increases in traffic noise levels over existing levels were calculated for both scenarios, and noise impact risks evaluated. The relative contributions of non-project and project related traffic to the total noise levels were also calculated, and an evaluation was made of possible traffic noise impacts resulting from the project.

Evaluations of the potential noise impacts associated with the overall Management Plan and the Restaurant/Retail Complex Plan shown in Figure IV-3 were provided. These evaluations of potential traffic and construction noise impacts and

TABLE IV-1

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

<u>LOCATION</u>	<u>Time of Day</u> <u>(HRS)</u>	<u>Ave. Speed</u> <u>(MPH)</u>	<u>Hourly Traffic Volume</u>			<u>Measured</u> <u>Leq (dB)</u>	<u>Predicted</u> <u>Leq (dB)</u>
			<u>AUTO</u>	<u>M.TRUCK</u>	<u>H.TRUCK</u>		
A1. 50 FT from the center-line of Alii Drive. (2/07/22)	0657 TO 0757	46	491	4	5	68.3	67.7
A2. 96 FT from the center-line of Alii Drive. (2/07/22)	0657 TO 0757	46	491	4	5	63.5	64.1
A1. 50 FT from the center-line of Alii Drive. (2/07/22)	1557 TO 1657	45	566	6	2	67.9	67.6
A2. 96 FT from the center-line of Alii Drive. (2/07/22)	1557 TO 1657	45	566	6	2	63.8	64.1
B. 50 FT from the center-line of Alii Drive. (2/08/22)	0833 TO 0933	36	575	16	3	62.9	62.8
C. 36 FT from the center-line of Kamehameha III Rd. (2/07/22)	0824 TO 0924	35	105	2	0	57.6	57.8

TABLE IV-1 (CONTINUED)

TRAFFIC AND BACKGROUND NOISE MEASUREMENT RESULTS

	<u>LOCATION</u>	<u>Time of Day</u>	<u>Ave. Speed</u>	<u>Hourly Traffic Volume</u>			<u>Measured</u>	<u>Predicted</u>
		<u>(HRS)</u>	<u>(MPH)</u>	<u>AUTO</u>	<u>M.TRUCK</u>	<u>H.TRUCK</u>	<u>Leq (dB)</u>	<u>Leq (dB)</u>
D.	59 FT from the center-line of Manukai Street (2/07/22)	1054 TO 1154	25	47	0	3	50.8	50.7
E.	50 FT from the center-line of Kaleiopapa Street (2/07/22)	1350 TO 1450	25	45	0	0	46.3	46.1
F.	50 FT from the center-line of Kaleiopapa Street (2/08/22)	1600 TO 1700	31	224	6	0	56.5	56.5
G.	At north end of future improved Old Kona Road (2/07/22)	0932 TO 1032	N/A	N/A	N/A	N/A	44.8	N/A
H.	At Makai end of foot path shoreline and 90 feet past pump station (2/07/22)	1203 TO 1303	N/A	N/A	N/A	N/A	59.4	N/A
I.	50 FT from the center-line of Kaleiopapa Street (2/08/22)	0700 TO 0800	32	125	3	1	54.5	54.5

FIGURE IV-1

HOURLY TRAFFIC NOISE LEVELS VS. TIME OF DAY

STA. B71018600600; ALII DRIVE BETWEEN KALUNA ST. AND KALEIOPAPA ST.; JANUARY 8, 2019

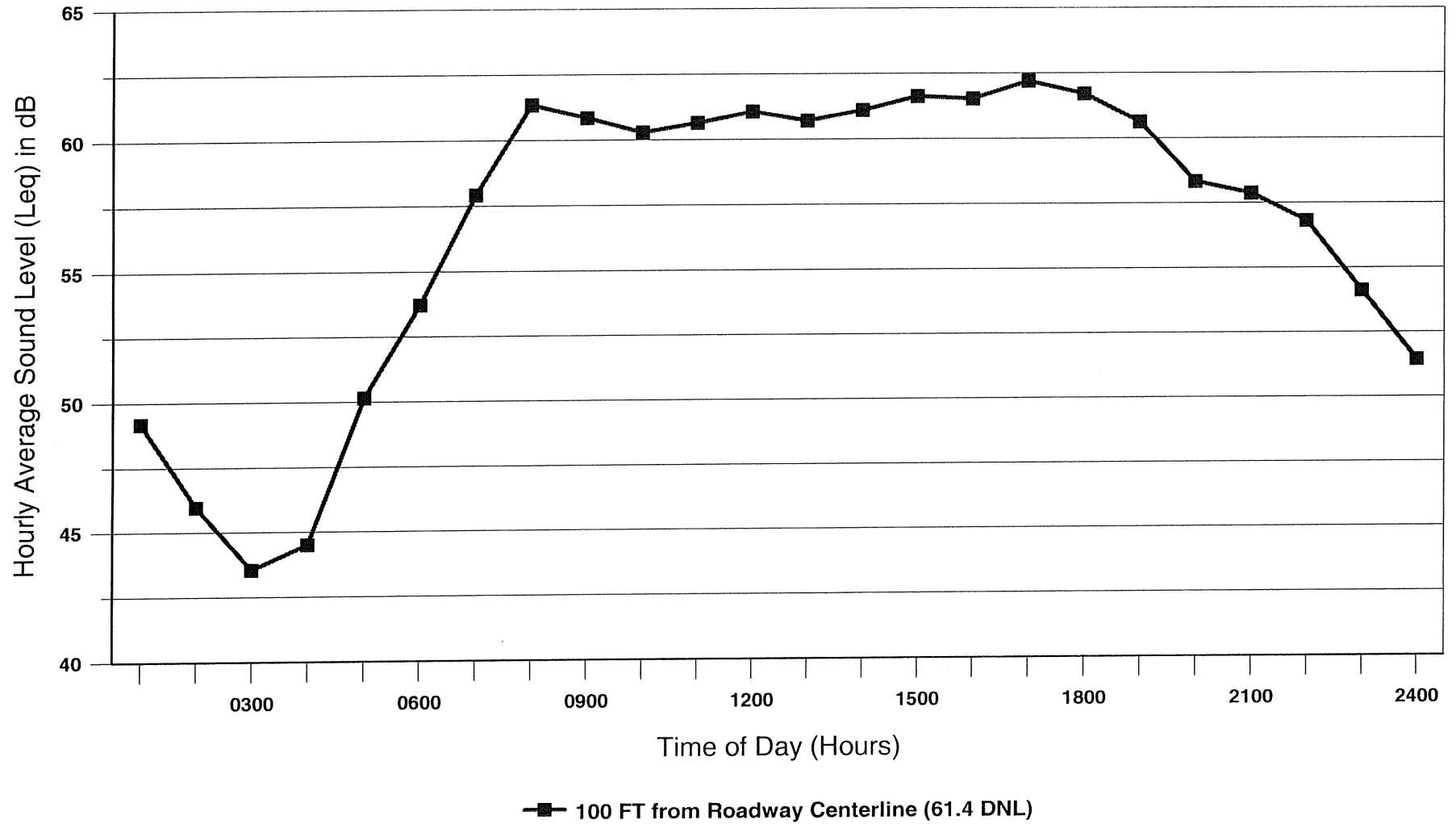
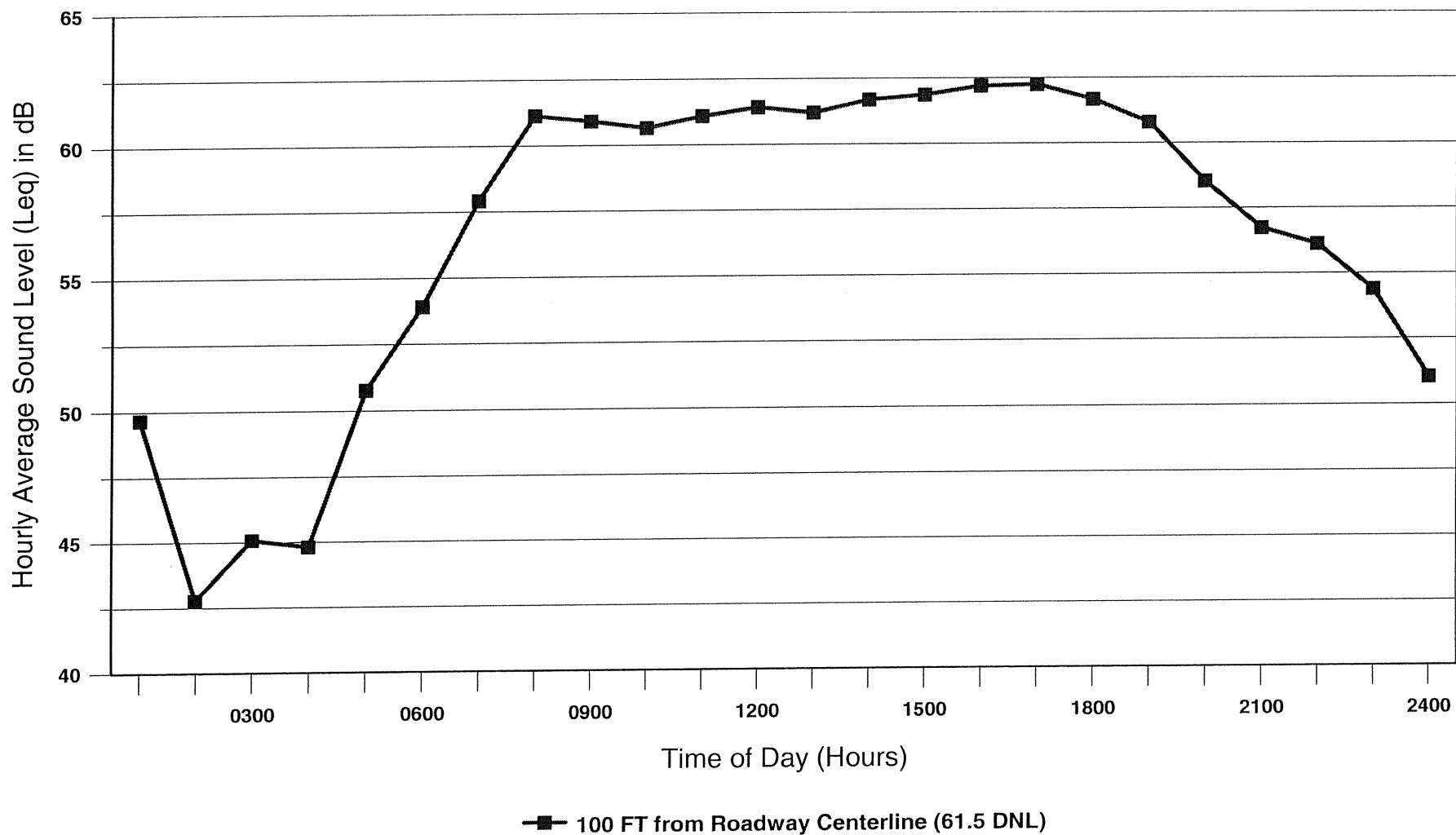
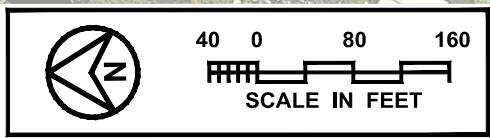
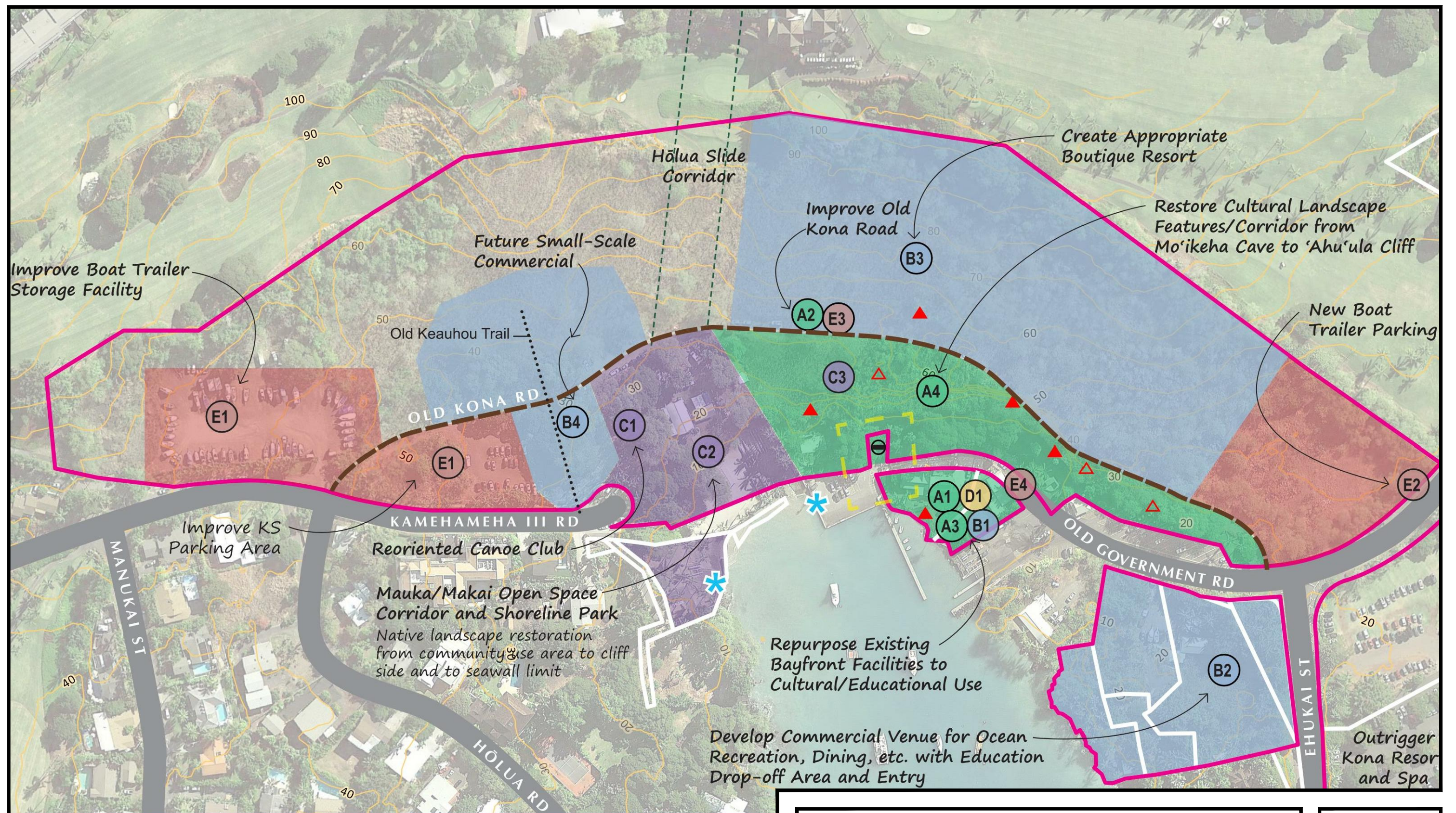


FIGURE IV-2

HOURLY TRAFFIC NOISE LEVELS VS. TIME OF DAY

STA. B71018600600; ALII DRIVE BETWEEN KALUNA ST. AND KALEIOPAPA ST.; JANUARY 9, 2019





**KEAUHOU BAY MANAGEMENT PLAN
RECOMMENDATIONS**

**FIGURE
IV-3**

mitigation measures were included in this study by comparing existing background noise levels with potential future background noise levels.

CHAPTER V. EXISTING NOISE ENVIRONMENT

The existing traffic noise levels in the project environs are controlled by traffic along Alii Drive, Kamehameha III Road, and Kaleiopapa Street. Within the Keauhou Bay Management Plan lands, existing background noise levels along the mauka boundaries are controlled by distant traffic on Alii Drive, Kamehameha III Road, and Kaleiopapa Street. Along the makai boundaries of the management plan lands, surf and ocean activities, and traffic along Kaleiopapa Street and Kamehameha III Road control the background ambient noise levels.

Calculations of existing traffic noise levels during the weekday PM peak traffic hours are presented in Table V-1. The hourly Leq (or Equivalent Sound Level) contribution from each roadway section in the project environs was calculated for comparison with forecasted traffic noise levels with and without the project. The PM peak hour Leq's for a weekday were calculated using traffic data from Reference 7. The existing setback distances from the roadways' centerlines to their associated 65, 70, and 75 DNL contours were also calculated as shown in Table V-2. The contour line setback distances do not take into account noise shielding effects or the additive contributions of traffic noise from intersecting street sections. Based on the results of Table V-2, it was concluded that the existing 65 DNL traffic noise contour is located approximately 26 to 79 FT from the centerline of Alii Drive in the project area, and not more than 12 FT from the centerlines of Kamehameha III Road and Kaleiopapa Street.

Existing noise sensitive receptors in the project environs were probably not exposed to traffic noise levels of 65 DNL or higher in CY 2021. The existing background noise levels at noise sensitive receptors were probably in the Minimal to Moderate Exposure, Unconditionally Acceptable or Acceptable categories (see Table III-1). In the large project area designated for future resort use, existing background noise levels are relatively low because of the large setback distances from Alii Drive, and the undeveloped character of the land. Along the makai boundaries of this project area, existing background noise levels probably ranged from 45 to 65 DNL due to commercial and recreational activities along the shore and due to the natural sounds associated with the surf along the shoreline.

Existing traffic noise levels along Kamehameha III Road and Kaleiopapa Street are less than 65 DNL along their Rights-of-Way, and the traffic noise contributions from Kamehameha III Road and Kaleiopapa Street are probably less than 60 DNL at noise sensitive residences closest to those two roadways. Due to a lower posted speed of 35 miles per hour along Alii Drive between Kaleiopapa Street and Kamehameha III Road, and the relatively large setbacks of at least 75 feet from the centerline of Alii Drive, traffic noise levels were probably less than 65 DNL in CY 2021 at residences located in areas mauka of the project management area.

Existing background noise levels at the project site, which is beyond 400 feet from Alii Drive, are very low (between 45 and 50 DNL) due to the large setback

TABLE V-1

**EXISTING (CY 2021) TRAFFIC VOLUMES AND NOISE LEVELS
ALONG ROADWAYS IN PROJECT AREA
(PM PEAK HOUR)**

<u>LOCATION</u>	<u>SPEED (MPH)</u>	<u>TOTAL VPH</u>	<u>***** VOLUMES (VPH) *****</u>			<u>50' Leq</u>	<u>75' Leq</u>	<u>100' Leq</u>
			<u>AUTOS</u>	<u>M TRUCKS</u>	<u>H TRUCKS</u>			
Alii Drive NW of Kamehameha III Rd.	35	679	669	7	3	62.5	60.4	58.9
Alii Drive Between Kamehameha III Rd. & Kaleiopapa St.	36	784	772	8	4	63.9	61.5	59.9
Alii Drive South of Kaleiopapa St.	45	637	628	6	3	68.2	66.1	64.6
Kamehameha III Rd. NE of Alii Dr.	45	414	406	8	0	66.3	64.0	62.3
Kamehameha III Rd. SW of Alii Dr.	35	129	126	3	0	57.4	55.2	53.8
Kamehameha III Rd. North of Holua Rd.	35	64	63	1	0	54.0	51.9	50.5
Kamehameha III Rd. South of Holua Rd.	33	58	57	1	0	53.7	51.5	50.1
Holua Road West of Kamehameha III Rd.	25	10	10	0	0	37.4	35.4	34.0
Old Kona Road East of Kamehameha III Rd.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Kaleiopapa St. West of Alii Dr.	31	242	235	6	1	56.9	54.9	53.4
Kaleiopapa St. SE of Ehukai St.	32	121	118	2	1	54.3	52.2	50.8
Kaleiopapa St. N of Ehukai St.	25	100	100	0	0	49.4	47.3	45.9
Ehukai St. West of Kaleiopapa St.	25	29	28	1	0	45.4	43.4	41.9
Old Kona Road East of Kaleiopapa St.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

TABLE V-2

**EXISTING AND CY 2035 DISTANCES TO 65, 70,
AND 75 DNL CONTOURS**

<u>STREET SECTION</u>	<u>65 DNL SETBACK (FT)</u>		<u>70 DNL SETBACK (FT)</u>		<u>75 DNL SETBACK (FT)</u>	
	<u>EXISTING</u>	<u>CY 2035</u>	<u>EXISTING</u>	<u>CY 2035</u>	<u>EXISTING</u>	<u>CY 2035</u>
Alii Drive NW of Kamehameha III Rd.	26	35	10	13	4	5
Alii Drive Between Kamehameha III Rd. & Kaleiopapa St.	36	44	16	19	7	8
Alii Drive South of Kaleiopapa St.	79	98	30	37	12	14
Kamehameha III Rd. NE of Alii Dr.	55	67	23	28	9	12
Kamehameha III Rd. SW of Alii Dr.	8	22	4	9	2	4
Kamehameha III Rd. North of Holua Rd.	4	17	2	6	1	2
Kamehameha III Rd. South of Holua Rd.	4	4	2	1	1	1
Holua Road West of Kamehameha III Rd.	0	1	0	0	0	0
Old Kona Road East of Kamehameha III Rd.	N/A	20	N/A	11	N/A	6
Kaleiopapa St. West of Alii Dr.	9	13	3	5	1	2
Kaleiopapa St. SE of Ehukai St.	5	10	2	4	1	1
Kaleiopapa St. N of Ehukai St.	2	1	1	0	0	0
Ehukai St. West of Kaleiopapa St.	1	3	0	1	0	0
Old Kona Road East of Kaleiopapa St.	N/A	8	N/A	3	N/A	1

Notes:

- (1) All setback distances are from the roadways' centerlines.
- (2) See Tables V-1 and VI-1 for traffic volume, speed, and mix assumptions.
- (3) Setback distances are for ground level receptors.
- (4) "Hard Soil" conditions assumed along all roadways.

distances from Alii Drive and the currently undeveloped nature of the large mauka parcel. At these planned resort designated lands on the project site, distant traffic, helicopter noise, and the natural sounds of birds, and winds in foliage are the dominant noise sources. Between traffic, helicopter, bird, or wind noise events, background ambient noise levels drop to a range of 40 to 45 dBA. During calm wind periods, background ambient noise levels decrease to levels less than 40 dBA at the interior locations removed from Alii Drive, Kaleiopapa Street, and Kamehameha III Drive, and the shoreline. The minimum background ambient noise levels at these interior locations are controlled by distant traffic, birds, and wind noise.

At locations near the unsheltered shorelines of Keauhou Bay and Heeia Bay, the natural sounds of surf controls the background noise. Even during low surf conditions during measurements at Location H on February 7, 2022, background noise levels were typically greater than 50 dBA, and exceeded 65 dBA during the louder surf events. Surf noise can interfere with unaided speech communications outdoors. In the more sheltered waters along the east end of Keauhou Bay, surf noise is not comparable to the other sounds produced by local street traffic, tour boats, and human recreational activities.

CHAPTER VI. FUTURE NOISE ENVIRONMENT

Figure IV-3 depicts the proposed Conceptual Improvement Plan, which includes the improvement of the Old Kona Road connecting Kaleiopapa Street with Kamehameha III Road. The future traffic noise levels and potential traffic noise impacts associated with the proposed plan were examined by calculating future traffic noise levels in CY 2035 along Alii Drive, Kaleiopapa Street, Kamehameha III Road, Old Kona Road, Holua Road, and Ehukai Street with the proposed plan. In addition, future traffic noise levels in CY 2035 along the existing roads (excluding Old Kona Road) were calculated for the Do Nothing Alternative. Future traffic noise levels under the Proposed Action and Do Nothing Alternatives were compared with each other as well as with the existing traffic noise levels described in the previous chapter.

Predictions of future traffic noise levels were made using the traffic volume assignments of Reference 7 for CY 2035 with and without the Proposed Action. The future assignments of project plus non-project traffic on the roadway sections which would service the project are shown in Table VI-1 for the weekday PM peak hour of traffic. Table VI-2 provides the predicted changes in future traffic noise levels along these roadways which are attributable to non-project and project traffic. As indicated in Table VI-2, by CY 2035 and following completion of the Proposed Action, traffic noise levels along Alii Drive in the project environs are predicted to increase by 1.2 to 1.4 DNL. Along Kaleiopapa Street and Kamehameha III Road, predicted increases of 1.2 to 6.1 DNL are anticipated in CY 2035 following completion of the plan. Decreases in future traffic noise levels of 1.2 to 3.6 DNL are predicted along the makai ends of Kamehameha III Road and Kaleiopapa Street following the improvements to Old Kona Road and the additional parking facilities planned at both ends of the Old Kona Road.

The traffic noise increases due to project traffic range from 0.0 to 4.0 DNL along existing roadways, with increases due to non-project traffic ranging from 0.5 to 6.0 DNL. Along the improved Old Kona Road, future traffic noise levels are predicted to increase existing background noise levels by 11 to 13 DNL at 50 Ft setback distance. These increases in traffic noise levels are considered to be moderate to high, and reflect the anticipated growth in future project and non-project traffic from low volumes in the project environs from CY 2021 to CY 2035. The largest increases in future traffic noise levels are anticipated to occur where both existing and future traffic noise levels should not exceed 65 DNL at existing noise sensitive receptors.

Table V-2 summarizes the predicted increases in the future setback distances to the 65, 70, and 75 DNL traffic noise contour lines along the roadways in the project environs and attributable to both project plus non-project traffic in CY 2035 under the Proposed Action. The setback distances in Table V-2 do not include the beneficial effects of noise shielding from terrain features and buildings, or the detrimental effects of additive contributions of noise from intersecting streets. As indicated in Table V-2, the setback distances to the 65 DNL contour are predicted to range from 8 to 19 FT from the centerline of Alii Drive following project completion in CY 2035 under the

TABLE VI-1

**FUTURE (CY 2035) TRAFFIC VOLUMES AND NOISE LEVELS
ALONG ROADWAYS NEAR INTERSECTIONS IN PROJECT AREA
(PM PEAK HOUR, BUILD)**

<u>LOCATION</u>	<u>SPEED (MPH)</u>	<u>TOTAL VPH</u>	<u>***** VOLUMES (VPH) *****</u>			<u>50' Leq</u>	<u>75' Leq</u>	<u>100' Leq</u>
			<u>AUTOS</u>	<u>M TRUCKS</u>	<u>H TRUCKS</u>			
Alii Drive NW of Kamehameha III Rd.	35	940	926	9	5	63.9	61.8	60.4
Alii Drive Between Kamehameha III Rd. & Kaleiopapa St.	36	1,001	986	10	5	65.0	62.6	60.9
Alii Drive South of Kaleiopapa St.	45	817	805	8	4	69.3	67.2	65.7
Kamehameha III Rd. NE of Alii Dr.	45	543	532	11	0	67.5	65.2	63.5
Kamehameha III Rd. SW of Alii Dr.	35	330	323	7	0	61.4	59.2	57.8
Kamehameha III Rd. North of Holua Rd.	35	250	245	5	0	60.1	58.0	56.6
Kamehameha III Rd. South of Holua Rd.	33	43	42	1	0	52.5	50.4	49.0
Holua Road West of Kamehameha III Rd.	25	40	40	0	0	43.4	41.4	40.0
Old Kona Road East of Kamehameha III Rd.	30	207	201	5	1	58.1	54.7	50.9
Kaleiopapa St. West of Alii Dr.	31	390	378	10	2	59.1	57.1	55.6
Kaleiopapa St. SE of Ehukai St.	32	240	233	5	2	57.5	55.4	53.9
Kaleiopapa St. N of Ehukai St.	25	43	43	0	0	45.8	43.7	42.2
Ehukai St. West of Kaleiopapa St.	25	109	106	2	1	51.6	49.5	48.1
Old Kona Road East of Kaleiopapa St.	30	128	124	3	1	56.0	53.9	52.4

TABLE VI-2

**CALCULATIONS OF PROJECT AND NON-PROJECT
TRAFFIC NOISE CONTRIBUTIONS (CY 2035)
(PM PEAK HOUR LEQ OR DNL)**

<u>STREET SECTION</u>	<u>NOISE LEVEL INCREASE DUE TO: NON-PROJECT TRAFFIC</u>	<u>PROJECT TRAFFIC</u>
Alii Drive NW of Kamehameha III Rd.	0.5	0.9
Alii Drive Between Kamehameha III Rd. & Kaleiopapa St.	0.8	0.3
Alii Drive South of Kaleiopapa St.	0.8	0.3
Kamehameha III Rd. NE of Alii Dr.	1.0	0.2
Kamehameha III Rd. SW of Alii Dr.	1.3	2.7
Kamehameha III Rd. North of Holua Rd.	2.1	4.0
Kamehameha III Rd. South of Holua Rd.	1.7	-2.9
Holua Road West of Kamehameha III Rd.	6.0	0.0
Old Kona Road East of Kamehameha III Rd.	N/A	13.1
Kaleiopapa St. West of Alii Dr.	1.3	0.9
Kaleiopapa St. SE of Ehukai St.	1.6	1.6
Kaleiopapa St. N of Ehukai St.	1.5	-5.1
Ehukai St. West of Kaleiopapa St.	2.5	3.7
Old Kona Road East of Kaleiopapa St.	N/A	11.0

Note:

Future noise levels at 50 FT from the centerline of Old Kona Road are predicted to be 11 to 13 DNL higher than existing background noise levels.

Proposed Action. The increases in setback distances to the 65 DNL contour along Kamehameha III Road are predicted to increase by a range of 0 to 14 FT following plan completion by CY 2035. The setback distances to the 65 DNL contour along Kaleiopapa Street are predicted to increase by a range of 0 to 5 FT following plan completion by CY 2035.

Based on the results shown in Tables V-2 and VI-1, future traffic noise levels are not expected to exceed 65 DNL at noise sensitive receptors or residences within the project environs shown in Figure I-1. This is due to the relatively low posted speed limits of 20 to 35 miles per hour (mph). The anticipated posted speed limit along the improved Old Kona Road is 20 mph. The average speeds shown in Tables IV-1 and V-1 may be higher than posted speed limits, but were used in the TNM noise modeling of existing and future traffic noise levels in order to achieve the best agreement between the measured and modeled traffic noise levels as shown in Table IV-4.

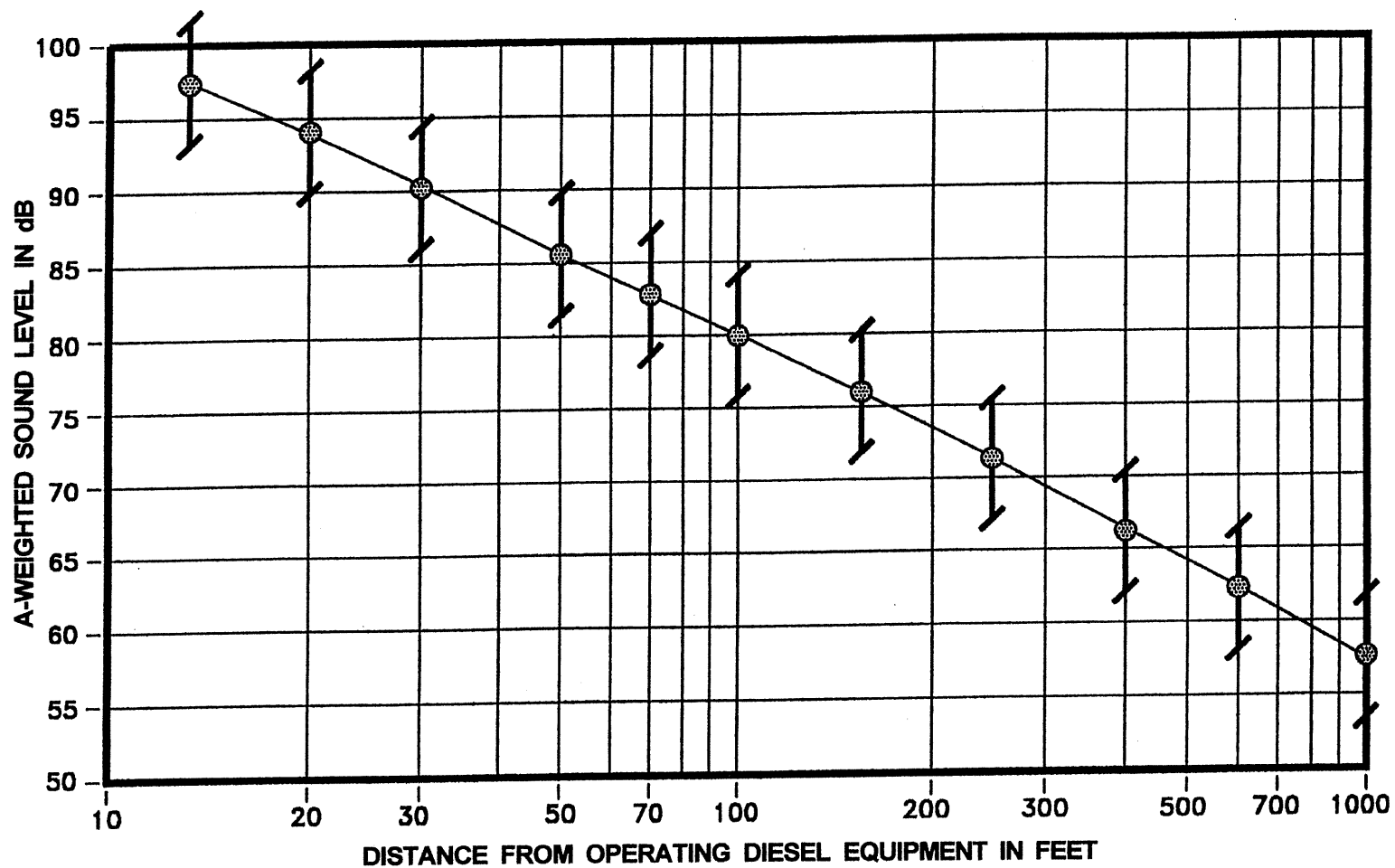
CHAPTER VII. CONSTRUCTION NOISE IMPACTS

Short-term noise impacts associated with construction activities anticipated in the project planning areas shown in Figures IV-3, IV-4, and IV-5 may occur on both the mauka and makai sides of the corridor centered along the Old Kona Road. The greatest impacts are expected during the earthwork and excavation phases, when site preparation work and/or roadway construction occur. Anticipated noise levels during construction activities of these types are shown in Figure VII-1. Noise levels of diesel powered construction equipment typically range from 80 to 90 dBA at 50 FT distance. The maximum impulsive noise levels of rock breaking equipment (such as hoe rams) can be 5 to 8 dBA greater than those shown in Figure VII-1. The total duration of the construction period for the proposed project is not known, but noise exposure from construction activities at any one receptor location is not expected to be continuous during the total construction period.

Construction noise levels at the closest existing residences along Kaleiopapa Street can intermittently exceed 70 dBA when work is being performed at the south end of Old Kona Road or at the Kaleiopapa Street entrance to the planned retail and restaurant complex. These noise levels are not unusually high and are similar to an automobile at 50 feet. Existing residences along Kamehameha III Road near the Holua Road intersection will probably experience higher noise levels of 79 to 81 dBA during construction of the north end of the Old Kona Road. The State Department of Health currently regulates noise from construction activities under a permit system (Reference 5). Under current permit procedures (see Figure VII-2), noisy construction activities are restricted to hours between 7:00 AM and 6:00 PM, from Monday through Friday, and exclude certain holidays. Noisy construction activities are normally restricted to the hours of 9:00 AM to 6:00 PM on Saturdays, with construction not permitted on Sundays. These restrictions minimize construction noise impacts on noise sensitive receptors (such as residences) along the roadway project corridor, and have generally been successfully applied. In this way, construction noise impacts on noise sensitive receptors can be minimized.

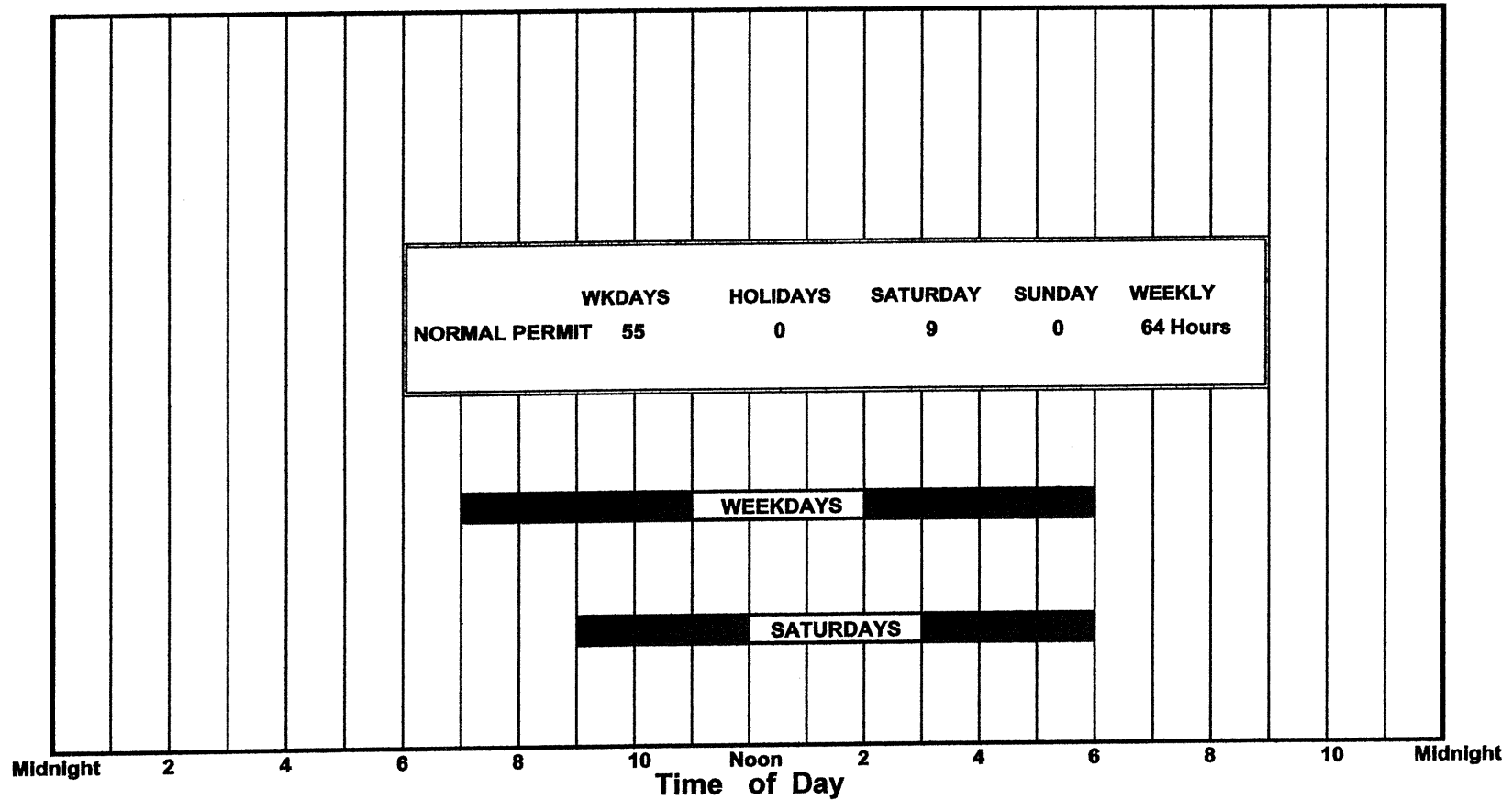
Adverse impacts from construction noise are not expected to be in the "public health and welfare" category due to the temporary nature of the work and due to the administrative controls available for its regulation. Instead, these impacts will probably be limited to the temporary degradation of the quality of the acoustic environment in the immediate vicinity of the project work areas.

In addition to the anticipated application of State DOH noise permit requirements and procedures during noisy construction activities, the use of quieted portable engine generators and diesel equipment should be specified for use within 500 FT of noise sensitive properties. Heavy truck and equipment staging areas should also be located at areas which are at least 500 FT from noise sensitive properties whenever possible. Truck routes which avoid residential communities should be identified wherever possible.



**ANTICIPATED RANGE OF CONSTRUCTION
NOISE LEVELS VS. DISTANCE**

**FIGURE
VII-1**



**AVAILABLE WORK HOURS UNDER DOH PERMIT
PROCEDURES FOR CONSTRUCTION NOISE**

**FIGURE
VII-2**

APPENDIX A. REFERENCES

(1) "Guidelines for Considering Noise in Land Use Planning and Control;" Federal Interagency Committee on Urban Noise; June 1980.

(2) American National Standard, "Sound Level Descriptors for Determination of Compatible Land Use," ANSI S12.9-1998/ Part 5; Acoustical Society of America.

(3) "Environmental Criteria and Standards, Noise Abatement and Control, 24 CFR, Part 51, Subpart B;" U.S. Department of Housing and Urban Development; July 12, 1979.

(4) "Information on Levels of Environmental Noise Requisite to Protect the Public Health and Welfare with an Adequate Margin of Safety;" U.S. Environmental Protection Agency; EPA 550/9-74-004; March 1974.

(5) "Title 11, Administrative Rules, Chapter 46, Community Noise Control;" Hawaii State Department of Health; September 23, 1996.

(6) "FHWA Highway Traffic Noise Model User's Guide;" FHWA-PD-96-009, Federal Highway Administration; Washington, D.C.; January 1998 and Version 2.5 Upgrade (April 14, 2004).

(7) Keauhou Bay Management Plan: Mobility Analysis Report (Draft); Fehr & Peers; January 4, 2022.

(8) 24-Hour Traffic Counts, Station B71018600600, Alii Drive Between Kaluna Street and Kaleiopapa Street; State Department of Transportation; January 8-9, 2019.

APPENDIX B

EXCERPTS FROM EPA'S ACOUSTIC TERMINOLOGY GUIDE

Descriptor Symbol Usage

The recommended symbols for the commonly used acoustic descriptors based on A-weighting are contained in Table I. As most acoustic criteria and standards used by EPA are derived from the A-weighted sound level, almost all descriptor symbol usage guidance is contained in Table I.

Since acoustic nomenclature includes weighting networks other than "A" and measurements other than pressure, an expansion of Table I was developed (Table II). The group adopted the ANSI descriptor-symbol scheme which is structured into three stages. The first stage indicates that the descriptor is a level (i.e., based upon the logarithm of a ratio), the second stage indicates the type of quantity (power, pressure, or sound exposure), and the third stage indicates the weighting network (A, B, C, D, E.....). If no weighting network is specified, "A" weighting is understood. Exceptions are the A-weighted sound level and the A-weighted peak sound level which require that the "A" be specified. For convenience in those situations in which an A-weighted descriptor is being compared to that of another weighting, the alternative column in Table II permits the inclusion of the "A". For example, a report on blast noise might wish to contrast the LCdn with the LAdn.

Although not included in the tables, it is also recommended that "Lpn" and "LepN" be used as symbols for perceived noise levels and effective perceived noise levels, respectively.

It is recommended that in their initial use within a report, such terms be written in full, rather than abbreviated. An example of preferred usage is as follows:

The A-weighted sound level (LA) was measured before and after the installation of acoustical treatment. The measured LA values were 85 and 75 dB respectively.

Descriptor Nomenclature

With regard to energy averaging over time, the term "average" should be discouraged in favor of the term "equivalent". Hence, Leq, is designated the "equivalent sound level". For Ld, Ln, and Ldn, "equivalent" need not be stated since the concept of day, night, or day-night averaging is by definition understood. Therefore, the designations are "day sound level", "night sound level", and "day-night sound level", respectively.

The peak sound level is the logarithmic ratio of peak sound pressure to a reference pressure and not the maximum root mean square pressure. While the latter is the maximum sound pressure level, it is often incorrectly labelled peak. In that sound level meters have "peak" settings, this distinction is most important.

"Background ambient" should be used in lieu of "background", "ambient", "residual", or "indigenous" to describe the level characteristics of the general background noise due to the contribution of many unidentifiable noise sources near and far.

With regard to units, it is recommended that the unit decibel (abbreviated dB) be used without modification. Hence, DBA, PNdB, and EPNdB are not to be used. Examples of this preferred usage are: the Perceived Noise Level (Lpn was found to be 75 dB. Lpn = 75 dB). This decision was based upon the recommendation of the National Bureau of Standards, and the policies of ANSI and the Acoustical Society of America, all of which disallow any modification of bel except for prefixes indicating its multiples or submultiples (e.g., deci).

Noise Impact

In discussing noise impact, it is recommended that "Level Weighted Population" (LWP) replace "Equivalent Noise Impact" (ENI). The term "Relative Change of Impact" (RCI) shall be used for comparing the relative differences in LWP between two alternatives.

Further, when appropriate, "Noise Impact Index" (NII) and "Population Weighed Loss of Hearing" (PHL) shall be used consistent with CHABA Working Group 69 Report Guidelines for Preparing Environmental Impact Statements (1977).

APPENDIX B (CONTINUED)

TABLE I
A-WEIGHTED RECOMMENDED DESCRIPTOR LIST

<u>TERM</u>	<u>SYMBOL</u>
1. A-Weighted Sound Level	L_A
2. A-Weighted Sound Power Level	L_{WA}
3. Maximum A-Weighted Sound Level	L_{max}
4. Peak A-Weighted Sound Level	L_{Apk}
5. Level Exceeded x% of the Time	L_x
6. Equivalent Sound Level	L_{eq}
7. Equivalent Sound Level Over Time (T) ⁽¹⁾	$L_{eq(T)}$
8. Day Sound Level	L_d
9. Night Sound Level	L_n
10. Day-Night Sound Level	L_{dn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$
12. Sound Exposure Level	L_{SE}

(1) Unless otherwise specified, time is in hours (e.g. the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified as $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine).

SOURCE: EPA ACCOUSTIC TERMINOLOGY GUIDE, BNA 8-14-78,

APPENDIX B (CONTINUED)

TABLE II
RECOMMENDED DESCRIPTOR LIST

<u>TERM</u>	<u>A-WEIGHTING</u>	<u>ALTERNATIVE⁽¹⁾</u> <u>A-WEIGHTING</u>	<u>OTHER⁽²⁾</u> <u>WEIGHTING</u>	<u>UNWEIGHTED</u>
1. Sound (Pressure) ⁽³⁾ Level	L_A	L_{pA}	L_B, L_{pB}	L_p
2. Sound Power Level	L_{WA}		L_{WB}	L_W
3. Max. Sound Level	L_{max}	L_{Amax}	L_{Bmax}	L_{pmax}
4. Peak Sound (Pressure) Level	L_{Apk}		L_{Bpk}	L_{pk}
5. Level Exceeded x% of the Time	L_x	L_{Ax}	L_{Bx}	L_{px}
6. Equivalent Sound Level	L_{eq}	L_{Aeq}	L_{Beq}	L_{peq}
7. Equivalent Sound Level ⁽⁴⁾ Over Time(T)	$L_{eq(T)}$	$L_{Aeq(T)}$	$L_{Beq(T)}$	$L_{peq(T)}$
8. Day Sound Level	L_d	L_{Ad}	L_{Bd}	L_{pd}
9. Night Sound Level	L_n	L_{An}	L_{Bn}	L_{pn}
10. Day-Night Sound Level	L_{dn}	L_{Adn}	L_{Bdn}	L_{pdn}
11. Yearly Day-Night Sound Level	$L_{dn(Y)}$	$L_{Adn(Y)}$	$L_{Bdn(Y)}$	$L_{pdn(Y)}$
12. Sound Exposure Level	L_S	L_{SA}	L_{SB}	L_{Sp}
13. Energy Average Value Over (Non-Time Domain) Set of Observations	$L_{eq(e)}$	$L_{Aeq(e)}$	$L_{Beq(e)}$	$L_{peq(e)}$
14. Level Exceeded x% of the Total Set of (Non-Time Domain) Observations	$L_{x(e)}$	$L_{Ax(e)}$	$L_{Bx(e)}$	$L_{px(e)}$
15. Average L_x Value	L_x	L_{Ax}	L_{Bx}	L_{px}

(1) "Alternative" symbols may be used to assure clarity or consistency.

(2) Only B-weighting shown. Applies also to C,D,E,.....weighting.

(3) The term "pressure" is used only for the unweighted level.

(4) Unless otherwise specified, time is in hours (e.g., the hourly equivalent level is $L_{eq(1)}$). Time may be specified in non-quantitative terms (e.g., could be specified as $L_{eq(WASH)}$ to mean the washing cycle noise for a washing machine.

APPENDIX C

SUMMARY OF BASE YEAR AND YEAR 2035 TRAFFIC VOLUMES DURING WEEKDAY AM AND PM PEAK HOURS

ROADWAY LANES	***** CY 2021 *****		CY 2035 (NO BUILD)		CY 2035 (BUILD)	
	AM	PM	AM	PM	AM	PM
Alii Drive NW of Kamehameha III Rd. (NB)	356	260	430	310	465	384
Alii Drive NW of Kamehameha III Rd. (SB)	213	419	260	490	320	556
Two-Way	569	679	690	800	785	940
Alii Drive Between Kamehameha III Rd. & Kaleiopapa St. (NB)	397	304	465	365	487	401
Alii Drive Between Kamehameha III Rd. & Kaleiopapa St. (SB)	293	480	350	565	376	600
Two-Way	690	784	815	930	863	1,001
Alii Drive South of Kaleiopapa St. (NB)	383	240	450	290	475	317
Alii Drive South of Kaleiopapa St. (SB)	226	397	270	470	284	500
Two-Way	609	637	720	760	759	817
Kamehameha III Rd. NE of Alii Dr. (NB)	165	189	200	230	208	247
Kamehameha III Rd. NE of Alii Dr. (SB)	225	225	270	280	283	296
Two-Way	390	414	470	510	491	543
Kamehameha III Rd. SW of Alii Dr. (NB)	46	62	70	80	107	159
Kamehameha III Rd. SW of Alii Dr. (SB)	66	67	90	100	153	171
Two-Way	112	129	160	180	260	330
Kamehameha III Rd. North of Holua Rd. (NB)	23	31	40	50	77	129
Kamehameha III Rd. North of Holua Rd. (SB)	33	33	50	50	113	121
Two-Way	56	64	90	100	190	250
Kamehameha III Rd. South of Holua Rd. (NB)	21	28	40	50	22	24
Kamehameha III Rd. South of Holua Rd. (SB)	30	30	50	50	18	19
Two-Way	51	58	90	100	40	43
Holua Road West of Kamehameha III Rd. (EB)	4	5	20	20	20	20
Holua Road West of Kamehameha III Rd. (WB)	5	5	20	20	20	20
Two-Way	9	10	40	40	40	40
Old Kona Road East of Kamehameha III Rd. (EB)	N/A	N/A	N/A	N/A	95	102
Old Kona Road East of Kamehameha III Rd. (WB)	N/A	N/A	N/A	N/A	55	105
Two-Way	N/A	N/A	N/A	N/A	150	207
Kaleiopapa St. West of Alii Dr. (EB)	49	118	60	150	80	192
Kaleiopapa St. West of Alii Dr. (WB)	102	124	130	160	165	198
Two-Way	151	242	190	310	245	390
Kaleiopapa St. SE of Ehukai St. (NB)	51	62	70	80	105	118
Kaleiopapa St. SE of Ehukai St. (SB)	24	59	40	80	60	122
Two-Way	75	121	110	160	165	240

APPENDIX C (CONTINUED)

SUMMARY OF BASE YEAR AND YEAR 2035 TRAFFIC VOLUMES DURING WEEKDAY AM AND PM PEAK HOURS

ROADWAY LANES	***** CY 2021 *****		CY 2035 (NO BUILD)		CY 2035 (BUILD)	
	AM	PM	AM	PM	AM	PM
Kaleiopapa St. N of Ehukai St. (NB)	42	51	60	70	18	19
Kaleiopapa St. N of Ehukai St. (SB)	21	49	40	70	22	24
Two-Way	63	100	100	140	40	43
Ehukai St. West of Kaleiopapa St. (EB)	7	14	20	30	28	48
Ehukai St. West of Kaleiopapa St. (WB)	13	15	30	30	55	61
Two-Way	20	29	50	60	83	109
Old Kona Road East of Kaleiopapa St. (EB)	N/A	N/A	N/A	N/A	52	58
Old Kona Road East of Kaleiopapa St. (WB)	N/A	N/A	N/A	N/A	30	70
Two-Way	N/A	N/A	N/A	N/A	82	128

Appendix P

Economic Impact Report

DRAFT

Economic Impact Report for the Keauhou Bay Management Plan

October 2024

Prepared for:

Kamehameha Schools

Prepared by:

Environment & Economics LLC

EXECUTIVE SUMMARY

This Economic Impact Report was conducted to assess the economic impacts that the proposed Keauhou Bay Management Plan would have on the economy of the County of Hawai'i and the fiscal revenue of the State of Hawai'i and County of Hawai'i governments. Potential economic and fiscal impacts are assessed for two construction phases (to occur over a 15-year period) and the full-operations phase to include impacts associated lodging and commercial operations and the visitor spending of low-impact lodging guests.

Table ES-1 shows that over the course of the 15-year construction period, a total of 2,619 jobs would be generated or sustained. Approximately \$138.6 million in labor income would be generated through that employment, and total economic output would be approximately \$344.7 million.

Table ES-1. Economic Impacts, Construction, Totals by Phase, 2025 \$s

	Jobs	Labor Income	Economic Output
Phase 1(5-years)	353	\$18,712,772	\$45,554,996
Phase 2 (10-years)	2,266	\$119,913,063	\$299,209,205
Totals (15-years)	2,619	\$138,625,835	\$344,764,201

Table ES-2 shows that, when construction is complete and full operations are reached, an annual total of 318 jobs would be generated or sustained, approximately \$17.0 million in annual labor income would be generated through that employment, and total economic output, on an annual basis, would be approximately \$45.9 million. Planning assumptions indicate that full operations would commence in approximately 2040.

Table ES-2. Economic Impacts, Annualized at Full-operations, 2025 \$s

	Jobs	Labor Income	Economic Output
Lodging and Commercial Operations	169	\$10,020,688	\$30,008,677
Visitor Spending (by lodging guests)	149	\$6,985,232	\$15,877,774
Totals	318	\$17,005,920	\$45,886,451

Table ES-3 shows estimated fiscal impacts in terms of revenue to the State of Hawai'i and County of Hawai'i governments. The State of Hawai'i would accrue approximately \$15.1 million in revenue due to project construction while the County of Hawai'i would accrue about \$5.1 million. At full operations, the State of Hawai'i would accrue approximately \$2.8 million per year from lodging and commercial operations and \$0.9 million per year from associated visitor spending. Also at full operations, the County of Hawai'i would accrue approximately \$3.2 million per year from lodging and commercial operations and \$0.35 million per year from associated visitor spending.

Table ES-3. Fiscal Impacts, 2025 \$s

Project Phase	State of Hawai'i Government Revenue	County of Hawai'i Government Revenue
Construction (total over 15-years)	\$15,115,704	\$5,067,869
Lodging and Commercial Operations (annual) ¹	\$2,800,269	\$3,170,627
Visitor Spending (annual)	\$934,946	\$350,802

*Note*¹: Includes estimated annual on-site property tax revenue for the County of Hawai'i of approximately \$2,700,000.

Economic Impact Report for the Keauhou Bay Management Plan

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Abbreviations and Acronyms

Acronym	Definition
%	percent
\$s	dollars
DEIS	Draft Environmental Impact Statement
EIR	Economic Impact Report
GET	General Excise Tax
IMPLAN	Impact Analysis for Planning
KBMP	Keauhou Bay Management Plan
KS	Kamehameha Schools
RevPar	Revenue Per Available Room
ROI	Region of Influence

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1 Introduction

Keauhou Bay is a small bay along the Kona Coast, traditionally known as a place of ali'i residence and of pastimes such as hōlua sledding and surfing. Keauhou Bay is perhaps most well known as the birth site and resuscitation site of Kamehameha I, also known as Kamehameha III, who was the son of Kamehameha 'Ekahi and Keōpūolani. Today, kama'āina and visitors alike recognize the historical significance of Keauhou Bay relative to the birth of this significant Hawaiian leader while also enjoying the area as a popular ocean recreation and resort destination.

The bay is highly used by residents, visitors, and community groups, which creates congestion and competing interests. Kamehameha Schools (KS), as a major landowner of approximately 54 acres at Keauhou Bay, started developing a management strategy in 2018 to address some of the challenges that have resulted from these multiple uses that sometimes conflict with one another in a relatively confined geographical space.

An Economic Impact Report (EIR) was conducted to assess and report on the impacts that the proposed Keauhou Bay Management Plan (KBMP) would have on the County of Hawai'i economy where the project would be developed, and that EIR accompanied the Draft KBMP Environmental Impact Statement (DEIS). This EIR is an update that provides additional context on economic background and project timeline, and applies updated economic data (e.g., updated construction cost estimates) as appropriate. Additionally, estimated fiscal benefits to both the County of Hawai'i and State of Hawai'i governments have been updated.

Estimated economic and fiscal impacts are provided for the three aspects of the project that would generate economic effects: 1) construction, 2) lodging and commercial operations, and 3) visitor spending of low impact lodging guests.

- 1) *Construction* impacts relate to the construction of parking and boat storage, vendor kiosks, a canoe club, improvements to Old Kona Road, a new low impact lodging establishment with approximately 150 rooms, and the renovation of existing facilities that would be used for cultural education, as well as retail and restaurant (commercial) space. Estimates related to construction are delineated into two phases; the first phase is anticipated to occur over a 5-year period from 2025 to 2029, and the second phase is anticipated to occur over a 10-year period from 2030 to 2039. These timeframes represent the best available information but are planning assumptions which are subject to change.
- 2) *Lodging and commercial operations* would include low impact lodging, cultural education activities, and retail and restaurant operations, as well as operations of the low impact lodging establishment. These impacts are presented on a combined, annualized, basis representing the level of economic activity at the time when the commercial and lodging establishments are at full operational levels, which is anticipated to be in 2040.
- 3) *Visitor spending* impacts represent the economic impacts generated by the spending of low impact lodging guests in the County of Hawai'i economy. These impacts are presented on a combined, annualized, basis representing the level of economic activity at the time when the commercial and lodging establishments are at full operational levels, which is anticipated to be in 2040.

Impacts are presented in terms of jobs, labor income, economic output, State of Hawai'i government revenue, and County of Hawai'i government revenue and were calculated using the Impact Analysis for Planning (IMPLAN) economic model, which was fitted with 2022 data for the County of Hawai'i (the most recent available data).

2 Approach to Analysis

2.1 Region of Influence

The Region of Influence (ROI) considered in this EIR is the County of Hawai‘i, which is the location of the proposed project. All fiscal impacts that would accrue to the State of Hawai‘i government are those that would be generated by economic activity that would take place within the County of Hawai‘i. Some economic benefits may spill over into locations outside of the ROI, as workers are likely to spend portions of their income elsewhere, such as Maui, Honolulu, and Kaua‘i Counties but these potential spill-over effects would likely be minimal and are not captured in this report.

2.2 Input Data and Modeling Procedures

The IMPLAN model is an input-output modeling application, which develops detailed data sets at various levels of geography on an annual basis (IMPLAN, 2024); it is the current industry standard for economic modeling. The data that were input into the IMPLAN model are presented below in Section 2.2.1 and Section 2.2.2 and generally include: construction expenditures, direct employment at proposed retail, restaurant, and educational establishment, projected hotel revenue, and estimated spending of guests of the proposed low impact lodging. Input data for different economic aspects are input in the dollar year for which the data is available, however, all results are presented in 2025 constant dollars.

Primary data on construction expenditures were derived from construction cost estimates, which listed costs at an individual project level of detail. Initial construction cost estimates were prepared in 2021 (J. Uno & Associates, 2024), and these were applied for analysis in the DEIS. Since analysis for the DEIS was conducted, updated construction cost estimates were developed (J. Uno & Associates, 2024), and these updated estimates were utilized for analysis in this report.

The construction cost estimates also provided information on commercial square footage, which was used in conjunction with information from the U.S. Energy Information Agency to develop estimates of direct employment at retail, restaurant, and educational facilities. Projected hotel revenue was estimated using information from the Hawai‘i Department of Business Economic Development and Tourism (DBEDT) and a feasibility study for the hotel (CBRE Inc., 2017). Visitor spending estimates were developed utilizing data from DBEDT along with project planning data on number of lodging rooms.

2.2.1 Construction Inputs

Table 2-1 shows how estimated KBMP construction expenditures were applied to the IMPLAN model. The largest project expenditures relate to the construction of new commercial structures (i.e., the low impact lodging establishment as well as new retail and restaurant space). Other major project expenditures relate to maintenance and repair of streets, landscaping, and maintenance and repair of existing structures.

Table 2-1. Construction Inputs, 2024 \$s

IMPLAN Sector Description	IMPLAN Code	Estimated Expenditure
Construction of new commercial structures	55	\$194,132,816
Maintenance and repair of Highways, streets, and related work	62	\$16,703,866
Landscaping and Horticultural services	477	\$10,296,794
Maintenance and repair construction of nonresidential structures	60	\$864,024
Total		\$221,997,500

Sources: J. Uno & Associates, 2021 & 2024

2.2.2 Lodging and Commercial Operations Inputs

Operational inputs for retail, restaurant, and cultural education activities include estimates of direct employment, which were calculated based on the planned square footage for those facilities (J. Uno & Associates, 2021) in conjunction with square footage per worker data from the U.S. Energy Information Administration (2021). Table 2-2 shows the type of facility, planned square footage for each type, the U.S. Energy Information Administration estimate of square footage per worker, the estimated number of direct employees at each facility (as calculated based on facility square footage and the square footage per worker factor), and the IMPLAN code and description that each of the categories of direct workers were input into.

Table 2-2. Commercial Operations Inputs, Estimated Annual Direct Employment

Facility Type	Square Footage ¹	Square Footage per Worker Factor ²	Direct Employment (calculated)	IMPLAN Code	IMPLAN Sector Description
Retail	8,010	922	9	412	Miscellaneous store retailers
Restaurant	530	500	1	509	Full-service restaurants
Cultural Education	4,600	1,064	4	482	Other Educational Services

Sources: ¹J. Uno & Associates, 2024; ²U.S. Energy Information Administration, 2024

Table 2-3 shows data used to calculate projected hotel revenue along with the IMPLAN code and IMPLAN description that the revenue figure was input into. Inputs for hotel operations were developed by estimating annual operational revenue based on the number of planned rooms (150) and projected revenue per available room (RevPar). RevPar (\$374.61 per room, per day) was estimated based on 2024 RevPar data from DBEDT (2024) as an average of Hawai'i Island and Kohala Coast RevPar.

Table 2-3. Lodging Operations Inputs, Estimated Annual Hotel Revenue, 2024 \$\$

Variable	Data Point	IMPLAN Code	IMPLAN Description
RevPar ¹	\$374.61		
Rooms ²	150		
Days	365		
Annual Revenue	\$20,509,761	507	Hotels and motels

Sources: ¹DBEDT, 2024; ²CBRE Inc., 2017

2.2.3 Visitor Spending Inputs

Table 2-4 shows anticipated annual non-lodging visitor spending for low impact lodging guests, by industry description. Spending estimates were developed using estimated hotel visitation along with DBEDT published Hawai'i Island averages of 2.2 guests per room, a 74% occupancy rate, and per person per day total spending by industry category (DBEDT 2024).

Table 2-4. Annual Non-lodging Visitor Spending Inputs, 2023 \$\$

Spending Category	IMPLAN Code	Estimated Expenditure
Restaurants	509	\$4,166,866
Entertainment and Recreation	504	\$1,812,236
Transportation	420	\$2,711,061
Retail Trade	412	\$1,546,964
Total		\$10,237,128

2.3 Economic Result Variables

Economic variables that are presented as results include jobs, labor income, and economic output. Each of these variables consists of a direct, indirect, and induced element. Estimated results for the variables were calculated by the IMPLAN model using the input data described above in Section 2.2. Increases in the result variables are generally considered beneficial as they tend to be associated with higher living standards.

Direct impacts are associated with the proposed project itself and include workers directly associated with initial project-related expenditures, the incomes earned by those workers, and the economic output generated by these initial project-related expenditures.

Indirect impacts are generated by the businesses that would supply goods and services that would facilitate various aspects of the project. Indirect jobs include jobs at companies that supply goods and services that support direct activities. Indirect jobs extend to include jobs related to the manufacture of products, to the extent that activity may occur in the County of Hawai‘i. Indirect labor income includes the income earned by people working indirect jobs. Indirect economic output includes the total sales volume related to the supply of goods and services net intermediate purchases.

Induced impacts are the result of spending of the wages and salaries of the direct and indirect workers on items such as food, housing, transportation, and medical services. This spending creates induced employment, labor income, and economic output in nearly all sectors of the economy, especially service sectors.

2.3.1 Jobs

Job impacts represent the number of jobs that would be created or sustained within the ROI as a result of the proposed project. The IMPLAN model generates job numbers that include both full-time and part-time jobs, including jobs that may be short-term. Short-term jobs may include, for example, construction trades specialists such as carpenters that may only conduct part of the construction work.

2.3.2 Labor Income

Labor income impacts represent the income generated through the jobs that would be created or sustained as a result of the construction, operations, and other related economic activity in the County of Hawai‘i.

2.3.3 Economic Output

Economic output equals the value of production by various industries in the County of Hawai‘i in a calendar year. It can also be described as annual revenue plus net inventory change.

2.4 Fiscal Result Variables

Fiscal variables include State of Hawai‘i government revenue and County of Hawai‘i government revenue. Each of these consist of multiple sources of revenue as described below in Section 2.4.1 and Section 2.4.2. Increases in government revenue are generally considered beneficial as revenue can be used by governments to fund public services and capital expenditures. Also, when governments spend the revenue that they receive from the project, additional jobs, labor income, and economic output would be generated; however, potential effects of government expenditures are not captured in this EIR.

2.4.1 State of Hawai‘i Government Revenue

Revenue that would be accrued by the State of Hawai‘i government as a result of construction and operations are presented in four categories: 1) General Excise Tax (GET) and Use Tax, 2) Corporate Profits Tax, 3) Personal Income Tax, and 4) Other. Estimates were calculated by the IMPLAN model based on incomes, spending of incomes, and industry expenditures.

2.4.2 County of Hawai‘i Revenue

Revenue that would be accrued by the County of Hawai‘i government as a result of construction and operations of the project are presented in two categories: 1) Property Tax, and 2) Other. Estimated property tax was calculated by the IMPLAN model based on additional property tax revenue associated with income from project-related jobs and additional economic activity. Other revenue to the County of Hawai‘i calculated by the IMPLAN model include, but are not limited to, sales tax revenue and revenue from licenses and fees.

Property tax revenue associated with the KBMP site was estimated using data from the County of Hawai‘i (2024) on property tax rates and historic property value at the site, in conjunction with data on KBMP construction expenditures. Historic property value for the site (approximately \$17.2 million) was added to the value of new construction (approximately \$222 million) and the sum was multiplied by a weighted (commercial and hotel) property tax rate of 1.14%.

3 Economic Background

Table 3-1 provides population data for 2010, 2015, and 2022 for the State of Hawai‘i, the County of Hawai‘i, and each of the Census County Divisions (CCDs) in the county, along with average annual growth rates from 2010 to 2015 and 2015 to 2022. As of 2022, the population for the State of Hawai‘i was about 1.45 million, with 202,163 of that population residing in the County of Hawai‘i (about 13.9% of the State population). The North Kona CCD, where the proposed project would occur, had a 2022 population of 46,386, making up about 23% of the County of Hawai‘i population.

Population growth rates statewide, countywide, and through most County of Hawai‘i CCDs were lower from 2015 to 2022 than they were from 2010 to 2015. However, the North Kona CCD grew more quickly from 2015 to 2022 than it did from 2010 to 2015. North Kona population grew at an average annual rate of 1.2% from 2010 to 2015 equaling the County rate, and exceeded the county growth rate from 2015 to 2022 (1.8% compared to 0.8%).

Table 3-1. Population Totals and Annual Growth Rates by Area

	2010	2015	2022	Average Annual Growth Rate 2010-2015	Average Annual Growth Rate 2015-2022
State of Hawai‘i	1,333,591	1,406,299	1,450,589	1.1%	0.4%
County of Hawai‘i	180,362	191,482	202,163	1.2%	0.8%
Hilo	50,805	47,409	49,859	-1.3%	0.7%
Honokaa-Kukuihaele	4,509	4,171	3,619	-1.5%	-1.9%
Kau	6,949	7,942	8,230	2.9%	0.5%
Keaau-Mountain View	27,063	34,124	37,995	5.2%	1.6%
North Hilo	1,896	1,661	1,459	-2.5%	-1.7%
North Kohala	5,303	6,490	6,435	4.5%	-0.1%
North Kona	38,825	41,213	46,386	1.2%	1.8%
Paauhau-Paauilo	2,415	3,270	2,654	7.1%	-2.7%
Pahoa-Kalapana	9,644	10,226	10,154	1.2%	-0.1%
Papaikou-Wailea	5,649	4,877	4,499	-2.7%	-1.1%
South Kohala	17,752	18,831	19,631	1.2%	0.6%
South Kona	9,552	11,268	11,242	3.6%	0.0%

Source: U.S. Census, 2010, 2015, 2022

Table 3-2 provides labor statistics for the State of Hawai‘i and the County of Hawai‘i for the years 2018 to 2024. The labor statistics include the size of the labor force, the total number of employed individuals, the total number of unemployed individuals, and the unemployment rate. Unemployment rates for both the State and County were generally very low from 2018 to 2019 but surged in 2020 due to business closures and travel restrictions forced by the COVID-19 pandemic. Employment conditions have normalized since then and unemployment rates are back at a generally low levels.

Table 3-2. State of Hawai‘i and County of Hawai‘i Labor Statistics, 2018-2024

	2018	2019	2020	2021	2022	2023	2024
State of Hawai‘i							
Labor force	692,457	686,066	665,964	670,193	672,727	676,355	670,558
Employment	675,849	668,769	588,159	630,151	650,672	656,336	650,878
Unemployment	16,608	17,297	77,805	40,042	22,055	20,019	19,860
Unemployment rate	2.4%	2.5%	11.7%	6.0%	3.3%	3.0%	2.9%
County of Hawai‘i							
Labor force	94,797	93,850	92,138	93,904	93,707	95,112	94,392
Employment	92,056	90,832	81,651	88,505	90,508	92,251	91,615
Unemployment	2,741	3,018	10,487	5,399	3,199	2,861	2,777
Unemployment rate	2.9%	3.2%	11.4%	5.7%	3.4%	3.0%	3.0%

Source: U.S. Bureau of Labor Statistics, 2024

Note: 2024 data is through August of 2024.

Table 3-3 shows employment by industry for the County of Hawai‘i in 2023. The largest industries in terms of employment were the Educational services, and health care and social assistance industry, the Arts, entertainment, and recreation, and accommodation and food services industry, and the Retail trade industry. There were 6,304 construction industry employees in the county in 2023.

Table 3-3. County of Hawai‘i Employment by Industry, 2023

Industry	2023 Employment
Agriculture, forestry, fishing and hunting, and mining	2,993
Construction	6,304
Manufacturing	2,130
Wholesale trade	2,149
Retail trade	11,455
Transportation and warehousing, and utilities	3,974
Information	892
Finance and insurance, and real estate and rental and leasing	4,149
Professional, scientific, and management, and administrative and waste management services	8,934
Educational services, and health care and social assistance	17,498
Arts, entertainment, and recreation, and accommodation and food services	15,520
Other services, except public administration	4,518
Public administration	6,739

Source: U.S. Census, 2023

Table 3-4 shows data on visitor arrivals to the State of Hawai‘i and the County of Hawai‘i from 2010 to 2023 along with year-over-year rates of change and the proportion of total statewide visitors who visited the County of Hawai‘i. The State saw increases in visitor arrivals every year from 2010 to 2019, with the largest year-over-year growth being experienced from 2011 to 2012. The County of Hawai‘i experienced slower but consistent visitor growth from 2010 to 2016 and saw a substantial increase from 2016 to 2017. Travel restrictions in 2020 led to a massive decline in visitor arrivals, down 73.8% statewide and 72.0% in the County of Hawai‘i from 2019 to 2020. As of 2022, the number of visitor arrivals had recovered, with the County of Hawai‘i seeing an all-time high in arrivals in 2023 (1.78 million). Through the first half of 2024, visitor arrivals in the County of Hawai‘i are slightly down from 2023 levels (DBEDT 2024).

In 2023, the average per person visitor expenditure was approximately \$208 per day with approximately 46% spent on lodging, 22% spent on food and beverage, 14% spent on transportation, 10% spent on entertainment and recreation, and 8% spent on shopping (DBEDT 2024).

Table 3-4. Statewide & County of Hawai‘i Visitor Arrivals, 2010-2023

Year	Statewide Visitor Arrivals (by Air)	Statewide Year over Year Change	Hawai‘i Visitor Arrivals (by Air)	Hawai‘i Year over Year Change	Hawai‘i % of Statewide Total
2010	6,916,894		1,281,232		18.5%
2011	7,174,397	3.7%	1,318,311	2.9%	18.4%
2012	7,867,143	9.7%	1,433,282	8.7%	18.2%
2013	8,003,474	1.7%	1,435,245	0.1%	17.9%
2014	8,196,342	2.4%	1,454,684	1.4%	17.7%
2015	8,563,018	4.5%	1,514,973	4.1%	17.7%
2016	8,821,802	3.0%	1,549,943	2.3%	17.6%
2017	9,277,613	5.2%	1,767,144	14.0%	19.0%
2018	9,761,448	5.2%	1,706,218	-3.4%	17.5%
2019	10,243,165	4.9%	1,763,904	3.4%	17.2%
2020	2,686,403	-73.8%	493,817	-72.0%	18.4%
2021	6,777,761	152.3%	1,183,458	139.7%	17.5%
2022	9,138,674	34.8%	1,667,633	40.9%	18.2%
2023	9,499,995	4.0%	1,779,063	6.7%	18.7%

Source: DBEDT, 2024

4 Economic Results

4.1 Construction

4.1.1 Jobs

Table 4-1 shows that there would be an estimated 2,619 total jobs generated or sustained from project construction – 1,937 direct, 247 indirect, and 436 induced. During Phase 1 of construction, there would be an annual average of 71 jobs per year, 221 jobs per year in Phase 2, and an overall annual average of 175 jobs per year over a 15-year period.

Table 4-1. Jobs, by Phase, Total, and Annual Average

	Phase 1 (5-Years)	Phase 2 (10-Years)	15-Year Total
Direct	263	1,674	1,937
Indirect	31	216	247
Induced	59	377	436
Total	353	2,266	2,619
Average Annual	71	227	175

4.1.2 Labor Income

Table 4-2 shows that there would be an estimated \$138.6 million in total labor income generated or sustained from project construction – \$105.4 million direct, \$12.2 million indirect, and \$21.0 million induced. During Phase 1 of construction, there would be an annual average of \$3.7 million, \$12.0 million in Phase 2, and an overall annual average of \$9.2 million in labor income over a 15-year period.

Table 4-2. Labor Income, by Phase, Total, and Annual Average (2025 \$s)

	Phase 1 (5-Years)	Phase 2 (10-Years)	15-Year Total
Direct	\$14,342,366	\$91,060,068	\$105,402,435
Indirect	\$1,532,750	\$10,678,203	\$12,210,952
Induced	\$2,837,656	\$18,174,792	\$21,012,448
Total	\$18,712,772	\$119,913,063	\$138,625,835
Average Annual	\$3,742,554	\$11,991,306	\$9,241,722

4.1.3 Economic Output

Table 4-3 shows that there would be an estimated \$344.8 million in total economic output generated or sustained from project construction – \$219.6 million direct, \$50.8 million indirect, and \$74.4 million induced. During Phase 1 of construction, there would be an annual average of \$9.1 million, \$29.9 million in Phase 2, and an overall annual average of \$23.0 million in labor income over a 15-year period.

Table 4-3. Economic Output, by Phase, Total, and Annual Average (2025 \$s)

	Phase 1 (5-Years)	Phase 2 (10-Years)	15-Year Total
Direct	\$29,022,793	\$190,552,289	\$219,575,081
Indirect	\$6,484,881	\$44,305,519	\$50,790,400
Induced	\$10,047,322	\$64,351,398	\$74,398,719
Total	\$45,554,996	\$299,209,205	\$344,764,201
Average Annual	\$9,110,999	\$29,920,921	\$22,984,280

4.2 Lodging and Commercial Operations

4.2.1 Jobs

Table 4-4 shows that there would be an estimated total of 169 jobs generated or sustained from lodging and commercial operations annually – 119 of the jobs would be direct, 20 indirect, and 30 induced. These jobs would primarily be in service industries such as the hotel industry (e.g., building maintenance and clerks), retail industry (e.g., retail sales), and restaurant industry (e.g., food and beverage service and cooks).

Table 4-4. Jobs, Annual at Full Operations

	Annual
Direct	119
Indirect	20
Induced	30
Total	169

4.2.2 Labor Income

Table 4-5 shows that there would be a total increase of \$10.0 million in labor income generated or sustained from project operations annually – \$7.7 million of the labor income would be direct, \$0.9 million indirect, and another \$1.4 million induced.

Table 4-5. Labor Income, Annual at Full Operations (2025 \$s)

	Annual
Direct	\$7,669,182
Indirect	\$912,521
Induced	\$1,438,986
Total	\$10,020,688

4.2.3 Economic Output

Table 4-6 shows that there would be a total increase of \$30.0 million in economic output generated or sustained from project operations annually – \$21.8 million of the economic output would be direct, \$3.1 million indirect, and another \$5.1 million induced.

Table 4-6. Economic Output, Annual at Full Operations (2025 \$s)

	Annual
Direct	\$21,809,363
Indirect	\$3,106,880
Induced	\$5,092,435
Total	\$30,008,677

4.3 Visitor Spending

4.3.1 Jobs

Table 4-7 shows that there would be an estimated total of 149 jobs generated or sustained from lodging and commercial operations annually – 109 of the jobs would be direct, 19 indirect, and 21 induced. These jobs would primarily be in service industries such as the restaurant industry (e.g., food and beverage service and cooks) and entertainment and recreation industry.

Table 4-7. Jobs, Annual at Full Operations

	Annual
Direct	109
Indirect	19
Induced	21
Total	149

4.3.2 Labor Income

Table 4-8 shows that there would be a total increase of \$7.0 million in labor income generated or sustained from project operations annually – \$5.1 million of the labor income would be direct, \$0.83 million indirect, and another \$1.0 million induced.

Table 4-8. Labor Income, Annual at Full Operations (2025 \$s)

	Annual
Direct	\$5,117,134
Indirect	\$833,183
Induced	\$1,034,915
Total	\$6,985,232

4.3.3 Economic Output

Table 4-9 shows that there would be a total increase of \$15.9 million in economic output generated or sustained from project operations annually – \$9.5 million of the economic output would be direct, \$2.7 million indirect, and another \$3.7 million induced.

Table 4-9. Economic Output, Annual at Full Operations (2025 \$s)

	Annual
Direct	\$9,503,758
Indirect	\$2,710,835
Induced	\$3,663,181
Total	\$15,877,774

5 Fiscal Results

5.1 Construction

Table 5-1 shows that over the 15-year construction period there would be a total of approximately \$15.1 million in State of Hawai'i government revenue generated or sustained. The majority of this revenue (\$9.2 million) would be generated through GET & Use taxes. On an annualized basis, during Phase 1 there would be about \$0.4 million in State of Hawai'i government revenue, and about \$1.3 million per year during Phase2. Over the course of the 15-year construction period, there would be an annual average of \$1.0 million per year in State of Hawai'i government revenue generated.

Table 5-1. State of Hawai'i Government Revenue, Total (2025 \$s)

Tax Category	Phase 1 (5-Years)	Phase 2 (10-Years)	15-Year Total
GET & Use	\$1,184,108	\$8,032,432	\$9,216,540
Corporate Profit	\$39,166	\$273,888	\$313,054
Personal Income	\$676,893	\$4,334,233	\$5,011,126
Other	\$74,882	\$500,102	\$574,984
Total	\$1,975,049	\$13,140,655	<u>\$15,115,704</u>
Average Annual	\$395,010	\$1,314,066	<u>\$1,007,714</u>

Table 5-2 shows that over the 15-year construction period there would be a total of approximately \$5.1 million in County of Hawai'i government revenue generated or sustained. The majority of this revenue (\$3.9 million) would be generated through property taxes. On an annualized basis, during Phase 1 there would be about \$0.1 million in County of Hawai'i government revenue, and about \$0.44 million per year during Phase2. Over the course of the 15-year construction period, there would be an annual average of \$0.34 million per year in County of Hawai'i government revenue generated.

Table 5-2. County of Hawai'i Government Revenue, Total (2025 \$s)

Tax Category	Phase 1 (5-Years)	Phase 2 (10-Years)	15-Year Total
Property	\$497,705	\$3,376,198	\$3,873,903
Other	\$153,879	\$1,040,086	\$1,193,965
Total	\$651,585	\$4,416,284	<u>\$5,067,869</u>
Average Annual	\$130,317	\$441,628	<u>\$337,858</u>

5.2 Lodging and Commercial Operations

Table 5-3 shows that there would be a total of approximately \$2.8 million in State of Hawai‘i government revenue generated or sustained from lodging and commercial operations, annually. The majority of this revenue (\$2.3 million) would be generated through GET and Use taxes.

Table 5-3. State of Hawai‘i Government Revenue, Annual (2025 \$s)

Tax Category	Annual
GET & Use	\$2,267,945
Corporate Profit	\$85,233
Personal Income	\$332,821
Other	\$114,270
Total	\$2,800,269

Table 5-4 shows that there would be a total of approximately \$3.2 million in County of Hawai‘i government revenue generated or sustained project operations, annually. The majority of this revenue (\$2.9 million) would be generated through property taxes, including annual payments of an estimated \$2.7 million for the KBMP site itself.

Table 5-4. County of Hawai‘i Government Revenue, Annual (2025 \$s)

Tax Category	Annual
Property ¹	\$2,889,834
Other	\$280,793
Total	\$3,170,627

*Note*¹: Includes estimated annual on-site property tax revenue of approximately \$2,700,000.

5.3 Visitor Spending

Table 5-5 shows that there would be a total of approximately \$0.9 million in State of Hawai‘i government revenue generated or sustained from the visitor spending of low impact lodging guests, annually. The majority of this revenue (\$0.6 million) would be generated through GET and Use taxes.

Table 5-5. State of Hawai‘i Government Revenue, Annual (2025 \$s)

Tax Category	Annual
GET & Use	\$640,631
Corporate Profit	\$15,177
Personal Income	\$242,234
Other	\$36,904
Total	\$934,946

Table 5-6 shows that there would be a total of approximately \$0.35 million in County of Hawai‘i government revenue generated or sustained from the visitor spending of low impact lodging guests, annually. The majority of this revenue (\$0.27 million) would be generated through property taxes.

Table 5-6. County of Hawai‘i Government Revenue, Annual (2025 \$s)

Tax Category	Annual
Property	\$269,271
Other	\$81,531
Total	\$350,802

6 Summary

The proposed KBMP would generate economic benefits for residents of the County of Hawai‘i and improve the fiscal position of the County and the State of Hawai‘i, both in the short-term and long-term. In the short-term, over a 15-year construction period, construction activity would generate employment and income in construction and related industries, while providing an overall boost to the local economy in terms of economic output. Also, from construction, State and County revenue would increase by millions of dollars, allowing for those governments to fund infrastructure and other improvements that could benefit the community for years to come. Long-term economic benefits would also include increases in employment and income, in service sectors, and providing an expanded base for tourism and cultural education in the County derived from both lodging and commercial operations as well as the spending, throughout the county, of lodging guests. Annual fiscal revenue derived from KBMP operations would allow the State and County to maintain or improve vital public services (e.g., police and fire protection services) for the benefit of the community.

Table 6-1 provides summary annualized impacts for three timeframes of the proposed project. Generally, economic and fiscal impacts would increase over time. The 2025-2029 period (Phase 1 construction) would have a lower level of annualized impacts than the 2030-2039 period (Phase 2 construction), and the 2040 forward (full operations) period would have the most substantial annualized impacts. During the first two periods, from 2025-2039, jobs would primarily be in the construction industry while in the third time period, 2040 forward, jobs would tend to be in the service sector (food service, entertainment, and hospitality)

Table 6-1. Summary of Annualized Impacts, 2025 \$s

Impact Category	Annual 2025-2029	Annual 2030-2039	Annual 2040 Forward
Jobs	71	227	318
Labor Income	\$3,742,554	\$11,991,306	\$17,005,920
Economic Output	\$9,110,999	\$29,920,921	\$45,886,451
State of Hawai‘i Revenue	\$395,010	\$1,314,066	\$3,735,215
County of Hawai‘i Revenue	\$130,317	\$441,628	\$3,521,429

Note: The 2025-2029 period includes Phase 1 construction. The 2030-2039 period includes Phase 2 construction. The 2040 forward period includes lodging and commercial operations and visitor spending impacts.

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