National Park Service
Cultural Landscapes Inventory
2025



Kahuku Ranch
Hawai‘i Volcanoes National Park

Kahuku Ranch
Hawai‘i Volcanoes National Park

Hawai‘i Volcanoes National Park concurs with the findings of the Kahuku Ranch CLI, including the management category and condition assessment as identified below:

MANAGEMENT CATEGORY: **B: Should be preserved and maintained**

CONDITION ASSESSMENT: **Poor**

RHONDA LOH Digitally signed by RHONDA LOH
Date: 2024.01.08 15:31:44 -10'00'

Superintendent, Hawai‘i Volcanoes National Park Date

Please return to:

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December 27, 2024

IN REPLY REFER TO:
Project No: 2024PR00073
Doc No: 2412NG01
History & Culture

Rhonda Loh, Park Superintendent
Hawaiʻi Volcanoes National Park
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Aloha e Superintendent Loh,

SUBJECT: Hawaiʻi Volcanoes National Park, Kahuku Ranch Cultural Landscape Inventory, Kahuku Ahupuaʻa, Kaʻū District, Island of Hawaiʻi, TMK: (3) 9-2-001:002.

This letter is in response to a request from the National Park Service (NPS) dated January 11, 2024 and received by the State Historic Preservation Division (SHPD) on May 20, 2024. The request seeks SHPD concurrence on specific findings of the Kahuku Ranch Cultural Landscape Inventory (CLI). SHPD concurs with the following findings:

- Kahuku Ranch is eligible for the National Register of Historic Places under Criterion A.
- Kahuku Ranch's period of significance starts with the purchase of the ranch by Parker Ranch in 1912 and ends in 1947 when Kahuku Ranch was sold to James Glover.
- While a portion of the historic Kahuku Ranch lies outside of the borders of TMK: (3) 9-2-001:002, we concur that the Historic District boundaries for Kahuku Ranch within the property are as described in the NPS Cultural Landscape Inventory for the site.
- The contributing and non-contributing resources of the historic district, as well as the landscape characteristics identified in the Cultural Landscape Inventory are as described in the document.

SHPD has no issue with the Cultural Landscape Inventory and thanks the authors for their work. Any questions should be addressed to Noah Gomes, Ethnographer, at (808) 987-5001 or noah.gomes@hawaii.gov

Mahalo,

Jessica L. Puff
State Historic Preservation Administrator
Deputy State Historic Preservation Officer

cc: Summer Roper Todd, *Cultural Resource Program Manager*, summer_roper_todd@nps.gov
Vida Germano, *NPS/PWR Cultural Landscape Inventory Coordinator*, vida_germano@nps.gov

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Inventory Unit Summary & Site Plan

Inventory Summary

Cultural Landscapes in the Cultural Resources Inventory System:

The Cultural Resources Information System (CRIS)

CRIS is the National Park Service's database of cultural resources on its lands, consisting of archeological sites, historic structures, ethnographic resources and cultural landscapes. The set of CRIS records for cultural landscapes is referred to as CRIS-CL. CRIS-CL records conform to a standardized data structure known as the Cultural Landscapes Inventory (CLI). The legislative, regulatory and policy directions for conducting and maintaining the CRIS are: Section 110 of the National Historic Preservation Act, NPS Management Policies (2006), Director's Order 28 (Cultural Resources) and Director's Order 28a (Archeology).

The Cultural Landscapes Inventory (CLI)

The CLI is the data structure within CRIS used to document and evaluate all potentially significant cultural landscapes in which NPS has, or plans to acquire, any enforceable legal interest. Each CRIS-CL record is certified complete when the landscape is determined to meet one of the following: Landscape individually meets the National Register of Historic Places criteria for evaluation; or, Landscape is a contributing element of a property that is eligible for the National Register; or, Landscapes does not meet the National Register criteria, but is managed as cultural resources because of law, policy or decisions reached through the park planning process. Cultural landscapes vary from historic sites, historic designed landscapes, historic vernacular landscapes to historic ethnographic landscapes, but may also fit within more than one type. Those eligible for the National Register have significance in the nation's history on a national, state or local level, as well as integrity or authenticity. The legislative, regulatory and policy directions for conducting and maintaining the CLI within CRIS are:

National Historic Preservation Act of 1966 (16 USC 470h-2(a)(1)). Each Federal agency shall establish a preservation program for the identification, evaluation, and nomination to the National Register of Historic Places…of historic properties…

Executive Order 13287: Preserve America, 2003. Sec. 3(a)…Each agency with real property management responsibilities shall prepare an assessment of the current status of its inventory of historic properties required by section 110(a)(2) of the NHPA…No later than September 30, 2004, each covered agency shall complete a report of the assessment and make it available to the Chairman of the Advisory Council on Historic Preservation and the Secretary of the Interior…

Executive Order 13287: Preserve America, 2003. Sec. 3(c) Each agency with real property management responsibilities shall, by September 30, 2005, and every third year thereafter, prepare a report on its progress in identifying…historic properties in its ownership and make the report available to the Council and the Secretary…

The Secretary of the Interior's Standards and Guidelines for Federal Agency Historic Preservation Programs Pursuant to the National Historic Preservation Act, 1998. Standard 2: An agency provides for the timely identification and evaluation of historic properties under agency jurisdiction or control and/or subject to effect by agency actions (Sec. 110 (a)(2)(A) Management Policies 2006. 5.1.3.1 Inventories:

The Park Service will (1) maintain and expand the following inventories…about cultural resources in units of the national park system…Cultural Landscape Inventory of historic designed landscapes, historic vernacular landscapes,…and historic sites…

Cultural Resource Management Guideline, 1997, Release No. 5, page 22 issued pursuant to Director's Order #28. As cultural resources are identified and evaluated, they should also be listed in the appropriate Service-wide inventories of cultural resources.

Inventory Unit Description:

The Kahuku unit of Hawai'i Volcanoes National Park contains three component cultural landscapes; Kahuku Ethnographic Landscape, Kahuku Military Landscape, and Kahuku Ranch, which are each documented in separate cultural landscape inventories due to their scale and historical contexts. The Kahuku Ranch cultural landscape is located in Ka'ū, a remote and sparsely populated southern district of the Island of Hawai'i. The approximately 13,402-acre Kahuku Ranch cultural landscape is a part of the original 184,000-acre cattle ranch that assumed the traditional ahupua'a (land division) boundary of Kahuku and is representative of the development of the island ranching operations through the 20th century. This land parcel stretched from the summit of Mauna Loa to the southern tip of the island in a triangular parcel with a wide base at the ocean. The historic Kahuku Ranch includes within its boundary Mauna Loa's very active southwest rift zone, a long series of fractures, fissures, craters, cinder cones, lava flows, and faults and ranged from 2,000 to 13,000 feet in elevation, all of which significantly influenced the development of a ranch on the island.

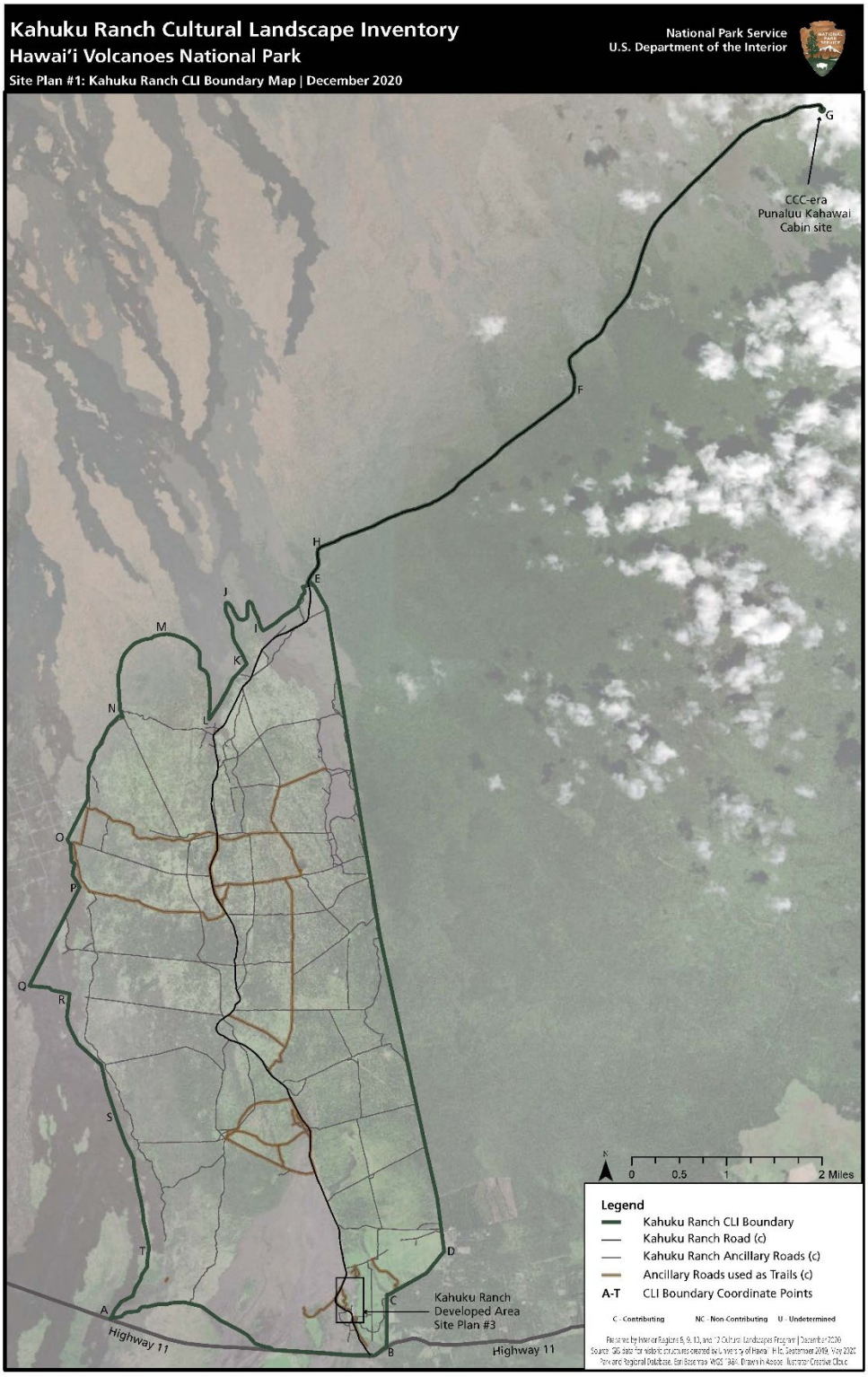
Located mauka, upslope and north, of Highway 11, in the southeastern area of the park-owned lands, the Kahuku Ranch cultural landscape includes fences, roads, and trails that comprise a sophisticated pasture-paddock system that reflects the evolution of the ranching landscape from 1912 to the turn of the twenty-first century. Particularly significant in this landscape are the features from the complex water system, first established in early-twentieth century, including water tanks, water troughs, watersheds, and pipes that are strategically located across the paddocks to unite the mauka (north) pastures of Kahuku Ranch into a single water system. Also of notable interest are the larger, lesser-dissected mauka (north) paddocks located primarily to the west of the Kahuku Road and the Glover trail (east branch of the Kahuku-Ainapo Trail, established in the first half of the twentieth century, that bear contrast to the smaller, sectioned paddocks to the east of the road and the Glover trail, established during the mid-to-late-twentieth century. The larger, lesser dissected mauka (north) paddocks were established between 1912 and 1947 under the management of Parker Ranch (see Appendix E).

Also within this inventory unit is a small developed area that was used as a maintenance area in the post-war era. While this developed area was established circa 1942, it was constructed as a World War II military training facility, and was released from the military control in 1947. Therefore, the developments in this area do not contribute to the Kahuku Ranch landscape under the ranching context within the period of significance of 1912 to 1947. However, the land on which the developments were made has been a part of the 184,000-acre Kahuku since its first establishment as a cattle ranch in 1866.

Kahuku Ranch is locally significant for its association with the patterns of development in the cattle industry on the Island of Hawai'i and is particularly representative of the specific period in island ranching when ranching operations transitioned from land-responsive approaches of management, operating within the parameters of natural limitations of the landscape, to more intensive manipulation of the natural environment through the application of "modern," or contemporary, technology (Criterion A). The period of significance begins in 1912 when Kahuku was purchased as a satellite ranch of Parker Ranch and ends in 1947 when the Parker Ranch sold Kahuku to James Glover. This period reflects the years of development that incorporate early ranching (mid-to-late-nineteenth century), and contemporary knowledge and practice of land use, and signals the transition to an increasingly systematized approach of range management and cultivation. This significance is conveyed through several cultural landscape characteristics, including natural systems and features, spatial organization, circulation, vegetation, buildings and structures, small-scale features, constructed water features, and archaeology, which evaluated together, contribute to the character of the historic district.

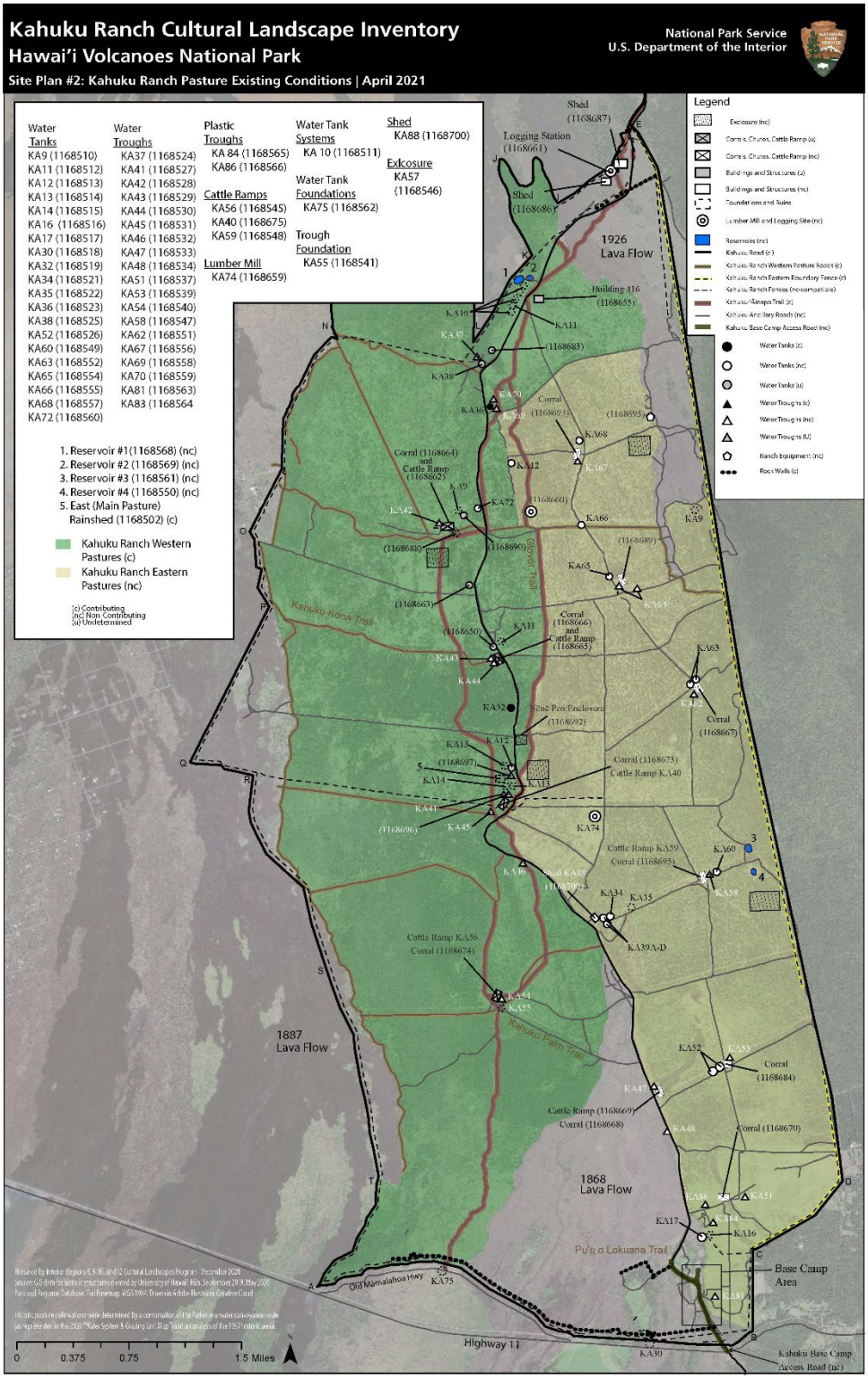
Kahuku Ranch retains its historic integrity and conveys its historic significance as representative of the transition period in island ranching in the first half of the twentieth century, incorporating elements of early ranching land use practices, such as the siting and concentration of pasture-paddock development, with the introduction of intensive infrastructural development and contemporary range management. The land use of the area remained consistent for over a century since the establishment of the Kahuku Ranch and, although no longer a cattle ranch, its incorporation into the National Park Service as a managed unit of the Hawai'i Volcanoes National Park has not detracted from the historic setting and feeling of the ranch. Kahuku Ranch retains its integrity in association with the natural landscape that so dramatically influenced the development of the ranch. The extant pasture-paddock and water systems dating to the Parker era contributed to the ranch and also served as the foundation for the extensive development of ranching infrastructure through the second half of the twentieth century. These systems retain their spatial layout from the historic period. Although much of ranch systems' integrity in materials and workmanship have diminished through the ranching years of continuous repairs and replacements, Kahuku Ranch is historically significant for its association with the development in island ranching history and retains integrity in design, location, setting, feeling, and association to convey this significance. Today, Kahuku Ranch is in poor condition.

Site Plan



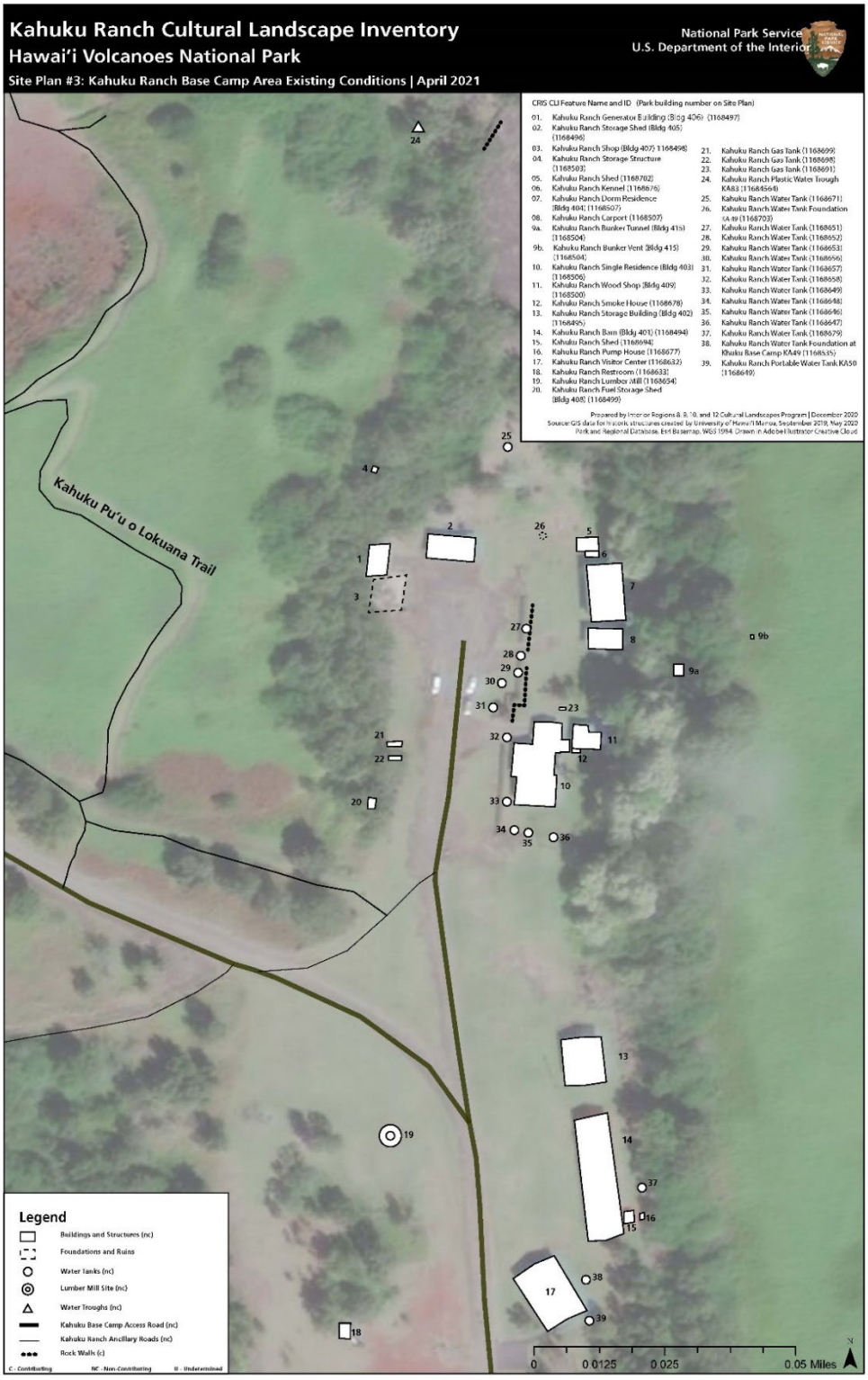
Site Plan #1: Boundary Map. See Appendix A for large scale version of site plan.

Site Plan



Site Plan #2: Pasture Map. See Appendix A for large scale version of site plan.

Site Plan



Site Plan #3: Developed Area map. See Appendix A for large scale version of site plan.

Property Level and CLI Numbers

Inventory Unit Name: Kahuku Ranch

Property Level: Landscape

CLI Identification Number:

Park Information

Park Name and Alpha Code: Hawai'i Volcanoes National Park HAVO

Park Organization Code: 8300

CLI Hierarchy Description

Kahuku Ranch is a component cultural landscape of the Kahuku parent landscape.

The parent landscape is the Kahuku Unit. Within the parent landscape, there are three component landscapes, including Kahuku Ethnographic Landscape, Kahuku Military Landscape, and this inventory of Kahuku Ranch.

Concurrence Status

Inventory Status: Complete

Completion Status Explanatory Narrative:

The baseline history for the CLI was adopted from the *Volcano Ranch: An Environmental History of Kahuku* by Christy Avery in 2009. An initial survey of historic structures was conducted by the park in 2005. Aerial photography and creation of GIS for the historic structures in the lower portion of the Kahuku unit was collected and prepared by University of Hawai'i Hilo between September 2019 and May 2020. Photography of the existing conditions of historic structures was carried out by National Council for Preservation Education (NCPE) interns Naftalia Flatté and Taylor Wainani Traub, under the supervision of Elizabeth Pidgeon, R.A. (HAVO Historical Architect) in August, 2020. In August-October, 2020, supplemental research and development of the statement of significance and physical history were completed by Sang Bae (Historian in the San Francisco regional office) with the assistance of Laura C. Schuster (HAVO Cultural Resources Division Lead) and Kristi A. Ausfresser (HAVO Museum and Archival Staff). The analysis and evaluation of the landscape as well as the graphics development for the CLI were completed by Erika Schroeder (Historical Landscape Architect intern in the San Francisco regional office). The CLI was certified in 2024.

Concurrence Status:

Park Superintendent Concurrence:	Yes
Park Superintendent Date of Concurrence:	01/08/2024
National Register Concurrence:	Eligible - SHPO Consensus Determination
Date of Concurrence Determination:	12/27/2024

Geographic Information & Location Map

Inventory Unit Boundary Description:
The Kahuku Ranch cultural landscape is a 13,402-acre site located in the area referred to by the park as "lower Kahuku." Ranging from 2,000 feet to 6,000 feet above sea level, this unit is located north and mauka (upslope, north) of Highway 11. Beginning at the western end of the Old Māmalahoa Highway moving eastward, the Kahuku Ranch cultural landscape follows the official park boundary for its southern and eastern boundary for the extent of the pasture-paddock system. At approximately 5,000 feet in elevation, the unit boundary departs from the park boundary northwestward to meet the ten-foot buffer line from the center line of the Kahuku Road. From this point, the boundary follows this buffer line along the alignment of the road for some seven miles northeastward to the Civilian Conservation Corps (CCC)-era cabin, or the Punalu'u Kahawai Cabin, where it encompasses a circular area with the diameter of approximately 200 feet, to include the cabin and a redwood water tank. The boundary then follows the northern edge of a ten-foot buffer of Kahuku Road back southwestward to the 5,000-foot elevation where it follows the northern edge of a ten-foot buffer of the northernmost/outermost ancillary ranch roads to the western edge of the 1926 lava flow where it rounds upslope to capture approximately 75 acres of historic pastureland before resuming to follow the northern edge of a ten-foot buffer of the northernmost/outermost ancillary ranch road to approximately 4,700-foot elevation. From this point, boundary loops upslope again to capture approximately 438 acres of historic pastureland and continues south-southwestward along the western edge of a ten-foot buffer of the westernmost fence. The boundary continues southward for approximately one mile until it meets and follows the park boundary for about two miles, to about 3,400 feet above sea level. From this point, the boundary turns eastward along the southern edge of a ten-foot buffer of the fence for approximately 0.5 miles then shifts southeastward along the western edge of a ten-foot buffer from the westernmost fence in this section of the pasture. The boundary follows this fence buffer down to meet the starting point at the western edge of the Old Māmalahoa Highway (see Site Plan #1, Boundary Map, in Appendix A).

Inventory Unit Boundary Justification:
The Kahuku Ranch cultural landscape encompasses the developed area, also known as the Kahuku Base Camp, and the entire extant pasture-paddock system and ranch-managed lands between 2,000 feet to 5,000 feet above sea level established during the period of significance. It includes a seven-mile 20-foot corridor along the Kahuku Road above 5,000 feet to include the CCC-era cabin that housed the workers as they constructed significant and necessary infrastructure for efficient operation of the ranch at Kahuku, the boundary fence in the 1930s. Although another cabin is located mauka, north, of the CCC-era cabin, known as the Nēnē Cabin, this building is excluded from the boundary as it was constructed as a part of the Hawaiian agricultural diversification efforts on the island in 1967 does not date to the historic ranching period of Kahuku.

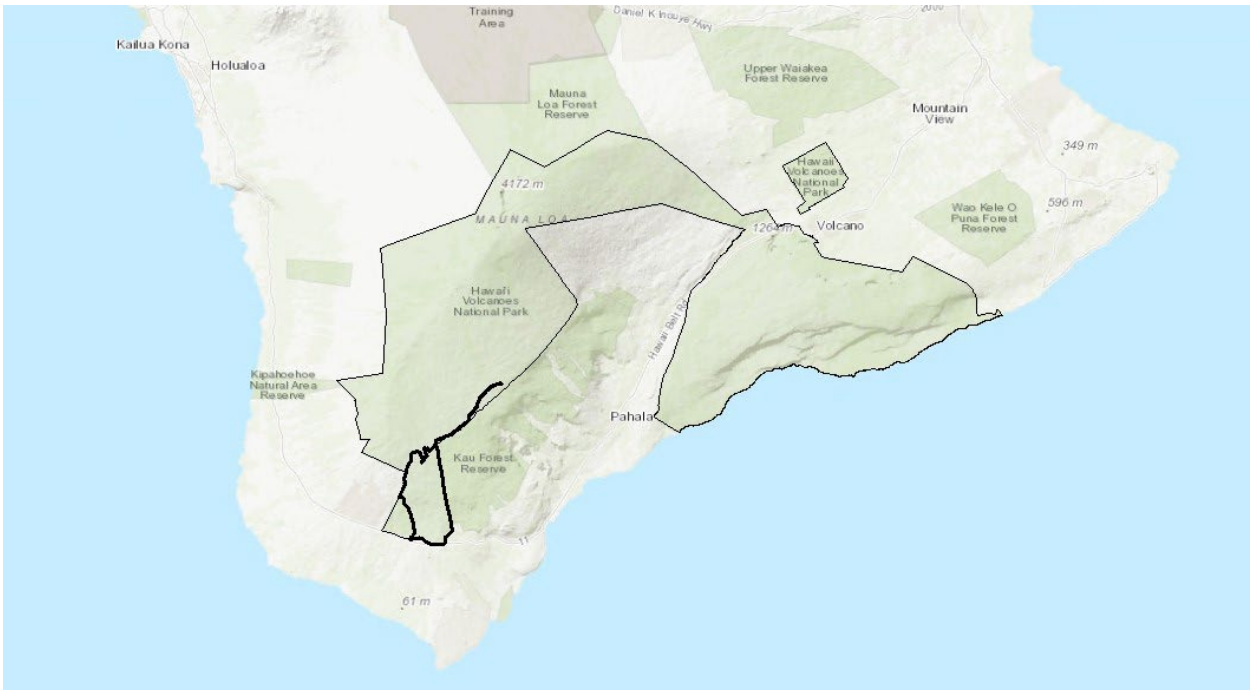
State and County:
State: Hawai'i
County: Hawai'i

Size (Acres): 13,402.45 acres

Boundary Coordinates:

Source	Type	Datum	Boundary Point	Longitude	Latitude
Other	Point	PSC NAD 1983 UTM Zone 5	A	-155.7149619	19.063849224
Other	Point	PSC NAD 1983 UTM Zone 5	B	-155.673239	19.05938195
Other	Point	PSC NAD 1983 UTM Zone 5	C	-155.6725234	19.06751918
Other	Point	PSC NAD 1983 UTM Zone 5	D	-155.6641238	19.07411294
Other	Point	PSC NAD 1983 UTM Zone 5	E	-155.6847142	19.17635863
Other	Point	PSC NAD 1983 UTM Zone 5	F	-155.6443339	19.20517828
Other	Point	PSC NAD 1983 UTM Zone 5	G	-155.6064419	19.24781579
Other	Point	PSC NAD 1983 UTM Zone 5	H	-155.6833248	19.18109691
Other	Point	PSC NAD 1983 UTM Zone 5	I	-155.6916664	19.1686762
Other	Point	PSC NAD 1983 UTM Zone 5	J	-155.6971942	19.1729437
Other	Point	PSC NAD 1983 UTM Zone 5	K	-155.6941597	19.1636122
Other	Point	PSC NAD 1983 UTM Zone 5	L	-155.6998850	19.1552103
Other	Point	PSC NAD 1983 UTM Zone 5	M	-155.7073175	19.1680414
Other	Point	PSC NAD 1983 UTM Zone 5	N	-155.7134979	19.1567423
Other	Point	PSC NAD 1983 UTM Zone 5	O	-155.7214814	19.1368884
Other	Point	PSC NAD 1983 UTM Zone 5	P	-155.7195797	19.1296697
Other	Point	PSC NAD 1983 UTM Zone 5	Q	-155.7271544	19.1145793
Other	Point	PSC NAD 1983 UTM Zone 5	R	-155.7211556	19.1133367
Other	Point	PSC NAD 1983 UTM Zone 5	S	-155.7140172	19.0944930
Other	Point	PSC NAD 1983 UTM Zone 5	T	-155.7091459	19.0740710

Location Map



Kahuku Ranch Cultural Landscape is located in the southeasternmost portion of the park-owned Kahuku unit, mauka, north, of Highway 11. The CLI boundary is denoted in the heaviest line weight (Esri Topographic Map, 2020). See Appendix F for a full-page image of the location map.

Management Information

General Management Information

Management Category: B: Should be Preserved and Maintained

Management Category Date: 01/08/2024

Management Category Explanatory Narrative:

The inventory unit meets the following criteria for Management Category B: It meets National Register criteria (criterion A); the inventory unit is compatible with the park's legislated significance; and the inventory unit has a continuing or potential purpose that is appropriate to its traditional use or function.

NPS Legal Interest

Type of Interest: Fee Simple

Public Access

Type of Access: Unrestricted

Adjacent Lands Information

Do Adjacent Lands Contribute? Yes

Adjacent Lands Narrative:

The Kahuku Ranch historically spanned the entire 184,000 acres of the ahupua'a of Kahuku, including the lower elevation lands makai, south, of Highway 11 where the historic ranch complex and headquarters were located through the period of significance. Although this area presently lies outside the park boundary, the establishment of the historic ranch core is discussed as a key component of the development of Kahuku Ranch in the physical history.

National Register Information

Existing National Register Status

National Register Landscape Documentation:

Undocumented

National Register Explanatory Narrative:

The Kahuku Ranch cultural landscape as a whole has not been previously documented or listed on the National Register of Historic Places. However, two specific resources within the CLI boundary have

received State Historic Preservation Office (SHPO) concurrence as eligible for listing on the National Register of Historic Places: the Punalu'u Kahawai Forestry Cabin under the Civilian Conservation Corps (CCC) historic context and the Zig-Zag Corral and Chute within the context of early cattle ranching. The cabin received concurrence on April 22, 2008 and was also determined potentially eligible under Criterion C for its uniqueness in building type. The corral and chute received concurrence on October 21, 2008.

In 2011, the Kahuku Base Camp, a small developed area within the Kahuku Ranch cultural landscape, also received SHPO concurrence as eligible for listing on the National Register under Criterion A specifically for its association with the context of World War II military history.

National Register Eligibility

National Register Concurrence:	Eligible - SHPO Consensus Determination
Contributing/Individual:	Individual
National Register Classification:	District
Significance Level:	Local
Significance Criteria:	A – Associated with events significant to broad patterns of our history
Period of Significance:	1912-1947
Historic Context Theme:	Developing the American Economy
Subtheme:	Cattle Frontier
Facet:	Ranches
Area of Significance:	
Area of Significance Category	Agriculture

Statement of Significance

Summary

Kahuku Ranch is locally significant for its association with the patterns of development in the cattle industry on the Island of Hawai'i and is particularly representative of the transition point in ranching history from land-responsive methods of cattle operations to more intensive infrastructure development and range management to support ranching operations in the first half of the twentieth century (Criterion A). The period of significance begins in 1912 when Kahuku underwent the first development as a part of the Parker Ranch and ends in 1947 when this initial phase of development was completed and the ranch was sold to James W. Glover. This period reflects the establishment of the foundation of modern cattle ranching on the island, on which succeeding ranching operations were built and expanded. The Parker-era Kahuku represents the integration of early ranching practices, of large pastures and open ranges, and the first efforts to operate the ranch through infrastructural development and range management.

Historic Context of Island Ranching

Prior to Euro-American contact in late-eighteenth century, traditional Hawaiian life was based on a communal subsistence economy within a feudal societal structure. The sociopolitical structure was one of rigid, pyramidal hierarchy with the highest chief or king at the top and the common people at the bottom. The king granted land to his chiefs, who then ruled over the commoners residing on the said land. The common person worked the land for his or her subsistence and to pay the necessary tribute or taxes.[1]

This sociopolitical framework in pre-contact Hawai'i solidified during the fifteenth and sixteenth centuries with advancements in agriculture and in association with dramatic population growth and the implementation of a rigid land management system. At least by the thirteenth century, Hawaiian agriculture had evolved to develop complex systems of wetland agriculture. Employing constructed features such as terraces, stone walls, and ditches, well-watered areas such as intermittent stream beds, river valleys, and open floodplains across the islands were transformed into highly cultivable, productive land. Often referred to as irrigated pondfields, the primary crop of this wetland agricultural system was taro.[2]

Following the proliferation of wetland agriculture, Hawaiian agricultural technology further evolved to cultivate those areas of higher elevation which typically had less surface water. This form of agriculture, known as dryland agriculture, emerged on the Hawaiian landscape in early-fourteenth century and took advantage of the nutrient-rich soils in the drier areas of the islands, as opposed to those wet soils that had depleted its nutrients through millennia of weathering and leaching. These fertile areas were cleared of vegetation and developed with a complex system of long, linear stone and earthen embankments that served varying agronomic functions: depending on their alignment, they captured and maintained soil moisture by blocking wind, or decreased soil erosion and created additional planting surfaces. This mode

[1] Ralph S. Kuykendall, *The Hawaiian Kingdom, Volume I 1778-1854, Foundation and Transformation*, (Honolulu: University of Hawai'i Press, 1938), p. 9-10.
[2] Noa Kekuewa Lincoln and Peter Vitousek, "Indigenous Polynesian Agriculture in Hawai'i," Oxford Research Encyclopedia of Environmental Science, March 2017, DOIL 10.1093/acrefore/9780199389414.013.376, p. 12-13.

of cultivation continued to evolve through the sixteenth and seventeenth centuries to become more expansive, into the marginal lands, and more homogenous in layout.[3]

These extensive developments in agricultural technology, which enabled the cultivation of larger sections of the land, likely yielded greater and more consistent surplus capable of supporting larger populations. On the other hand, a growing population may have served as the driving factor in expanding cultivation into marginal areas, to increase production and support a growing society. Also contemporaneous with these phenomena was the implementation of the ahupua'a system of land management, circa fifteenth century. This system established a politically controlled unit of land, an ahupua'a, nested within larger political units that were controlled by the hierarchy of chiefs. This method of land management strengthened the feudal sociopolitical structure of the islands by creating a channel of political control down to the smallest unit of land. An ahupua'a, defined by natural boundaries, was a tract of land that extended from mauka to makai, from the mountains to the sea, and contained all the varied resources therein. Once established, these boundaries were strictly enforced and commoners were not allowed to trespass on other units. This system of land management provided a sense of permanence and security to those residing on the land, as competition for resources decreased and individuals had access to the diverse resources of their respective ahupua'a.[4] While it is clear that these three historic events (the cultivation of increasingly marginal lands, population growth, and implementation of the ahupua'a system) are interrelated, there is no evident linear evolution of the three phenomena.

This mode of subsistence-based, feudal life continued until the first Euro-American contact in the late-eighteenth century. Following the arrival of Captain James Cook in 1778, Hawai'i quickly became a regular stopping point for international vessels in need of provisions. This prolonged and regular contact with the western world subsequently opened the doors for Euro-American merchants and traders to settle in Hawai'i in the early-nineteenth century; as a result, these settlers increasingly disrupted the traditional subsistence economy of the Hawaiian people. The newcomers commodified the islands' natural resources and incorporated Hawai'i into the commercial market of diverse international goods. The Hawaiian economic system shifted into a market economy.[5]

While Hawai'i was involved in three major branches of trade during the early years of its market economy, fur, sandalwood, and whale oil, the sandalwood was the only marketable commodity of these three to be actually produced in the islands.[6] While the sandalwood trade experienced immense international demand, the aromatic wood proved too popular to sustain a long-term market. These raw materials were highly valued in the production of incense, furniture, and perfume in Asia where the produced goods were then sold or traded across the world. The popularity of this Hawaiian commodity in turn brought foreign luxury goods to the islands, to which the Hawaiian royalty became accustomed. In an effort to continue their participation in the international market and sustain their life of luxury, the

[3] Lincoln and Vitousek, "Indigenous Polynesian Agriculture in Hawai'i," p.17-18, 20; Thegn N. Ladefoged, Patrick V. Kirch, Samuel M. Gon III, Oliver A. Chadwick, Anthony S. Hartshorn, and Peter M. Vitousek, "Opportunities and Constraints for Intensive Agriculture in the Hawaiian Archipelago Prior to European Contact," *Journal of Archaeological Science*, 36 (2009), p. 2375-2376; Seth Quintus and Noa Kekuewa Lincoln, "Integrating Local and Regional in Pre-Contact Hawaiian Agriculture at Kahuku, Hawai'i Island," *Environmental Archaeology*, 2020, Vol. 25, No. 1, p.54.
[4] Lincoln and Vitousek, "Indigenous Polynesian Agriculture in Hawai'i," p. 15, 17, 26-27; Christy Avery, *Volcano Ranch: An Environmental History of Kahuku Ranch*, National Park Service, September 2009, p. 5.
[5] Avery, *Environmental History of Kahuku*, p.7.
[6] The involvement of Hawai'i in the fur and whale oil trade were, in the early years of post-contact, limited to providing provisions for the trade vessels traveling to and from the trade posts, often in the form of perishable goods.

crown encouraged the Hawaiian people to maximize extraction of these resources beyond their subsistence needs. In so doing, the strictly enforced traditional land division system dwindled and people trespassed across the ahupua'a boundaries to harvest the wood. The sandalwood trade finally declined in the 1820s only after the tree was harvested nearly to extinction.[7]

The cattle industry developed in response to the collapse of the sandalwood trade in the early-nineteenth century. When the trade reached its inevitable end, numerous cultivable resources were prospected as the next primary marketable commodity. These included sugar, coffee, and other agricultural crops which were especially targeted at those in the whaling industry; however, in the early-nineteenth century, there was little return from these sectors comparable to the returns from the sandalwood trade. Although it is unclear if this was contemporaneous to or the result of the slow returns of the prospective industries, the Hawaiian royalty turned their attention to the thousands of wild cattle that roamed the island as the next marketable good.[8] These livestock animals had been presented to King Kamehameha in the late-eighteenth century: Captain James Cook had gifted the king with goats in 1778 and Captain George Vancouver had presented the king with cattle in 1793. Under royal protection (the king had forbidden their slaughter), and without the threat of other large predators, these animals multiplied rapidly. In fact, until 1778, the only land mammals on the island consisted of small lightweight pigs, dogs, Polynesian Rats, and Hoary Bats, of which only the bats were endemic to the islands.[9] In a worldwide demand for meat, hides, and tallow, the Hawaiian royalty believed that the cattle trade would enable them to continue their life of luxury goods.[10]

As the market strengthened with the steady demand by American consumers and transportation of goods expedited by whaling and merchant ships based in the islands, ranching boomed across Hawai'i. By the mid-nineteenth century, immigrants and the Hawaiian people alike took advantage of new private property laws and the thousands of wild goats and cattle that roamed the islands to establish private ranches.[11] Ranching became the most widespread on the Island of Hawai'i where half of all cattle in the Hawaiian Islands roamed at the time and large expanses of land suited for this use were available. While the Island of Hawai'i was deemed to contain the lowest percentage of cultivable land in the archipelago (some 20 percent),[12] these statistics eliminated competition for other agricultural pursuits such as rice and sugar cultivation and enabled ranchers to utilize these otherwise "marginal" lands.[13]

Although thousands of acres of lands were established as cattle ranches through the latter half of the nineteenth century, the developing industry assumed a land-responsive management approach that not involve preemptive maximization of the land's potential for capacity and production. During this time, new ranchers did not intensively develop the land in order to increase their operating capacity but took

[7] Avery, *Environmental History of Kahuku*, p.8.
[8] Given the imminent, explosive growth of the sugar industry in Hawai'i, which, along with tourism became a backbone of the island economy, the emphasis on, and the proliferation of, the cattle industry in the early-nineteenth century may have been influenced by those controlling the initial markets. Independent businessmen pursued the sugar, coffee, and other agricultural markets; the monarchy drove the cattle industry.
[9] Burt Smith, George Love, and Earl Spence, "Livestock in the Land of Aloha," *Rangelands*, Vol. 5, No. 3, June 1983, p.100.
[10] Avery, *Environmental History of Kahuku*, p.8.
[11] Ibid., p.2.
[12] This low number may have been based on a Euro-American assessment of cultivable lands and not based on the traditional Hawaiian use of land, or that it was assessed after volcanic activities that damaged significant sections of the island, including Ka'ū.
[13] Ibid., p.12.

advantage of the resources already available. They looked to the large numbers of wild cattle in these ranches as their primary livestock (of 20,000 head of cattle roaming the slopes of the Island of Hawai'i in 1851, only 8,000 were tamed)[14] and did not actively establish their own herds of tamed cattle; they built fences to keep these wild animals from wandering off their ranch and into neighboring land. They also relied on the available natural resources of the island as forage rather than establishing pastures of optimal grass palettes. While the ranchers expended efforts to establish a domestic core in the ranch for themselves, cattle-related improvements were most often limited to stone walls, barns, outbuildings, corrals, and chutes, the minimal necessities of a cattle operation. Little attention was given to improve the methods of cattle and ranch management.[15]

Such minimally-developed cattle ranching operations are evident at Kahuku Ranch through the late-nineteenth century. When the former ahupua'a of Kahuku first established as a cattle ranch in 1866,[16] owner Robert Brown reportedly established a domestic complex for his family and employees. However, the extent of improvements associated with the actual ranching operation were limited to the construction of stone walls to delineate pastures and paddocks. While he and his family planted ornamental vegetation for gardens, there were no reports of active infrastructural development or pasture management at Kahuku. Like Robert Brown, the following owner of Kahuku Ranch, George Jones, expended great efforts to establish a domestic core at the ranch. His family home was equipped for hosting visitors and included all the necessities such as a bath house, ironing room, kitchen, and dining room. Jones also established the base of ranch operations with an office, a blacksmith shop, and numerous workshops. However, also like Brown, Jones was not known to have actively improved the operation of his expansive 184,000-acre ranch through infrastructure. Like his predecessor, Jones' Kahuku Ranch operation were almost completely dependent on the natural weather patterns and rainfall, and relied on natural water holes and cisterns to supply not only the domestic core but also the cattle and pastures.[17]

The impacts of such limited cattle management across the island altered the natural and traditional environment. Oceanic islands like the Hawaiian Islands were especially susceptible to colonization by nonnative plants as they had been sheltered from many of the events that continental plants routinely faced, such as livestock trampling, insect infestations, and disease. When animals consumed native plants, they also spread seeds of exotic plants in their manure. Many of these alien plants thrived in disturbed soil, predominantly in heavily grazed lands. As both the tamed and wild livestock population grew and were allowed to graze freely across the extensive ranch lands of the Island of Hawai'i during the mid-to-late-nineteenth century, the most fertile plains were overgrazed and replaced by noxious weeds. While some of these nonnative species provided good forage, much of the dominating species, such as Hilo grass, proved an unpalatable plant. This shift in vegetation pushed cattle to roam farther and disturb the natural vegetation upslope. Further resulting from this process, the traditional Hawaiian land management practices were also subject to erasure: as cattle roamed across the landscape, they were prone to disturb, if not completely destroy, the complex systems of walls and embankments that comprised large sections of dryland field system.[18]

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[14] Kepa Maly and Bruce A. Wilcox, "A Short History of Cattle and Range Management in Hawaii," *Rangelands*, Vol. 22, No. 5, October 2000, p.22.
[15] Avery, *Environmental History of Kahuku*, p.2; Chalmer Kirk McClelland, "Hawaii Agricultural Experiment Station, Bulletin No. 36 Grasses and Forage Plants of Hawaii," U.S. Department of Agriculture, Office of Experiment Station, February 20, 1915, p.7.
[16] While the Kahuku Ranch entered private ownership in 1861 under Charles C. Harris, the land was not developed as a cattle ranch during his 5-year tenure.
[17] See the Physical History section for a detailed discussion of the ranch development under these owners.
[18] Ibid., p.14.

By the turn of the century the ranchers had become more aware of the devastating effects of the ranch management methods of the previous decades on the economics of their operations. This realization resulted in a shift to a systematic approach to improve operating capacity by responding to overgrazed and disturbed lands, and limited feed during droughts, through more developed pastures. Around this time, island ranchers began to introduce "tame grasses" and other forage plants while destroying the "undesirable" grasses and weeds. They also began to grow crops and establish a backup supply of feed for livestock during periods of drought and shortage of forage.[19] Most significantly associated with these efforts were the development of reliable water systems to sustain not only the cattle, but also the improved pasture vegetation. Where early island ranchers had relied on simple water catchments and cisterns to supply their operations, the ranchers around the turn of the century began to introduce complex water conveyance systems. In contrast to the relatively small-scale (in that the improvements to the infrastructure of the ranches were minimal) ranches of the nineteenth century, large, organized ranch operations began to dominate the industry in Hawai'i in the twentieth century.[20]

One of such large, organized cattle ranches of the time was the Parker Ranch. The Parker Ranch was a cattle operation established by John Palmer Parker, the first man allowed by the king to shoot wild cattle that roamed the island slopes and who significantly contributed to the proliferation of the beef, hide, and tallow market in the Hawaiian Islands, in 1847. During his leadership of the ranch, until his death in 1868, Parker established a well-built domestic core of the ranch, cleared land for his trucker garden, and kept a semidomesticated herd of cattle. He and his ranching team built cisterns to capture precious rainwater, stone walls to safeguard the ranch herd, and built corrals, barns, and other ranching structures for the operation of the ranch. Comprising some 640 acres by 1850, the Parker Ranch established as a quality operation of its time.[21] However, from the time of Parker's death through the late-nineteenth century, the impacts of minimal infrastructural development, characteristic of the ranches of mid-nineteenth century, began to present themselves in the business, and coupled with the challenges in management in the absence of its original founder, the Parker Ranch substantially declined by the end of the century.[22]

At the turn of the century, Alfred Wellington Carter was appointed ranch manager and granted control of Parker Ranch as the guardian of and trustee for Parker Ranch heir Thelma Parker. Under Carter's leadership, Parker Ranch transformed from an operation of minimal infrastructure, inadequate water facilities, and overgrazed pastures, inevitable characteristics of a mid-nineteenth century ranch, into a business with modern and highly developed management techniques. The ranch manager used new techniques in agriculture, pest control, animal husbandry, and forestry management in the early 1900s to develop the ranch to its fullest capacity. Within the first decade of his role as ranch manager, Carter had successfully established Parker Ranch as an organized, large-scale ranch. Carter's contributions to the Parker Ranch enabled the operation to carry on into the next century to become one of the oldest, longest-

[19] "Bulletin No. 36 Grasses and Forage Plants of Hawaii," p.7.
Both the initial destructive patterns of the cattle and the response of the ranchers, who not only introduced additional species of flora that competed with the endemic vegetation but also cleared forests for pasture development, continued to prove detrimental to the natural (and traditional) landscape. In an effort to protect the watershed, the Forest Reserve System was created by the Hawaiian government in 1903, under which authority the Ka'ū Forest Reserve, neighboring Kahuku, was established in 1906. ("Ka'ū Forest Reserve," State of Hawai'i, Department of Forestry and Wildlife, Forestry Program, accessed April 2, 2021, https://dlnr.hawaii.gov/forestry/frs/reserves/hawaii-island/kau/.)
[20] Avery, *Environmental History of Kahuku*, p.28.
[21] Joseph Brennan, *The Parker Ranch of Hawai'i, The Saga of a Ranch and a Dynasty*, (Honolulu: Mutual Publishing LLC., 2004), p.78-99.
[22] Ibid., p,100.

operating cattle ranches in not only the Hawaiian Islands but the country; the Parker Ranch continues its operations today. Upon reviving the Parker Ranch from the calamities of the late-nineteenth century, Carter looked to expand the ranch operation.[23]

When the Kahuku Ranch was put up for sale in 1911, the vast, albeit volcanic, terrain of the southern ranch piqued the interest of Alfred W. Carter. Upon personal inspection of the ranch, Carter noted that lava covered approximately 140,000 acres of the ranchlands and that nonnative grasses of little nutritional value, such as Hilo grass and Bermuda grass, carpeted the fertile range; despite these observations, he found the land promising as a southern extension of the Parker Ranch. Where few people saw little potential in the volcanic landscape, Carter saw what the land could become upon applying the advanced methods of ranch management as he had done at Parker Ranch. That Carter assessed, and purchased, Kahuku Ranch at a price that was deemed too high by other potential buyers, for $100,000 in 1912, signaled the transition point in the development of Kahuku as a cattle ranch. Under the direction of Alfred Carter, Kahuku Ranch would come to represent the evolution of cattle ranching in Hawai'i.[24]

Soon after the purchase of Kahuku Ranch, Carter appointed Parker Ranch paniolo (cowboy) James Lindsey to manage the new unit. Through the remainder of the decade, Carter set Lindsey and the other employees to work to bring the newly acquired land up to par with the main ranch. One of Carter's first directives was to improve the grasslands at Kahuku. As he had done at Parker, Carter sought to improve the pastures and therefore the quality of the livestock. Hilo grass and Bermuda grass in overgrazed fields were ploughed swiftly and efficiently in the early years and a carefully selected species of forage grasses, clovers, and legumes (tested on experimental plots and tried at the main ranch) were sown. These newly sown and restored pastures were enclosed with stone walls and fences. The enclosing of the pastures enabled Carter to introduce a rotation system that would eliminate the dangers of overgrazing. Corn was also sown for livestock feed.[25]

Also immediately following the purchase of the ranch, Carter set out to construct a boundary fence around the newly acquired property. In late-1912, he hired surveyor G.F. Wright to survey the line of Kahuku on the Ka'ū side to clearly identify the boundary of the new ranch. Wright found that the existing boundary fence, either established under Jones' management when the property boundary was legally fixed, or built by adjacent property owners, was largely inaccurate and that the surveyed boundary line crossed the old fence in multiple places, in some instances "quite a distance from the old fence."[26] These new findings allowed for Carter to allot the proper funding for the construction and minimize the potential for error in alignment. Upon completion of the survey in 1913, the new ranch manager convinced neighboring landowners, George Gibb of Hutchinson Sugar and C. Brewer of C. Brewer & Company, to each fence one-third of the boundary.[27] These fences were completed circa 1915, though Carter was dissatisfied with the quality of the fence built by his neighbors. As such, in 1936, Carter readily entered into an arrangement with the Territorial Forestry Department and the Civilian Conservation Corps (CCC) to build a new fence.[28]

[23] Avery, *Environmental History of Kahuku*, p.28; Brennan, *The Parker Ranch of Hawai'i*, , p.121, 132.
[24] Avery, *Environmental History of Kahuku*, p.29.
[25] Brennan, *The Parker Ranch of Hawai'i*, p.132.
[26] George Gibb (Hutchinson Sugar) to C. Brewer & Co., March 19, 1913, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[27] A.W.C. to W.E. Wall, Surveyor, November 27, 1912 and C. Brewer to A.W.C. March 25, 1913, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[28] Avery, *Environmental History of Kahuku*, p.34;

Contemporaneously with the initial range management and boundary survey, and perhaps most importantly, thousands of feet of pipes were laid, and numerous water sheds and tanks were constructed to harness the scarce water sources within the ranch boundary. Since as early as the time of contact, water at Kahuku had been deemed a challenge to potential Euro-American settlers: Captain Cook's crew men noted only brackish water available during their survey.[29] By 1918, the "Kahuku Pipeline," a 10,974-foot water conduit was completed and connected the higher elevation water spring with the main ranch core in the lower elevations.[30] A 1924 topographic map shows that the pipeline followed the general alignment of the Kahuku-'Āinapō Trail (just south of the split into east and west branches) on a north-south axis in the southern central portion of the ranch. At the northern end of this pipeline, at about 3,500 feet above sea level, watershed is depicted as a part of the water system. The pipeline continues southward and terminates just west of the ranch core. Further north along the eastern branch of the Kahuku-'Āinapō Trail, at about 4,500 feet, is another watershed that served water features in the upper regions.[31] This development of a water collection and conveyance system would serve a crucial role in the successful operation of the ranch under the Parker Ranch operation and under future ownership, as both land production and human labor critically depended on the availability of water.
Accounts from Parker-era ranch workers confirm that the Kahuku-'Āinapō Trail was also used as the passage for cattle drives during the early years under Carter's management. Though its period of establishment is uncertain, the Kahuku-'Āinapō Trail was a part of an "old trail system" that connected various cattle ranching operations associated with the Parker Ranch, with stopover locations at Kapāpala Ranch, Keauhou Ranch, Humu'ula Sheep Station, and Pu'u 'Ō'ō Ranch. Since as early as 1918, paniolos drove cattle to Kahuku via this "old cattle trail."[32] Former ranch worker Rally Greenwell and son David Greenwell also noted that while cattle drives were done by trucks during their tenure in the late-1930s and 1940s and therefore the drives via the trail were only made once every five to ten years, paniolos would run the cattle on the trail more frequently in the earlier years of the Parker era.[33]

Development of these ranch infrastructure persisted through the thirty-five years of Parker Ranch management of Kahuku Ranch. By the time Carter sold Kahuku in 1947, the ranch had fences, water tanks, and pastures with palatable, nutritious grass species characteristic of ranches of the twentieth century. Although it never escalated in value as significantly as Carter had hoped, unable to increase the original acreage identified as pastureland at the time of purchase, some 15,000 acres, the quality of these pastures and the operation of the ranch improved significantly.[34] Kahuku Ranch had successfully evolved into a large, organized, and operational cattle ranch.

Criterion A

[29] Ibid., p.7.
[30] Ibid., p.31-34.
[31] Honuapo Quadrangle, U.S. Geological Survey, 1924.
It is also possible that this watershed fed into the southerly watershed by natural gravitational flow.
[32] Christopher L. Quiseng, B.A., *Kahuku Inventory Survey 2004 – 2005: An Archeological Report on the Phase I Kahuku-Ainapo Trail Inventory (2004) and Phase II Transect Reconnaissance (2005)*, Hawai'i Volcanoes National Park, April 2008, p. 13; Rick Warshauer, "The Proposed Mauka Trails system – Historical Setting, Alignment, Physical Setting, and Natural History," Submitted to the Nature Conservancy, October 2005, p. 10. While Warshauer proposes a pre-contact Hawaiian origin, the reports of a trail that existed above the woodlands at Kahuku around the time of Carter's purchase of the ranch suggests that the Kahuku-'Āinapō section of the trail may have been established under Carter's direction to connect the pastures to the existing trail.
[33] Quiseng, *Kahuku Inventory Survey*, p. 33; Rally Greenwell and David Greenwell, interview by Kepā Maly and Laura Carter, February 15, 2004. Interview notes on file at Hawai'i Volcanoes National Park Archives.
[34] Avery, *Environmental History of Kahuku*, p. 38.

Kahuku Ranch is locally significant under Criterion A as representative of the transition point in island ranching history from land-responsive ranching practices to developed cattle operations in the first half of the twentieth century. Kahuku Ranch reflects the early ranching land use patterns and a transition to a more intensively developed ranching operation by adapting existing pasturelands with the application of new range management techniques, a clear delineation of the ranch boundary, and the construction of a complex water conveyance system that maximized the availability of water and enabled its effective and efficient distribution across the ranching landscape to support palatable grasses for cattle feed through the year.

While questions have been raised about the extent to which the traditional Hawaiian dryland field systems influenced the development of the Kahuku pastures, an analysis of the recent archaeological study conducted at Kahuku[35] suggests that the dryland agricultural practices and associated infrastructure from the fifteenth to seventeenth centuries did not directly impact the development of the cattle ranch. While agronomic investigations involving a Geographical Information System (GIS) predictive model have identified Ka'ū as a site of dryland agriculture in 2009, the 2020 targeted archaeological study at Kīpuka Ka'ōpapa, an area surrounded by one or more younger lava flows, located immediately north of Highway 11 and west of Kahuku Road at an elevation between 2,000 and 2,200 feet, has determined this site to be the general northern extent of the Ka'ū field system.[36] As most of the Parker-era pasture developments mauka, north, of the highway took place north and northwest of this kīpuka and extended up to 5,000 feet in elevation, beyond the defined northern extent of the Ka'ū dryland field system, it is unlikely that the developments from the period of significance within the cultural landscape boundary were directly influenced by the traditional Hawaiian land use.

Aspects of early ranching practices are most notably conveyed through the size of paddocks established during the period of significance. The pasture-paddocks developed under the management of Carter, located to the primarily to the west of the main mauka (north) road, present-day Kahuku Road, and the Glover Trail/east branch of the Kahuku-'Āinapō Trail, between the present-day Highway 11 and 5,000-foot elevation, were larger than those established by his successors, particularly Freddy Rice. Rice described the Parker-era paddocks as "larger and not dissected," compared to those that he had developed, which were each divided into quadrants to support a hyper-systematic grazing rotation.[37] These larger paddocks, while encompassing the water conveyance system and delineated to protect the newly sown grasses from overgrazing, demonstrate the less-intensively developed cattle operations of the early ranching era. The paddocks' larger size is particularly evident in contrast to the neighboring Damon Estate-era paddocks to the east of the road and the Glover Trail/east branch of the Kahuku-'Āinapō Trail which demonstrate a complex system of quadrant rotation.

The alignment of the Kahuku-'Āinapō Trail from the pasture-paddocks to the northeast of the ranch also conveys the early island ranching practices of overland cattle drives. Transportation of livestock had presented a challenge to all island ranchers since the beginning of the ranching industry in Hawai'i in the early nineteenth century. The lack of shipping facilities and the unwillingness of shipping companies to handle livestock with care made inter-island transportation of cattle exceptionally difficult and complicated. While Alfred Carter was at the forefront of tackling this issue and eventually, together with other prominent Hawaiian ranchers, established a steamship company solely for the purpose of

[35] Quintus and Lincoln, "Integration Local and Regional in Pre-Contact Hawaiian Agriculture," p. 53-68.
[36] Ibid., p. 56; Ladefoged et al, "Opportunities and Constraints for Intensive Agriculture," p.2378.
[37] Harold Freddy Rice, Jr., interview by Laura C. Schuster, June 6, 2004. Interview notes on file at Hawai'i Volcanoes National Park Archives.

transporting cattle, these efforts would not prove successful until at least the mid-1920s. In the meantime, Carter stocked his newly acquired Kahuku Ranch with cattle that were driven from Waimea, upland and around Mauna Kea and Mauna Loa.[38] While the frequency at which these overland, horse-back cattle drives occurred decreased through the decades with improvements in water transportation and the introduction of automobile-based cattle drives, the Kahuku-'Āinapō Trail was used at least as the passage to stock the Kahuku Ranch during the early years of the Parker era and represents the early island ranching patterns of cattle transportation, specifically, the difficulties in water transportation of livestock.

Other infrastructural development at Kahuku Ranch under Carter's management was the construction of a system of ranch roads. During the period of significance, particularly in the early years, ranch records showed that the existing circulation system was improved and repaired and new roads were constructed at Kahuku. While the locational information of these developments is lacking, the 1922 topographic map shows various dirt trails coursing mauka, northward, from the present-day Highway 11.[39] A 1954 aerial photograph also shows the present-day alignment of the Kahuku Road, particularly the section north of 3,500 feet in elevation, in close spatial affiliation with the water features, which suggests that this section of the road was established in association with the development of the water conveyance system. This hypothesis is further supported by the knowledge that the ranch owner succeeding Carter, James W. Glover, was suggested to have minimally improved the ranching infrastructure during his management of Kahuku between 1947 and 1958 and thus was unlikely to have established a new ranch road. The same photograph also depicts dirt roads delineating the western pastures which, along with the other mauka (north) dirt trails, were also likely developed in association with the new pasture-paddocks to improve efficiency in access.

While the number of cultivated pasture acreage, some 15,000 acres, did not increase beyond his initial estimation of grazing potential during his management of Kahuku Ranch, Carter vastly improved the efficiency of the cattle operations through the introduction of a carefully selected palette of grasses and other feed. At the same time, he tapped into the natural, albeit limited, sources of water to maximize capacity and distribution throughout the pasture system. Based on the natural topography of the area, the Kahuku Pipeline took advantage of the gravitational flow to catch water upslope and convey water downslope. The thousands of feet of pipes and associated water features such as water tanks and troughs that comprised the Kahuku Pipeline supported increasingly intensive cattle operations through the following years. Though the Parker-era water system has been repaired, re-piped, and expanded upon through the decades of ranching operation, the water conduit still retains its general southerly alignment from the reservoir seaward to the lower elevations and display two distinct areas of concentration of water features at 3,500 feet and approximately 5,000 feet above sea level consistent with the locations of the Parker Ranch-era watersheds.

In addition to enhancing the Kahuku Ranch cattle operations by establishing a complex water conveyance system, Carter safeguarded the ranch's land and herd through additional infrastructural development. Specifically, the construction of a clearly surveyed and delineated boundary line not only physically established a sense of Parker Ranch's ownership and jurisdiction of Kahuku but also prevented the ranch's increasingly improved herd from wandering into adjacent lands.[40] Without a properly fenced

[38] Avery, *Environmental History of Kahuku*, p. 35; Quiseng, *Kahuku Inventory Survey*, p. 14.
[39] A.W. Carter, October 14, 1913, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives ; Kahuku Quadrangle, U.S. Geological Survey, 1922.
[40] Through the first half of the twentieth century, Carter had actively improved the quality of the Parker Ranch herds by importing purebreds of varying favorable traits to increase the cattle's hardiness and overall size, and to reduce risk of disease. (Billy Bergin, *Loyal to the Land: The Story of Parker Ranch* (Honolulu : University of Hawaii Press, 2004), p. 199.

boundary, the financial and managerial efficiency of the cattle operation would dwindle from the loss of cattle. While an earlier iteration of a boundary fence was in place by the time Carter arrived at Kahuku, the 1913 survey proved that this delineation was largely inaccurate and presented the risk of future challenges and contestations over property ownership. It appears, then, that under Carter's management, the sense of Kahuku as a private property and a legitimate cattle operation emphasized, especially with the delineation of its boundaries. This significance of the boundary fence as both an emphasis of property ownership and as a means of enclosing the valuable livestock within ranch lands for financial and management efficiency is further highlighted in 1936 when Carter expresses his frustrations over the quality of the construction of the boundary fence: he complained that portions of the boundary fence built by the adjacent property owners were so poorly constructed that "they would not hold cattle."[41] In the same year, he entered into an agreement with the Territorial Forestry Department and the CCC to build the fence anew, and properly. While, like the water conveyance system, the eastern boundary fence of Kahuku has been repaired and replaced through the decades of active cattle ranching, the fence retains its alignment as established by the 1913 survey and continues to mark the extent of property ownership.

Criteria B

National Register Bulletin 15 stipulates that a property eligible under Criterion B should be one that "best represent[s] the person's historic contributions" and that multiple properties may be eligible in association with the same individual if each "represents a different aspect of the person's productive life."[42] Although Kahuku Ranch is associated with Alfred Wellington Carter, a historically significant figure of the Hawaiian cattle industry, it is not the only property that demonstrates his contributions to the industry. Carter, a Honolulu-born son of a whaler who had distinguished himself in various sectors of island commerce and government, was inducted into the Paniolo Hall of Fame in 2003 in recognition for his accomplishments "running Parker Ranch."[43] Carter managed and operated the main Parker Ranch for almost fifty years, a period over a decade longer than that of his association with Kahuku Ranch, and is more widely known and credited for his contributions to the building, maintaining, and preservation of the ranching enterprise in Waimea. As such, Kahuku Ranch does not meet National Register Criterion B for its association with Alfred Wellington Carter, and is not associated with any other historically significant figures of the Hawaiian cattle industry.

Criterion C

Kahuku Ranch is not eligible under Criterion C. There are several buildings within the Kahuku Ranch cultural landscape, but none of them are individually or collectively eligible under Criterion C because they do not represent a specific type, period, or method of construction. Additionally, the ranching landscape is not significant for specific design styles or methods of construction.

There are two main buildings within Kahuku Ranch: Kahuku Ranch Single Residence (Building 403) and Kahuku Ranch Dorm Residence (Building 404) that were originally constructed in the Plantation style. The Kahuku Ranch Single Residence (Building 403) was constructed outside the period of significance of the military era, 1942-1944, and outside of the ranching period of significance of 1912-1947. The Kahuku Ranch Single Residence was built circa 1973, under the management of the Damon Estates. The Kahuku

[41] A.W.C. to R. Smart, November 27, 1936, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[42] National Park Service, *National Register Bulletin 15: How to Apply the National Register Criteria for Evaluation*, Department of the Interior, 1995, p. 14-15.
[43] "Alfred Wellington Carter," Paniolo Hall of Fame, Hawai'i Cattlemen's Council, Inc., accessed May 5, 2022, https://www.hicattle.org/paniolo-hall-of-fame/inductees/alfred-wellington-carter.

Ranch Dorm Residence (Building 404) has lost physical integrity to the historic period. The Kahuku Ranch Dorm Residence was constructed for use as a dormitory, or barracks, at the Kahuku Base Camp circa 1942; the military release of the base camp site and the subsequent modifications of the building to accommodate ranching operation needs during the period of significance have modified the vernacular Hawaiian architectural character that remains today. The vernacular architectural character was further modified in 2018 when the building was moved eight to ten feet away from the hillside. During this effort, the laundry room addition was removed and the roof was repaired to its original profile.[44] The Kahuku Ranch Dorm Residence is not a good example of the Plantation style architecture due to these modifications and the relocation of the building.

The remainder of the buildings and structures, comprising a variety of shops and shed, at the developed area were non-residential, utilitarian buildings that were constructed by the military and adapted by the ranchers strictly for operational use. These structures do not reflect the tenets of the Plantation or any other vernacular Hawaiian architectural styles and do not conform to a typical vernacular ranching style because they were adapted from military construction.

Further, the landscape is a blend of several periods of development that does not reflect a specific type, period, or method of construction. The pasture-paddock system of land division at Kahuku Ranch is a specific land use, rather than a specific design, and therefore also does not qualify as a distinctive type of construction under Criterion C.

Criterion D

Kahuku Ranch area has only undergone a reconnaissance archaeological survey (*Kahuku Inventory Survey 2004 – 2005" An Archeological Report on the Phase I Kahuku-Ainapo Trail Inventory (2004) and Phase II Transect Reconnaissance (2005)* by Christopher L. Quiseng) and has not yet been fully evaluated for information potential under Criterion D within the historic ranching context.

World Heritage Status

Hawai'i Volcanoes National Park was listed as a World Heritage Site in 1987 under Criterion (viii) as a unique example of significant island building through ongoing volcanic processes. While the Kahuku Ranch is located within the boundaries of the park, it lies outside of the boundary of the World Heritage Site.

National Historic Landmark Information

National Historic Landmark Status: No

[44] "Kahuku Buildings Repair and Rehab Work," Planning, Environment, and Public Comment (PEPC) # 82257, July 18, 2018.

World Heritage Site Information

World Heritage Site Status: No

Chronology & Physical History

Cultural Landscape Type and Use

Cultural Landscape Type: Historic Vernacular Landscape

Current and Historic Use/Function

Primary Historic Function–Major Category: Agriculture/Subsistence

Primary Historic Function–Category: Livestock

Primary Current Function–Major Category: Recreation/Culture

Primary Current Function–Category: Outdoor Recreation

Primary Current Use: Outdoor Recreation – Other

Current and Historic Names

Current and Historic Name	Type of Name
Kahuku Ranch	Current and Historic
Kahuku Unit	Current
Kahuku Management Unit	Current

Chronology

Date	Period	Event	Annotations
300-500	CE	Settled	The first Polynesian settlers from the Marquesas Islands arrived in the Hawaiian Islands.
300-1200	CE	Established	Some 23 subsistence plants were introduced to the Hawaiian archipelago by the Polynesian settlers.
ca.1200	CE	Constructed	The first irrigated terrace and pondfield system of agriculture appeared on the landscape at least by 1200 CE.
Early-1300s	CE	Constructed	The first dryland agricultural cultivation sites appeared on the landscape beginning in the 14th century.
1400-1500	CE	Established	The ahupua'a system of land management was adopted across the Hawaiian Islands.
1400-1700	CE	Constructed	The dryland agricultural field systems grew more extensive and homogenous across the island landscape.
1400-1600	CE	Constructed	Development of the Ka'ū Dryland Field System (KDFS) began in the 15th century and expanded and intensified into the 16th and 17th centuries.
1778	CE	Explored	Captain James Cook reached the Hawaiian Islands and marked the beginning of Euro-American contact.
1786	CE	Established	Trade and whale ships began to stop in Hawai'i for provisions.
1793	CE	Explored	Captain George Vancouver gifted King Kamehameha with cattle. The king forbade their slaughter.
Late-18th Century	CE	Established	The sandalwood trade began in Hawai'i .
Early-19th Century	CE	Established	The traditional subsistence-based economy of Hawai'i shifted to a market economy.
1820s	CE	Farmed/Harvested	Kahuku was renowned for its sandalwood and commoners from across the island trespassed on the ahupua'a in hopes of finding the resources.
1820s-1840s	CE	Established	The main commodity in Hawai'i began to shift from sandalwood to the cattle market.
1839	CE	Established	King Kamehameha III and the Hawaiian chiefs agreed to reform the land ownership system: the Hawaiian Bill of Rights was passed to reflect the belief that commoners had rights to the land.

Date	Period	Event	Annotations
1840	CE	Established	Hilo grass, a tough but unpalatable plant, appeared on the Island of Hawai'i . It quickly and aggressively spread across the grasslands into the forests where it choked out native forest undergrowth.
1840	CE	Established	Hides, not sandalwood, became the biggest export in Hawai'i.
1848	CE	Land Transfer	The Hawaiian government awarded Kahuku to William Pitt Leleiōhuku but he subsequently surrendered the land back to the government in order to keep title to other lands he had been granted, as required by Hawaiian law.
1850	CE	Land Transfer	By 1850, commoners were awarded about 29,000 acres of land.
1850s	CE	Established	Kahuku forests had been denuded of sandalwood, some Native Hawaiian farms had been abandoned and overrun by wild cattle, and others that had grown staples of the Hawaiian diet now produced foods that were valuable to American consumers and merchant ships.
1850s	CE	Established	Residents of Ka'ū fled to growing cities and left the landscape less populated.
1861	CE	Purchased/Sold	Charles C. Harris was granted the Kahuku parcel by King David Kalākaua under Patent 2791 for $3,100. The land was advertised to contain 2,500 wild goats and unknown numbers of sheep and cattle. Harris was involved in pulu collection.
1866	CE	Purchased/Sold	Harris sold Kahuku to Robert and Theopolis Brown in 1866, just five years after he purchased the ranch, for $5,250.
c.1866	CE	Built	Brown built his domestic complex some seven miles upslope from the sea to include a three-bedroom lavastone home with an adjacent kitchen and dining room, and five additional employee houses.
1866-1867	CE	Built	Brown built stone walls to delineate pastures and paddocks for cattle, goats, and pigs.
1866-1867	CE	Planted	Brown planted rows of mulberry, fig, peach, and other tropical fruit trees to the front of the main house. A large orchard of banana trees was planted near the domestic complex. A beautiful garden with long shaded walks flanked by flowers was established, with golden hearted lilies, baby's breath, and a Japanese pepper tree.
1868	CE	Established	Mauna Loa erupted causing violent earthquakes to begin on March 27.

Date	Period	Event	Annotations
1868	CE	Destroyed	The Mauna Loa eruption destroyed Robert Brown's ranch home and the stone walls that framed the paddocks, pastures, and gardens. The temblors destroyed the cistern under the residence and cracked and drained all its valuable water reserve.
1868	CE	Destroyed	On April 7, lava burst from a fissure about a mile above the Brown house and consumed the Brown house and gardens, paddocks, pastures, and even livestock. Some 2,000 acres of Kahuku were destroyed by lava. The family and ranch employees fled to Wai'ohinu.
1869	CE	Established	Another wave of severe earthquakes shook Ka'ū.
1871	CE	Purchased/Sold	Robert Brown sold Kahuku and the remaining cattle and goats to George Jones, William H. Reed, Charles E. Richardson, and Lord George Kaina for $8,000 in September 1871.
Eary-1870s	CE	Platted	The new owners of Kahuku applied for a boundary commission hearing to determine the ranch's exact boundaries. The Ranch boundaries were legally fixed.
1872-1873	CE	Planned	The new owners of Kahuku received a price quotation for the first road from Wai'ohinu to Kahuku.
1877	CE	Purchased/Sold	By 1877, or possibly sooner, George Jones bought out his partners of their shares of Kahuku.
c.1877	CE	Built	Jones built a one-and-one-half story clapboard structure at about 2,000 feet above sea level, makai, south, of Māmalahoa Highway, outside the present park boundaries. The ranch house consisted of three bedrooms and a parlor on the ground floor, with a large room on the upper level to be used as the boys' bedroom. The kitchen and dining room were separate but connected to the main house by ornamental vegetation. A veranda was located to the east of the house where a room, or a guest cottage, was kept ready for guests.
c.1877	CE	Built	A bath house, ironing room, and the residences of the Hawaiian and Chinese employees were located behind the main ranch house. A storage building for livestock feed with an adjacent office, a blacksmith shop, and a number of workshops were also constructed, establishing the ranch core. These structures were a part of the ranch complex, located makai, south, of Māmalahoa Highway, outside the present park boundaries.

Date	Period	Event	Annotations
c.1877	CE	Planted	The Jones family created a garden landscape of scarlet trumpet flowers, honeysuckles, violets, heliotrope, tuberoses, and verbena. Mulberry and pepper trees were planted as windbreaks, eucalyptus and magnolia provided shade across the landscape; two cypresses were also planted. Gardens of morning glories, mountain apples, oranges, limes, guava, and cherimoya were also established. The garden landscape was established around the ranch house, makai, south, of Māmalahoa Highway, outside the present park boundaries.
c.1877	CE	Built	Stone fences, a pen for calves, paddocks, and a new dairy were constructed to the north of the yard.
1883	CE	Established	Kahuku Ranch recovered from its devastated state and became a functioning cattle operation.
1887	CE	Established	Mauna Loa erupted causing two streams of molten lava to pour out about ten miles north of the Joneses' home. The lava streams stopped short of the ranch buildings and left Kahuku overall intact.
1888	CE	Purchased/Sold	Jones sold Kahuku to Colonel Samuel Norris for $28,000 to include 184,628 acres, livestock, and improvements.
1907	CE	Destroyed	A fourteen-day eruption caused a fissure to appear a mile-and-a-half from the ranch buildings and the lava flow burned forests, covered pastures, and buried parts of the road.
1910	CE	Land Transfer	Norris "sold" Kahuku Ranch to his ranch staff Charles Macomber for $1. This sale included the land but not the livestock.
1912	CE	Purchased/Sold	Alfred Wellington Carter purchased Kahuku Ranch for $100,000 on behalf of the Parker Ranch.
1912	CE	Planted	Carter ordered workers to plow as much land as possible and burn off Hilo grass during the first of Kahuku ownership. Employees sowed pigeon peas, nutritious legumes, and planted more desirable pasture grasses such as paspalum. Workers also pulled up guava and ivy.
1912	CE	Planted	Corn was planted for livestock feed.
1913	CE	Surveyed	Carter hired G.F. Wright to survey the line of Kahuku. The boundary survey was carried out in January.
1913	CE	Built	Improvements to the existing circulation system were made and new roads were constructed.

Date	Period	Event	Annotations
1913-1914	CE	Built	Workers impounded water from the natural spring, Wahia, by laying pipes to the ranch. By 1914, 862 feet of pipe was laid.
1913-1914	CE	Built	A three-thousand-foot stone wall was constructed at Kahuku. The completed product measured four feet high at most.
c.1914	CE	Built	Water tanks, a water catchment shed, and water troughs were constructed.
1914	CE	Destroyed	An earthquake shook the grounds in April and destroyed most of the wall on the makai (south) side of the road.
1915	CE	Repaired	The damaged stone walls were repaired.
1915-1916	CE	Built	Carter hired contractors to build a portion of the Kahuku boundary fence.
1916	CE	Built	By 1916, a total of 12,240 feet of stone wall were completed.
1916	CE	Established	Mauna Loa erupted, beginning on ranchlands, ten miles north of the Volcano Road, the early iteration of Highway 11, between 6,500 and 7,500 feet. A flow thirty feet wide blanketed part of the ranch's upper slopes. The eruption rendered useless some twenty-eight square miles of land, most of it within the Kahuku Ranch property.
Post-1916-Pre-1930s	CE	Built	A corral and chute were built from ʻōhiʻa posts in a zig-zag form on top of the 1916 lava flow.
1917	CE	Purchased/Sold	Carter sold 5,700 acres of ranch land at Mauna Loa's summit to the Territory of Hawaiʻi , for $100, as contribution towards the newly established Hawaii National Park.
1917	CE	Built	Workers were hired to construct other fences and corrals within Kahuku. A corral, using ʻōhiʻa wood harvested from the ranch forest, was completed.
1918	CE	Built	The "Kahuku Pipeline," a 10,974-foot water conduit, was completed.
1918	CE	Built	Employees installed a 50,000-gallon water tank on concrete foundation.
Post-1918	CE	Built	Two 100,000-gallon water tanks were constructed after the completion of the Kahuku Pipeline.
1921	CE	Land Transfer	Carter leased land on the upper slopes of Kahuku to Hawaiʻi politician, cattle rancher, and sugar plantation owner Lincoln McCandless.
1922	CE	Built	By 1922, two lightly improved roads branched southward from the main road down to the ranch core.

Date	Period	Event	Annotations
1922	CE	Built	By 1922, a lightly improved road ran westward to Kahuku from Wai'ohinu. This may have been the road planned during the Jones era.
1933-1941	CE	Built	The Civilian Conservation Corps (CCC), under the supervision of the Department of Forestry, constructed the Punaluu Kahawai Forestry Cabin
1935	CE	Purchased/Sold	Carter deeded 7,542 acres to McCandless.
1936	CE	Built	The Civilian Conservation Corps (CCC), under the supervision of the Department of Forestry, reconstructed the Kahuku boundary fence.
1937	CE	Purchased/Sold	Carter sold 22,880 acres of Kahuku to C.Q. Yee Hop.
1945	CE	Purchased/Sold	McCandless purchased another 788 acres of Kahuku.
1942-1944	CE	Established	The Kahuku Base Camp was established at the base of Pu'u o Lokuana.
1942-1944	CE	Built	The Military Dormitory (Building 404), Military Electric Generator House (Building 406), Vehicle Maintenance Shed (Building 407), Concrete Storage Vault (Building 414), Radar Room/Air Vent (Building 415a/b), Radar Antenna Support Structures, and the Mid-Level Tank and foundation were constructed.
c.1942	CE	Built	A single entrance road that served the Kahuku Base Camp was constructed. A single driveway extended from the road to grant access to the buildings.
1947	CE	Established	By 1947, but more likely before, military occupancy of the 11 acres of Kahuku Ranch ended.
1947	CE	Land Transfer	Carter sold Kahuku Ranch to James Wilson Glover for $436,000 in 1947.
1947-1958	CE	Improved	Glover expanded the Kahuku Base Camp site into a koa sawmill operation based on timber harvesting and processing.
1948	CE	Built	The sawmill facility, including the electric plant (Building 402), were constructed.
1948	CE	Rehabilitated	The dormitory (Building 404) was decreased in size and its interior was split into multiple residential units for the ranch/mill workers. The building measured 3,404 square feet with two levels and an extension measuring three feet by six feet was added.

Date	Period	Event	Annotations
1948	CE	Rehabilitated	The electric generator house (Building 406) was rehabilitated as a tire and tool storage structure, with tires stored in the main, military-era structure, and tools stored in the addition made under Glover's management.
1948	CE	Rehabilitated	The vehicle maintenance shed (Building 407) was rehabilitated into a truck and tractor repair shop.
c.1948	CE	Built	A new structure, the gas pumphouse, was constructed around this time.
1949	CE	Mined	The cinder pit located near Pu'u o Lokuana adjacent the military radar antenna site was mined since at least 1949.
1950	CE	Land Transfer	Glover sold approximately 12,000 acres of land towards the western boundary of the ranch for residential land development.
1958	CE	Land Transfer	The Samuel Mill Damon Estate purchased Kahuku Ranch for $1,363,630 on October 29. Kahuku Ranch was assessed as containing 156,1226 acres at this time.
1958-1964	CE	Built	New water troughs were installed in the new paddocks, new pipes were laid to connect water systems, and creep and feed pens were constructed.
1959	CE	Rehabilitated	The old dormitory at Kahuku Base Camp (Building 404) was reconfigured into a duplex residential building.
Late-1950s	CE	Land Transfer	Damon Estates sold 12,000 acres to the Crawford Oil Company who built the Hawaiian Ocean View Estates.
1961	CE	Built	An airstrip was built near the Kahuku Base Camp.
1961	CE	Built	The Ranch Office and a hot house for the Main Ranch House were built.
1962	CE	Removed	The eastern of the two roads makai (south) of the main highway was removed by 1962.
1962	CE	Moved	The Kahuku-'Āinapō Trail was realigned by 1962, with its lower segment turned into a jeep trail and the upper segment removed.
1963	CE	Built	A manager's cottage was constructed.
1964	CE	Ranched/Grazed	By 1964, some 2,070 acres of rainforest was cleared and developed into new pastures; some 2,241 acres of existing pasture were improved.
1965-1977	CE	Moved	Highway 11, or the Māmalahoa Highway, was realigned.
1965-1977	CE	Established	The old alignment of the highway was turned into a secondary road called Old Māmalahoa Highway.

Date	Period	Event	Annotations
1965-1977	CE	Built	A reservoir was built at or near Wahia at 3,500 feet above sea level.
1966	CE	Built	Ranch staff completed a new 3-million-gallon reservoir at Kealakoa Spring.
1966	CE	Planted	Two acres were cleared as a test production area for Christmas trees.
c.1966	CE	Built	A redwood water tank was constructed by the CCC era cabin at Punaluu Kahawai.
1966-1972	CE	Planted	A windbreak and shade project was initiated. Windbreaks of Norfolk pine, ironwoods, and monkey pod trees were planted for the offices, the main ranch camp and headquarters, and the Kamaoa holding pen to the south.
1967	CE	Built	The State Department of Forestry and Wildlife built a cabin near the nēnē enclosure. This cabin is now referred to as the "Nēnē Cabin."
1968	CE	Established	All ranch houses and facilities were installed for electricity, with all wires installed underground.
1968	CE	Established	Mouflon sheep were introduced to the ranch.
1968	CE	Purchased/Sold	Damon Estates sold 20,000 acres of the ranch to International Resources, Ltd., for unknown purposes.
1969	CE	Repaired	Old fences built during or before the Glover era were repaired or replaced.
1969	CE	Planned	The sawmill road was deemed the most traveled road on the ranch and a proposal was made to pave this road. This proposal was rejected at the time.
Late-1960s	CE	Built	Sidewalks around Building 404 were poured and circulation around the building was potentially reconfigured.
Late-1960s	CE	Built	The carport system, storage shed, and covered deck additions to the newly converted duplex (Building 404) were constructed around this time.
Late-1960s	CE	Rehabilitated	The three-bay truck and tractor repair shop (Building 407) was altered into a two-bay structure with an attached door system.
1970s	CE	Established	Through the 1970s, sulfur dioxide emissions skyrocketed due to increased volcanic activity and corroded/deteriorated metal objects rapidly.
1971	CE	Built	A Lindal cedar home was built at the Kahuku Base Camp site.
1972	CE	Built	A residence, Building 403, was constructed at the Kahuku Base Camp site.
1972	CE	Built	J.R. "Junior" Molcilio's house was constructed.

Date	Period	Event	Annotations
1973	CE	Built	A pole shed (Building 405) was constructed at the Kahuku Base Camp site.
1973	CE	Planted	Ranch employees established ornamental gardens around their homes, comprising of bird of paradise, wild olive, bougainvillea, gardenia, dwarf bougainvillea, wax plant, Chinese privet, pepper trees, and periwinkle.
1973	CE	Established	There were eleven introduced bison on the slopes of Kahuku by 1973.
1974	CE	Established	By 1974, all the land Freddy Rice felt could be transformed into productive pasture had been developed.
1974	CE	Repaired	The tire storage (Building 406) and the shop (Building 407) were reroofed with corrugated iron sheets.
1974	CE	Planted	Twenty-five citrus trees were planted.
Mid-1970s	CE	Planted	Ranch staff planted 2,000 Australian red cedar, 1,500 loblolly pine, 1,200 koa, and 500 eucalyptus trees as a part of the reforestation efforts on some of the ranch's marginal lands to earn a property-tax break.
1976	CE	Repaired	The rock walls that lined the Ranch Road were repaired or rebuilt.
1982	CE	Established	By 1982, Kahuku Ranch comprised of two separate and different water systems and sources of supply.
1982	CE	Built	A third reservoir was constructed adjacent to the reservoir circa 1966 at 5,000 feet above sea level.
1982	CE	Established	The ranch fenced the largest silversword population on the ranch as a protected area.
1982-1984	CE	Built	A 1.5-million-gallon tank was built and 16,000 feet of pipe was installed.
1982-1984	CE	Repaired	Approximately 15,500 feet of water pipe was replaced.
Mid-1980s	CE	Repaired	Kahuku Ranch managers began to replace the steel posts in the ranch fencing system with galvanized metals and fiberglass posts.
1989	CE	Built	A barn was constructed at the Kahuku Base Camp site.
Late-1980s-1990s	CE	Farmed/Harvested	The Damon Estates hired contractors to harvest sandalwood and ʻōhiʻa from the ranch lands; loggers were allowed to harvest distressed or downed koa trees.
1991	CE	Established	The state government zoned 95,000 acres of Kahuku Ranch for conservation.

Date	Period	Event	Annotations
1992	CE	Repaired	The fence around the silversword enclosure was rebuilt.
1995	CE	Paved	By 1995, the main north-south axis road mauka (north) of Highway 11 was paved into a light-duty, hard-surfaced circulation corridor.
1999	CE	Established	The estate was fined $466,800 for failing to obtain permits to harvest koa from the ranch lands. The ranch negotiated to restore the disturbed land in lieu of paying the fine.
Late-1990s	CE	Maintained	The pole shed (Building 405) received routine maintenance in roof and exterior finishes.
2000	CE	Established	By this time, Kahuku Ranch was approximately 126,000 acres.
2002	CE	Surveyed	The existing condition of ranchlands and improvements were surveyed: the mauka (north) pastures counted sixteen water storage tanks, three reservoirs, and one catchment area. Twelve pastures were surveyed within the mauka (north) grazing lands.
2002	CE	Established	Some of the mauka (north) pastures had been renamed since 1988: Lumber Mill Paddocks were renamed the Hilo Cell and the Kona Cell; Waina, Palm Tree, Number I Maluna, and Number I Kīpuka pastures were consolidated into the Palm Tree pasture; the upper Maluna pasture was incorporated into the Glover Pasture; Keo Keo, Number III Hilo, Number III Koa, Hapai Mamo, Number III, and Pele Paddock were consolidated into Number III Hilo/Kona pasture.
2003	CE	Land Transfer	116,000 acres of the original 184,000-acre Kahuku Ranch were sold to the Nature Conservancy and the National Park Service for 22 million dollars. The 116,000 acres excluded the sections of the land south of the highway, including the ranch headquarters area.
c.2003	CE	Established	11,000 acres of Kahuku Ranch was designated a critical silversword habitat by the Fish and Wildlife Service.
2003-present	CE	Established	Efforts to remove incipient invasive plants began upon acquisition of Kahuku land.
Post-2003	CE	Rehabilitated	Building 403 was transformed into the main office building, and the duplex residence was turned into a storage building.
2004-present	CE	Established	Silversword restoration efforts began in 2004.

Date	Period	Event	Annotations
c.2005-present	CE	Established	Plant materials from rare and endangered species were collected for propagation and planting.
2005-present	CE	Established	Experimental forest restoration work initiated in 2005 which involved the establishment of four ungulate-proof exclosures within which three temporary grass removal treatments were tested.
2005-2020	CE	Destroyed	Three water tanks and the Main Pasture rain shed were lost likely due to external environmental factors. The Kahuku Ranch Shop at the Base Camp was reportedly demolished.
2006	CE	Built	A new holding tank of 3,000-gallon capacity was installed at the top of the hill above the houses. Water lines were replaced with a larger pipe and a new line was added to supply drinking water to the house and pasture.
c.2008	CE	Rehabilitated	The CCC-era Punaluu Kahawai Forestry Cabin was restored, with all non-historic additions removed.
c.2008	CE	Repaired	The zig-zag corral and chute and the redwood water tank at the CCC cabin were repaired.
c.2008	CE	Removed	Targeted alien weeds, such as Christmas berry, from approximately 1,000 acres of Kahuku below 4,400-foot elevation were removed.
2010	CE	Established	Special Use Permit (SUP) allowing cattle to graze expired and cattle removed from the slopes of Kahuku Ranch.
2010	CE	Built	An 800-meter segment of six-foot boundary fence was constructed along the shared boundary between Kahuku and Hawaiian Ocean View Estates (HOVE) to deter nonnative mouflon sheep from entering mauka (northern) areas.
2010-11	CE	Removed	Barbwire and electric fences from the lower Kahuku paddock system (except for those paddocks adjacent and east of the ranch houses) were removed to protect the endangered Hawaiian hoary bat from injury or death.
2010-present	CE	Built	The CCC exclosure was constructed for rare plant protection and recovery.
2012	CE	Established	The Kahuku Wilderness Eligibility Assessment was completed.
2012	CE	Built	Internal fencing was installed to protect the lowland ecosystems from ungulates at Kahuku. This project also involved ungulate removal efforts.

Date	Period	Event	Annotations
2013	CE	Proposed/Planned	A project was begun to restore the 34-acre forest in the Pu'u Akihi Special Ecological Area.
c.2003-present	CE	Built	Fence construction along park boundary to exclude non-native ungulates to serve as a defensible ungulate barrier.
c.2003-present	CE	Removed	Efforts were expended to remove mouflon sheep and feral pigs from the Kahuku Unit.
2015	CE	Built	An additional temporary water tank was installed at the end of the administrative area cul-de-sac.
2018	CE	Repaired	The main office building and the storage building were repaired and repainted.

Physical History

Although the National Park Service-owned Kahuku section only comprises the northern, mauka, portion of the historic ranch, a comprehensive narrative of the development of Kahuku Ranch requires discussion of the entire 184,000 acres and is therefore included in the following history.

Kahuku Ranch was one of the oldest continuously operating cattle ranches in Hawai'i, from 1866 to 2008. Located in the moku (land district) of Ka'ū, a remote and sparsely populated southern district of the Island of Hawai'i, the original boundary of the ranch assumed the ahupua'a (land division) boundary of Kahuku. The ahupua'a reflected the traditional Hawaiian land-use system, defined by oral traditions and natural boundaries, and stretched from the summit of Mauna Loa to the southern tip of the island in a triangular parcel with a wide base at the ocean. Stretching from 2,000 to 13,000 feet in elevation, Kahuku included within its 184,000-acre boundary Mauna Loa's very active southwest rift zone, a long series of fractures, fissures, craters, cinder cones, lava flows, and faults where ground had spread apart. This difficult volcanic landscape presented a challenge to every rancher who operated Kahuku Ranch. These ranchers in turn were driven to drastically and continuously alter Kahuku's natural environment to in attempts to transform the land into a profitable business.

Before the Ranch
Early Settlement of Ka'ū – Ahupua'a of Kahuku

Until the mid-nineteenth century, Kahuku was an ahupua'a, or land division, of Ka'ū, one of the six moku, or districts, on the Island of Hawai'i. Stretching from the summit of Mauna Loa to the southern tip of the island, the ahupua'a of Kahuku was the largest of such land division in Hawai'i, comprising over 184,000 acres of incredibly diverse landscapes. Reaching from sea level to over 13,000 feet, Kahuku contained most of the world's identified climate zones within its bounds: lava fields, pastures, desert, shrub lands, and rainforests.[45]

The advantages of the varying terrains of Ka'ū likely passed immediate notice of the first settlers of the island, Polynesians from the Marquesas Islands, between 300 and 500 CE (or between 900 and 1200 CE as suggested by new research)[46] as evidenced by early settlements having taken place on the western side of the island. Although the first Hawaiians likely arrived near South Point, possibly near the southern boundary of what would later become the ahupua'a of Kahuku, archaeological evidence suggests that they first formed communities in Kona and Kohala where land proved more hospitable. While the area bound by the ahupua'a of Kahuku was located in the immediate vicinity of the first arrival, the apparent lack of water source, among other factors such as the barren volcanic landscape above 7,500 feet in elevation and the extreme temperatures, likely deterred the first Hawaiians from settling in the region.[47]

Early settlement communities tended to be located in large, broad river valleys where fresh water was readily available, marine resources were abundant, and alluvial soils allowed for agricultural productivity. However, while these areas offered lush valleys and sweeping volcanic plains ideal for agriculture, endemic flora across the landscape included very few fruits, tubers, or otherwise edible plants. As such, the early development of agriculture in Hawai'i was based almost entirely on introduced crops, some 23 subsistence plants that the Polynesian settlers had brought with them on their voyage through the

[45] Avery, *Environmental History of Kahuku,* p.1.
[46] Patrick Kirch, "When Did the Polynesians Settle Hawai'i? A Review of 150 Years of Scholarly Inquiry and a Tentative Answer," *Hawaiian Archaeology,* 12 (2011), p.22.
[47] Avery, *Environmental History of Kahuku,* p.1.

centuries. Among others, these plants included bananas/plantains, breadfruit, taro, sweet potato, and sugarcane. Such plants were found in simple plantings around the household, near rivers, and along valley slopes as the earliest indications of agriculture. These simple forms of agriculture evolved over the centuries to slash and burn agriculture and ultimately to systems of both irrigated and dryland forms of cultivation.[48]

At least by the 1200 CE, Hawaiian agriculture had evolved to encompass complex systems of terraces and irrigation that established wetland agriculture. Irrigated terraces, known as lo'i, occurred in intermittent stream beds and other areas within river valleys or open floodplains to harness water accessible by gravitational flow. The composition and forms of the irrigated terraces varied depending on the quality of soil: complexity of the structures could range from simple ponds dug into the earth to elaborate surface structures with massive stone walls reinforced with compacted earth to be watertight. 'Awai, canals that transferred water from the river through the pondfields and back, were constructed in conjunction with mānowai, dam-like structures that allowed for sufficient pooling of water while employing mechanisms to prevent excess flow during high water events. Upon completion, a lo'i was a hyper-complex system that allowed for purposeful water diversion and targeted flooding. This form of agricultural infrastructure was adopted across the compatible landscapes and eventually, moderate slopes of every river valley and flat lowland plains were converted into highly productive terraces. The primary crop of wetland agriculture was taro, one of the major stable crops of Hawai'i.[49]

Following the establishment and proliferation of these irrigated terraces and pondfields, permanent upland garden sites began to emerge beginning in the 14th century. While the concept of house gardens and slash and burn agriculture had become fully prevalent in the centuries prior, evidence of permanent management and harvesting of the uplands, those areas of higher elevation which typically had less surface water but often included extensive springs or spring-fed rivers, was a relatively new development by the 1300s. This form of agriculture, known as dryland agriculture, or māla, took advantage of the nutrient-rich soils in the drier areas, as opposed to those wet soils that, through millennia of weathering and leaching, had depleted its nutrients. Within areas of such fertile soil, existing vegetation was removed and long, linear stone (most often of basalt cobbles) and earthen embankments were constructed to encompass the cleared fields. These embankments, known as kuaiwi, served agronomic functions: where the embankments were aligned perpendicular to the dominant wind patterns and slope, these features are suggested to have aided in capturing and maintaining soil moisture by blocking wind and reducing evapo-transpiration. On the other hand, where cross-slope forms of embankments were present, these features likely functioned as terracing that decreased soil erosion and created additional planting surfaces.[50]

While the earliest sites of dryland agriculture were limited to those micro-areas of ideal soil and moisture content, this form of agriculture evolved and expanded through the following centuries to establish extensive field systems. Where the early dryland farming sites of the 14th century reflected variations in size and layout reflecting adaptation to the local topography, these systems began to be established in larger sections of the land, including those deemed marginal, during the 15th century. By the 17th and 18th centuries, the dryland field systems were more homogenous in layout and blanketed vast sections of the landscape across the Hawaiian Islands. The primary crop cultivated in these field systems of

[48] Lincoln and Vitousek, "Indigenous Polynesian Agriculture in Hawai'i," p.3, 7, 11-12.
[49] Ibid., p. 12-13.
[50] Ibid., p.17-18, 20; Ladefoged et al, "Opportunities and Constraints for Intensive Agriculture," p. 2375-2376; Quintus and Lincoln, "Integration Local and Regional in Pre-Contact Hawaiian Agriculture,"p.54.

embankments and walls was 'uala, or sweet potato. The sweet potato, surviving in drier climates than kalo, or taro, was critical for the sustaining of these dryland, rain-fed fields.[51]

In 2009, a study was conducted using Geographical Information System (GIS) to predictively model regions most suitable for intensive agriculture. This GIS model, based on a climate, hydrology, topography, substrate age, and soil fertility data, calculated that the Island of Hawai'i, the youngest island, could have supported some 572 km^2 of intensive agriculture, of which 97% was likely rain-fed (dryland) agriculture.[52] Included in this predictive model results of dryland farming were large sections of Ka'ū, including portions of Kahuku. Further archaeological and ethnographic research confirmed that Kahuku was a site of māla development, as a part of the Ka'ū Dryland Field System (KDFS), since as early as the 15th and continued its expansion through 16th and 17th centuries. While recent lava flows have covered substantial areas and the full extent of KDFS is unknown, predictive models suggest an area some 44 km long and 13 km at its widest extent.[53]

A targeted archaeological study that was completed in 2020 at *kīpuka* Ka'ōpapa, an area surrounded by one or more younger lava flows, suggests that this kīpuka, located immediately north of Highway 11 and west of Kahuku Road at an elevation of approximately 2,000 to 2,200 feet above sea level, is at the high elevation extent of the KDFS. Based on soil analysis, the dryland field system likely did not extend north, inland, of the kīpuka in significant expanses, although remnants of the system have been documented to the immediate east and north of the developed area; the above dimensions of the KDFS more likely encompassed the fertile soils of Kahuku further seaward and south, makai, of the kīpuka.[54] The expanse of the KDFS to the south is expansive and visible on satellite imagery.

Like those dryland field systems found in Kona and Kohala, the kīpuka Ka'ōpapa is constituted by several infrastructural types, most notable of which were linear embankments constructed of earth and stone. The dominant alignments of these features were found to be arranged perpendicular to the dominant wind patterns, similar to the layout found at Kohala, which signals that these structures were designed to capture and retain soil moisture. This intended purpose of the embankments then suggests that the size and density of the embankments found across the landscape indicate areas more susceptible to variation in soil moisture. Possibly related, the size of linear embankments identified varied with location, with those on the seaward side built higher and wider than their inland counterparts. Data derived from radiocarbon dating suggests that while initially developed in the 15th century, KDFS continued to be expanded and intensified well into the 16th and 17th centuries.[55]

Ethnographic studies have identified a correlation between agricultural developments and sociopolitical complexity across the islands. Agricultural surplus provided the resources needed to invest time and energy in societal progress, while, in turn, political stability and hierarchy allowed for large-scale mobilization of labor and investment into land-based capital improvements. Both of these phenomena are also correlated to demographic growth associated with greater numbers of households inhabiting the field systems. While the cause and effect of these correlations have not been clearly determined, it is clear that extensive agricultural development is accompanied by sociopolitical evolution and population growth.

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[51] Lincoln and Vitousek, "Indigenous Polynesian Agriculture in Hawai'i," p.18.
The sweet potato was a later introduction to the Hawaiian Islands; the timeline stemming from Polynesia suggests that it was introduced around the 12th or 13th centuries, supporting the chronology of the later development of the māla systems.
[52] Ladefoged et al., "Opportunities and Constraints for Intensive Agriculture," p. 2374, 2378.
[53] Quintus and Lincoln, "Integrating Local and Regional Pre-Contact Hawaiian Agriculture," p.53-54, 61.
[54] Ibid., p. 54, 63.
[55] Ibid., p.59, 63-64.

The increasingly homogenous development and construction of the field systems and their embankments across the island—the field systems at Kona and Kohala were found to have developed at a similar time as KDFS—also reflect a growing labor cooperation and increased sociopolitical integration. As such, the complexity of the social, political, and demographic structure in Ka'ū, and those in other parts of the island, likely paralleled the complexity of the dryland field systems by the 15th century.[56]

Such development of multifaceted sociopolitical structures reflected the "golden age" in the history of Hawai'i.[57] This period, spanning from the 15th to 16th century, was identified by the continued hierarchical development that ultimately resulted in the consolidation of multiple districts under single chiefs and thereby decreasing the number of independent polities. This consolidation provided political stability and reduced the frequency of conflicts between and among chiefdoms; the strengthened political hierarchy, a centralization of power, enabled the execution of large-scale, organized labor across the landscape for further development of agricultural infrastructure. This constant investment into landscape capital was met with constant returns, which in turn supported the burgeoning population. The system of taxation that was introduced circa 12th or 13th century was also reformed to equally distribute the burden of production among chiefs and commoners.[58]

It was during this era that the ahupua'a system of land management was quickly adopted across the islands. This land management system established the smallest politically controlled units nested within larger political units that were controlled by higher and higher chiefs; this system likely strengthened the feudal, pyramidal sociopolitical structure of the islands. An ahupua'a was defined by natural boundaries such as waterways or ridges and extended from the mountains to the sea ; this method of land division ensured that each unit had access to a range of necessary resources both marine and terrestrial. Once established, these boundaries were rigidly enforced and commoners were not allowed to trespass on other units. This centrally organized hierarchy and regimented land use provided a sense of permanence and security for those residing on the land. Since the implementation of the ahupua'a land management system, some 1,300 ahupua'a units, including Kahuku, were established on the Island of Hawai'i; majority of these units were likely established during the 15th and 16th centuries.[59]

Under this economic structure, as long as sufficient tribute was offered or taxes paid, and *kapu* (restrictions) observed, the common people residing in the ahupua'a of Kahuku were given access to the diverse terrain of the land division. The ahupua'a of Kahuku included a barren, windswept coastline, dense koa forests, and rocky alpine slopes; residents communally utilized the land's marine resources, agricultural land, timber, and birds. Owing to the strictly adhered boundaries and resource management, despite the feudal economy, commoners were able to minimize competition for resources and lived above the subsistence levels with a varied diet of marine and terrestrial foods.[60]

In addition to the extensive agricultural developments and cultivation across the island, the settlers of Ka'ū modified the natural landscape of the island through other forms of land use. Along with the introduction of Polynesian flora to the island, early settlers had introduced a number of fauna: lightweight hogs, chickens, dogs, and Polynesian Rats. These animals, together with the endemic Hoary Bat,

[56] Quintus and Lincoln, "Integrating Local and Regional Pre-Contact Hawaiian Agriculture," p.63-64; Lincoln and Vitousek, "Indigenous Polynesian Agriculture in Hawai'i," p.4.
[57] Lincoln and Vitousek, "Indigenous Polynesian Agriculture in Hawai'i," p. 26.
[58] Ibid., p.17, 26.
[59] Ibid., p. 15, 26-27; Avery, *Environmental History of Kahuku*, p.5.
[60] Avery, *Environmental History of Kahuku*, p.5; Helen Wong Smith, "Appendix E Cultural Impact Assessment for Kahuku, Ka'ū," in *Kahuku Village, Kahuku, Ka'ū, Island and County of Hawai'i, Draft Environmental Impact Statement*, Vol. II of III, PBR Hawai'i & Associates, Inc., 2011, p. 10.

comprised the entire list of land mammal species on the Hawaiian Islands prior to European contact.[61] The introduced animals significantly impacted the natural environment as they ate bark and seeds, or in the case of hogs, rooted throughout the forest. Island inhabitants felled koa trees for canoes and tools and ʻōhiʻa trees for other wooden implements. Where ʻōhiʻa forests were intact, useful ferns and shrubs were planted in the understory to increase nutrient cycles associated with forests, and to maximize moisture interception.[62] In other areas, large sections of forests were depleted for firewood, and inhabitants burned areas of native vegetation in order to encourage grasses used for thatching. These activities likely impacted the weather patterns as the area became windier and drier due to the loss of forest cover. Such introduction of nonnative flora and fauna, in conjunction with destruction of habitat and hunting, also likely caused the extinction of dozens of native species.[63]

These human modifications of land, however, were considered light-handed in comparison to the transformations wrought by Mauna Loa's eruptions. Situated on its southern slope, life in Kaʻū was dominated and shaped by the volcano. Frequent eruptions resulted in a high decomposed basalt (black volcanic rock) content in the soil and lava flows created a jagged coastline that rendered marine resource collection dangerous. Lava flows blanketed the area and warmed and dried the air above and buried grasslands, forest, springs, and perennial streams. The volcanic activity increasingly rendered much of the area barren and uncultivable.[64]

European Contact – Transition to Market Economy

Contact with the Euro-American world began in the late-eighteenth century when Captain James Cook reached the Hawaiian Islands in 1778. Following the initial contact, Hawaiʻi became a stopping point for vessels in need of provisions since as early as 1786. By this time, Kaʻū, including Kahuku, had been transformed by centuries of volcanic activity. The volcanic impacts were so prevalent that early European visitors described the land as a desolate landscape. Captain Cook noted that the coast of Kaʻū presented "a prospect of the most horrid and dreary kind" where ground is "covered with cinders and intersected in many places with black streaks." In 1823, Reverend William Ellis also observed that Kaʻū was a "gloomy and cheerless desert of rugged lava" where plants struggle for existence in the volcanic landscape. According to Ellis, Kahuku in particular was a "rough and desolate tract of lava" that sharply contrasted with the lush green of Waiʻohinu to the east. Although some parts of Kahuku had escaped destruction and was noted as a "fine plantation belonging to King Kamehameha" by Archibald Menzies in 1794, the lava-ridden landscape was predominant by the late-eighteenth, early-nineteenth century. This vastly expansive, arid, and lava-covered district of Kaʻū was the last place on the island for Europeans to settle. Though a mission station was established in Waiʻohinu as an early Euro-American outpost, by Reverend William Ellis of the London Missionary Society, only two foreigners besides the mission family resided in Kaʻū until the mid-nineteenth century.[65]

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[61] Avery, *Environmental History of Kahuku*, p. 6; Burt Smith, George Love, and Earl Spence, "Livestock in the Land of Aloha," *Rangelands*, Vol. 5, No. 3, June 1983, p.100.
[62] Lincoln and Vitousek, "Indigenous Polynesian Agriculture in Hawaiʻi," p. 23-24.
[63] Avery, *Environmental History of Kahuku*, p.6.
[64] Ibid.
[65] Ibid., p.7; "Ellis, William (1794-1872) and Mary Mercy [Moor] (1793-1835), London Missionary society (LMS) Missionaries to Polynesia," Boston University School of Theology, History of Missiology, accessed April 1, 2021, http://www.bu.edu/missiology/missionary-biography/e-f/ellis-william-1794-1872-and-mary-mercy-moor-1793-1835/.
All observations quoted in the text are referenced as referenced in Avery's *Environmental History of Kahuku*, p.7.

As Euro-American merchants and traders began to settle in Hawai'i in the early-nineteenth century, they increasingly disrupted the traditional subsistence economy of the Hawaiian people. The new settlers transformed the existing economic system into a market economy and commodified the natural resources of Hawai'i with lasting social, political, and environmental impacts. Early commercial enterprise of Hawai'i depended upon three commodities: furs, sandalwood, and whale oil. Of these, only sandalwood was produced in Hawai'i. The other two commodities brought traders and trading ships to the islands and increased the trade traffic across Hawai'i.[66]

While the concept of commerce in the modern sense was near non-existent in the communal subsistence-based economy of pre-contact Hawai'i, Hawaiians quickly developed an idea of trade and implemented the law of supply and demand upon extended interactions with foreign traders. The price of commodity goods rose shortly thereafter, as attested by early visitors' complaints.[67]

The trade in sandalwood, the only commodity of international demand to be directly produced in Hawai'i during the early years of international commerce, had apparently been prospected since as early as 1790. However, the sandalwood trade was slow to develop, with a small supply of the aromatic wood being exported for several years before it was at the center of international attention and demand. By 1810, the wood was being actively extracted and by the mid-1810s, the primary trade good had become sandalwood.[68]

The overwhelming growth in the sandalwood trade encouraged not only the Euro-American settlers of the island but also the Hawaiian people to maximize extraction of these resources beyond their subsistence needs. Kahuku was renowned for its sandalwood, and commoners from across the island trespassed on the ahupua'a in the hopes of finding the resource. The strictly enforced traditional land division system began to dwindle further as King Kamehameha ordered his chiefs to procure sandalwood for export: almost all Hawaiian men and women were drawn from their usual work in agriculture or fishing to harvest the wood. As the foreign trade grew, commoners were also burdened with procuring food, fresh water, and firewood for merchant ships. The sandalwood trade declined in the 1820s, only after the tree was harvested nearly to extinction.[69]

When the sandalwood trade collapsed as a result of unsustainable extraction, the newly developed market economy of Hawai'i strived to replace the aromatic wood with another exportable commodity. While there was a demand, albeit limited, for perishable food stuff from the whalers, this trade derived little benefit for the Hawaiian people. During this period of reconnaissance of marketable goods in Hawai'i, from the 1820s to 1830s, a business-minded few attempted to manufacture sugar as an exportable commodity. The first permanent sugar plantation was established by three Americans in 1835 at Kōloa, Kaua'i, on the land granted to Ladd and Company. Despite the opposition from the local chiefs, the Hawaiian residents joined the sugar plantation labor force, and by the end of the first year, had planted some 25 acres of sugar cane and built the sugar mill. However, the sugar industry was slow to establish, and it was reported that there had been no sugar manufactured in the first season. The sugar endeavors

[66] Avery, *Environmental History of Kahuku*, p. 7; Ralph S. Kuykendall, *The Hawaiian Kingdom, Volume I 1778-1854, Foundation and Transformation*, (Honolulu: University of Hawai'i Press, 1938), p. 82.
[67] Kuykendall, *Hawaiian Kingdom, Volume I*, p. 83.
[68] Ibid., p.86-88.
[69] Avery, *Environmental History of Kahuku*, p. 7-8.

persisted through following decades across the islands despite the disheartening returns in the early years and ultimately established itself as a commercial staple crop by the late-19th century.[70]

Nearly contemporaneously with sugar production, or perhaps shortly after the initial sugar endeavors (owing to the slow development of the sugar industry), Hawaiian royalty turned their attention to the thousands of wild cattle that roamed the island as the next potential marketable good in the 1830s. Captain George Vancouver had presented King Kamehameha with a gift of cattle during his visit in 1793; under royal protection (the king had forbidden their slaughter) they had multiplied rapidly. Recognizing the worldwide increase in demand for meat, hides, and tallow associated primarily with the whaling industry, the Hawaiian royalty believed that the cattle trade would enable them to continue their life of foreign luxury goods to which they had become accustomed and to pay off the crown's debt to foreign merchants.[71]

Like the sandalwood trade, the cattle trade presented lasting social, environmental, and political impacts to the traditional way of life in Hawai'i. As the livestock products stimulated the Hawaiian economy, the large-scale cattle industry proved exceptionally destructive to the island's cultivated plants and native vegetation. Each cow could consume six times the amount of one hog and was able to travel greater distances and reach trees and other plants that were out of hogs' reach. The free-ranging cattle also caused a conflict between the interests of cattlemen and those in other agricultural industries such as sugar, potatoes, etc.: complaints were made about the depredations of cattle upon cultivated fields. These animals destroyed crops and gardens and, further, even ate natives' thatched roof homes, and Hawaiians were forced to build stone walls around their homes and fields. The expanding presence of cattle made crop raising nearly impossible and once-thriving agricultural areas such as Waimea became a de facto cattle ranch. In Ka'ū, famine resulted after free-roaming cattle consumed crops across the district and caused a diaspora out towards Hilo, Kona, or off the island entirely, to O'ahu. Although new fences and a decline in numbers of wild cattle helped mitigate some of these problems by 1850, environmental degradation increased as cattle ranching expanded.[72]

As the Hawaiian way of life shifted from a subsistence to a market economy, the traditional system of land use and ownership was also challenged. The idea that commoners had rights to the land, in conjunction with the Euro-Americans' demand to be allowed to buy and sell land in the kingdom, became evermore present in the early-nineteenth century. Finally, in 1839, upon the pressures set by missionaries, traders, and other foreigners, King Kamehameha III and Hawaiian chiefs agreed to upend the system. The Hawaiian Bill of Rights passed in 1839 and reflected the beliefs of private land ownership. Subsequently, in 1846, the government established a Board of Commission of Quiet Land Titles to facilitate land distribution among Hawaiians. In 1848, an event known to historians as the Māhele (royal land division) officially transformed Hawaiian land ownership from a feudal to a private system. The event disbanded the ahupua'a system and land was distributed to the crown, the government, and Hawaiian chiefs. During this historic event, the land was divided among 245 chiefs and Kamehameha III. Within Ka'ū , Kamehameha III received forty-three ahupua'a, forty of which he relinquished.[73]

In 1850, commoners were also awarded about 29,000 acres across the islands. These lands were awarded in the form of Land Commission Awards (LCA) based on claims filed by the native tenants of the lands

[70] Kuykendall, *The Hawaiian Kingdom, Volume I*, p. 171, 175-176, 323.
[71] Kuykendall, *The Hawaiian Kingdom, Volume I*, p.317-318; Avery, *Environmental History of Kahuku*, p. 8.
[72] Avery, *Environmental History of Kahuku*, p. 9; Kuykendall, *The Hawaiian Kingdom, Volume I*, p. 318.
[73] Smith, "Appendix E Cultural Impact Assessment for Kahuku," p.24.

known as the *kuleana* claims. These claims could be filed regardless of the owner of the ahupua'a though they had their limitations: the claims were permitted only for house lots, not to exceed one-quarter-acre, and garden lands the claimant had under cultivation to feed his own family. Commoners were not permitted to claim any land for purposes of profit; they could not claim any lands they cultivated for the purpose of selling the crop or any of the *kula* lands they utilized for grazing livestock.[74]

During these transformative years, a legal change was also made to allow non-Hawaiians to participate in land ownership in Hawai'i, which in turn, spurred an influx of immigrants to further exploit the natural resources of Hawai'i.[75] This influx was furthered by the rights granted to the foreigners that permitted them to, unlike the native tenants, claim or purchase lands for commercial purposes.[76]

Amidst this booming market economy, Ka'ū residents' attempts to participate in the new economic system were largely unsuccessful. The remote location of the district hindered the residents' ability to transport goods to market and farmers were forced to rely on infrequent, unscheduled schooner landings, or resorted to make the sixty-five-mile trip to Hilo by land, which meant up to a week of travel across desert and through dense forests. These attempts to participate in the market economy drastically imprinted on the landscape of Hawai'i, including that of Kahuku, by the 1850s. Forests had been denuded of sandalwood. Some native farms had been abandoned and overrun by wild cattle, and others that had grown staples of the Hawaiian diet now produced foods that were valuable to American consumers and merchant ships, such as sugar, rice, coffee, potatoes, and sweet potatoes. Ka'ū farmers fled to the growing cities of Hawai'i, leaving the landscape less populated.[77]

The sparsely populated Ka'ū, coupled with the thriving export industry kingdom-wide, lured American entrepreneurs to the archipelago and to Kahuku. To these newcomers, the former ahupua'a was perceived valuable not for its ability to sustain a large community with a wide variety of marine and terrestrial resources, but for its extractable commodities that held value in distant markets. One of such entrepreneurs, Charles C. Harris, became the first private owner of Kahuku.[78]

Prior to Harris, the ahupua'a of Kahuku had been "claimed" by William Pitt Leleiōhuku, whose "sister-cousin," Kekau'ōnohi, was a granddaughter of Kamehameha, but the land was relinquished to the king in lieu of commutation fees due on the lands awarded him. In 1850, when Kahuku was ceded to the government, the ahupua'a was valued at $20,400. Upon the relinquishment of Kahuku, the Hawaiian government subsequently set apart and designated Kahuku as School Lands for the use and income of the Department of Public Instruction. On July 8, 1861, the entire ahupua'a of Kahuku was granted to Harris by King David Kalākaua under Patent 2791 for $3,000. As such, Harris became the first official private, non-Hawaiian owner of Kahuku.[79]

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[74] [74] Smith, "Appendix E Cultural Impact Assessment for Kahuku," p. 27.
[75] Avery, *Environmental History of Kahuku*, p. 9.
[76] [76] Smith, "Appendix E Cultural Impact Assessment for Kahuku," p. 27.
[77] Avery, *Environmental History of Kahuku*, p. 10.
[78] Ibid., p. 15.
[79] Smith, "Appendix E Cultural Impact Assessment for Kahuku," p. 26, 34, 40.
The purchase price for Kahuku is listed as $3,100 in Avery's *Environmental History of Kahuku*, p. 15.
The series of land tranfers in Kahuku between its relinquishment to the government by Leleiōhuku and the sale of the ahupua'a under the Royal Patent Grant to Charles C. Harris in 1861 is unclear. Smith, in the "Cultural Impact Assessment" does not specify whether the entire ahupua'a of Kahuku was set apart and designated as School Lands, or if there were land grants award to native tenants prior to this designation. Further, seven kuleana claims are recorded as granted within Kahuku, all post-dating 1861 and into the

In 1861, Charles C. Harris, who purchased the ahupua'a of Kahuku, advertised for sale as 300,000 acres of land containing 2,500 wild goats and unknown numbers of sheep and cattle, for $3,100, was also likely tempted by the promise that Kahuku was rich in pulu. Harris had been granted a monopoly on the collection of pulu on the Island of Hawai'i in 1856 and had soon after cofounded Abel, Harris & Company, Honolulu's primary pulu dealer. Pulu, the soft, wooly fiber pulled from the fiddleheads and stems of the tree fern, was used for stuffing in mattresses and pillows. Pulu grew abundantly in Hawai'i between 1,000 and 4,000 feet in elevation, and it became a major Hawaiian export beginning in 1851.[80]

The extent to which Kahuku was extracted of its pulu resources for the export market is unknown. While Kahuku was likely subjected to targeted collection of pulu by laborers, it is unlikely that any improvements were made to the land under Harris' ownership: Harris' career appears to have taken a trajectory towards government office. Only a year after he purchased the former ahupua'a, Harris was appointed Attorney General of Hawai'i by Kamehameha IV, and later became a member of the Hawaiian legislature, Minister of Finance, Minister of Foreign Affairs, and an associate justice on the territorial Supreme Court. These duties may have kept him preoccupied, or perhaps Kahuku's pulu resources had been exhausted; Harris sold Kahuku in 1866, just five years after he had purchased the ranch.[81]

Kahuku Ranch – Robert and Theopolis Brown (1866-1871)

Robert and Theopolis Brown, two enterprising immigrants involved in numerous economic endeavors in the Hawaiian kingdom, purchased the Kahuku property from Harris in 1866. The two men were brothers and whale shipmasters from New England who moved to Honolulu in 1851 to be closer involved in the whaling grounds of the pacific. By the time they had purchased Kahuku, Robert Brown had purchased various properties in and around Honolulu where he opened or acquired a ship chandlery, a blacksmith's shop, and a butcher shop. In 1866, Theopolis Brown purchased Kahuku for $5,250; however, only Robert Brown, his family, and their employees lived on the newly purchased land.[82]

At the time of purchase, Kahuku offered a number of economic opportunities that required little investment. The cattle and hide market in the United States remained steady and the cattle ranching industry in Hawai'i continued to grow between the 1860s and 1880s. The former ahupua'a of Kahuku, containing over two thousand goats and unknown numbers of sheep and cattle since its privatization, presented an appealing business endeavor to those entrepreneurs wishing to enter the cattle market.[83]

1870s, five of which are recorded as "unlocated." These are suggested to be situated in an area known as Keopuka, south of the Māmalahoa Highway near the eastern edge of Kahuku, but cannot be definitively located. As the entire ahupua'a, later identified to be 184,298 acres, was sold to Harris in 1861, who then sold his claim to Robert and Theopolis Brown in 1866, it is unclear how the property owernship was implemented in conjunction with the kuleana land grants.

[80] Avery's *Environmental History of Kahuku*, p. 15.

[81] Ibid., p. 15-16.

[82] Avery's *Environmental History of Kahuku*, p. 16.
Tax records show that Brown had paid taxes on 364,000 acres of land in 1865, land grant #2791. While this land grant is assumed to the Kahuku Ranch, the inconsistency in acreage (Kahuku property was estimated at 300,000 acres at the time of sale to Harris but was actually some 184,000 acres) presents the potential that this was not Kahuku but another property owned by the Browns. This hypothesis is further supported by records of purchase of land by Theopolis Brown in 1866 for $5,250. (Ruth Dana Miller Rice, "Our Ancestors," Unpublished Data, July 2000, Kahuku File, Kona Historical Society Archives, pdf. pg. 7)

[83] Avery, *Environmental History of Kahuku Ranch*, p.15.

The arrival of the Robert Brown family and employees marked the official beginning of Kahuku's legacy as a ranch. Brown produced salted beef and hides from the cattle he raised on his new Kahuku Ranch. He built stone walls to delineate pastures and paddocks for cattle, goats, and pigs. He also kept other animals on the ranch, mostly fowl and horses. Further, unlike his predecessor Harris, Brown resided in Kahuku as he operated the ranch and made vast improvements to accommodate his family and ranch hands. Brown built his domestic complex some seven miles upslope from the sea, to the north of the road on a grassy plateau to comprise a main house and five workers' dwellings.[84] The main house was a three-bedroom lava-stone home with an adjacent kitchen and dining room. Based on family accounts of their time at Kahuku, it is possible that the main home was a reconstruction of their disassembled Honolulu house: the family had planned to move the house to their new property but only half of the house reached the ranch while the other half was left at the coast. Another possibility is that the lava-stone home was built to house the family until their Honolulu house arrived in Kahuku and could be reconstructed. Robert Brown's fourth daughter, Alura Eliza Brown, recounts her dwelling as being "large and white."[85] All new constructions were fashioned out of lava stones abundant in Kahuku's volcanic landscape.[86]

In addition to building the ranching complex infrastructure, Robert Brown also landscaped around his home to create spaces for his family's use. To the front of the main house was a grassy plot; to the south and rear of the house were gardens divided by long rows of mulberry, fig, peach, and other tropical fruit trees. A large orchard of banana trees was also established near the domestic complex. Alura Eliza Brown recalls a long, shaded walk in the garden, flanked by flowers on each side, leading to her late sister's grave[87] where a Japanese pepper tree provided shade over the gray headstone and footstone. Around the grave mound were golden hearted lilies and baby's breath perfuming the air. Brown also planted figs, peaches, bananas, mulberries, and a variety of flowers in stone wall-enclosed gardens around the house.[88]

Despite the efforts to establish a productive ranch and a "well kept and luxuriant" home at Kahuku, the Brown family fell in hard times when Mauna Loa erupted in 1868.[89] Violent earthquakes began on March 27 and forced the family to flee their home like many other residents of the Ka'ū area. The shaking destroyed Robert Brown's ranch home and the stone walls that framed the paddocks, pastures, and gardens. Along with the collapse of the ranch house, the cistern under the residence, too, cracked and drained all its valuable water reserve. The family subsequently moved into a small, wooden servant's house that withstood the initial temblors but when this structure too collapsed, Brown and his foreman, Mr. Swain, built makeshift shelters of salvaged wood and sheet iron from tumbled down roofs. Following over a thousand tremors, on April 7, lava burst from a fissure about a mile above the Brown

[84] The seven-mile distance may not be an accurate measurement as it likely did not account for the changing coastline and water levels. The "Pu'u o Lokuana Trail Guide" published by Hawai'i Volcanoes National Park in 2012 and Rice's observation of the historical marker of Robert Brown's house along Highway 11, "this is not the actual place as the old road was farther up the hill and the house was another mile above that" (Rice, "Our Ancestors," pdf pg.27), support that the ranch complex under Brown's ownership was situated *mauka* (inland) of the predecessor to Highway 11. The complex is suggested to be located near the airstrip west of Pu'u o Lokuana cinder cone under the desolate tract of lava.
[85] Rice, "Our Ancestors," pdf pg.61.
[86] Ibid., p.23, 170; Avery, *Environmental History of Kahuku Ranch*, p.16; Marge and Dennis Elwell, *History of Kahuku Ranch* (Naalehu, HI: Elwell Associates, 2009), p.13.
[87] Amanda W. Brown died of dysentery at the age of thirteen and was buried at the Browns' Kahuku home, in the garden by her favorite tree house. (Elwell, *History of Kahuku Ranch*, p.13)
[88] Rice, "Our Ancestors," pdf pg.23.
[89] Avery, *Environmental History of Kahuku Ranch*, p.16.

house, at 3,800 feet in elevation, and swiftly flowed towards the sea at about twenty miles per hour. The main lava flow was nearly a mile wide and three smaller branches deviated from the main trunk. The lava consumed the Brown house and gardens, as well as the paddocks, pastures, and even the livestock. The Brown family and ranch workers, a party of at least thirty people, fled to Wai'ohinu.[90]

The volcanic eruption devastated Kahuku Ranch. The ranch was left in ruins, with some 2,000 acres of the ranch, including the site of the Browns' family home, destroyed by lava and its aftermath. Two large craters formed on Kahuku, one due to earthquakes and another due to a lava tube collapse. About a thousand cattle were killed at Kahuku and on adjacent land; the Brown family also lost their new litter of piglets. Much of the Kahuku landscape was blanketed by cinder and ash up to two inches thick, while drifts up to fifteen inches deep appeared in places. The Brown family never returned to reside in Kahuku after the eruption of 1868.[91]

Having suffered great losses, Robert Brown attempted to mitigate his financial hardship by acquiring new pastureland and undertaking new economic ventures. Brown continued to raise cattle in Kahuku and bargained for grazing land and water rights on nearby lands with Princess Ruth Ke'elikōlani, governess of the island. He also acquired additional land near Wai'ohinu, where the family settled after the eruption, and built a dairy. Brown also tried a hand at sugar production in his new acreage. However, when another wave of severe earthquakes shook Ka'ū in 1869, Brown again suffered heavy losses. By 1871, Robert Brown abandoned all of his Hawaiian ventures and moved his family to the Washington Territory.[92]

Kahuku Ranch – George Jones (1871-1888)

Before Brown relocated his family to the mainland, he sold Kahuku and the remaining cattle and goats to George Jones, William H. Reed, Charles E. Richardson, and Lord George Kaina for some $8,000 in September 1871.[93] These new owners were mostly Ka'ū residents, with the exception of L. Kaina who was primarily associated with Puna, who were likely aware of the challenges of ranching on an active volcano. In fact, two of the new owners had been directly affected by the 1868 earthquakes: Reed lost hundreds of cattle in the landslide that followed the April 2 earthquake and Jones's general merchandise business on the shore was completely destroyed during the tidal wave associated with the same temblor. Despite witnessing these devastating losses first-hand, the new owners were also likely aware of the still-thriving trade in goatskins, cattle hides, and pulu in Hawai'i, all of which were abundant on the 184,000 acres of Kahuku Ranch, and were willing to undertake the risk associated with the ranch's natural environment.[94]

At the time of purchase from Brown, Kahuku Ranch had been devasted by the series of natural disasters and most of the improvements made by the sea captain were severely damaged if not destroyed. The ranch core comprising of the main ranch house and workers' dwellings were destroyed by the 1868 lava

[90] Avery, *Environmental History of Kahuku*., p.17-18; Rice, "Our Ancestors," pdf pg.25-26.
[91] Ibid., p.18-19 and pdf pg.25, respectively.
[92] Avery, *Environmental History of Kahuku,* p.19.
[93] Elwell, *History of Kahuku Ranch*, p.19.
[94] Avery, *Environmental History of Kahuku*, p.19-20.
Reed, Richardson, and Kaina were known to have been in the pulu business with an individual known as J.C. King in the Puna and Volcano districts. Richardson, Jones, and Kaina also owned and operated the first Volcano House. Kaina was also appointed and served as the Judge of the Third Judicial Circuit Court from 1858 through1887, among other professional positions. (Maxine Hughes, "Some 250 descendants of Lord George Kaina set for Kalapana reunion, genealogy update," *Tribune Herald, August 19, 1984*)

flow and its aftermath. Accounts of Robert Brown's efforts to exhume his late daughter Amanda's remains from under many feet of lava following the 1868 eruption confirms that the beautifully planted gardens around the ranch house and the lovingly landscaped grave site described by Alura Eliza Brown were also destroyed (see Physical History #1). Acres of land, blanketed by layers of ash and cooled lava, had been rendered unusable as grazing land; valuable water holes were also covered or filled with lava. Very little ranching infrastructure likely remained intact at Kahuku Ranch by the time its new owners arrived.[95]

Upon purchasing Kahuku Ranch from Robert Brown, the new owners applied for a boundary commission hearing in order to determine the ranch's exact boundaries. Kahuku, traditionally an ahupua'a whose boundaries were communicated orally based on natural features, had been awarded only by name in the nineteenth century during the Māhele of 1848 by the Hawaiian government and lacked official definition. In the young capitalist economy, oral tradition proved inadequate in defining borders of private property and the new owners likely sought to solidify their title to the entire tract of land before expending resources for improvements. The associated boundary survey proved surprisingly difficult as centuries of geological upheavals, including the eruption in the recent years, had constantly changed the natural boundaries defining Kahuku. False, and often contradicting, accounts of the boundary provided by witnesses presented further difficulties in the task. Despite these challenges, Kahuku Ranch's boundaries were legally fixed by the early 1870s.[96]

Beyond the legal boundary determination, the extent of activities at Kahuku Ranch in the early years under the new ownership is little known. A price quotation for the first road from Wai'ohinu to Kahuku (specifically to Pali o Mamalu) dating late-1872 to early-1873 was found which suggests that improvements to infrastructure, particularly transportation, were considered. The document outlined a six-foot-wide road to take twelve men five months to complete. It also made provisions for an additional road tax for "parties living contiguous to the proposed road."[97] The road would cross a ravine during which portion it would widen to eight feet and assume "an inward inclination of three inches to every foot height."[98] Although it is unclear whether or not the owners of Kahuku constructed the road immediately following the price quotation, a road connecting Pali o Mamalu and Wai'ohinu is depicted in the 1922 topographic map labeled as the "Wai'ohinu Road." This road stretched westward from Wai'ohinu and merged with a north-south ranch road at Kahuku Ranch; the junction located between Lua Poai and Lua Puali. As this topographic map post-dates the Jones era by almost five decades, it is unclear whether or not this road was constructed under his ownership. An 1886 survey map does not provide the same level of detail and the construction date of the road therefore cannot be determined prior to 1922 (See Physical History #2 and #3).[99]

For reasons unknown, George Jones began to buy out his partners of their shares of Kahuku in 1873 and by 1877, or possibly sooner, had become the sole owner of Kahuku's 184,298 acres. Around this time, Jones also set out on developing his new property. Jones built a one-and-one-half story clapboard structure at about 2,000 feet above sea level as his home. Topographic maps suggest that the area at this elevation within Kahuku Ranch was farther south of Brown's house, locating the new ranch house *makai*,

[95] Rice, "Our Ancestors," pdf pg.27, 172.
[96] Avery, *Environmental History of Kahuku*, p.20.
[97] "Estimated Cost of Opening a New Road Between Waiohinu and Mamalu Pali (Kahuku)", as cited in Elwell, *History of Kahuku*, p.20, original at the Hawaii State Archives.
[98] Elwell, *History of Kahuku*, p. 20.
[99] Elwell, *History of Kahuku*, p.20-21; "Hawaii , Island and County of Hawaii, Kau District, Kahuku Quadrangle," U.S. Geological Survey, Department of the Interior, 1922; "Map of the Island of Hawaii, Hawaiian Islands," W.D. Alexander, Surveyor-General, and W.A. Wall, Hawaiian Government Survey, 1886.

or seaward, of the old road.[100] An 1886 map of the Island of Hawai'i also confirms this theory as it labels Kahuku Ranch to be located to the south of the road.[101] The new ranch house consisted of three bedrooms and a parlor on the ground floor, with a large room on the upper level to be used as the boys' bedroom. The kitchen and dining room were separate but connected to the main house by vines of honeysuckle and scarlet trumpet flowers. The house reportedly included a veranda to its east where a room, likely a small visitor's cottage, was kept ready to receive guests. A laundry, bath house, ironing room, and the residences of the Hawaiian and Chinese employees occupied the area behind Jones's home. In the immediate vicinity of the main house, Jones constructed a storage building for livestock feed with an adjacent office, a blacksmith shop, and a number of workshops thereby establishing the basis of all ranch operations.[102]

Like the Browns before them, the Jones family created a garden landscape of nonnative plants and flowers around their property. The family planted violets, heliotrope, tuberoses, and verbena in front of the veranda and lined the stone fences with mulberry and pepper trees as windbreaks. Eucalyptus and magnolia provided shade across the landscape and two cypresses provided further ornamentation. Gardens of morning glories, mountain apples, oranges, limes, guava, and cherimoya afforded a beautiful source of nutrients. All of these domestic developments likely post-date Jones's attainment of sole property ownership of Kahuku as there is no evidence of his previous partners residing on the ranch.[103]

In addition to creating a home for his family, George Jones sought to transform the devastated ranch into a fully functioning, profitable operation. The new owner stocked the ranch with purebred cattle such as Herefords, Durhams, Ayrshires, and Angus; he purchased work animals such as horses, mules, oxen, and donkeys; and he raised sheep and angora goats for their wool as an additional valuable export commodity. To the north of the yard, Jones built a pen for calves and a paddock separating the yard from the new dairy. He kept pigs and chickens for domestic consumption. Wild turkeys, geese, quail, and feral chickens also roamed the ranch. It is unclear whether or not Jones introduced these birds; these animals may have been the remnants of the fowl introduced by Robert Brown.[104]

By 1883, Kahuku Ranch had recovered from its devastated state and was described as having "an abundance of grass and crop to sustain quite a number of cattle or sheep" during the rainy season. Around this time, Jones had also leased an additional 60,000 adjoining acres from Princess Pauahi Bishop's estate for pasture and water to supplement his ranch through the dry seasons. By 1884, Jones had grown his stock to 1,700 head of cattle, fifty-three horses, and thirty mules and donkeys. Kahuku Ranch had not only become operational but became a prominent self-sustaining cattle ranch on the island. The construction of a wharf at Honu'apo to the east of the ranch in 1883 likely furthered the operation's success by providing a more reliable means of transport.[105]

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[100] Kahuku Quadrangle, U.S. Geological Survey, 1922.
[101] Alexander and Wall, "Map of the Island of Hawaii, Hawaiian Islands."
[102] Avery, *Environmental History of Kahuku*, p.20-21; Elwell, *History of Kahuku*, p.19-20.
[103] Avery, *Environmental History of Kahuku*, p.21.
[104] Ibid., 20-21; Elwell, *History of Kahuku*, p.20.
[105] Avery, *Environmental History of Kahuku*, p.13, 21.
Transporting cattle proved especially difficult for ranchers as most ports lacked wharves. The animals had to be loaded into schooners or streamers that anchored offshore one by one, driven into the sea by paniolos. The Reciprocity Treat of 1875, a free-trade agreement between the U.S. and the Hawaiian Kingdom that guaranteed a duty-free market, brought on a trade boom that soon led to the construction of wharves and enlargement of servicing interisland fleets. The wharf at Honu'apo was also likely associated with the trade boom.

Like the Browns, the Joneses' life at Kahuku was interrupted by volcanic activity. On January 18, Mauna Loa erupted causing two streams of molten lava to pour out about ten miles north of the Joneses' home. The Joneses experienced better luck than their predecessors as one of the lava streams, headed straight for their house, stopped short of the ranch buildings. The other branch reached the sea without destroying any ranch structures though it caused some damage to the overall ranch property. The Kahuku Ranch was left overall intact after the 1887 eruption.[106]

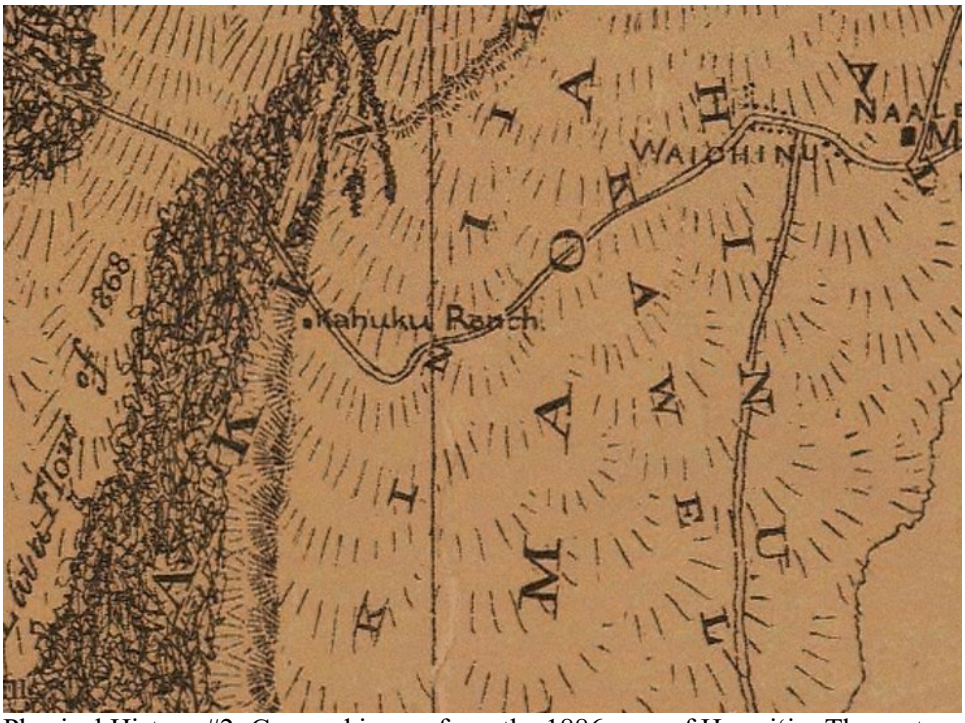
While Jones had been spared extensive damage to his ranch, tourists flooding to witness the post-eruption volcanic landscape of Kahuku posed another difficulty to ranch operations. An increasing number of tourists flocking to Kahuku made it difficult to carry on the ranching business; all resources had been diverted to accommodating guests who required lodging and provisions.[107]

This unproductive interest in Kahuku Ranch associated with the eruption, coupled with the fact that cattle ranching in Hawai'i proved less profitable than he had hoped, even though Kahuku was considered the fifth largest cattle raising operation on the island, drove George Jones to release his holdings at Kahuku.[108] In September 1888, Jones sold Kahuku to Colonel Samuel Norris for $28,000 and moved his family to Honolulu. This sale included all of Kahuku's 184,628 acres, livestock, and improvements, including the ranch house.[109]

[106] Avery, *Environmental History of Kahuku*, p.22-23.
[107] Ibid., p.23.
[108] The markets for Hawaiian beef had begun to shrink as the whaling market dwindled. The unregulated hunting depleted the number of whales and no whaling ships were based in Hawai'i after 1880. As the ranching industry in California and Oregon developed, the West Coast no longer needed to import significant amounts of Hawaiian beef. (Ibid.)
[109] Ibid.
This discrepancy in acreage of Kahuku is not explained in any of the cited literature; even under the scenario that Jones had purchased the seven kuleana land grants during his opertations at Kahuku, the marginal sizes of kuleana claims do not account for the difference exceeding 300 acres.



Physical History #1: Image of Captain Brown locating the grave of his departed daughter Amanda at Kahuku for reburial at a nearby churchyard. (http://www.captainbrown.net/index.shtml, as referenced in Pu'u o Lokuana Trail Guide, Hawai'i Volcanoes National Park, 2012)



Physical History #2: Cropped image from the 1886 map of Hawai'i . The east-west road depicted in the map is the early iteration of Highway 11. Note the location of the "Kahuku Ranch" label, to the south of the road. ("Map of the Island of Hawai'i , Hawaiian Islands," W.D. Alexander, Surveyor-General, and W.A. Wall, Hawaiian Government Survey, 1886)



Physical History #3: Cropped image from the 1922 topographic map of the Kahuku Quadrangle. The Wai'ohinu Road is highlighted in white. The east-west road along the top of the image is the early iteration of Highway 11. ("Hawai'i , Island and County of Hawai'i , Ka'ū District, Kahuku Quadrangle," U.S. Geological Survey, Department of the Interior, 1922)

Kahuku Ranch – Colonel Samuel Norris and Charles Macomber (1888-1911)

The new owner of Kahuku Ranch was of a very different character than the previous owners. "Colonel" Samuel Norris was a loner who was notoriously unfriendly and confrontational. Since his arrival to the U.S. from his birthplace, Denmark, in 1843, Norris developed a tendency to get involved in legal disputes, so much so that lawyer and history enthusiast Allen Chickering coined him the "litigious pioneer" in 1946. Samuel Norris had been involved in several legal disputes by the time he purchased Kahuku Ranch in 1888 and his confrontational behavior continued even after acquiring ownership of the ranch. Under Norris, the days of opening the ranch to visitors and passersby were over..[110]

At the time of purchase, the amount of pastureland at Kahuku had been greatly reduced as a result of the volcanic activities in the previous years. Although the ranch complex had been spared from destruction, the overall Kahuku Ranch was viewed as no longer being able to support a large herd size. Likely the result of a combination of these environmental factors and the unconventional character of its new owner, Kahuku Ranch was understaffed and poorly operated under the management of Samuel Norris..[111]

Samuel Norris likely expended little efforts to improve his ranch. He operated his ranch with only three staff members, a Japanese servant, a paniolo (Hawaiian cowboy), and Charles Macomber who worked as part cowboy and part carpenter; a group of four people was too small for proper functioning of a 184,628-acre ranch. Cattle were allowed to run wild on the unfenced ranch and were often stolen. In 1897, an

[110] Elwell, *History of Kahuku*, p.26-28.
Norris acquired the title "colonel" because of a story that he had fought in wars against Mexico, most likely fictitious.
[111] Ibid., p.28.

American tourist traveling the Hawaiian Islands, John. R. Musick, described Norris's Kahuku as "a collection of half a dozen or more cottages, barns and sheds, surrounded by stone walls, having the general appearance of an old-fashioned stockade."[112] Needless to say, Musick was not made welcome at Kahuku Ranch and was turned away upon requesting lodging. He and his companion were forced to set off across the 1887 lava flow late in the day; they chanced upon an old hut with a cistern containing water amidst the lava-covered field and took shelter for the night. The exact location of this shelter is unknown; it is possible that the hut is located outside the Kahuku boundary.[113]

Norris was said to have resided on a small hill with fairly recent lava on both sides. While it is difficult to determine a more specific location based on this description, based on his character and unwillingness to improve his ranch, it is unlikely that he constructed substantial home for himself; it is possible that he resided in one of the extant buildings from the Jones era as the buildings dating to the previous owner were situated between two 1868 lava streams.[114]

Very little is known about the operation of Kahuku Ranch under Norris other than that it was run in "slipshod fashion."[115] The owner likely quickly lost interest in operating the ranch as he put Kahuku Ranch up for sale twice, in 1889 and 1890, and sold a part of his cattle, 50 head of fat steers, in 1890.[116] Without receiving any satisfactory offers, Norris finally "sold" Kahuku Ranch to his ranch staff Charles Macomber in 1910 for $1, after a fourteen-day eruption caused a fissure to appear a mile-and-a-half from the ranch buildings and the lava flow burned forests, covered pastures, and buried parts of the road through the ranch in 1907. The purchase price of one dollar did not include cattle; the animals were sold to Samuel Kauhane of Wai'ohinu Ranch for $30,000.[117]

Despite inheriting the largest ranch in the Territory at the time, Charles Macomber chose not to pursue cattle ranching and focused his attention to the timber resources of Kahuku. He and his partners were described as having high hopes for "some lumbering scheme."[118] When this venture proved less than profitable, Macomber put the ranch up for sale in 1911.[119]

Kahuku Ranch – Alfred W. Carter and the Parker Ranch (1912-1947)

The exact course of transaction between Charles Macomber and Alfred Wellington Carter in the transfer of ownership of Kahuku Ranch is unclear. A correspondence dated September 9, 1910 between J.R. Galt, Treasurer, Hawaiian Trust Company, and R. Hind of Kamuela, suggests that the Kahuku Ranch was up for sale since as early as 1910, following Macomber's acquisition of the ranch and the passing of Samuel Norris. Upon Norris's death, his "Danish Heirs" and a Mrs. Emilie L. d'Herblay, a former "investor" in Norris's cotton venture who later sued him in 1892, entered into a litigious battle to properly appropriate the late Colonel's estate. The correspondence acknowledges that all parties, including Charles

[112] John. R. Musick, "Hawai i, Our New Possessions," (New York: Funk and Wagnalls, 1898), as cited in Elwell, *History of Kahuku Ranch*, p.28.
[113] Ibid., p.29.
[114] Ibid., p.28.
[115] *Hawaii Herald*, September 29,1910, as cited in Avery, *Environmental History of Kahuku*, p.24.
[116] *Daily Bulletin,* March 28, 1889, February 10, 1890, and December 20, 1890.
[117] Avery, *Environmental History of Kahuku*, p.24-25.
[118] Kahuku Ranch Journal, April 21, 1911, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[119] Avery, *Environmental History of Kahuku*, p.24.

Macomber, agreed to sell Kahuku Ranch if they could "secure a satisfactory price for this property."[120] In 1912, in a letter to Mrs. Knight, Alfred W. Cater describes that by this time, a Judge Cooper "held an option" on Kahuku Ranch for the sum of $90,000 and was willing to sell at the price of $150,000. Upon inspection and personal appraisal of the ranch lands, Carter purchased Kahuku Ranch for $100,000 on behalf of the Parker Ranch.[121]

Alfred Wellington Carter was the manager and controller of Parker Ranch, a large, operational cattle ranch located on the northern side of the island. Carter first became associated with Parker Ranch in 1899 when Elizabeth "Tootsie" Parker, the widow of John Parker III, requested that he become the legal guardian of her fatherless daughter, Thelma. Thelma, the great-great-granddaughter of John Palmer Parker, the founder of Parker Ranch, had inherited half of the Parker Ranch upon her father's death. Only five years old, she required a legal guardian to oversee her inherited property. Around the same time, Samuel Parker, grandson of the elder John Parker, offered his interest in the ranch, the other one-half, to be managed and controlled by Carter. Carter accepted both offered positions, guardian and ranch manager, on September 25, 1899 and arrived in Waimea in 1900.[122]

When Carter assumed management, the Parker Ranch had grown from its modest beginnings of a two-acre establishment in 1847 to an enterprise of over 150,000 acres with some 25,000 cattle. Sprawling across the northwestern slopes of Mauna Kea, the ranch was rich in grazing pastures and surrounded by forest lands with ample timber resources. Under Carter's direction, the Parker Ranch expanded into strategic locations. As a part of this expansion, Carter purchased the Kahuku Ranch in 1912 in a strategic move to guard against government leases to soon expire.[123]

Prior to making the purchase, Alfred W. Carter had traveled to Kahuku to assess its ranching potential. Carter's initial assessment of Kahuku was optimistic: despite the lava having deemed up to 140,000 acres of the ranch worthless, he estimated the land to have a carrying capacity of approximately 3,000 head of cattle when properly fenced, and a few hundred good acres of land which could be cultivated and planted with corn for feeding purposes. He also placed great value in the many *kīpukas*, small areas of pastureland surrounded by old and hardened lava flows, which provided very lush pastures. Carter noted two known water sources on Kahuku near the main road: one known as "Wahia," situated at an elevation of approximately 2,500 feet, which supplied a large wooden tank that supported some 600 head of cattle during the dry season, and the other located about two miles above "Wahia," at an elevation of 3,500 feet, which was supplied by large swamps above it. Carter estimated that this water could be harnessed in a reservoir of approximately 500,000-gallon capacity. He also noted that the ranch house, likely that constructed by Jones, was located approximately a quarter of a mile makai (south) of the main road.[124] Despite paying double the price as assessed in 1911, assessed at $50,000, Carter believed that Kahuku was worth more and was pleased with his purchase in the following year. He claimed that the assessor, a

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[120] Kahuku Ranch Journal, Correspondence between J.R. Galt and R. Hind, September 9, 1910, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
The unsuccessful logging venture may not have been Macomber's only motivating factor in selling the ranch.
[121] Kahuku Ranch Journal, "Purchase of Kahuku," A.W.C. to Mrs. Knight, October 15, 1912, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
Whether or not there was another property owner before Judge Cooper is unknown.
[122] Joseph Brennan, *The Parker Ranch of Hawai'i, The Saga of a Ranch and a Dynasty*, (Honolulu: Mutual Publishing LLC., 2004), p.117-119.
[123] Bergin, *Loyal to the Land*, p.264; Brennan, *The Parker Ranch of Hawai'i*, p.87; Avery, *Environmental History of Kahuku*, p.27-28.
[124] Kahuku Ranch Journals, "Kahuku Ranch," 1910, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.

Johnny Jones, "[knew] nothing" about valuating ranching capabilities of land other than having lived on Kahuku some thirty to forty years prior.[125]

Since his initial inspection of the land, Carter had recognized the importance of an established fence system to maximize the efficiency of the ranch land. Immediately following the purchase, Carter hired G.F. Wright to survey the line of Kahuku: he claimed that there was a "long stretch of this boundary which borders on Government lands" to which "differences" should be avoided in the future. Like Jones, he likely wanted to officially settle the extent of his land before expending funds for improvement. The survey was carried out in January 1913.[126]

By the early-twentieth century, Hawaiian ranchers had begun to take active roles in improving pastures and water sources. They shifted their focus from responding to the natural limitations of the land to actively changing and improving the natural factors to enhance their ranching operations. Ranchers began to develop more efficient and sophisticated systems of improving their cattle in breeding, raising, and marketing processes. Parker Ranch, too, had adopted these strategies of advancement: it transformed from an operation with little development, inadequate water systems, and overgrazed pastures into a business with highly developed marketing and management techniques. These improvements were made under the direction of Alfred Wellington Carter and he aimed to do the same at Kahuku.[127]

One of Carter's first directives at Kahuku was to improve the grasslands. During the first year, he ordered workers to plow as much land as possible and burn off Hilo grass, which first appeared on the island in 1840 and spread aggressively but contained few nutrients for cattle.[128] The workers also pulled up unpalatable plants such as guava and ivy, plowed the arable land, and planted more desirable pasture grasses such as paspalum. Employees sowed pigeon peas, nutritious legumes suitable for tropical and subtropical areas with poor soils. These also improved the soil of marginal lands as their roots provided nitrogen to the soil. Additionally, Carter tested different grasses at Kahuku in large, unfenced, experimental plots north of the highway and west of the ranch road.[129] While locational information regarding these improvements is limited during the Parker era, it can be induced from the ranch reports from Carter's successors in the 1960s and 1970s that Carter had developed an extensive pasture system makai (south) of the highway.[130] In contrast, only the four paddocks were established along the west of the main mauka (north) road during his management of the ranch (See Appendix E).[131] Corn was also planted for livestock feed; fifteen tons of corn were grown on Kahuku by 1914 and Kahuku Ranch

[125] Kahuku Ranch Journals, "Kahuku Ranch," A.W.C. to Mrs. Knight, October 15, 1912, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives; Brennan, *The Parker Ranch of Hawai'i, p.138.*
[126] A.W. Carter to James Lindsey, November 27, 1912, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
It is possible that G.F. Wright had set up camp along the eastern boundary of Kahuku along the Kahuku-'Āinapō Trail between Kīpuka Pahipa and Kīpuka Nene during his survey as a 1924 topographic map labels a site in his namesake.
[127] Avery, *Environmental History of Kahuku*, p.28.
[128] Ibid., p.14.
[129] While the specific varieties are not known, Carter introduced Kikuyu and orchard grasses at Parker Ranch; other ranchers sowed bluegrass, Italian rye grass, velvet grass, tall oat grass, redtop, and sweet vernal grass during this time. The experiments at Kahuku were likely of a similar palette. (Ibid., p.31)
[130] Kahuku Ranch, Operations, 1964, HAVO17000.SeriesVI.B22.F7, Hawai'i Volcanoes National Park Archives.
[131] Rally Greenwell and David Greenwell, interview by Kepā Maly and Laura Carter Schuster, February 15, 2004.

produced up to fifty-seven tons of corn annually after 1915.[132] Grassland development and maintenance persisted throughout the years under Parker Ranch management.[133]

Besides pasture improvement, the Kahuku Ranch staff undertook three major categories of infrastructure development: water system, fences, corrals, and walls, and ranch buildings and roads. Almost immediately following the assessment of the ranch boundary, Carter entered into an agreement with the adjacent landowners to build a boundary fence. The boundary assessment of 1913 established a new boundary line for Kahuku and it apparently "[crossed] the old fence in different places, in some instances quite a distance from the old fence," and necessitated new construction.[134] In March 1913, Carter, C. Brewer of C. Brewer & Co., and George Gibb of Hutchinson Sugar agreed to each fence one-third of the boundary. Short in labor supply, Carter hired contractors to build the fence in 1915. ‘Ōhi‘a wood was harvested from the ranch forests and transported to the work site by pack animals to be installed as fence posts during this endeavor. This boundary fence was completed in 1916.[135] Contractors were also hired to build many of the other fences and corrals in similar fashion within Kahuku. One of the most important projects in 1917 was the construction of a corral, using ‘ōhi‘a wood harvested from the ranch forest. Based on a correspondence addressed to Carter, the men were to "come down" upon completion of the corral construction, which suggests that the corral was located on the higher grounds within Kahuku.[136] This was a strenuous, labor-consuming project as the ‘ōhi‘a forests were far from the corral site and transporting the materials exhausted the staff's time and energy.[137] It is possible that these construction projects included the building of a zig-zag corral and chute made of ‘ōhi‘a posts. This corral and chute measured approximately 60 feet by 87 feet and was constructed in a unique zig-zag style that was not familiar to the local cowboys who worked at the ranch during the 1930s and 1940s and likely dated to the early Parker years. This structure, extant, is located on a 1916 lava flow within Kahuku.[138]

In addition to the wood post fences, Carter hired workers to construct a three-thousand-foot stone wall at Kahuku. These were planned to be three feet wide at the bottom and taper to two feet on top, with a height of four and one-half feet, to stand five feet inside of the road or embankment. This suggests that the three-thousand-foot wall was located along a circulation passage. The wall construction began in 1913 and Carter was frustrated that the carpenter he had hired was slow in his work; only about half of the wall was finished by June 19, 1913. When the wall was finally completed in 1914, to Carter's dismay, it measured only four feet high at most and only three and one-half feet in many places.[139] Additional frustrations resulted from an earthquake that shook the grounds in April 1914 and destroyed most of the wall on the makai (south) side of the road.[140] The damaged wall was repaired in the following year. A

[132] Kahuku Ranch, Operations, 1964, HAVO17000.SeriesVI.B22.F7, Hawai‘i Volcanoes National Park Archives.
[133] While available sources largely point to existing grassland improvement and development under Carter's management, it is likely that some logging was associated with the development of the pastures, particularly those located mauka, north, of the highway, as 1954 aerial photographs display an unnaturally straight break in woodland canopy along the mauka (north) road. (Aerial photograph Mission HAI0, Flight Line 1, Frame 28, Reference Number 017-1780, U.S. Navy, Spring 1954)
[134] George Gibb (Hutchinson Sugar) to C. Brewer & Co., March 19, 1913, Parker Ranch Papers, Hawai‘i Volcanoes National Park Archives.
[135] Avery, *Environmental History of Kahuku*, p.34.
[136] George K. Campbell, April 5, 1917, Parker Ranch Papers, Hawai‘i Volcanoes National Park Archives.
[137] Avery, *Environmental History of Kahuku*, p.32.
[138] "Kahuku Ranch Zig-Zag Corral and Chute," NPS Cultural Resources Inventory System (CRIS) #789394; "Stabilize Zig-Zag Corral," NPS Project Management Information System (PMIS) #105092, December 14, 2006.
[139] A.W. Carter, January 9, 1914, Parker Ranch Papers, Hawai‘i Volcanoes National Park Archives.
[140] O. Sorenson, May 1, 1914, Parker Ranch Papers, Hawai‘i Volcanoes National Park Archives.

total of 12,240 feet of stone wall were reportedly completed by August 12, 1916; the exact locations of these walls are unknown.[141]

Around the same time that the initial phase of fence and wall construction occurred, in the early- to mid-1910s, Carter also ordered his ranch workers and other contractors to develop an efficient water system. Water shortages had proven one of the biggest challenges for the ranch and the limited water catchment systems were in grave disrepair when the Parker staff arrived at Kahuku. Carter immediately ordered Lindsey to repair broken cisterns so that they could capture any rain that fell while they developed a more expansive and advanced system. The Parker Ranch had relied on rainwater caught in catchments and stored in tanks and Carter planned to apply these techniques to Kahuku. However, finding the drought season harsher at Kahuku, Carter made plans for a more extensive water impounding system to tap into the few natural water sources available. On October 14, 1913, he directed his ranch staff to estimate the distance from the natural spring above the road, likely "Wahia" that he noted in his preliminary survey of the land, to the ranch house. He ordered the workers to impound the water from this spring by way of a pipe that would cross the Wai'ohinu side of the gate as to not disturb the new road. Additional plans were made to put up water tanks, build a shed mauka (north) to catch water for the tank, lay pipes, and make water troughs.[142] While Carter planned to install a 6,382-foot-long pipe from the water tank to the cattle pen in the first year, only 862 feet had been laid by the end of 1914 due to challenges presented by the harsh terrain. Another water conduit measuring 10,764 feet, from the main road to the pen and referred to as the "Kahuku Pipeline," was planned in 1914 and laid by 1918.[143] At the same time, employees installed a 50,000-gallon water tank on a concrete foundation.[144] Two 100,000-gallon water tanks were also constructed sometime after the completion of the pipeline. Although their construction were not detailed, more tanks were likely installed at Kahuku Ranch throughout the years under Parker Ranch management. By 1922, three water tanks and one water shed were connected by the pipeline along the Kahuku-'Āinapō Trail; by 1928, there were three water tanks, two water sheds, one at 3,500 feet and another at approximately 4,500 feet above sea level, and six water holes dotting the expansive Kahuku Ranch.[145]

Finally, the last category of development at Kahuku Ranch was buildings and roads that would not only sustain the operation of the cattle ranch but also support those who worked these lands. Immediately following the purchase of Kahuku Ranch, James Lindsey reported that along with the cistern, the ranch structures were in poor condition.[146] Norris and Macomber likely did not expend great efforts or resources to maintain the ranch core as laid out by George Jones in the late-nineteenth century. Damage caused by earthquakes and years of neglect necessitated immediate attention. By 1913, improvements to

[141] Wilmot Vredenberg, August 12, 1916, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[142] A.W. Carter, October 14, 1913 and November 10, 1913, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[143] O. Sorenson, October 30, 1914, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[144] O. Sorenson, January 12, 1914, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[145] Kahuku Quadrangle, U.S. Geological Survey, 1922; Honuapo Quadrangle, U.S. Geological Survey, 1924; Mauna Loa Quadrangle, U.S. Geological Survey, 1928; Honaunau Quadrangle, U.S. Geological Survey, 1928; Hoopuloa Quadrangle, U.S. Geological Survey, 1928.
As the map series ranges across six years and none of them are of a complete set for Kahuku, it is possible that there were more water features extant during these years than depicted in the maps. One of these water holes was located in the parcel of land transferred to establish Hawaii National Park.
[146] James Lindsey to A.W. Carter, October 26, 1912, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.

the ranch structures were made, including the installation of gutters on the outhouses, dilapidated sheds around the stable were torn down, and silos were constructed upslope of the old cattle pen.[147]

Also in 1913, preparations were made to improve the existing circulation system and construct new roads at Kahuku. Carter purchased varying coarseness of crushed rocks and sand, purchasing only the "best which has been used on that road."[148] These materials were also meant to be allotted towards plaster and concrete mixture for other projects at the ranch. While the location of these roads were not specified, that Carter directed his workers to lay pipes on the Wai'ohinu side of the gate so as to not "cut up the new road," one of the roadwork sites were likely located farther west of the ranch core, potentially on a segment of the "Volcano Road," the earlier iteration of Highway 11, near Pu'u Nanaia. By 1922, two lightly improved roads branched southward from the main road down to the ranch core, one directly into the building complex and the other stretching farther south to merge with another lightly improved road running westward from Wai'ohinu.[149] Various dirt trails, or perhaps pack trails, coursed northward, mauka, from the Volcano Road. A trail also connected the ranch complex with a water tank located makai, south, of the buildings.[150]

All of these activities at Kahuku Ranch required immense manpower. However, finding and retaining employees proved particularly difficult. Located on an active volcano in remote region that required a three-day trek from Waimea, Kahuku left much to be desired by prospective employees. In addition to the location of the ranch, the ranch dwellings, as established during the Jones (and possibly Norris) era, were insufficient to accommodate the number of necessary workers, let alone their families.[151] Ranch hands were forced to separate from their wives and children for months to work at Kahuku; many refused to return upon visiting family. Employees from Ka'ū were even more difficult to retain as they preferred the higher paying jobs at sugar plantations over the $1 per day wage at Kahuku. Those workers who remained at the ranch sometimes lived at temporary camps that frequently moved; Carter resorted to depending on contracted labor. Despite the expansive grounds and intense development taking place at the ranch, these complaints and difficulties suggest that the domestic complex at Kahuku remained small during the Parker Ranch era.[152]

As Kahuku Ranch became a quality cattle ranching operation once again after immense years of improvement, Mauna Loa erupted in 1916. This eruption began on ranchlands, ten miles north of the Volcano Road between 6,500 and 7,500 feet, near Pu'u o Keokeo. Three-and-a-half miles of earth cracked along which lava welled, and a flow thirty feet wide blanketed part of the ranch's upper slopes with five to ten feet of lava. The eruption lasted for fifteen days and rendered useless some twenty-eight square miles of land, most of it within the Kahuku Ranch property.[153] It is perhaps for this reason that Carter so willingly released 5,700 acres of ranch land at Mauna Loa's summit to the Territory of Hawai'i,

[147] A.W. Carter, October 14, 1913, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[148] Ibid.
[149] Kahuku Quadrangle, U.S. Geological Survey, 1922.
It is unclear whether the Wai'ohinu Road was constructed during the Jones era, as the price quotation outlines, or it was built during the Parker years of the Kahuku Ranch.
[150] Ibid.
[151] George Campbell to A.W. Carter, March 7, 1917, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[152] Avery, *Environmental History of Kahuku*, p.32-33.
[153] Ibid., p.35.

for only $100, as contribution towards the newly established Hawai'i National Park on October 1, 1917.[154] This 5,700-acre property included a water hole, a valuable resource at Kahuku.[155]

Kahuku Ranch carried very few animals during its first two years under the Parker Ranch management. Carter likely aimed to properly equip the newly acquired land before stocking it to full capacity. In 1915, 820 head of cattle were kept on Kahuku and the number increased to 1,150 by 1918. However, the ranch and pasture improvements met with limited success. 1,150 head of cattle proved more than the land could support and Carter was driven to decrease the numbers to between 595 and 705 head of cattle between 1919 and 1923. By 1927, only about 1,000 head of cattle and 40 horses grazed on the ranch, a vastly lower number than Carter's initial assessment of some 3,000 head of cattle. In 1918, Carter also learned that, despite his optimistic assessment of 15,000 acres of good pasture, only about 10,000 acres of Kahuku were well-suited for grazing as reported by the agricultural agents from the University of Hawai'i.[156]

Such inhospitable conditions of the land likely influenced Carter to be open to leasing portions of the ranch to profit from marginal lands. In addition to the 5,700 acres transferred for incorporation into Hawai'i National Park in 1917, Carter leased land on the upper slopes of Kahuku to Hawai'i politician, cattle rancher, and sugar plantation owner Lincoln McCandless in 1921. In 1935, Carter deeded 7,542 acres to McCandless who purchased another 788 acres of Kahuku in 1945. In March 1937, he sold 11,880 acres of Kahuku to C.Q. Yee Hop, who owned lands bordering Kahuku. The C.Q. Yee Hop Company owned a sawmill in Kona and a furniture store in Honolulu and was undoubtedly interested in Kahuku's Koa resources.[157]

Despite the unpredictable activities of Mauna Loa and the disappointing pace of development at Kahuku Carter pressed on with the ranching operations through the 1920s and 1930s. Although the ranch only held about 1,000 to 1,200 cattle by the late-1920s, Carter believed that the ranch was worth retaining until a satisfactory offer was made. He had declined an offer in 1917 following the volcanic eruption as he deemed the offer too low. In 1936, ten years after another eruption, he rejected another offer, this time of $200,000, double his purchase price, which he felt was still too low.[158]

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[154] Governor Pinkham to A.W. Carter, October 1, 1917, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.

[155] Mauna Loa Quadrangle, U.S. Geological Survey, 1928.

[156] Avery, *Environmental History of Kahuku*, p.32.

[157] Ibid., p.37.
Interestingly, while Carter leased and sold parts of Kahuku land to independent entrepreneurs, he rejected the proposition put forth by volcanologist Thomas Augustus Jaggar who wanted purchase significant portions of Kahuku for scientific study. Although this would have been the chance to profit off the most marginal lands of Kahuku, the desolate upper slopes of the ranch (Jaggar offered $10 per square), Carter was unwilling to sell. Perhaps Carter believed the rate was too low or that he was unwilling to part with such a significant portion of the ranch. By the mid-1920s, Jaggar developed plans for a Kahuku Observatory that would span some 79,000 acres (120 square miles) and pleaded for local support for not only scientific knowledge but also a boost in tourism that would result from an access road. When Jaggar gained the support of Lorrin Thurston, one of the territory's biggest boosters, Carter conceded to a right-of-way for the road and a lease to build the observatory. However, Carter only agreed to lease ten acres for a station site and no more. Despite such passionate campaigning in favor of the observation station, the road and facilities on top of Mauna Loa were never built. (Ibid., p.36-37)

[158] Ibid., p.35, 38.

With a firm belief that, albeit underperforming to initial expectations, Kahuku was still valuable land and proper upkeep would bring in a better offer. One major improvement at Kahuku after the first decade of Parker Ranch management took form of a boundary fence construction. In 1936, almost exactly two decades following the completion of the boundary fence, Carter entered into an agreement with the Department of Forestry and the Civil Conservation Corps (CCC) authorities to reconstruct the fence. Carter claimed that, while he "put in a very good fence," the two landowners with whom he had an understanding to each construct one-third of the boundary fence installed such poor quality structures that "they would not hold cattle."[159] This new agreement with the Department of Forestry and the CCC would require little contribution from the ranch and the Department would be responsible for its upkeep. The resulting new fence increased the ranch's grazing area by bringing some kīpukas into use.[160]

Additional CCC activities at Kahuku during the 1930s included the construction of a cabin, known as the Punaluu Kahawai Forestry Cabin or Punaluu Kahawai Ranger Station. Located approximately seventeen miles north of the main road at Punaluu Kahawai at 6,167 feet above sea level, the cabin was constructed as a twelve-foot by twenty-six-foot structure as a part of the CCC program to provide assistance to the Board of Agriculture and Forestry for the Territorial Government of Hawai'i. Located along the Kahuku-'Āinapō Trail in a 'ōhi'a-koa forest (adjacent an open meadow), this dwelling was used to accommodate laborers working along the eastern boundary of Kahuku. The forestry cabin would often be referred to as both the "CCC Cabin" and the "Lower State Cabin," in the following years.[161]

World War II at Kahuku Ranch (c.1942-1944)
During World War II, Kahuku claimed value not only as a cattle ranch but also as a strategic military installation. The Island of Hawai'i was home to about 50,000 Marines between 1942 and 1945, most of these men based at Camp Tawara, a staging area for military operations in the Pacific located at the main Parker Ranch. However, a small group of fifty-five men were assigned to an eleven-acre radar station at Kahuku Ranch. The unit's headquarters was established at the base of Pu'u o Lokuana and northeast to the Kahuku Ranch core, immediately mauka, north, of Volcano Road (earlier iteration of Highway 11). This area was selected for its well-concealed location of a natural cul-de-sac, an enclave formed by steep cliff walls of solid basalt and tower vegetation at its periphery. This enclave's proximity to the main road made the site all the more attractive.[162] Prior to the war, this area likely saw little activity precisely due to the spatial limitations presented by the natural landscape. This area was named the Kahuku Base Camp.

Under military use, this enclave was developed as part of advanced aircraft warning operations. The growing Japanese aggression and increased threats to American soil, ultimately resulting in the attack on Pearl Harbor on December 7, 1941, prompted the U.S. to enhance its defensive presence and to accelerate the establishment of aircraft warning and radar systems across the Hawaiian Islands. The Kahuku Base Camp was likely developed to support the SCR-271 radar, the newer, fixed radar unit comprised of an

[159] A.W. Carter to R. Smart, November 27, 1936, Parker Ranch Papers, Hawai'i Volcanoes National Park Archives.
[160] Avery, *Environmental History of Kahuku*, p.34.
[161] Punaluu Kahawai Forestry Cabin Determination of Eligibility Concurrence Letter, Hawaii State Historic Preservation Officer Laura H. Thielen, April 22, 2008; "Eugene Yap and Kahuku Cabin," Correspondence between Laura C. Schuster and Cindy Orlando, May 7, 2008, Hawai'i Volcanoes National Park Archives; "Rehabilitate CCC Cabin in Kahuku," NPS Project Management Information System (PMIS) #112431, December 14, 2006; Christopher L. Quiseng, B.A., *Kahuku Inventory Survey 2004 – 2005: An Archeological Report on the Phase I Kahuku-Ainapo Trail Inventory (2004) and Phase II Transect Reconnaissance (2005)*, Hawai'i Volcanoes National Park, April 2008, p. 34.
[162] Ibid., p.38; Lorenzo Frey and Laura C. Schuster, "Kahuku Base Camp Determination of Eligibility (DOE)," National Park Service, Hawai'i Volcanoes National Park, December 2011, p.33.

"antenna rig permanently mounted on a 100-foot steel latticed tower mounted on concrete piers" with the associated operations equipment and emergency generators concealed in tunnels dug into the hillsides.[163]

The natural terrain at Kahuku offered perfect camouflage for fortified structures. Some structures such as Buildings 406 and 407 were built against the lava rock walls; Buildings 414 and 415a were built directly into the lava rock walls; Building 415b was built into the lava rock and eventually tunneled vertically approximately thirty to forty feet. The natural height of the surrounding vegetation provided further concealment under its canopy. Where structures could not avoid exposure, the land's overall classification as a cattle ranch provided the military with another layer of concealment: these structures were designed and constructed to look like barns or other ranch structures through their shed-like appearances both from the air and the ground. As the surrounding lands continued to operate as a cattle ranch through the military activities, these structures were likely difficult to discern from the other ranching structures.[164]

Based on the research available today, approximately seven buildings/structures were constructed at the Kahuku Base Camp during the military era: the Military Dormitory (Building 404), Military Electric Generator House (Building 406), Vehicle Maintenance Shed (Building 407), Concrete Storage Vault (Building 414), Radar Room/Air Vent (Building 415a/b), Radar Antenna Support Structures, and the Mid-Level Tank Foundations.[165] Building 404 was originally constructed as a 98-foot long dormitory located in the northeast within the cul-de-sac.[166] Building 406 is a square structure capped with a pyramidal roof. Set on concrete floors, this structure was used to house the electric generator that was essential to the operation of the radar station, equipment, and the facility. This structure is located in the northwestern portion of the cul-de-sac layout, across the service area from the dormitory.[167] The original Building 407 as constructed during the military period retains its current position immediately south of Building 406; however, records suggest that the structure built during the early 1940s was one of a flat composition roof, canec exterior, and rectangular footprint.[168] Building 414, known as the Concrete Storage Vault, does not appear in the county tax records or permitting records. However, its placement directly into the cliff side, north of Building 406, suggests purposeful concealment consistent with the other military constructions. In a review of the Base Camp in 1992, the U.S. Army Corps of Engineers suggested that the structure was both used and disposed by the military during the military era.[169] Building 415a/b was constructed to house and operate the radar control station and was therefore purposely concealed by building into the lava walls southeast of the dormitory and further protected by the natural vegetation. It was a two-part, enclosed, irregularly shaped vault-like structure comprising of articulated entrance features and a vent shaft with a pyramidal cap.[170] The antenna support structures,

[163] Kahuku Base Camp DOE, p.7.
See the Kahuku Base Camp DOE for the full historical context of military activities and the development of radar technology in Hawaii.
[164] Kahuku Base Camp DOE, p.7.
[165] The DOE documents the twelve extant buildings/structures at Kahuku Base Camp; it is possible that, like Building 407, a building/structure from the military period was removed and built over in other areas of the site, or that some features might have been removed altogether.
[166] Kahuku Base Camp DOE, p.10.
[167] Ibid., p.14.
[168] Ibid., p.18.
[169] Ibid., p.22-23.
[170] Ibid., p.25-26.

five large, tapered concrete structures with formed concrete superstructures, were located to the northwest of the cul-de-sac and were most probably associated with a fixed SCR-271 radar system.[171]

According to topographic maps dating to 1924, there were two trails that afforded upslope access from the main road at Kahuku. One was the Kahuku-'Āinapō Trail which ran relatively parallel to the Kahuku Pipeline and crossed the highway near Pu'u Nanaia to the west of the base of ranch operations. At approximately 3,500 feet above sea level, at the watershed of the Kahuku Pipeline, the trail briefly diverged into two branches and shortly merged again at approximately 5,000 feet above sea level. Upon merging, the trail diverged once again, one branch, unlabeled from this point, coursing northwestward and the other branch, bearing the label Kahuku-'Āinapō Trail, leading northeast into the upper eastern section of the present-day park boundary and beyond into the Ka'ū forest reserve.[172] This trail was utilized by the ranch for driving cattle between various ranching operations; the route included stopover locations at Kapāpala Ranch, Keauhou Ranch, Humu'ula Sheep Station, and Pu'u O'o Ranch. A segment of an "old trail system" that existed above the woodlands, this trail was used to drive cattle from Waimea by 1918.[173] Ranch hand or cowboy workers from the Parker era (1936), Rally Greenwell, recounted that cattle drives on the Kahuku-'Āinapō were more frequently made in the earlier years of Parker Ranch management and that they grew increasingly infrequent, as seldom as once every five to ten years, in the last decade of the Parker era.[174]

The other trail that branched off of or intersected with the main road was an unnamed trail whose junction with the main road was located to the east of the ranch core, immediately east of the southerly dirt road that merged with the Wai'ohinu road. This trail meandered northeasterly upslope to reach the northwestern base of Pu'u o Lokuana where it briefly continued northeastward before shifting north-northwestward along edge of the 1868 lava flow before merging with the Kahuku-'Āinapō Trail just south of the northernmost water tank and water shed along the pipeline (see Physical History #4).[175] There were no indicators of direct access to the site chosen by the military at this time which suggests that any form of circulation paths within the military site were first established during the time of occupancy.[176]

As such, the single entrance road that served the Kahuku Base Camp, evident in a 1943 photograph, was likely established by the military. In 1962, this road is shown connected to a looped drive immediately before the site; it is unclear whether or not this was done by the military or during the years of ranching activities following military use.[177] The 1943 photograph suggests that a single driveway extended from the circular road to grant access to the buildings. Based on this photograph, is unlikely that this road was significantly improved during military use; the circulation paths for both vehicles and pedestrian appear to have been unpaved and rock lined.[178] (See Physical History #5)

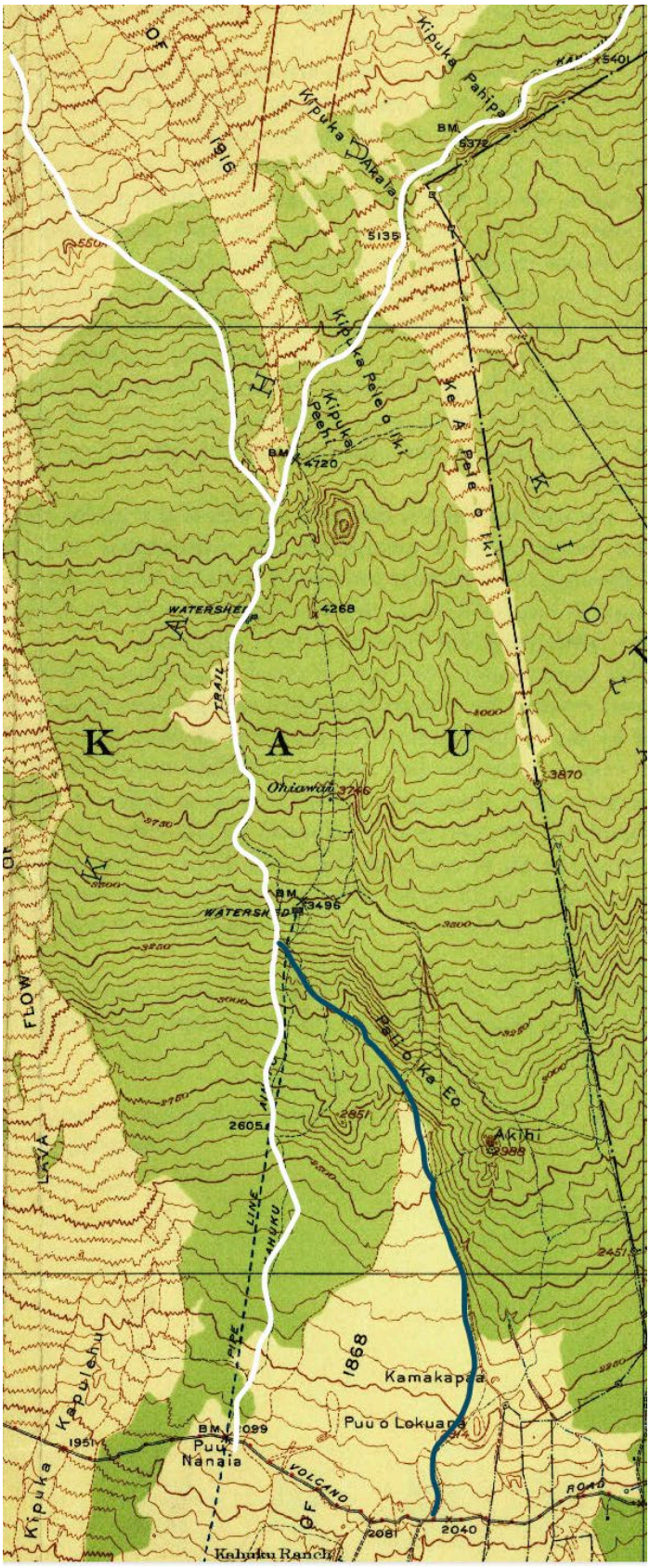
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171 Ibid., p.28.
Refer to the Kahuku Base Camp DOE for the full historical analysis of the military structures.
172 Honuapo Quadrangle, U.S. Geological Survey, 1924.
173 Quiseng, *Kahuku Inventory Survey*, p. 13, 33.
174 Rally Greenwell and David Greenwell, interview by Kepā Maly and Laura Carter Schuster, February 15, 2004.
175 There were other interconnecting trails present in the pastures during the Parker Ranch era; however, none of these provided direct access to the military base.
176 Honuapo Quadrangle, U.S. Geological Survey, 1924.
These trails would also not have been able to beat the capacity necessary to construct the Base Camp.
177 Kahuku Ranch Quadrangle, Island of Hawaii – Kau District, 7.5 Minute Series (Topographic), U.S. Geological Survey, Department of the Interior, 1962.
178 Kahuku Base Camp DOE, p.5, 33-34.

Also sometime during the Parker ownership of Kahuku, the first iteration of the Kahuku Road was likely established. This road, which today serves as the primary access road to Kahuku from Highway 11, is visible in its present alignment in a 1954 aerial photograph of the mauka (north) pastures of the ranch. While the southern portion of the road, downslope of 3,500 feet, is consistent with the alignment of the unnamed trail discussed above, a section of the road upslope courses between the two branches of the Kahuku-'Āinapō Trail until approximately 5,000 feet where it jogs northeast in a similar alignment with the same trail. Although not depicted in the 1924 topographic map, the alignment of the road shows a close spatial relationship to the Parker-era constructed water features such as the watersheds and water tanks, particularly between 3,500 and 5,000 feet, which suggests that it was first established in association with the development of the water conveyance system.

By 1947, more likely before, military occupancy of the 11 acres of Kahuku Ranch ended. The occupants left the site with their buildings intact and Kahuku was free to assume its operations across all of its land. However, although Kahuku Ranch had operated relatively well through the decades under the Parker Ranch management, even through the Great Depression and World War II, the ranch never reached the capacity optimistically estimated by Carter prior to its purchase. Whether he grew tired of expending resources on an underperforming ranch is unknown, but Carter accepted an offer of $443,200 ($365,000 for the land and $78,200 for the cattle)[179] in 1947. The thirty-five-year period of Parker Ranch management of Kahuku came to an end.[180]

[179] Avery's *Environmental History of Kahuku* states that the property was sold for a total of $436,200 but this number is not the sum of the price paid for land and for cattle as suggested. This may be the result of a mathematical error on the total sum, or a data error in the individual costs of land and cattle.
[180] Avery, *Environmental History of Kahuku,* p.38.



Physical History #4: Cropped image of a 1924 topographic map of the Honuapo Quadrangle. The diverging Kahuku-ʻĀinapō Trail is highlighted in white; the unnamed trail that merges with the aforementioned trail is highlighted in blue. (Honuapo Quadrangle, U.S. Geological Survey, 1924)



Physical History #5: Southeasterly view of the Kahuku Base Camp circa 1943. Note the rock-lined dirt circulation paths and the discrete positioning of the buildings under the canopy. (Hawai'i Volcanoes National Park Archives)

Kahuku Ranch – James Wilson Glover (1947-1958)

The new owner of Kahuku Ranch, James Wilson Glover, was a well-respected man from a construction background. Residing in O'ahu, he formed his own construction company, the James W. Glover Construction Company, in 1935 and worked as the general building contractor for the U.S. Navy during World War II. As such, it is unclear why this man, whose main life achievements were in the categories of engineering and construction, came to own a large ranch on the Island of Hawai'i.[181]

It is possible that Glover's background in construction drove him to purchase the Kahuku property for its timber resources. Since the days of the traditional ahupua'a, Kahuku had always offered a variety of natural resources, including forests of koa and 'ōhi'a trees. However, while logging had been attempted numerous times by various individuals throughout the history of Kahuku, including Macomber prior to selling the land to Carter, they had never managed to successfully profit from these resources. Glover's knowledge in building construction (and therefore building materials), in the context of a booming post-war economy and development, these timber sources likely contributed to Glover's interest in Kahuku.

Records show that Glover expanded and developed the Kahuku Base Camp site into a koa sawmill operation based on timber harvesting and processing from 1947 to 1958. A building permit was obtained in 1948 to construct the sawmill facility, including the electric plant (Building 402), in 1948.[182] In 2013, the remnants of the lumber mill site was uncovered a few meters to the west of the main Kahuku Ranch entrance road, just south of the point at which the road turns into a Y and heads up into the upper regions

[181] Elwell, *History of Kahuku*, p.38.
[182] Kahuku Base Camp DOE, p.10-11.

of the park. Archaeological documentation of the site revealed that the Glover-era lumber mill measured approximately 24 feet wide by 40 feet long and contained remnants of the sawmill concrete slab foundations, among other features.[183]

Around this time, the existing military buildings, such as the dormitory (Building 404), the electric generator house (Building 406) and the vehicle maintenance shed (Building 407), were also rehabilitated to suit the needs of the sawmill operation and the rest of the ranch. The dormitory building was decreased in size and its interior was split into multiple residential units for the ranch/mill workers. In 1948, the building was assessed as measuring 3,404 square feet with two levels; a small extension measuring three feet by six feet was made around this time. The ranch staff dwelling bore a board and batten exterior with canec ceilings and tongue and groove interior flooring.[184] The electric generator house was recorded as a tire and tool storage structure in 1948, with tires stored in the main, military-era structure and tools stored in the addition made under Glover's management around 1948.[185] The vehicle storage shed was noted as a "truck and tractor repair shop" during the 1948 public tax survey. This repair shop was a rectangular structure with three open bays set on heavy-duty concrete floors with an addition on the south side used as a "welding shed." Both the storage building and the repair shop (Buildings 406 and 407) were recorded as being topped with composite roof shingles.[186] A new structure, visible in a 1954 aerial photograph, Building 408, was also likely constructed around this time. This new structure was used as the gas pumphouse and was the southernmost structure on the west side of the enclave. By the end of this phase of development in the late-1940s, the Kahuku Base Camp had become a secondary developed area and served as the maintenance and service area mauka (north) of the main road.[187] (See Physical History #6)

Kahuku Ranch under Glover's ownership also targeted another area of resource extraction: cinder mining. Kahuku's location on the side of an active volcano had caused problems for generations of ranchers but Glover discovered a way to profit from these otherwise natural disasters. Cinder cones had formed as debris ejected from a volcanic vent accumulated around the opening, and the resulting cinder deposits proved valuable in road construction or road sanding. One of these volcanic vents, and the associated cinder pit, was located near Pu'u o Lokuana adjacent the military radar antenna site. This site appears to have been mined since at least 1949 and had potentially destroyed the antenna site in the process. The 1954 aerial photograph also shows a heavily extracted hillside, on the northern slope confirming that the cinder mining venture had begun under James Glover's ownership of Kahuku.[188]

Although both the sawmill was located immediately south of the developed area and the cinder pit operation was located at or near the Kahuku Base Camp, the single entry road into the enclave was likely not significantly improved during this time beyond a simple dirt road. The 1954 aerial photograph supports that this road remained a rough, narrow road; a 1962 topographic map further supports this theory as it depicts the road as an unimproved dirt road.[189] (See Physical History #7)

In addition to resource extraction, Kahuku reportedly continued its operation as a cattle ranch through the Glover years. Though limited sources are available from this period, accounts by a young ranch hand,

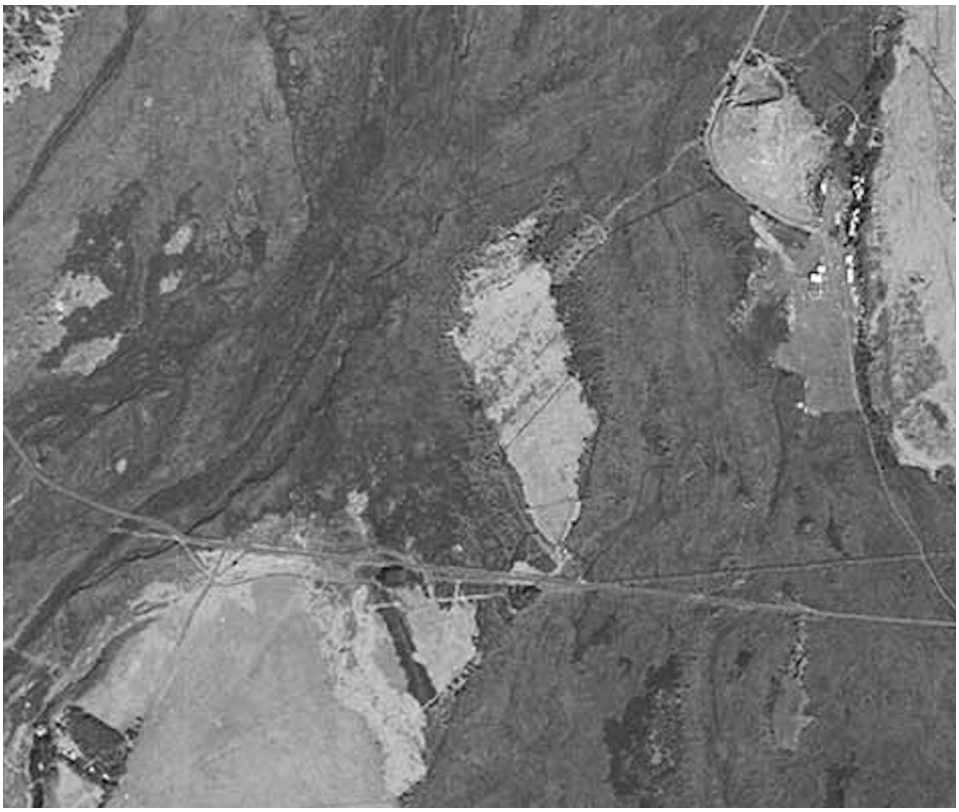
[183] "Kahuku Sawmill," Hawai'i Volcanoes National Park (HAVO) Site Form, State Site Number 50-10-73-31,157.
[184] Kahuku Base Camp DOE, p.10-11.
[185] Ibid., p.14-15.
[186] Ibid. p.18-19.
[187] Ibid., p.35-36.
[188] Avery, *Environmental History of Kahuku*, p.54; Kahuku Base Camp DOE, p.36.
[189] Kahuku Ranch Quadrangle, U.S. Geological Survey, 1962; Aerial photograph Mission HAI0, Flight Line 7, Frame 22, Reference Number 009-1421, U.S. Geological Survey, Fall 1954.

Emilio "J.R." Molcilio, suggests that the buildings at the Kahuku Base Camp was not only for those associated with the mill and cinder mines but also for other ranch hands who dealt with the everyday ranch activities. J.R. reportedly lived in one of the buildings at the base camp during his time at Kahuku Ranch under both Glover and Damon Estate management. The incorporation of the old military buildings into ranch use appears to have solved the shortage of housing for ranch workers.[190]

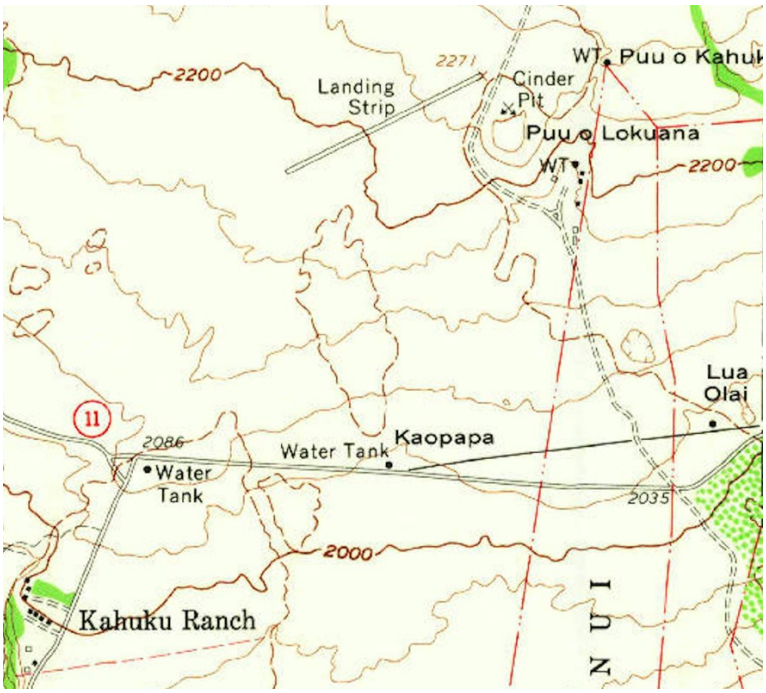
The extent of ranch activities at Kahuku during this period is unclear. Harold Fredrick ("Freddy") Rice Jr., the ranch manager who assumed management of Kahuku following the Glover era, reported that while the previous regime had cleared forests, they had left these cleared lands unsown. They had expended little effort towards pasture improvement: while nonnative weeds and pests had become major problems to ranchers in Hawai'i by 1950, Glover's operation had reacted minimally, if at all, to the issue. Rice also noted that Glover had built roads, fences, and "a pretty good water system,"[191] although the specifics such as the location and type of these constructions are not offered. The 1954 aerial photograph shows some distinct lines of fences makai (south) of the road near the base of operation, and another long fence line, possibly a rock wall, that branches east-northeastward from the main road, crossing the dirt road to the Base Camp, towards the eastern boundary of Kahuku. A faint trail is also visible stretching east-southeastward to the ranch complex from the main road, starting at the western base of the arc towards Pu'u Nanaia (see Physical History #8). While it is difficult to attribute these features to a particular era without consulting photographs pre-dating 1954, it is possible some of these features were established under the Glover era.

[190] Rally Greenwell and David Greenwell, interview by Kepā Maly and Laura Carter Schuster, February 15, 2004.

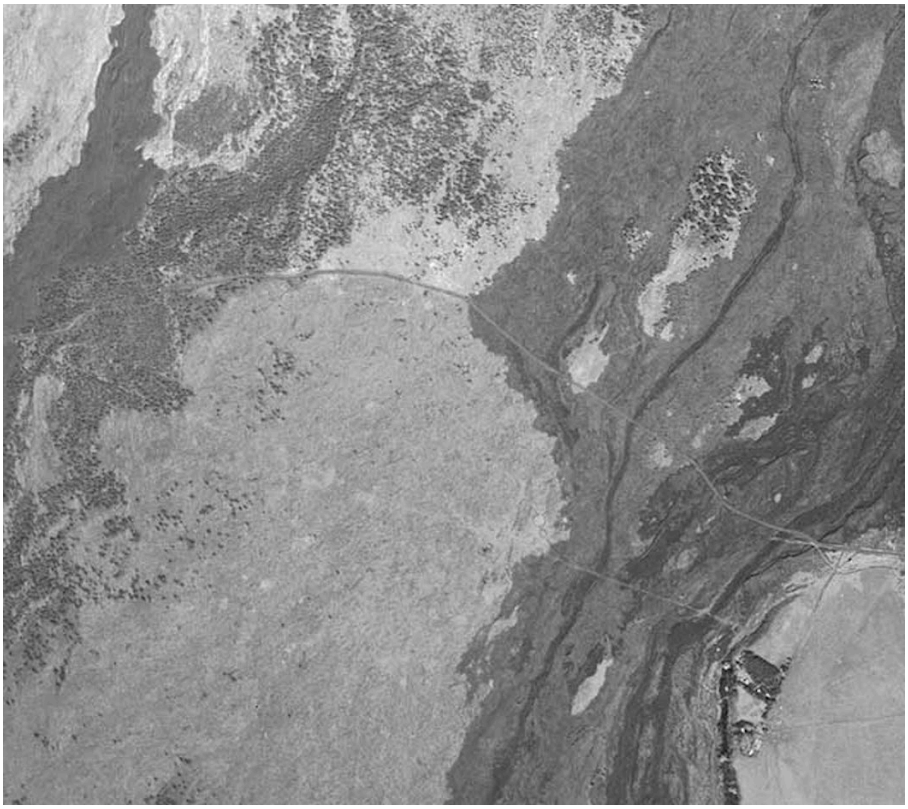
[191] Oahu Cattlemen's Association, *Paniolo Hall of Fame Oral History Interviews* (Ewa Beach, HI: Oahu Cattlement's Association, 2000) as cited in Avery, *Environmental History of Kahuku*, p.39.
It is unclear whether Rice was able to discern the Glover-era improvements from those of the Parker era, as little information is available on Glover's activities at Kahuku Ranch outside of timber harvesting and cinder mining. As an extensive water system was developed under Carter's management of Kahuku, it is likely that the system was maintained by Glover and his ranch staff, and not newly expanded or established.



Physical History #6: Cropped image of a 1954 aerial photograph. The Kahuku Base Camp is located photo right where a narrow road leads to the natural cul-de-sac. To the northwest of the Base Camp, the heavily disturbed cinder pit is visible. The image also shows a part of the main ranch complex to the bottom left. The hard line that represents either a fence or a rock wall is visible branching from the main road eastward across the Base Camp access road. (Aerial photograph Mission HAI0, Flight Line 7, Frame 22, Reference Number 009-1421, U.S. Geological Survey, Fall 1954)



Physical History #7: Cropped image of the 1962 topographic map of the Kahuku Ranch Quadrangle. Note the alignment of the access road to the Kahuku Base Camp near Pu'u o Lokuana which wraps around the landform to its west before extending north-northeastward. The airplane landing strip, built 1961, is also depicted in this map. The solid, straight line across the access road suggests that this feature is a rock wall. (Kahuku Ranch Quadrangle, U.S. Geological Survey, 1962)



Physical History #8: Cropped image of a 1954 aerial photograph depicting the faint trail that extents east-southeastward to the ranch complex from the main road, starting at Pu'u Nanaia. (Aerial photograph Mission HAI0, Flight Line 7, Frame 22, Reference Number 009-1421, U.S. Geological Survey, Fall 1954)

Kahuku Ranch – Damon Estate (1958-2003)

When James Wilson Glover died unexpectedly on March 1, 1957, his heirs entered into a legal battle over his estate that ultimately necessitated the sale of Kahuku Ranch to pay off the estate debts and to divide his assets. Kahuku Ranch was put up for sale at auction held by the Hawaiian Trust Company, the executor of the Glover estate, in the following year. On October 29, 1958, Kahuku Ranch was purchased by the Samuel Mill Damon Estate, a well-known land and banking trust, for $1,363,630. This purchase price comprised of $774,130 for the land and $589,500 for the buildings, fencing, water system, and 2,700 head of cattle. Kahuku Ranch was assessed as a 156,126-acre ranch at this time; in addition to the lands that were sold to third parties under Carter's management, Glover had also sold approximately 12,000 acres of land towards the western boundary for residential land development in 1950. The Damon Estates would also sell another 12,000 acres on Kahuku's edge to Crawford Oil Company, mainland developers who built a large development called Hawaiian Ocean View Estates.[192]

When the Damon Estate purchased Kahuku Ranch, cattle ranching was still an important industry on the Island of Hawai'i and the second-most important industry in Ka'ū, behind sugar production. Despite its economic prominence, Hawaiian cattle ranching continued to be a risky venture, with the majority of ranches operating at a loss in 1958 as production costs increased and beef prices fell. This rise in production costs is likely associated with the challenge that had long plagued the cattle industry: nonnative weeds and pests. While these challenges had begun to proliferate with the introduction of exotic species of flora and fauna since the early twentieth century, they had escalated to be considered ranchers' "biggest problem" by 1950.[193] The new owners of Kahuku Ranch sought to overcome these obstacles through the application of the latest research and chemical solutions and overall intensive pasture management. Through new scientific methods, they aimed to develop the Kahuku Ranch into an efficient, modern, and commercial operation.[194]

Upon purchase, Freddy Rice was appointed ranch manager of Kahuku Ranch. He, and the trustees of the estate, prioritized pasture improvements. These efforts outweighed even cattle management and breeding, as even the sturdiest breeds of cattle could not thrive on low-quality grass. Almost immediately after purchase of Kahuku, Rice developed a pasture rotation system in which he carved the ranch into individual pastures. Each of these pastures was divided into four paddocks through which cows would be rotated through the paddocks. This system of ranchland division, while requiring intensive development, was designed to not only prevent overgrazing but also to naturally eliminate weeds. The animals confined to a designated paddock would consume all available plants within it, including the pesky weeds. The relatively frequent and regular rotation of paddocks would also prevent the elimination of the most palatable grasses, ultimately increasing both the quantity and quality of grass. Although costly to first establish, restricting livestock to fenced enclosures would also eliminate the need for time-consuming and labor-intensive cattle drives that had so often drained the resources of the previous owners.[195]

Each pasture-paddocks system comprised an extensive fencing system that enclosed a holding pen, a water trough, and enough grazing land to support about 200 cows. Some of these pastures were divided

[192] Elwell, *History of Kahuku Ranch*, p.39, 41; Avery, *Environmental History of Kahuku*, p.42, 54-55; Kahuku Base Camp DOE, p.34.
Two sources (Avery and DOE) each mention one of the two 12,000-acre sale exclusively; it is unclear if these are separate sales or if a single event whose dates have been mixed up.
[193] Avery, *Environmental History of Kahuku*, p.43.
[194] Ibid.
[195] Ibid., p.45.

into quadrants while others took more irregular shape.[196] Ranch records suggest that the newly developed pasture system incorporated some existing pasturage, like those established by Carter primarily to the west of Kahuku Road Glover Trail/east branch of the Kahuku-'Āinapō Trail, and infrastructure rather than starting afresh under new management. Some fence lines around paddocks appear to have been retained, as evidenced by the reports of rotting 'ōhi'a posts that were replaced with steel posts through the years. The pasture around the ranch core, makai (south) of the main road, though possibly reorganized into new paddocks, was retained as reference to "the Ranch" appears consistently through the ranch records through the Damon Estate era. Ranching equipment such as the cattle chutes at the Ranch pasture from the Glover era were kept in use until these structures could no longer accommodate the growing size of cattle.[197]

In addition to the development of the paddock system, active pasture improvement became an integral part of ranching operations at Kahuku under Freddy Rice. Ranch staff introduced species of grass and legumes adaptable to Kahuku's challenging conditions. They planted varieties that would spread rapidly, tolerate poor soils, thrive in tropical climates, resist weed invasions, and withstand the impact of cattle grazing. These grasses included pangola and kikuyu, and the legumes included big trefoil, Kenya white clover, Kenland red clover, and white Dutch clover. Other varieties were selected for the higher elevations where the species selected would tolerate cooler temperatures, such as dallis grass, Kentucky bluegrass, and perennial ryegrass.[198]

Prior to sowing these carefully selected grasses, workers engaged in a labor-intensive process of removing unwanted vegetation. Ranch staff used bulldozers to clear small trees, blackberry and Christmas berry; they poisoned any remaining unwanted plants before using the roller. They then used a harrow and chains, dragged behind a large roller or a bulldozer to clear brush and prepare the soil for new planting. Larger trees were left alone to trap moisture from fog and mist, and to provide shade for the newly planted vegetation. Once this multi-step process was completed, grasses and legumes were sown and heavily fertilized. Around the same time, the fence was installed.[199]

By 1964, some six years following the purchase of Kahuku, Rice reported that some 2,070 acres of rainforest was cleared and developed into new pastures and 2,241 acres of existing pasture (from the Glover era and prior) were improved. The newly developed pastures included: Number I Makai, Waipau, 'ōhi'awai I Mauka, 'ōhi'awai I Makai, Manawai Nui, Waiopae (sometimes spelled Waiapai), and Kainoa. The existing but improved pastures included: Number I Mauka, Palm Tree, Number III Hilo Forest, Pele Paddock, Pakini, Kīpuka Mamalo, 'ōhi'awai I, Lumber Mill Paddocks, Kamaoa (paddocks Oya, Kapana, Ruiz House, Hewitt, Nicka, and Grass Field), Ranch (E Paddock and B Paddock), 'ōhi'awai II, Number III, Number III Hilo, and Number II Maluna. In addition, some 7,767 acres of existing pastures were extant at Kahuku, of which 2,046 acres were classified as good pasture and 5,380 acres were considered marginal. These included the remainder of the Ranch paddocks (A, C, Lower C, and D), Number I Kīpuka, Number I Maluna, Glover, Number II Maluna, Number III, Number III Kona, Hapai Mamo, Number IV, Keokeo, Pele Paddock, and the remainder of Kamaoa paddocks.[200] Undeveloped areas of high pasture potential were also noted at the Mauka Lumber Mill, Number III Hilo Forest, and Kainoa.[201]

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[196] Avery, *Environmental History of Kahuku*, p.45.
[197] Kahuku Ranch, Operations, 1961, HAVO17000.Series.VI.B22.F10, Hawai'i Volcanoes National Park Archives.
[198] Avery, *Environmental History of Kahuku*, p.45.
[199] Ibid., p.46.
[200] Some of these pasture locations were likely improved in targeted areas, thus included in both the improved and existing pasture lists.
[201] Kahuku Ranch, Operations, 1964, HAVO17000.SeriesVI.B22.F7, Hawai'i Volcanoes National Park Archives.

According to Rice, the paddocks on the left side of the main road and the Glover Trail/east branch of the Kahuku-'Āinapō Trail going mauka (northward) were developed by Parker Ranch prior to 1947 (contributing); these were larger and not dissected. All manipulated paddocks during the Damon era were located to the right/east of the road (non-contributing). There are no mentions of the paddocks located makai, south, of Highway 11 as being new development.[202]

Also during these six years, the water system, the ranch buildings, and the fence system underwent vast improvement. Within the first two years of ownership, circa 1959, an asphalt-lined reservoir and an asphalt catchment was constructed.[203] These likely refer to the water features located at the 5,000-foot elevation and replaced the Parker-era water shed in the same location to increase water catchment and storage capacity. New water troughs were also installed in the new paddocks to enable rotation, new pipes were laid to connect the pastures' water systems to the watersheds, and holding pens, salt houses, and creep feed pens were constructed. The improvements to the water system centered around increasing water storage capacity and expanding conveyance to the new pastures; there are no records to suggest that the primary conveyance system established along the Kahuku Road by Carter was significantly altered or rerouted. In 1961, the airstrip was built to maximize efficiency in fertilizing the improved pastures. Rice hired crop-dusting service Murray Air to top-dress pastures with 200 pounds per acre of dimonium phosphate and ammonium phosphate fertilizer. Ranch workers also repaired and constructed thousands of feet of fences every year. Time spent on this endeavor was cut in half by 1964 when the ranch adopted an Australian fencing practice called "suspension fencing." This was a more flexible and inexpensive method in which steel and wood posts were used interspersed: wood posts supported the fence at quarter-mile intervals and steel posts every 100 feet. This new system of fencing afforded ranch staff with more time for planting and additional fencing.[204]

By 1974, all the land Rice felt could be transformed into productive pasture had been developed. These areas included 'Akihi, 200 acres of uncleared rainforest north of the lumber mill, Number III Hilo Forest, 550 acres of fenced, but uncleared, rainforest, Number I Kīpuka, 100 acres of uncleared land north of the airstrip, and Maunaloa, 1,000 acres with the potential to raise the carrying capacity to 300 cows. This last portion of land was left last for development due to its remote location that would require additional man hours, horses, etc. Rice had earmarked this area for development on condition that the makai (southern) pastures were stocked to capacity.[205] Of course, the existing pastures were continuously weeded, fertilized, and otherwise maintained as well. In 1969, additional efforts had been expended to repair and replace old fences built during or before the Glover era. By the mid-1970s, Kahuku Ranch and all its pastures were in good shape (see Physical History #9 and #10).[206]

The ranch water system, roads, and buildings were also continuously updated and improved through Rice's management of Kahuku. In 1966, ranch staff completed a new 3-million-gallon reservoir at Kealakoa Spring, at 5,000 feet above sea level, to supplement water from the reservoir that existed when

[202] Harold Freddy Rice, Jr., interview by Laura C. Schuster, June 6, 2004.
[203] "Basal Ground Water Study," n.a. to Mr. F.B. Carter III, Executive Secretary to Estate of Samuel Mills Damon, April 30, 1961, Hawai'i Volcanoes National Park Archives.
[204] Kahuku Ranch, Operations, 1959-1960, HAVO17000.SeriesVI.B22.F11; Kahuku Ranch, Operations, 1961, HAVO17000.SeriesVI.B22.F10; Kahuku Ranch, Operations, 1962, HAVO17000.SeriesVI.B22.F9; Kahuku Ranch, Operations, 1963, HAVO17000.SeriesVI.B22.F8; Kahuku Ranch, Operations, 1964, HAVO17000.SeriesVI.B22.F7, Hawai'i Volcanoes National Park Archives; Avery, *Environmental History of Kahuku*, p.48.
[205] Avery, *Environmental History of Kahuku*, p.48; Kahuku Ranch Operations, 1968, HAVO17000.SeriesVI.B22.F3, Hawai'i Volcanoes National Park Archives.
[206] Avery, *Environmental History of Kahuku*, p.48.

they purchased the property.[207] and built the Ten Mile Road from the Pele Paddock reservoir up towards Mauna Loa..[208] It is possible that the redwood water tank by the CCC-era cabin was also constructed around this time as there are no records that suggest that a tank was built in conjunction with the cabin but the NPS has identified the redwood tank as a 1966 construction in its facilities management system..[209] In the following year, a road was constructed mauka, north, of Ocean View Estates to Kapua..[210] By 1969, the sawmill road, from the main highway (Highway 11) to the shop, was deemed the most traveled road on the ranch and a proposal was made to pave this road. However, this proposal was most likely rejected as evidenced by a 1981 topographic map depicting the road to the sawmill area from the highway as an unimproved road (see Physical History #11). This road may have been periodically graded and oiled instead, like the Eight Mile Road..[211]

In addition to the sawmill road, there were at least four established roads that were regularly discussed in various Kahuku Ranch operations reports through the Damon Estates period: the Eight Mile Road, the Five Mile Road, Ranch Road, and South Point Road. The Eight Mile Road likely referred to the road that served as the central circulation corridor through the mauka (north) paddocks, possibly the present-day Kahuku Road. A mauka, northern, paddock map circa 1988 labels the central road between the Parker era pastures and the Damon era developments the "mauka road."[212] Though records have never clarified the starting and end points of this road, the existing mauka (north) road in this location measures approximately eight miles to the reservoir at 5,000-foot elevation. The Ranch Road refers to the southerly road that leads from the main highway into the main ranch complex makai (south) of the latter. While there were two unimproved roads established in this area by the Parker era, the eastern of the two roads had disappeared by 1962. This road may be synonymous with the main entrance road which is described as leading towards the ranch camp. The road is reportedly lined with rock walls that were rebuilt in 1976..[213] The South Point Road is the main circulation through the Kamaoa section of Kahuku Ranch, which included Oya, Kapana, Ruiz House, Hewitt, Nicka, Grass Field, Ozorio, 60-acre Guinea Grass, South Point, Martinson, George Beck, Kaalualu, Kemio Corner, Guinea Grass Corner, Beke Bob, Gouveia, and Eight Acre paddocks. Other than that it is a makai (southern) road, little is known about

[207] This existing reservoir was likely constructed during the Parker era, as Carter is attributed to having established the water conveyance system at Kahuku, and records suggest that Glover had minimally improved the ranch operation during his decade of management. As this reservoir is not depicted in the 1924 topographic map but is visible in the 1954 aerial photograph, the water feature was likely constructed between 1924 and 1947.

[208] Ibid., p.49; Kahuku Ranch, Operations, 1966, HAVO17000.SeriesVI.B22.F5, Hawai'i Volcanoes National Park Archives.

[209] "Kahuku CCC Cabin Redwood Water Tank," Asset Number 419290, Facilities Management Software System.
It is unlikely that the redwood water tank was constructed during the CCC era because the DOE for the cabin does not include the discussion of such feature. It is unlikely that a discussion of such a feature would be omitted in the document if evidence was available to support its eligibility.

[210] Kahuku Ranch, Operations, 1967, HAVO17000.SeriesVI.B22.F4, Hawai'i Volcanoes National Park Archives.

[211] Kahuku Ranch, Operations, 1969, HAVO17000.SeriesVI.B22.F2; Kahuku Ranch, Operations, 1975-1976, HAVO17000.SeriesVI.B21.F13, Hawai'i Volcanoes National Park Archives; Kahuku Ranch Quadrangle, Island of Hawaii – Kau District, 7.5 Minute Series (Topographic), U.S. Geological Survey, Department of the Interior, 1981.

[212] "Kahuku Ranch Mauka Paddock Map," Kahuku Ranch, Operations, 1988-189, HAVO17000.SeriesVI.B21.F9, Hawai'i Volcanoes National Park Archives.

[213] Kahuku Quadrangle, U.S. Geological Survey, 1922; Kahuku Quadrangle, U.S. Geological Survey, 1962; Kahuku Ranch Operations, 1975-1976, HAVO17000.SeriesVI.B21.F13, Hawai'i Volcanoes National Park Archives.

this road.[214] Similarly, little is known about the Five Mile Road. By 1995, the central road extending northward from Highway 11, the sawmill road and Eight Mile Road, the primary north-south axis road mauka, north, of the highway, was transformed into a light-duty road.[215] (See Physical History #12)

Other notable changes to the Kahuku Ranch circulation system during the Damon Estates era were the realignment of the main highway and Kahuku-'Āinapo Trail. The Kahuku-'Āinapō Trail, which was depicted as coursing southward along the Kahuku Pipeline towards Pu'u Nanaia in the 1922 map, disappears in the 1962 topographic map. The lower segment of the old Kahuku-'Āinapō Trail appears to have turned into a jeep trail that turns into an unimproved road around 2,500-foot elevation. This dirt road then stretches northeastward to merge with the Eight Mile Road at Pali o Ka'eo at the apex of the lava flow of 1868. The upper segment of the Kahuku-'Āinapō Trail is not represented in the 1962 map.[216] The realignment of the main highway, Highway 11 or the Māmalahoa Highway, took place between 1965 and 1977 according to the historic aerial photographs available. The realignment took place to the west of the Kahuku Ranch core where the road once arced towards Pu'u Nanaia. This entire arc was retired and instead, the road progressed eastward in a straighter course for approximately one and one-half miles (see Physical History #13 and #14). This realigned section of the road resembles the faint trail visible in the 1954 aerial photographs; this trail may have been incorporated into the official alignment of Highway 11. The arc segment of the old road is now a secondary road called Old Māmalahoa Highway.[217]

The improvements to the ranch buildings and facilities during the Damon Estates era revolved around the need to accommodate ranch staff and to update the existing facilities to modern amenities. One of the most focused area of building improvements took place at the old Kahuku Base Camp from the late-1950s through the 1970s when the existing structures were improved to suit the needs of both the staff and the ranching operation. In 1959, the old dormitory, Building 404, was reconfigured into a duplex residential building. This involved constructing two separate dwellings from the single, larger dormitory; in so doing, a "middle 25-foot section" of the dormitory was demolished. The mess hall was also either demolished and replaced, or altered and reconfigured at this time.[218] In the late-1960s, sidewalks around Building 404 were poured and circulation potentially reconfigured; the carport system, storage shed, and covered deck additions also likely took place during this time.[219] This period marked the "residentializing" of the Base Camp, a process during which the enclave adopted a suburban ranch style of housing. To further this character, a Lindal cedar home was built in 1971; another was planned. In addition to the changes to the residential accommodations, the overall landscape adopted a more domestic character: garden beds were established and lava rock walls were laid.[220]

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[214] Kahuku Ranch Operations, 1964.
[215] Kahuku Ranch Quadrangle, Hawaii – Hawaii County, 7.5 Minute Series (Topographic), U.S. Geological Survey, Department of the Interior, 1995.
With the exception of the Eight Mile Road, likely the present-day Kahuku Road, and potentially the Ten Mile Road, these main roads established during the Damon Estates era fall outside the boundary of the Kahuku Ranch Cultural Landscape. The Five Mile Road lacks sufficient locational information to make a geographical estimation.
[216] Kahuku Ranch Quadrangle, U.S. Geological Survey, 1962.
[217] Aerial photograph mission EKL, Flight Line 13CC, Frame 26, Reference Number 075-6598, U.S. Department of Agriculture, March 1965; Aerial photograph mission VEEC, Flight Line 1, Frame 84, Reference Number 008-610, U.S. Geological Survey, December 1976.
[218] Kahuku Base Camp DOE, p.11, 36.
[219] Ibid., p.11.
[220] Ibid., p.35-36; Kahuku Ranch, Operations, 1971, HAVO17000.SeriesVI.B21.F17, Hawai'i Volcanoes National Park.

Updates to the non-residential facilities at the Base Camp also occurred during this period. In 1958, public tax record showed that all but the electrical plant (Building 402) at the sawmill operation site were demolished. This suggests that the electrical plant was likely used to serve the operational needs of the ranch through the Damon Estate era.[221] In the late-1960s, Building 407, the three-bay truck and tractor repair shop (see Physical History #15), was significantly altered if not reconstructed into a two-bay structure with an attached door system.[222] New construction also took place: a residence, Building 403, was constructed in 1972, a pole shed (Building 405) in 1973, and a barn (Building 401) in 1989.[223] In 1974, the tire storage (Building 406) and the shop (Building 407) were reroofed with corrugated iron sheets.[224]

Other building activities at Kahuku during the Damon Estates era included the construction of a Ranch Office and a hot house for the Main Ranch House in 1961, a manager's cottage in 1963, and J.R. "Junior" Molcilio's house in 1972. The exact locations of these new constructions are unspecified. In 1968, all ranch houses and facilities were installed for electricity, with all wires installed underground. By 1982, Kahuku prided itself on providing housing, electricity, and water for its manager, ranch foreman, and five ranch hands (though some without the complete amenities package).[225]

The fence system at Kahuku also began to see a change in 1980s through the turn of the century. Through the 1970s, sulfur dioxide emissions had skyrocketed due to numerous volcanic activities at Kīlauea and further intensified by the eruption of Pu'u 'Ō'ō in 1983. Sulfuric acid corroded metallic surfaces when it rained, and metal objects deteriorated rapidly. The Kahuku fence system, by this time constructed primarily of steel posts, began to corrode at an increasing rate.[226] Also by 1982, new ranch manager ThomasWaddoups claimed that the suspension fencing, a revolutionary fencing method that had saved much labor and funding, was more effective for an open, level plain than the harsh, rocky slopes of Kahuku. He claimed to have introduced a new fencing type around this time, though the type was not specified.[227] However, as galvanized metals and fiberglass posts replaced the wood and steel posts by 1997, it is likely that Waddaup began to switch the deteriorated steel posts with sturdier, corrosion-resistant materials as repair needs arose since the mid-1980s.[228]

All of these improvements, not to mention the cattle ranching operation, heavily depended on a reliable water system to properly function. Ranch staff, under Rice, had developed the water system since the beginning of the Damon Estates era, improving catchments, reservoirs, building and installing new tanks, and laying pipes; by 1982, Waddoups announced that Kahuku comprised of two separate and different water systems and sources of supply. One supplied the Kamaoa section to the south of the ranch core. This system was supplied by the county water system. The Kahuku area, referring to the mauka (northern) pastures, consisted of two large reservoirs for stock water, plus county water for the ranch headquarters.[229] While the construction date of the second reservoir serving the mauka (northern) pastures is not known to date, a comparison of historic aerial photographs suggests that it was established

[221] Kahuku Base Camp DOE, p.34.
[222] Ibid., p.18.
[223] Ibid., p.10.
[224] Kahuku Ranch, Operations, 1974, HAVO17000.SeriesVI.B21.F14, Hawai'i Volcanoes National Park Archives.
[225] Kahuku Ranch, Operations, 1961, 1963, 1968, 1972, and 1982.
[226] Avery, *Environmental History of Kahuku*, p.51.
[227] Kahuku Ranch, Operations, 1982.
[228] Avery, *Environmental History of Kahuku*, p.52.
[229] Kahuku Ranch, Operations, 1982.

between 1965 and 1977, most likely around the time that the reservoir at Kealakoa was built (see Physical History #16 and #17).[230] Shortly following this announcement, in the same year, the ranch built a third reservoir to the Kahuku area, adjacent to the one built in 1966 at 5,000-foot elevation. Within the following two years, a 1.5-million-gallon tank was built, approximately 15,500 feet of water pipe was replaced, and an additional 16,000 feet of pipe was installed.[231] The exact numbers of water tanks and troughs installed during the Damon era are not available to date.

In addition to pasture improvement, other forms of vegetation-planting took place at Kahuku during the Damon Estates era. One form of such plantings was for ornamental purposes. In 1973, purchase of 320 miscellaneous plants was reported in the ranch report. These plants and shrubs were reportedly purchased for "beautification of our Ranch home and grounds"; each house was distributed some 35 plants and all employees were enthusiastic in planting and beautifying their homes and gardens.[232] The varieties of plants planted include: bird of paradise, wild olive, bougainvillea, gardenia, dwarf bougainvillea, wax plant, Chinese privet, pepper tree, and periwinkle. These plants were also planned for propagation for future plantings.[233]

Another form of plantings was to protect the ranch landscape from the strong winds. In 1966, a windbreak and shade project was initiated and continued until at least 1972. During this period, windbreaks of Norfolk pine, ironwoods, and monkey pod trees were planted for the offices, the main ranch camp and headquarters, and the Kamaoa holding pen to the south. Several more fence lines at the ranch were planted with windbreaks, though their exact location and composition are unspecified. By 1972, however, Norfolk pine as windbreaks was rejected as the estate trustees had developed a low opinion of these trees' capacity for this purpose.[234]

Tree planting also took the form of an experimental venture. In light of a growing marketable nonnative trees, in 1966, two acres at the Number I Kīpuka pasture was cleared as a test production area for Christmas trees. About one acre of these trees were planted in the following year.[235] In 1974, twenty-five citrus trees were planted likely for similar reasons. These commercial-tree planting endeavors remained small-scale, however, and never developed into an extensive venture. Despite the minimal, if any, profit from these ventures, the ranch found another way in which tree planting would be beneficial: staff planted 2,000 Australian red cedar, 1,500 loblolly pine, 1,200 koa, and 500 eucalyptus in order to earn a property-tax break by reforesting some of the ranch's marginal lands.[236]

The last form of vegetating Kahuku Ranch was directly associated with the natural conservation efforts carried out by the state. In an attempt to maximize profits amidst the declining cattle market in Hawai'i, the Damon Estate trustees looked to exploit the ranch's extractable commodity. They hired contractors to harvest sandalwood and 'ōhi'a in the late-1980s and 1990s, and also allowed loggers to harvest distressed or downed koa trees. In 1999, the estate was fined $466,800 for failing to obtain permits to harvest koa

[230] Aerial photograph mission EKL, Flight Line 13CC, Frame 59, Reference Number 075-6464, U.S. Department of Agriculture, 1965; Aerial photograph mission VEEC, Flight Line 7, Frame 171, Reference Number 008-716, U.S. Geological Survey, 1977.
[231] Avery, *Environmental History of Kahuku*, p.50.
[232] Kahuku Ranch Operations, 1973.
[233] Kahuku Ranch Operations, 1973.
[234] Kahuku Ranch, Operations, 1966, 1968, and 1972; Avery, *Environmental History of Kahuku*, p. 51.
[235] Kahuku Ranch, Operations, 1966 and 1967.
[236] Avery, *Environmental History of Kahuku*, p. 54.

on some five hundred acres of the ranch. The ranch negotiated to restore the disturbed land in lieu of paying the fine.[237]

While not considered active planting efforts, Rice attempted to "conserve" the forests of Kahuku, so much of which he had declared unproductive wastelands. He described the forests as containing many "big, old, dying trees, with a lot of rubbish underneath." To improve the forest lands, Rice and the ranch staff worked to clear all the young "rubbish" trees and brush and kept the larger specimens. They then mounded the trees into compact piles, from the top of which would grow new seedlings. Rice claimed that these little piles of seedlings grew up into "little forests," supposedly expediting the natural process of forest rejuvenation "by a thousand years."[238] It is possible that some of these larger specimen trees were left undisturbed as a means of slowing the rate of evapo-transpiration and capturing the moisture in the air.

Damon Estate trustees also sought to increase profits by introducing game animals to the ranch to attract hunters. Although no game animals existed on the ranch when the Damon Estate bought the property, by the late-twentieth century, Corsican mouflon sheep, bison, and game birds such as pheasants and francolin could be found at Kahuku. Some of these animals, such as the mouflon sheep, increased in numbers exponentially, an introduced herd of eight in 1968 grew to 2,000 by 1993. These sheep had proven too successful and overgrazed meadows and forest openings above the cattle paddocks and were encroaching on the nearby forest reserves and Hawai'i Volcanoes National Park. The ranch developed a system to treat these sheep as a natural resource to be managed: the staff culled about 800 "inferior" sheep and left a sizeable herd of the largest, healthiest animals to continue to attract hunters. Bison were introduced as a means to profit from marginal lands not suitable for cattle grazing, in the upper elevations that were too cold and wet for cattle. However, these animals did not thrive in the poor conditions of the upper lands and required supplemental pellet feed to their diet. The bison were deemed an unprofitable animal and the trustees sought to reduce the size of the herd (eleven in 1973). They ultimately decided to dispose of the herd entirely; however, bison still roamed the ranch in 1986. It is unclear how they eventually eliminated the herd.[239]

These game animals, while adding $34,800 to ranch revenue from hunting, were the subject of great concern for scientists, environmentalists, and the federal government. These were considered unwanted, exotic species that preyed on native plants and disrupted ecosystems. The introduced species, in conjunction with the active land manipulations associated with cattle ranching, destroyed the natural habitat of native birds such as the nēnē and 'alalā (Hawaiian crow), native species that had been abundant on the ranch before European contact but had steadily dwindled. By 1958, no nēnē could be found on the ranch. These sentiments were reflected in the legal changes during the mid- to late-twentieth century. In 1967, the state department of wildlife released seventy-five nēnē on two places within Kahuku and built a cabin on the ranch, possibly to monitor the nēnē. This cabin was briefly referred to as the "Upper State Cabin," built near a nēnē enclosure at a higher elevation than the CCC-era cabin.[240] This cabin is most commonly referred to as the "nēnē cabin." In the late twentieth century, environmental protection policies further mandated the protection of endangered species and the Damon Estate was forced to comply. The mouflon sheep were particularly damaging to the Ka'ū silversword, once abundant on the island. Through the decades, wild cattle, hogs, and goats steadily reduced the number of silversword; upon introduction of the mouflon sheep, the silverword population dropped dramatically at Kahuku. By

[237] Ibid., p. 53-54.
[238] Ibid., p. 46-47.
[239] Avery, *Environmental History of Kahuku*, p. 55-56.
[240] Ibid., p.58; "Eugene Yap and Kahuku Cabin," Correspondence, 2008.

1991, only 176 small plants remained on the ranch compared to the several thousand observed in 1974. Upon the scientists' alarmed urging to remove sheep and to fence silversword stands in order to protect the few remaining, the ranch fenced the largest silversword population on the ranch in 1982 and rebuilt the fence around the two-and-a-half-acre enclosure in 1992. They never removed the sheep.[241]

Also in the late twentieth century, wildlife habitat became increasingly important and legal changes were made to protect these natural resources. The state government began designating conservation zones that restricted used of heavy machinery and limited the rancher's ability to clear land and remove vegetation. In 1991, the state rezoned agricultural land on several Big Island ranches. Despite the protests of the island ranchers, those of Kahuku included, the state zoned 95,000 acres of Kahuku Ranch for conservation.[242]

In the late 1990s, the estate trustees began to liquidate their assets in anticipation of the death of Joan Damon Haig, upon whose death the Damon Estate would expire. At the time of liquidation, the estate was the state's eleventh largest landowner. However, the trustees predicted that it would be difficult to find a buyer that would continue to operate Kahuku as a cattle ranch, particularly in light of the new environmental restrictions. In 2000, after forty-two years of ownership, the Damon Estate put Kahuku Ranch on the market. By this time, the size of Kahuku Ranch had decreased an additional 32,000 acres since the time of purchase from the Glover estate, to approximately 126,000 acres. 12,000 acres accounted for the sale in the late-1950s to Crawford Oil Company who built the Hawaiian Ocean View Estates, and 20,000 acres were sold to International Resources, Ltd., for unknown purposes in 1968.[243]

In 2002, possibly in an effort to inventory the existing condition of ranchlands and improvements, a water system and grazing unit map was made of the lands mauka, north, of Highway 11. Similar to the paddocks map of 1988, this map labeled and depicted the subunits of each pasture. Unlike the 1988 map, however, this map also represented the water system in greater detail to include pipes, water tanks, and reservoirs. By 2002, the mauka (northern) pastures of Kahuku counted sixteen water storage tanks, three reservoirs, and one catchment area. Water was piped from the catchment and two northernmost reservoirs down to the pastures along the mauka (northern) road as originally established by Carter; pipes also conveyed water from the third reservoir located near the eastern boundary of the ranch to the pastures closer to Highway 11. This map also shows that there were twelve pastures within the mauka, northern, grazing lands and that some of these had been renamed since 1988. The Lumber Mill Paddocks just north of Highway 11 were renamed the Hilo Cell and the Kona Cell; the Waina, Palm Tree, Number I Maluna, and Number I Kīpuka pastures were consolidated into the Palm Tree pasture split into four paddocks. The upper Maluna pasture was incorporated into the Glover Pasture; the northern units west of the mauka road, Keo Keo, Number III Hilo, Number III Kona, Hapai Mamo, Number III, and Pele Paddock were consolidated into Number III Hilo/Kona pasture with six paddocks. The exact number of water troughs is not available in this map.[244] (See Physical History #17)

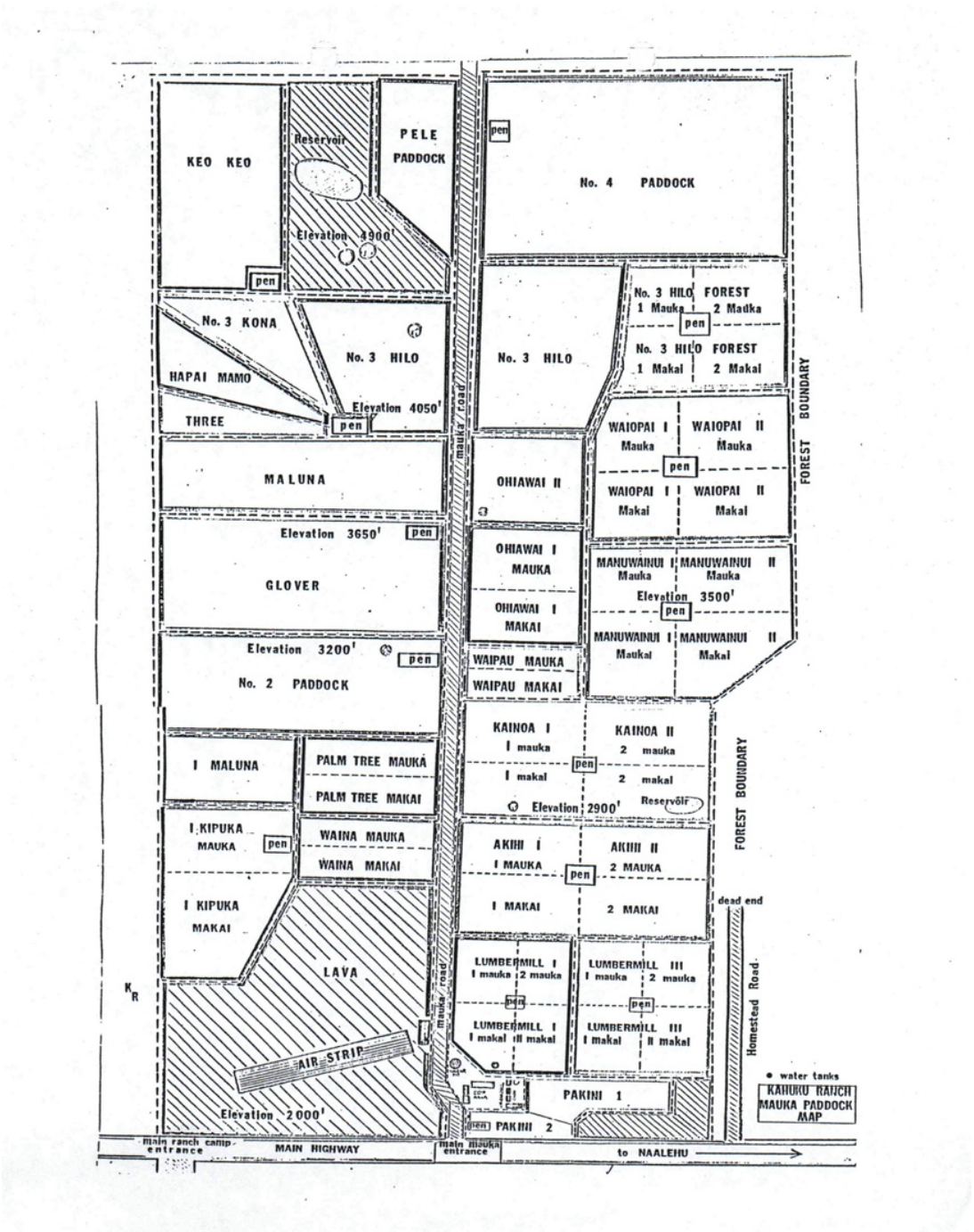
Likely by this time, two lumber milling stations were located in the mauka (north) section of Kahuku Ranch. The archaeological inventory of 2005 places one lumber milling station (KAT 2004 Temporary Site #6) at approximately 5,000 feet in elevation, within Kīpuka Akala, east of the 1926 lava flow. The site comprises a pile of milled koa wood planks. The second lumber milling station (KI 2005 Temporary

[241] Avery, *Environmental History of Kahuku,* p.57-58.
[242] Ibid., p.59.
[243] Avery, *Environmental History of Kahuku*, p.54-55.
[244] "Kahuku Ranch Water System & Grazing Unit Map, Kahuku Ranch Lands Mauka of Highway," 2002, Hawai'i Volcanoes National Park Archives.

Site #8) is reportedly located within the upper portion of the pastureland area of the Kahuku unit, at approximately 4,300 feet in elevation. Little information is available on these sites; the archaeological inventory dates them to the "modern era," post-1947.[245]

In 2003, 116,000 acres of Kahuku Ranch were sold to the Nature Conservancy and the National Park Service for 22 million dollars. The 116,000 acres excluded the makai, southern, sections, including the ranch headquarters area, and a portion of the mauka (north) section, the Ocean View Estates, of Kahuku Ranch.

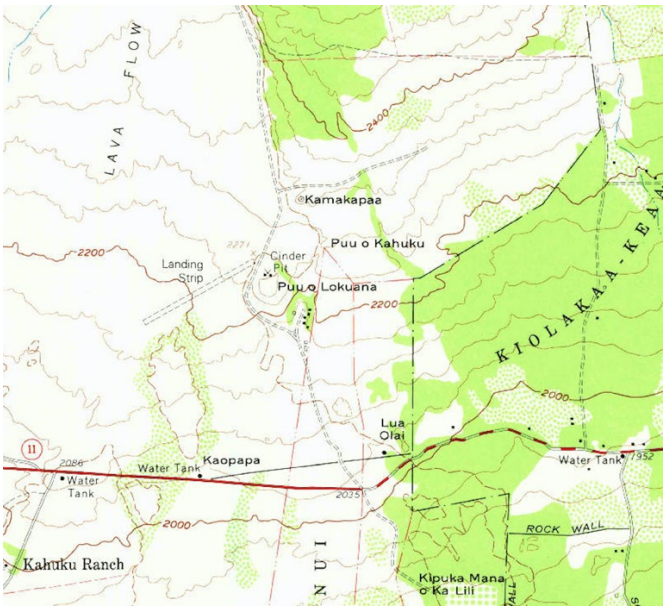
[245] Quiseng, *Kahuku Inventory Survey,* p. 15, 44, 68.



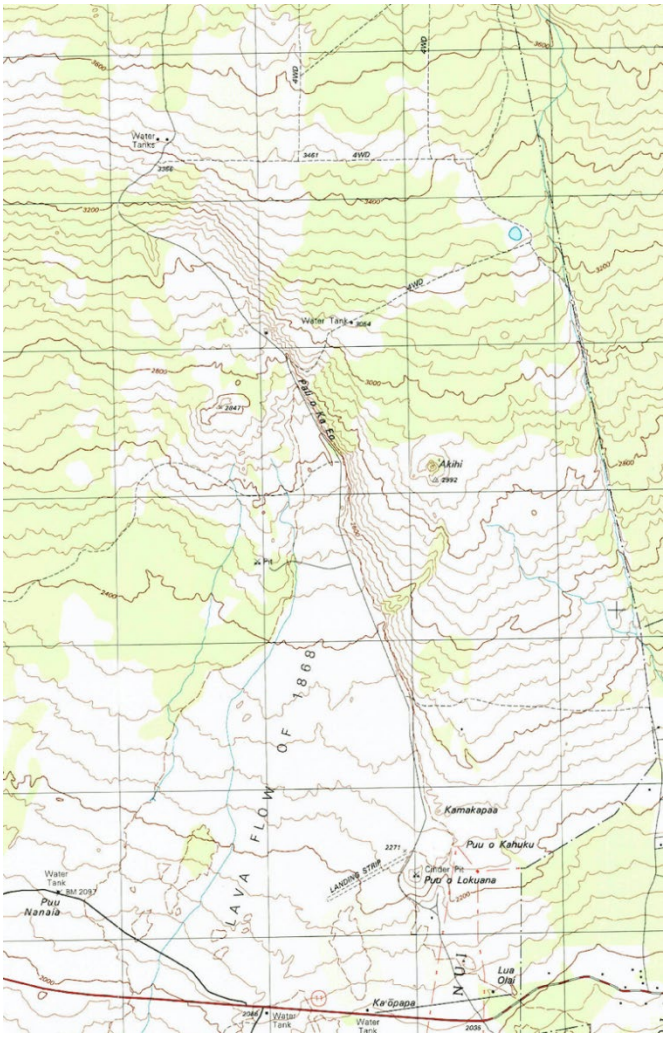
Physical History #9: 1988 map of the Kahuku Ranch mauka (northern) paddocks. This schematic map is representative of the fully developed pasture system of Kahuku as declared by Freddy Rice. ("Kahuku Ranch Mauka Paddock Map," Kahuku Ranch, Operations, 1988-1989, HAVO17000.SeriesVI.B21.F9, Hawai'i Volcanoes National Park Archives). See appendix for a larger image.



Physical History #10: Aerial photograph of Kahuku Ranch mauka, north, of Highway 11. Note the established pasture-paddock system and the contrast in vegetation with the neighboring Ka'ū Forest. (Aerial photograph mission VEEC, Flight Line 7, Frame 171, Reference Number 008-716, U.S. Geological Survey, 1977).



Physical History #11: Cropped image from the 1981 topographic map. Note the double-dashed lines depicting the main north-south axis road mauka, north, of Highway 11: it is shown as an unimproved road.
(Kahuku Ranch Quadrangle, Island of Hawaii – Kau District, 7.5 Minute Series (Topographic), U.S. Geological Survey, Department of the Interior, 1981)

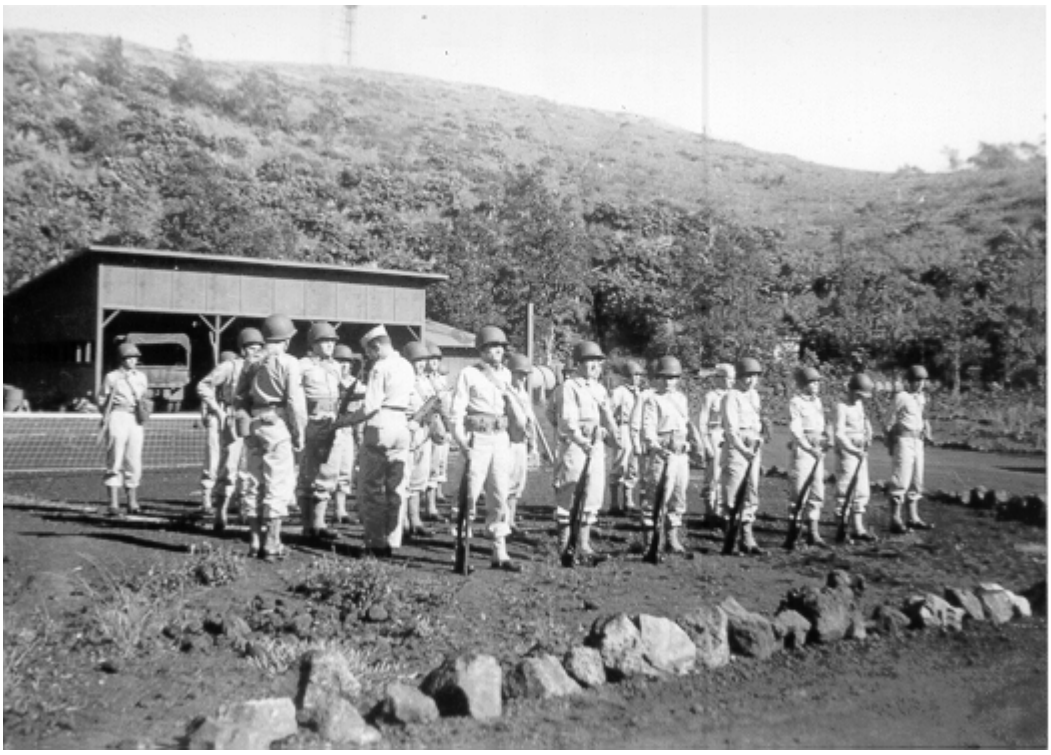


Physical History #12: Cropped image from the 1995 topographic map. Note the single solid line depicting the main north-south axis road mauka, north, of Highway 11: it is shown as a light-duty road. (Kahuku Ranch Quadrangle, Hawaii – Hawaii County, 7.5 Minute Series (Topographic), U.S. Geological Survey, Department of the Interior, 1995.)

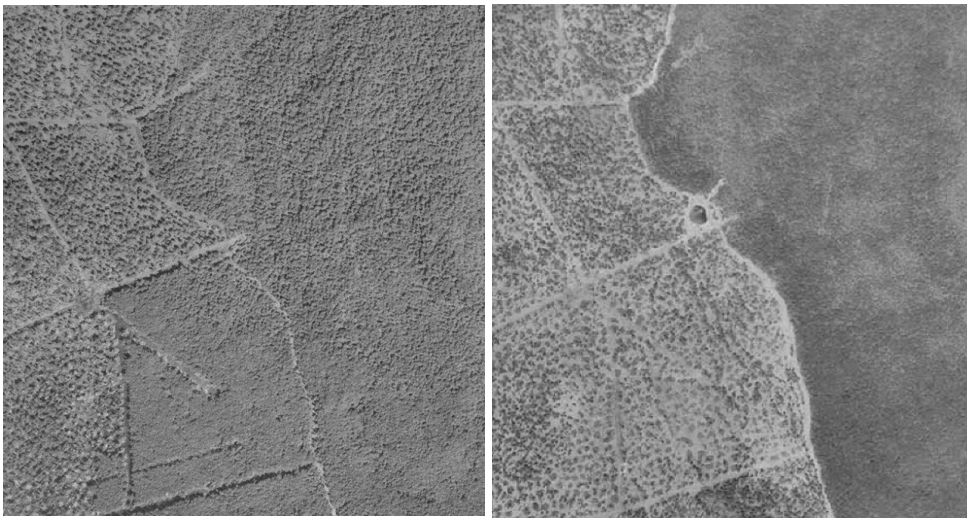




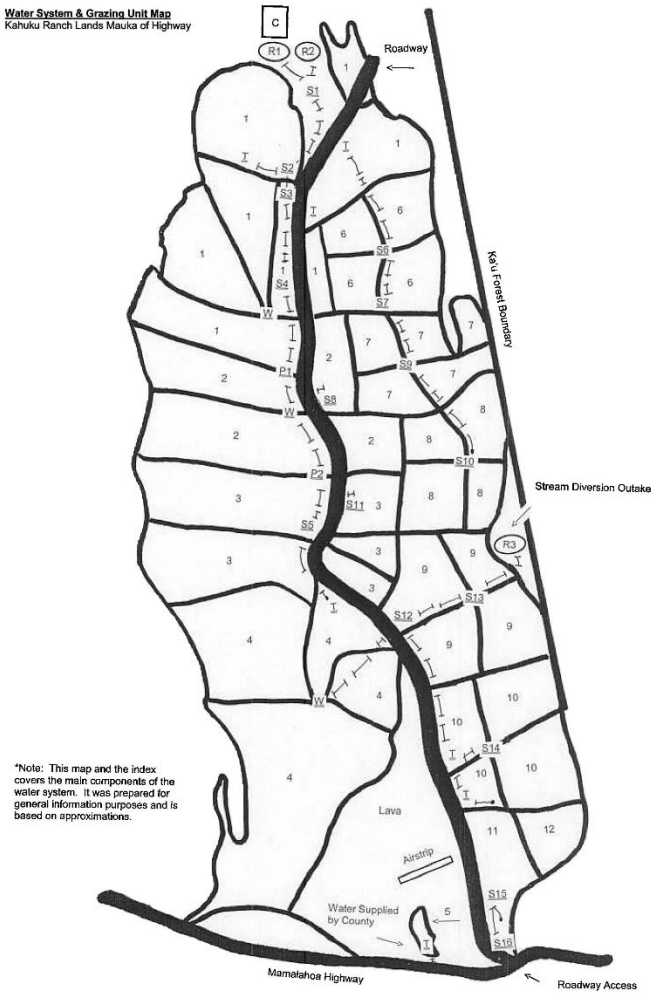
Physical History #13 (top) & #14 (bottom): Image #13 is a crop of the 1965 aerial photograph of the Pu'u Nanaia area prior to the realignment of Highway 11. Image #14 is the 1976 photograph of the same area, post-realignment. Note the difference in "line weight" of the two circulation features between the two years. (Aerial photograph mission EKL, Flight Line 13CC, Frame 26, Reference Number 075-6598, U.S. Department of Agriculture, March 1965; Aerial photograph mission VEEC, Flight Line 1, Frame 84, Reference Number 008-610, U.S. Geological Survey, December 1976)



Physical History #15: Photograph of the Kahuku Base Camp circa 1942-1943. The structure in the background is Building 407, the Vehicular Repair Shop prior to its alteration that changed it into a two-bay structure. (Hawai'i Volcanoes National Park Archives).



Physical History #16 (left) and #17 (right): Image #16 is a crop of the 1965 aerial photograph of the area at 3,500 feet above sea level, along the eastern boundary of Kahuku Ranch mauka, north, of Highway 11. Image #17 is a crop of the 1977 aerial photograph of the same area. Note the consistency in the spatial organization of the pastures between the two years, as well as the establishment of a reservoir in 1977. (Aerial photograph mission EKL, Flight Line 13CC, Frame 59, Reference Number 075-6464, U.S. Department of Agriculture, 1965; Aerial photograph mission VEEC, Flight Line 7, Frame 171, Reference Number 008-716, U.S. Geological Survey, 1977)



Physical History #18: "Kahuku Ranch Water System & Grazing Unit Map, Kahuku Ranch Lands Mauka of Highway," 2002, Hawai'i Volcanoes National Park Archives.

Kahuku Ranch – National Park Service (2003 – Present)

For over a hundred years, Kahuku Ranch's value had been based in its grasslands and extractable commodities. However, around the turn of the century, gaining momentum from the various environmental protection movements, many people began to believe that the ranch's value lay in its biodiversity. The Nature Conservancy lauded the eco-diversity of the ranch that encompassed numerous species of rare and federally listed endangered plants and birds, such as the Ka'ū silversword and the Nēnē. The National Park Service, too, spoke eagerly of the property for the potential of undiscovered cultural resources, such as archaeological sites, that might be revealed. As such, when the property was put on the market in 2003, the two entities together purchased 116,000 acres of the ranch. This purchase represented the largest land conservation deal in Hawaiian history.[246]

[246] Avery, *Environmental History of Kahuku,* p.60.

The property owners sought to manage the land to best preserve its natural and cultural resources. Park managers took quick action to develop plans to eliminate unwanted animal species harmful to the natural resources, such as feral pigs and mouflon sheep. In 2003, 11,000 acres of the ranch were designated by U.S. FWS as critical silversword habitat. Cattle were allowed to remain on the ranch to discourage the invasive species that might spread if unchecked by grazing. These cattle grazed the ranchlands through 2010; no cattle roam the slopes of Kahuku today.[247]

Under the management of NPS as a unit of Hawai'i Volcanoes National Park, the park service continued to expend efforts to protect, preserve, and restore the biodiversity of Kahuku. Beginning in 2003, fences were constructed to serve as defensible ungulate barriers along the boundary of the upper Kahuku section followed by removal of mouflon sheep and feral pigs. These boundary fences were eventually extended to include the lower sections of Kahuku and protect the lowland ecosystems from nonnative ungulates. In 2010, an 800-meter segment of six-foot boundary fence was constructed along the shared boundary between Kahuku and Hawaiian Ocean View Estates, located along the shared northeast corner of the subdivision boundary with the park, to deter nonnative mouflon sheep from entering mauka (northern) areas from the lower paddock units.[248] Additionally, barbwire and electric fences were removed from the lower Kahuku paddock system to protect the endangered Hawaiian hoary bat from injury or death.[249] Removal of incipient invasive plants started in 2003 and continues to be an ongoing effort today. Selected alien weeds were removed across some 1,000 acres below 4,400-foot elevation in 2008; spread of encroaching invasive weeds was carefully managed and highly invasive species such as the Monterey Pine were also removed.[250] Further efforts to control invasive weeds in Kahuku were implemented in 2019, incorporating various methods of response such as spot reatment, eradication, and containment.[251] Beginning in 2005, efforts towards restoration of mesic and wet forests began with the establishment of four ungulate-proof exclosures in which different temporary grass removal treatments were tested.[252] Samples of rare and endangered plant species were collected for propagation and outplanting circa 2009, to protect the genetic source materials of the most at-risk species; a similar outplanting project took place in through the following decade. A project was also executed to restore the 34-acre forest in the Pu'u 'Akihi Special Ecological Area in the ravine in 2013.[253] In 2015, the targeted removal of highly invasive faya trees, with a focus in the montane and subalpine communities above 5,000-foot elevation, was

[247] Avery, *Environmental History of Kahuku*, p.60-61.
[248] "Construct HOVE Boundary Fence, PR/ESF Number: 2010-032," Archaeological Compliance Survey Report Form, October 25, 2010, Hawai'i Volcanoes National Park.
[249] "Remove Barbwire Fences in Kahuku – Emergency Mitigation Action for Endangered Bat, PR# 2011-005," Categorical Exclusion Form, 10/26/2010, Hawai'i Volcanoes National Park.
[250] "Remove Disruptive Alien Weeds to Preserve Viewscape & Biodiversity in Kahuku Pioneer Communities," Project Management Information System (PMIS)# 120325, October 26, 2009; "Remove Invasive Weeds Planted Around Kahuku Facilities," Planning, Environment & Public Comment (PEPC)#16706, October 1, 2006; "Search and Remove Highly Invasive Monterey Pine, upper Kahuku Nene Cabin," PEPC #45616, March 1, 2013.
[251] "Control Invasive Weeds in Kahuku," Environmental Screening Form (ESF), August 30, 2019, Hawai'i Volcanoes National Park.
[252] Sieera McDaniel, Rohnda Loh, Susan Dale, and Corie Yanger, "Experimental Restoration of Mesic and Wet Forests in Former Pastureland, Kahuku Unit, Hawai'i Volcanotes National Park," Pacific Cooperative Studies Unit, University of Hawai'i at Mānoa, Technical Report 175, July 2011.
[253] "Protect Biodiversity of Rare Plants Discovered in New Kahuku Addition," PMIS #129369, October 27, 2009; "Building Capacity in Rare and Endangered Plant Populations in a Changing Climate," PMIS #156777, February 5, 2018; "Protect Rare & Endangered Species," PEPC #16340, June 15, 2009; "Restore Rare Forest In Puu Akihi Special Ecological Area, Kahuku Unit," PEPC #40956, May 1, 2013.

implemented and is an ongoing effort today.[254] Also initiated in 2015, and ongoing, was the program for Rapid ‘Ōhi‘a Death (ROD) early detection and rapid response that involved a systematic aerial and ground surveys to detect and map ROD infestations in the park in all areas where ‘ōhi‘a occur below 8,000-foot elevation.[255]

Along with these natural vegetation protection efforts, the fences and gates were repaired as necessary at Kahuku.[256] Other natural resource protection efforts include vegetation and land bird surveys. In 2012, a Wilderness Eligibility Assessment was completed which determined 121,015 acres of the Kahuku eligible wilderness areas. These identified areas comprised the majority of Kahuku land above the cultural landscape unit.[257] In 2016, the State of Hawai‘i Department of Fish and Wildlife (DOFAW) replaced the old 2,500-gallon water catchment tank with a new poly tank at the Nēnē cabin to enable the continuing use of the cabin for nēnē monitoring at Kahuku.[258]

As the Kahuku unit opened up to the public, many of the existing buildings at the former Kahuku Base Camp were rehabilitated for administrative use. A site adjacent to Building 401, the barn, was initially considered for an interim visitor contact station in 2012. In place of this option, however, park staff has confirmed that a new structure was constructed for this purpose.[259] Building 403 was transformed into the main office building and Building 404, the duplex during the Damon Estate era, was turned into a storage building. These buildings were repaired and repainted in 2018.[260]

Measures were also taken to provide the basic amenities such as water to the new administrative area. A vault toilet was installed in the developed area in 2004; in 2006, the waterlines at Kahuku, from outside the front gate up to the water tank on the hill above the houses, were replaced with a larger pipe and a new line was added to supply drinking water from the water tanks to the house and pasture. A new holding tank of 3,000-gallon capacity was installed at the top of the hill next to the existing water tank.[261] Around 2015, an additional temporary water tank was installed at the end of the administrative area cul-de-sac to supplement the inadequate water supply to the office during times of low pressure. This tank was a green poly water tank measuring seven feet and four inches wide and five feet and eight inches

[254] “Control Highly Invasive Faya Tree in Kahuku,” Environmental Screening Form (ESF), November 19, 2015, Hawai‘i Volcanoes National Park.
[255] “Rapid ‘Ōhi‘a Death (ROD) Early Detection and Rapid Response,” Environmental Screening Form (ESF), November 13, 2015, Hawai‘i Volcanoes National Park.
[256] “Replace Kahuku Upper Pasture and Kau Boundary Fence,” PEPC #14851, March 1, 2006; “Rehab Kahuku Gates at 2 Locations,” PEPC #16994, March 1, 2007; “Remove Nonnative Ungulates from Upper Elevation Kahuku Unit, Hawai‘i Volcanoes NP,” PMIS #170168, November 2, 2015.
[257] National Park Service, “Hawai‘i Volcanoes National Park, Draft General Management plan, Wilderness Study, and Environmental Impact Statement,” U.S. Department of the Interior, May 2015, p. 9, 19.
This figure was estimated using GIS; no official government survey has been completed to determine the acreage for the wilderness eligible portion of this parcel. As such the numbers can be inconsistent with the acreage of the NPS land transfer.
[258] “Replace Catchment at Nene Cabin in Kahuku” Environmental Screening Form (ESF), April 15, 2016, Hawai‘i Volcanoes National Park.
[259] “Kahuku Visitor Contact Station,” PEPC #39804, May 1, 2012.
Personal correspondence with Danielle Foster, Environmental Protection Specialist, Hawai‘i Volcanoes National Park, January 15, 2021.
[260] “Kahuku Buildings Repair and Rehab Work,” PEPC #82257, August 20, 2018.
[261] “Replace Waterlines at Kahuku Ranch,” PEPC #16343, October 1, 2007.

tall.[262] It is possible that the other plastic tanks found throughout Kahuku were installed around this time or shortly before.

In addition to the installation of a vault toilet and a new water system, the park conducted numerous cultural resource surveys since the acquisition of Kahuku Ranch. Between 2004 and 2005, the park conducted the Kahuku Inventory Survey, during which time the extant ranching structures were inventoried and an archaeological reconnaissance survey was conducted for the Kahuku-'Āinapo Trail; an archaeological survey was conducted for the Old Māmalahoa Highway in 2016; and Kīpuka Ka'ōpapa was initially surveyed in 2010, subsequently followed by resarch in 2017, and resulted in a published paper in *Environmental Archaeology, Volume 25, No.*1 in 2020: "Integrating Local and Regional in Pre-Contact Hawaiian Agriculture at Kahuku, Hawai'i Island." Further, under park management, numerous interpretive trails were established from existing ranch roads and trails to reflect both the natural and cultural history of Kahuku Ranch.

However, while the park managers expended great efforts to conserve the natural environment and to incorporate the existing ranch facilities into the park's administrative use, it was inevitable that some of the ranching-associated resources would be lost when cattle ranching ended at Kahuku. Four features of the water system, three water tanks and the Main Pasture rain shed, were lost between 2005 and 2020, likely due to external environmental factors. The Kahuku Ranch Shop at the Base Camp was reportedly demolished.

With a vast array of scenic and geologic wonders, and a range of interpretive potential, the Kahuku unit of Hawai'i Volcanoes National Park continues to develop its programs to cater to public use and to carry out the mission of conservation today.

[262] "Install a Temporary Water Tank at the Kahuku Administrative Area," PEPC #55114, December 1, 2014.

Analysis & Evaluation of Integrity

Analysis and Evaluation of Integrity Narrative Summary

The Kahuku Ranch cultural landscape is a 13,402-acre site located in the southern portion of the Hawai'i Island near South Point, immediately north of Highway 11 that is representative of the transition point in island ranching history from land-responsive methods of cattle operations to more intensive infrastructure development and range management to support ranching operations in the first half of the twentieth century. The period of significance is 1912 to 1947. Although no longer an operational cattle ranch and now under the jurisdiction of the National Park Service, Kahuku Ranch retains the land use patterns and infrastructural development that convey this historical significance. Kahuku Ranch retains its historical integrity through nine landscape characteristics, including natural systems and features, spatial organization, circulation, vegetation, buildings and structures, small-scale features, constructed water features and archeological sites (for existing condition photos, see Appendix B).

Natural systems that have influenced the development of Kahuku Ranch include volcanism, topography, hydrology, and flora. During the period of significance, aspects of the area's natural systems were altered to facilitate ranching development, which greatly affected the native flora, hydrology, and the micro-climates with the removal of dense forests for open pastures. Volcanic activities and the resulting lava flows rendered large portions of the Kahuku Ranch unworkable for ranching operations, thus shaping and influencing the layout of the pastures. The varying elevations influenced climate and selection vegetative species, and periods of drought influenced the development of an extensive water system for the pastures. Since the period of significance, native vegetation was extensively harvested or removed to expand the pasture system. Under the management of the NPS, efforts now focus on conserving aspects of the natural systems and features through reestablishing native species for forest regeneration.

The current spatial organization of Kahuku Ranch reflects the pasture development during the period of significance, which was influenced by the natural systems of Kahuku. Kahuku Ranch's higher elevation pasture-paddock areas were located between and north of the 1887 and 1868 lava flows (see Appendix A and D for lava flow locations) in areas that Carter deemed cultivable land. These pasture-paddocks were connected to the south to north by the Kahuku-'Āinapō Trail and the Kahuku Road and encompassed the water collection and conveyance system. Adjacent to the pastures is a developed area just north of Highway 11, and a CCC Cabin located at the far northeast extent of the boundary. Following the period of significance, aerial photographs from the Damon era show that the forest to the east of the historic pastures, delineated by the present-day Kahuku Road and the eastern branch of the Kahuku-'Āinapō Trail/Glover Trail, was removed for further pasture development and additional fences and roads were added to subdivide the pastures. However, the original pasture spatial relationships have been maintained.

Land use at Kahuku Ranch during the period of significance was characterized by activities related to cattle ranching, including pasture management, infrastructure development, and cattle grazing. Because of the termination of private ranching activities and the introduction of natural resource conservation efforts under the NPS, land use no longer contributes to the cultural landscape.

The circulation system within Kahuku Ranch provided access to the pastures and the northern areas of Kahuku Ranch, and included the Kahuku-'Āinapō Trail, Kahuku Road, pasture roads and trails that also delineated the paddocks, and an access road to the base camp and northern CCC cabin. Since the period of significance, in association with the expansion of grazing areas under Damon Estate management, the circulation system was expanded, and sections were updated with paved materials.[263] However, the

[263] Kahuku Base Camp DOE, p. 5.

majority of the roads from the period of significance are extant, though some less visible, in the landscape today.

Vegetation within Kahuku Ranch has been predominantly shaped by historic ranching and grazing practices. Practices primarily focused on pasture clearing and development, which entailed the constant management of pasture species. After the period of significance, pastures were expanded to the east which entailed the extensive removal of forest species, also harvested at this time. Under the management of the NPS, cattle no longer graze the pastures, and conservation efforts seek to restore native vegetation.

The buildings and structures of Kahuku Ranch primarily served military operations and secondarily served ranching operations. While there are several undated structures found throughout the pastures, including sheds and lumber mills, the majority of buildings and structures with known construction dates within Kahuku Ranch are located at the Base Camp area that was established between 1942-1944, and released by the military in 1947. Constructed under the military context, these buildings are non-contributing. The only contributing building at Kahuku Ranch is the CCC cabin that was built by CCC-era workers and served to house them during their efforts in constructing the eastern boundary wall of Kahuku, and thus contributed to the development of Parker-era Kahuku Ranch.

Small-scale features at Kahuku Ranch comprise of a variety of resources that supported ranching activities, including equipment, fences, rock walls, gas tanks, cattle ramps, and corrals. Changes to small-scale features since the period of significance were likely to have occurred, due to the continued operational needs of the ranch, but nonetheless help to convey the character of the district.

Constructed water features at Kahuku Ranch primarily served utilitarian purposes that supported ranching operations. While individual water features have been altered over time, likely with changes in hydrology, operational needs, and with the degradation and repair of materials, the features as a comprehensive water conveyance system continue to reflect the historic use, and therefore character, of the ranching landscape.

Archaeological features at Kahuku Ranch include the sites of buildings, structures, small-scale features, roads, and trails that once supported operations at Kahuku Ranch that have either fallen into ruin or have been removed in the recent years, leaving remnants, foundations, or traces on maps. These include remnants of the shop building, the east rain shed ruins, multiple collapsed water tanks and water feature foundations, the sawmill, and the Kahuku-ʻĀinapō Trail. These resources are important in conveying the historic spatial organization and land use of the ranching landscape.

Assessment of Integrity

While Kahuku Ranch is in poor condition, it retains integrity of design, setting, location, feeling, and association. Within the historic context of pasture development and management, Kahuku Ranch retains integrity and conveys its significance as a representative example of the specific period in island ranching when ranching operations transitioned from land-responsive approaches of management, operating within the parameters of natural limitations of the landscape, to more intensive manipulation of the natural environment through the application of "modern," or contemporary, technology.

When Kahuku Ranch was officially sold in 2003, the pasture-paddock system was transferred to the National Park Service intact and largely retaining the spatial layout as established during the Parker era. These paddocks to the west of the main mauka (north) road, the present-day Kahuku Road, and the Glover Trail/east branch of the Kahuku-ʻĀinapō Trail had escaped Freddy Rice's carving of the pasturelands during the 1960s and 1970s and possess their historic character of large, less-developed

parcels. This distinction is especially evident in the juxtaposition of the Parker era paddocks to those of the Damon era immediately to the east.

The extant ancillary dirt roads in this area also contribute to the delineation of these less systematically-developed pastures and help convey the spatial organization of the area. The Kahuku-'Āinapō Trail, too, retains much of its historic alignment within the cultural landscape boundary, though sections of it have been widened into jeep trails. This alignment leads into the wooded areas of higher elevations and signals the ranch's early connections to the larger Parker Ranch. These features, together, serve as a reflection of the earlier island ranching practices that pre-date the shift towards intensive development.

Today, the water conveyance system, comprising the Kahuku Pipeline and all associated constructed water features such as water tanks, troughs, and watersheds, is largely intact. While the historic material and workmanship of this water system have been lost, the remaining aspects of integrity, particularly in design, location, and association, are retained in that the water system possesses its general historic alignment along the Kahuku-'Āinapō Trail and Kahuku Road, as evidenced by its watersheds located upslope and other water features distributed downslope of the sheds. This conveyance system, though expanded upon through the decades of operation following its initial establishment, retains its historic location and layout, and still clearly demonstrates an association with the cattle ranching landscape. Similarly, the eastern boundary fence, though having undergone countless repairs and replacements, retains integrity in design, location, and association in that the fence follows the boundary as established in the 1913 survey and, given the purpose of this fence, all repairs and replacements adhered to the original layout of the boundary; there have been no reports of significant boundary adjustments since its delineation by Wright. This boundary fence, too, clearly demonstrates its association with the ranching landscape, especially as sections of it serve as the easternmost boundary of the Damon-era paddocks. These infrastructural developments, together, represent the shift in island cattle ranching practices, a shift towards intensive range management.

As such, Kahuku Ranch conveys its significance as a representation of the transition point in island ranching history from lesser developed and organized to intensively developed cattle operations through the Parker-era pasture-paddock system, the complex water conveyance system, the delineated boundary fence, and the historic circulation system, including the Kahuku-'Āinapō Trail and Kahuku Road. As the park service has not taken any direct actions to develop over the ranchlands or remove any of the associated resources, the overall cultural landscape of Kahuku retains integrity in design and location, in that the pastures, water system, and the boundary fence retain their historic spatial layout. Additionally, the landscape possesses integrity in setting, association, and feeling in that the landscape retains its connection to the volcanic landscape that significantly shaped the development of the ranch.

Natural Systems and Features

Natural systems and features are the natural aspects that have influenced the development and physical form of a landscape. Volcanic activity and its resulting impacts on geology, climate, and vegetation have significantly influenced the landscape of Kahuku Ranch—located in the remote and sparsely populated southern portion of the Island of Hawai'i. This area is characterized by diverse terrain that includes a barren, windswept coastline, dense mostly 'ōhi'a or mixed 'ōhi'a koa forests, and rocky alpine slopes that reach over 13,000 feet above sea level. The Kahuku Ranch district boundary was established upon the ahupua'a of Kahuku, a traditional land division system that was defined by these natural features. Located on the southern slope of the Mauna Loa volcano, the 13,000 feet summit of which defines the northern point of the triangular district, the boundary spans down the slope to a southern base along 2,000 feet, beyond which it once extended to the jagged cliffs of the coastline to the south.

Volcanism

Situated on the southern slope of Mauna Loa, the landscape of Kahuku has been continually transformed by volcanic activity. Mauna Loa is one of five volcanoes that form the Island of Hawai'i and is one of the largest subaerial volcanos in both mass and volume. Lava eruptions at Mauna Loa have occurred for the past 700,000 years, and tend to be non-explosive, fluid, silica-poor, and frequent. The result of this activity is a highly decomposed basalt (black volcanic rock) content in the soil. Within the current Kahuku boundary is Mauna Loa's very active southwest rift zone, a long series of fractures, fissures, craters, cinder cones, lava flows, and faults. Volcanic activities and the resulting lava flows rendered large portions of the Kahuku Ranch unworkable for ranching operations. For this reason, the layout of the pastures was restricted to, and fully utilized, the 184,000 acres of land that was not impacted by volcanic activity and considered cultivatable.

Climate

Across the Hawaiian Islands, trade winds blow from east to west. In areas of lost vegetation, the weather can be windier and drier than in highly vegetated areas. For Kahuku Ranch, Mauna Loa strongly affects the local climate depending on elevation. The summit of Mauna Loa is described as a periglacial region, where freezing and thawing significant shape the landscape. At lower elevations, the climate is considered tropical, with warmer temperatures. During eruptions, lava flows have a warming and drying effect on the air. The ranch also experiences wet and dry seasons that have led to the development of a water system to manage these influxes.

Hydrology

The Kahuku Ranch landscape presented developers difficulty, as it did not have many natural water sources, which is why they needed to develop sophisticated water systems to harvest water. Water springs at higher elevations were tapped with pipes to divert the water down to the systems that dispersed water throughout the landscape. Two such springs were the Wahia and Kealakoa. Within the period of significance, water shortages had proven one of the biggest challenges for the ranch, which led to the development of a system to harvest rainwater. When droughts proved more severe than anticipated, a further system of tanks and pipes were developed to manage the sparse hydrologic activity naturally occurring at the site. Further research is needed to determine larger natural hydrological patterns and changes to the landscape since the end of the period of significance.

Vegetation

The landscape of Kahuku Ranch once hosted brush, grassland, and native forests characteristic of the vegetation zones associated with the Mauna Loa volcano. According to the Hawai‘i Center of Volcanology at the University of Hawai‘i, “there are ten different vegetation zones on the island of Hawai‘i, and Mauna Loa encompasses all of them, from the kiawe and lowland shrubs zone found below 1,000 ft. to the Alpine stone desert above 10,000 ft.”[264] Kahuku’s diverse terrain included a barren coastline, dense koa forests, and rocky alpine slopes reaching to over 13,000 feet in elevation.[265] Closed, tall ‘ōhi‘a forest extended from the present-day Ka‘ū Forest Reserve into the eastern portion of Kahuku, interspersed with small patches of mixed grassland and lower-stature open ‘ōhi‘a forests. Upslope, most of the eastern Kahuku was scattered medium-stature ‘ōhi‘a with a treeless alpine native scrub communitiy The wstern portions of Kahuku were characterized by dry and open or scattered ‘ōhi‘a with native trees and shrubs.[266] Through the decades of uncontrolled cattle grazing in the nineteenth century, much of the native vegetation zones were impacted from both overgrazing and the introduction of non-native, aggressive species of florae by way of cattle movement. During the period of significance, the already-impacted natural brush and grassland areas were further influenced by the range management techniques introduced by ranch manager Alfred Wellington Carter who directed his ranch staff to remove unpalatable vegetation and to sow these lands with nutritious grasses to establish quality pastures. The removal of these “unwanted” grasses involved both manual pulling and burning. Further, while existing sources only point to existing grassland improvement by Carter, based on the unnaturally straight line of the woodland canopy as observed in the 1954 aerial photograph, some tree removal also likely occurred during this period to clearly delineate the pastures.

Summary

During the period of significance, natural systems and features were extensively modified by cattle ranching and the associated introduction of florae. Further, Kahuku Ranch was shaped by volcanism that influenced the layout of the pastures, a range of temperatures at varying elevations that influenced the selection pasture vegetative species, and by periods of drought that required the development of an extensive water system. Landscape characteristics influenced by the natural systems and features during the period of significance include spatial organization, seen through the volcanic activity that shaped the cultivatable land that defines the layout of the pastures between and north of the 1887 and 1868 lava flows (see Appendix A and D for lava flow locations); constructed water features related to the water system that were the result of the water shortages presented by the hydrology of the site, and the land use practices that continually managed vegetation as part of the pasture improvements that occurred.

[264] “Mauna Loa Flora,” Hawai‘i Center of Volcanology at the University of Hawai‘i, accessed April 5, 2021, http://www.soest.hawaii.edu/GG/HCV/mloa-flora.html.
[265] Avery, *Environmental History of Kahuku*, p.5.
[266] David M. Benitez, Thomas Belfield, Rhonda Loh, Linda Pratt, and Andrew D. Christie, “Inventory of Vascular Plants of Kahuku Addition.” Hawai‘i Volcanoes National Park Archive, 2008, p. 9.

Spatial Organization

Spatial organization is defined as the three-dimensional organization of physical forms and visual associations in the landscape. The historic operation of Kahuku Ranch was primarily defined by the relationship between and among the pastures, circulation features, constructed water features, and other infrastructural development that occurred during the period of significance.

First and foremost, the organization of space at Kahuku was established in response to the challenges presented by the natural systems and features of the southern slopes of Mauna Loa. A series of volcanic eruptions during the nineteenth century blanketed thousands of acres of the ranch under lava and in effect defined the cultivable lands that could be utilized by the cattle operation. By the period of significance, some 140,000 acres of the 184,000-acre property (the original extent of the ranch property) was under lava, and, further limited by factors such as natural vegetation and topography, only 15,000 acres were deemed to possess favorable grazing potential. Within these parameters, ranch manager Alfred W. Carter established four large pastures in a north-south alignment between the present-day Highway 11 and 5,000-foot elevation. These pastures were largely bound to the west by the 1887 lava flow and to the southeast by the 1868 lava flow. (See Appendix E for the western pastures map)

In conjunction with these geographical restrictions presented by the volcanic landscape, the scarcity of water also significantly impacted the development and organization of ranch infrastructure during the period of significance. To maximize the utilization of water, Carter developed a water conveyance system that aligned the available natural water sources such as that observed at 3,500-foot elevation and Kealakoa Spring at 5,000 feet and, utilizing the natural topography, diverted water downslope through a system of pipes, through his western mauka (north) pastures and down to the makai (southern) lands. This system was also supplemented by two rainsheds (or watersheds) and numerous water tanks and troughs to support cattle grazing north of the present-day highway.

This water conveyance route largely defined the eastern portion of Carter's mauka pastures. More specifically, historic aerial photographs from 1954, during the Glover era but with the understanding that Glover did little to improve pasture or ranching infrastructure, show that the Parker-era pastures encompassed the water conveyance system and extended further east to the present-day Glover Trail (east branch of the Kahuku-ʻĀinapō Trail). Spatial analysis of the 2002 survey of the grazing units and water system, in which the different pastures are delineated (Physical History #18), further confirm this boundary for the four larger pastures established by Carter during the Parker Ranch era (see Appendices C and E).

The spatial organization of Kahuku Ranch during the period of significance was further defined by the fences and circulation features established across the pasturelands. The eastern boundary fence, surveyed and constructed circa 1913 (and re-built in the late-1930s), clearly established the extent of the ranch property and enclosed the grazing lands of Kahuku strictly for ranch use. The circulation features that coursed northward, upslope, such as the Kahuku-ʻĀinapō Trail and the Kahuku Road, defined the alignment of the water conveyance system and also signaled the circulation patterns of ranch workers during the period of significance. Similarly, the pasture roads that were developed in association with the four mauka (north) pastures delineated these large fields and also provided circulation to these areas to support regular ranching operations.

Also during the period of significance, a cabin was built by the Civilian Conservation Corps (CCC) in association with the late-1930s construction of the eastern boundary fence. Located to the northeast of the mauka (northern) pasture developments at approximately 6,000 feet above sea level, the cabin was

used to accommodate laborers who constructed the boundary fence and was accessed by the northern section of the Kahuku Road.

By the end of the period of significance in 1947, the spatial organization of the Kahuku Ranch cultural landscape was defined by the four, large mauka, north, pastures established in a north-south orientation delineated by a system of pasture roads, bounded to the east by the Kahuku Road and the Glover Trail/east branch of the Kahuku-ʻĀinapō Trail; a water conveyance system, generally defined by the alignments of the Kahuku Road and the Kahuku-ʻĀinapō Trail, encompassed within the eastern boundary of these pastures; clusters of water features located along the easternmost sections of the pastures along the conveyance system; and the eastern boundary fence that defined the official extent of the Kahuku Ranch (see Appendix A Site Plan #2). The CCC cabin established a spatial relationship with the pasture area as a satellite structure to the northeast.

Although the cattle operation continued at Kahuku for over five decades following the period of significance and the ranch underwent major developments during this time, the spatial organization as established between 1912 and 1947 remained intact. Although the forested land between the Kahuku Road-Glover Trail (east branch of the Kahuku-ʻĀinapō Trail) and the eastern boundary fence was extensively developed into a complex pasture-paddock system and the water system was expanded to accommodate these additional cultivated lands, these efforts did not erase or detract from the spatial layout of the Parker-era pastures.

Summary
The overall organization of the Kahuku Ranch pastures and infrastructure as developed during the period of significance remains intact today. The four Parker-era pastures are still visible in a north-south alignment primarily along west side of the water conveyance system, at times still referred to as the Kahuku Pipeline, north of the highway; clusters of water features that supplied these western pastures are also present within the eastern portion of the pastures; and the mauka (northern) roads continue to both define the general alignment of the comprehensive water conveyance system and signal the circulation patterns during the historic ranching period. Pasture roads also continue to delineate and grant access to these pastures and the eastern boundary fence still defines the eastern extend of the historic cattle ranch. The CCC cabin remains in its remote location to the northeast. As such, spatial organization is a contributing landscape characteristic to the Kahuku Ranch cultural landscape.

Land Use

Land use is defined as the principal activities in the landscape that have formed, shaped, or organized the landscape as a result of human activity. Kahuku Ranch was once one of the largest cattle ranches in Hawai'i, and through the course of some 150 years of continuous operation, utilized the lands within the former ahupua'a to support its ranching activities. In particular, the ranching-related land use practices established during the period of significance, 1912-1947, have significantly shaped the landscape of Kahuku.

During the period of significance, ranch manager Alfred Wellington Carter, who had purchased Kahuku to be a satellite ranch for the larger Parker Ranch based in Waimea, introduced a pasture management system that actively improved the quality of available pasturelands that had previously been overgrazed and overtaken with unpalatable plants. Under Carter's direction, the grasslands of Kahuku mauka, north, of Highway 11 were cleared of Hilo grass, guava, ivy, and other plants of little nutritional value and were replaced with more desirable pasture grasses such as paspalum. Pigeon peas and legumes suitable for tropical and subtropical areas were also sown to improve the quality of soil by providing nitrogen. These newly sown mauka (northern) lands were enclosed into four large, fenced pastures that were established to support the grazing needs of an active cattle operation while preventing overgrazing. These fenced pastures were located to the west of the main mauka (north) road, present-day Kahuku Road, north of Highway 11. Associated with these large, fenced pastures were the establishment of pasture roads, walls, and corrals all of which supported the ranching operation. While existing sources only point to existing grassland improvements under Carter, it is possible that some trees were also removed along the mauka (north) road to better delineate the pastures.

Contemporaneously with the pasture development, Carter and his ranch staff established a complex water conveyance system coursing downslope from an elevation of approximately 5,000 feet. This water system captured both limited natural ground water and rainwater to support and sustain the cattle ranch. The potential removal of trees may also have been associated with the development of this water system.

In addition to these improved and enclosed pastures to the west of the mauka (north) road, ranch documents and correspondences from the Parker era confirm that the lands to the east of the road were also used to support cattle. In discussing his efforts to build a new and effective eastern boundary fence at Kahuku in 1936, Carter complains that the existing fence was "so poorly constructed that they would not hold cattle." This suggests that outside the enclosed pastures of domesticated forage plants, cows also roamed and grazed the eastern lands bound by the boundary fence.

During the last five years of the period of significance, the land use at Kahuku Ranch also accommodated military activities. During World War II, between 1942 and 1944, the military leased an eleven-acre parcel of land at the base of Pu'u o Lokuana to establish a radar station. Located immediately north of Highway 11, the military developed this area with some seven buildings and structures during their use of the land. When the military vacated the site between 1944 and 1947, the land was returned to the ranch and the military-era developments were later rehabilitated for ranching use, post-period of significance.

Shortly following, if not immediately after, the return of the military-leased land, Carter sold Kahuku Ranch, ending the period of significance in 1947. In the decades following, Kahuku Ranch underwent a period of extensive development under a series of new management. Timber harvesting was briefly introduced in the 1950s, and in the 1960s and 1970s, the pasture system was extensively expanded. In particular, the land east of Kahuku Road was developed into a complex system of pasture-paddocks that carved the former woodland into small units of cleared, sown land. Despite these changes in the second

half of the twentieth century, however, the historic land use of Kahuku Ranch remained consistent to the period of significance in that the area continued to support cattle grazing as its primary purpose.

When the Kahuku Ranch officially ended its commercial cattle operation and management of the land transferred to the National Park Service in 2003, the land use practices associated with ranching also came to an end. All cattle were removed from the slopes of Kahuku by 2010 and the park has since been developing plans to manage and protect the natural resources and habitat within the newly acquired park land. Despite the termination of the ranching operation, however, much of the pastures, paddocks, roads, and water conveyance system are still extant and continue to display the historic land use patterns of cattle grazing as established during the period of significance.

Summary

Land use is a non-contributing landscape characteristic to the Kahuku Ranch cultural landscape because of the termination of active ranching operations. However, the landscape displays the pastures and the associated infrastructural development such as the water conveyance system, roads, and fences that signal its past as cattle grazing lands. Although the infrastructural developments to the east of the mauka (north) road and the Glover Trail (east branch of the Kahuku-ʻĀinapō Trail) date to a later period, the land use of this area remains consistent with that established during the period of significance: cattle grazing. Further, the military-era developments also do not detract significantly from this historic land use patterns in that it took place in a small, targeted area and once released from military use, returned to the ranching operations that after the war.

Circulation

Circulation is defined as those spaces, features, and applied material finishes which constitute systems of movement in a landscape. The circulation system within Kahuku Ranch consists of paved, dirt, maintained, and unmaintained roads and trails that presently or historically provided access to the pastures and the northern areas of Kahuku Ranch, and include sections of the Kahuku Road, the Kahuku-ʻĀinapō Trail, pasture roads and trails that also delineated the paddocks, and an access road to the base camp and northern CCC cabin.

Since the period of significance, in association with the expansion of grazing areas under Damon Estate management, the circulation system was expanded, and sections were updated with paved materials.[267] Some of the roads from the period of significance are less visible in the landscape due to a lack of maintenance.

Kahuku Road System
The road system consists of roads and trails that were used to access the pastures and northern CCC areas during the period of significance. These includes the Kahuku-ʻĀinapō Trail and roads/trails that accessed and the pastures and paddocks.

Kahuku-ʻĀinapō Trail (State Site # 50-10-73-24,121) (Contributing)
The Kahuku-ʻĀinapō Trail is part of a trail system associated with the cattle ranching operations during the period of significance. It was once used by workers of the ranch to move cattle "doggies" across the island, and more site specifically from Kahuku to Parker Ranch lands within the saddle of the island. The trail starts at a point on Old Māmalahoa Road and crosses the pastures to connect with the adjacent ranch lands of Kapāpala. The route is a narrow, single-file, twisting, and occasionally slightly abraded trail over fields of cooled, hard, tough lavas, and leads up to the broad southeast flank of Mauna Loa volcano. In 2004, the trail was surveyed and inventoried in the "Kahuku Inventory Survey 2004-2005" as a part of the Phase I Kahuku-ʻĀinapō Trail Inventory and Phase II Transect Reconnaissance. The linear transect covered a total distance of approximately 13.7 miles in an ascent from 2,000 to 6,000 feet above sea level. Because it was used during the period of significance and retains integrity, it is contributing.

Kahuku Western Pasture Roads (Contributing)
A number of roads/trails were established in association with the development of the pastures during the period of significance to not only provide workers access to the sites during the initial establishment of the pastures but also to grant the ranch staff access under regular ranching operations. An analysis of a series of aerial photographs of the mauka, northern, lands of Kahuku dating 1954 confirms that most of the road alignments to the west of the Kahuku Road, and three road segments to the east of the road, visible in these photographs are consistent with those extant today (see Appendix C Pasture Site Plan). While the aerial photographs date some seven years post-period of significance, based on available historical data, these roads were most likely established during the period of significance. As the next recorded major development period relating to ranching date some ten years after the Parker era, under the Damon Estate ownership (1958-2003), and as available records suggest that most of the developments under James Glover between 1947 and 1958 were associated with his timber harvesting and cinder mining ventures, these roads were likely established during the Parker era as a part of the pasture development. As such, this system of western pasture roads, including the three road segments to the east, are contributing resources to the cultural landscape.

[267] Kahuku Base Camp DOE, p. 5.

Kahuku Road (Contributing)
Kahuku Road presently serves as the primary access to the site, providing access to both the historic pastures on the west and the non-historic pastures on the east. The road currently enters Kahuku Ranch from the southeastern corner of the unit boundary, running north-northwestward and diverges into a Y at the base camp, with one branch granting access to the developed area and the other creating a westerly arc around Pu'u o Lokuana before it follows the eastern edge of the 1868 lava flow and courses upland. The alignment of this road is consistent with that observed in the 1954 aerial photograph. With the exception of the Y section, the portion of this road south of the first convergence at 3,500 feet is consistent in alignment with the unnamed trail visible in the 1924 topographic map. The upper section of this road, particularly between 3,500 and 5,000 feet, display a close spatial relationship with the clusters of constructed water features from the Parker era, which suggests that this upper section of the road, or its first iteration, was likely established during the period of significance in association with the development of the water conveyance system. This road converges with the Kahuku-'Āinapō Trail twice at approximately 3,500 feet above sea level then courses between the two branches of the trail northward, and converges again briefly just above 4,500 feet before jogging northeast to the higher elevations. As such, the Kahuku Road, excluding the Y section at its southernmost point, is a contributing resource to Kahuku Ranch cultural landscape.

Kahuku Base Camp Access Road (Non-Contributing)
The Kahuku Base Camp Access Road is the short road segment that connects the larger Kahuku Road to Highway 11. This road segment comprises the Y section of the road from the highway before it meets the historic Kahuku Road alignment, including the road into the Kahuku Base Camp and the westerly divergent road that wraps around the southwestern portion of Pu'u o Lokuana. The road from the highway into the Base Camp area was likely established during the military era, outside the historic ranching context. The westerly divergent road was established at least by 1962. This lower section of the Kahuku Road, named the Kahuku Base Camp Access Road for the purpose of distinction, falls outside the historic ranching context of the cultural landscape and partially post-dates the period of significance; this road is therefore a non-contributing resource.

Kahuku Eastern Pasture Roads (Non-Contributing)
A number of roads/trails were established in association with the extensive development of the pasture-paddock system under the Damon Estate management, particularly in the 1960s and 1970s. The pastures, and thefore the roads, were developed to the east of the Kahuku Road, between the road and the eastern boundary fence. Established post-period of significance, these pasture roads to the east of Kahuku Road, with the exception of the road segments addressed in association with the Parker-era development above, are non-contributing to the cultural landscape.

Kahuku Ranch Concrete Walkways (Non-Contributing)
Concrete walkways were added to the basecamp during the 1960s, when the structures were improved to suit the needs of both the staff and continued ranching operation. During this time, the base camp was "residentialized," a process that adopted a suburban ranch-style configuration of residential spaces. The walkways were constructed of poured concrete. Since they were built after the period of significance, the concrete walkways are considered non-contributing.

Summary

The circulation system within Kahuku Ranch consisted of road/trail system that was developed to provide access to the pastures and the northern areas of Kahuku Ranch. These included two major systems of pasture roads, the western system developed during the period of significance and the eastern system established in the 1960s and 1970s, the Kahuku-ʻĀinapō Trail which was used to drive cattle to and from the main Parker Ranch, the Kahuku Road that serves as the primary north-south access road today, and the access road to the base camp that connects Highway 11 to Kahuku Road. Pedestrian circulation is also present within the Kahuku Base Camp. Among these, the western pasture roads, the Kahuku-ʻĀinapō Trail, and the Kahuku Road reflect the historic circulation pattern as established during the period of significance and contribute to the historic character of the Kahuku Ranch cultural landscape.

Contributing Features:

Kahuku Western Pasture Roads
Resource ID: 1168635

Kahuku-ʻĀinapō Trail
Resource ID: 1168976

Kahuku Road
Resource ID: TBD

Non-Contributing Features:

Kahuku Base Camp Access Road
Resource ID:

Kahuku Eastern Pasture Roads
Resource ID:

Kahuku Ranch Concrete Walkways
Resource ID: TBD

Vegetation

The vegetation section documents human manipulated vegetation: deciduous and evergreen trees, shrubs, vines, ground covers and herbaceous plants used for design and/or ornamental purposes, whether indigenous or introduced in the landscape. The manipulation of vegetation at Kahuku Ranch during the period of significance primarily concerned ranching, which included the management of pasture species and cattle grazing.

Native lowland (or low elevation) vegetation was impacted nearly 1,600 years ago by Polynesian settlers, who cleared lands and introduced plant and animal species for subsistence agriculture. Over the past 200 years, these impacts have increased, and natural areas below 5,000 ft. elevation have been extensively modified by cattle ranching, logging, and introduced plant and animal species.

During the period of significance, approximately 10-15,000 acres were managed as pastureland, and the northern portion of Kahuku Ranch (above Hwy 11) contained four paddock areas located on the east side of the 1887 lava flow and northwest of the 1868 lava flow, to the west of Kahuku Road. By the time Carter purchased Kahuku in 1912, eighty-three exotic grasses were already established in the territory. Noxious pasture weed species were identified and managed, including guava (*Psidium guajava*), Hilo grass (*Paspalum conjugatum*), ivy, and lantana (*Lantana camara*).[268] Carter ordered the removal of these weeds from the existing pasturelands and introduced a carefully selected palette of nutritious grasses to improve the quality of the pastures. Species introduced included Kikuyu, orchard grasses, paspalum grass, dallies grass, Kentucky blue grass, and perennial rye grass; and legumes such as big trefoil, Kenya white clover, Kenland red clover, and white Dutch clover. Pigeon peas and corn were also grown for animals on the ranch, although the location is not known. Within the CLI boundary, in an area north of the highway and west of the ranch road, Carter tested different grasses in large, unfenced plots.[269]

After the period of significance, under the ownership of James Glover from 1947 to 1958, the forested areas to the east of the Kahuku Ranch Road were logged as a part of the new owner's timber venture. During this period, where koa (*Acacia koa*) were logged, the exposed grounds were not replanted and left vulnerable to colonization by undesirable species.

When the Damon Estate purchased Kahuku from Glover in 1958, ranch manager Freddy Rice accelerated the development of the eastern lands. Where the former owner had logged and cleared the land, he quickly eradicated the noxious colonizing species, such as prickly Florida blackberry (*Rubus argutus*) and Hāmākua pāmakani (*Ageratina riparia*), and in their place introduced forage legumes. Through the 1960s and 1970s, Rice and his staff further cleared the forested lands and developed favorable pasturelands. By 1968, ranch managers estimated that there were over 24,000 acres, now including areas east of the Kahuku Road and in the higher elevations, of pastures throughout the entire Kahuku Ranch. The clearing of forests for pastures and the introduction of forage species continued until the late 1980s.

During the Damon Estates era, further planting activities beyond pasture development also occurred, including the introduction of ornamental vegetation and windbreaks at Kahuku Ranch. The varieties of ornamental plants included: bird of paradise, wild olive, bougainvillea, gardenia, dwarf bougainvillea, wax plant, Chinese privet, pepper tree, and periwinkle—though evidence suggests that these were added to the Ranch core located outside of the current boundary. The windbreaks included species of Norfolk pine, ironwoods, and monkey pod trees that were planted for the offices, the main ranch camp and

[268] Benitez et al., "Inventory of Vascular Plants of Kahuku Addition," p. 1.
[269] Avery, *Environmental History of Kahuku,* p. 60-61.

headquarters and the Kamaoa holding pen, also outside of the current boundary. Several fence lines were also planted with windbreaks, though their exact location and composition are unspecified.

In the 1990s, the last private land holder hired contractors to harvest additional koa, ʻōhiʻa (*Metrosideros polymorpha*), and sandalwood (*Santalum paniculatum*). By the time the NPS acquired Kahuku Ranch in 2003, the pastures established during the period of significance and later eras remained, and soon after, grazing practices were halted with the final removal of cattle. The park began conservation efforts toward managing native ecosystems and identified species-rich forest fragments interspersed through the pastures and native mature forest with subalpine and alpine native plant communities at upper elevations above the Kaʻū forest reserve. Under this management, efforts have been made to restore the mesic and west forests, protect rare and endangered species, manage invasive weeds, and to remove highly invasive species. In 2005, four exclosures were established throughout the pastures, approximately 10 acres each, which served to test methods for facilitating native forest recovery.

Summary

The overall vegetative character of the Kahuku Ranch Western Pastures and Paddocks contributes to the cultural landscape. Throughout the period of significance, the manipulation of vegetation primarily revolved around pasture development, which entailed the constant management of pasture species. These efforts were largely targeted in the area west of the Kahuku Road and remnants of these efforts are still visible in the landscape today and contribute to the historic ranching character of Kahuku Ranch. After the period of significance, pastures were expanded to the east which entailed the extensive removal of forest species, which were also harvested at this time. The eastern pastures and paddocks do not contribute to the cultural landscape. Under the management of the NPS, cattle no longer graze the pasture, and conservation efforts focus on restoration of native vegetation.

Contributing Features:

Kahuku Ranch Western Pastures and Paddocks
Resource ID:

Non-Contributing Features:

Kahuku Ranch Eastern Pastures and Paddocks
Resource ID:

Buildings and Structures

Buildings are defined as elements primarily built for sheltering any form of human activity. Structures are defined as features constructed for purposes other than sheltering human activities. The one contributing building at Kahuku Ranch served ranching operations during the period of significance.

Contributing Features:

Kahuku CCC Cabin (Punaluu Kahawai Cabin) (Contributing)
Resource ID: 789376
Date constructed: 1933-1941
The Kahuku CCC Cabin was built during the CCC-era to accommodate workers working on the eastern boundary of Kahuku. It is a single-story wood frame building topped with a gabled roof of corrugated metal. The building presently includes modern additions on its south and west sides and is irregular in footprint. The project to remove these additions, planned 2008/2009, has been postponed indefinitely due to lack of staff and equipment at the location. It is located in the far northeastern finger of the unit boundary. The associated resource listing in the CRIS database is the "upper cabin" (CRIS: 1168508). This cabin was built by CCC-era workers and served to house them during their efforts in constructing the eastern boundary wall of Kahuku (the CCC crew also possibly introduced various economically viable trees into the area), and thus contributed to the development of Parker-era Kahuku Ranch. For this reason, it is contributing.

Non-Contributing Features:

Kahuku Ranch Dorm Residence (Non-contributing)
Resource ID: 1168507
Building 404
Date constructed: ca. 1942
The Kahuku Ranch Dorm Residence is a single-story frame building topped with a medium-pitched hipped roof framed with cedar, covered with green corrugated metal that has open eaves with cedar rafter tails and simple planked fascia along roof edge. The building, situated westward, is accessed by a paved driveway from main road into the developed area, on the west side of a spur off the Kahuku Road that terminates into a cul-de-sac, and is surrounded to the rear by a canopy of trees. It has a regular in footprint, and measures approximately 26" x 49' for the dorm, and 31'9" for the carport/storage. It is constructed on a post and pier block foundation with single-wall construction, and sided with cedar board and batten, and has simple wood trim at doors and windows. Window types include sliders, double hung and 'picture' plate with jalousie. A laundry/washhouse, carport with storage, and a screened porch were added on to the structure at the south elevation. To the rear northeast corner of the dorm are the woodshop, the smokehouse, and a gas tank. The dorm is surrounded by a grass lawn and has foundation plantings along two elevation walls. The dorm residence was constructed circa 1942 as a part of the military base camp, and has undergone two phases of significant alterations in the late-1940s and 1960s. According to FMSS records, it was last modified in 1970. Although the building was constructed during the period of significance and was later incorporated into the ranching operation, the Dorm Residence falls outside the historic ranching context of the cultural landscape during the period of significance and is therefore non-contributing.

Kahuku Ranch Bunker Tunnel and Bunker Vent (Non-contributing)
Resource ID: 1168504
Built: 1942-1944

Condition: Poor
The Kahuku Ranch Bunker Tunnel and Bunker Vent is a primarily underground feature constructed for military purposes between 1942-1944. The tunnel is cut into a steep hillside, located to the western side of the developed area, accessed via the spurring cul-de-sac from Kahuku Road at an opening behind the Dorm Residence and the Single Residence. Two steel panel doors are set in concrete at the entrance of the tunnel, measuring ¼" thick and 25" wide. The tunnel is unfinished curved stone with a mortar ceiling, measuring approximately 7' width and 75' length. At the rear of the tunnel is a large room with a connecting air vent that surfaces at the apex if the hill. The vent cover consists of a square base with open sides and a gabled roof all constructed of concrete. Five concrete pier blocks are located 52' to the southwest of the vent. The blocks are 15″ in height, have a base of 17″ and a top of 11″. The tunnel and the vent were possibly used for ammunition storage and are currently in poor condition. The tunnel is currently cluttered with small boulders and timbers from an earlier ceiling and wall cave-in. The tunnel entrance is obscured by dense vegetation consisting of plants such as avocado and impatiens, and near the vent are kukui and other grasses. Although constructed during the period of significance, the Kahuku Ranch Bunker Tunnel and Bunker Vent was used for military purposes and not adapted for ranch use after the war. It does not contribute to the ranching landscape, and is non-contributing.

Kahuku Ranch Generator (Non-contributing)
Resource ID: 1168497
Building 406
Date constructed: Pre-1943
The Kahuku Ranch Generator is single-story wood frame structure topped with a corrugated metal hipped and shed roof, built on concrete pier blocks and covered with vertical wood siding, and corrugated metal siding at N, E, and W elevations. The structure consists of one large square building with a shed built off the west wall, and measures approximately 16'15" x 24'2." The entire building is painted green. Based on the interior framing, it originally may have had windows that have since been walled over. The generator is located within the developed area, north of the shop and at the northwestern end of the cul-de-sac that spurs from Kahuku Road. It is set against the lava rock walls. Upon the sale of Kahuku Ranch to James Glover, 1948 tax records show that Glover had added to the structure and used it as a storage for tires and tools. Although the exact construction date for this structure cannot be determined (the Kahuku Base Camp DOE suggests a date of pre-1943), its placement against the lava rock walls is consistent with the consideration given to camouflage during the establishment of the Kahuku Base Camp between 1942 and 1944. As such, the construction and use of the Kahuku Ranch Generator during the period of significance falls outside the historic ranching context of the cultural landscape; the resource is therefore non-contributing.

Kahuku Ranch Storage Structure (Non-contributing)
Resource ID: 1168503
Date of construction: ca. 1940s
Building 414
Condition: Fair
The Kahuku Ranch Storage Structure is a single-story structure built of concrete. It is regular in footprint, and measures 5' in length, 6' in width, and 6.5' in height, with 5.5' thick walls and ceiling. The door is made of wood and is falling off the metal hinges. It was historically used for military storage. The storage structure is located within the developed area, north of the similarly named Storage Shed and the generator, at the end of the cul-de-sac that spurs form Kahuku Road. The Kahuku Ranch Storage Structure is in fair condition, and although it was constructed during the period of significance, it was used for military purposes, and not adapted for ranch use after the war. It is non-contributing.

Kahuku Ranch Fuel Storage Shed (Non-contributing)
Resource ID: 1168499
Date constructed: ca. 1948-1958
Condition: Poor
The Kahuku Ranch Fuel Storage Shed is a single-story wood frame structure constructed on a foundation of red lava rock slabs. It has corrugated metal siding and roofing with a flat roof painted green. It is regular in footprint, and measures 8' x 10'5." The Fuel Storage Shed is located in the developed area, west and across the road from the Dorm Residence, on the western side of the spur road from Kahuku Road that leads to a cul-de-sac. It was built ca. 1948-1958 to serve the sawmill and the ranch service area. One set of standard double doors are present on the east wall of the building. Constructed during the Glover area to serve the sawmill and the ranch service area, the Kahuku Ranch Fuel Storage Shed is considered non-contributing as it was built after the period of significance.

Kahuku Ranch Carport (Non-contributing)
Resource ID: 1168672
Date constructed: ca. 1968
Condition: Good
The Kahuku Ranch Carport consists of a small building and covered parking area that share a green corrugated shed roof. The building portion is on a concrete slab and has wood siding painted green. A dimension of the structure measure 31'9" long. The carport is located within the developed area, south of the Kahuku Ranch Singe Residence, set against the eastern canopy of trees, and on the eastern side of the cul-de-sac. It is in good condition. The carport was built circa 1968 as part of the residentializing of the Base Camp area, after the period of significance, and is non-contributing.

Kahuku Ranch Single Residence (Non-contributing)
Resource ID: 1168506
Building (Quarters) 403
Date constructed: 1972
Condition: Good
The Kahuku Ranch Single Residence is a single-story frame building topped with a cross-gabled roof of corrugated metal. The building, situated westward, is irregular in footprint and measures approximately 32' x 53'11". An attached, side-gabled garage to the north of the residence measures 21'7" x 22'10." The Residence is accessed by a paved driveway from main road into the developed area, a spur of the Kahuku Road that terminates into a cul-de-sac, where three wood steps located at the northwestern corner of the residence grants access to the front porch. Constructed after the period of significance, the Single Residence is non-contributing.

Kahuku Ranch Wood Shop (Non-contributing)
Resource ID: 1168500
Building 409
Date: ca. post-1972
The Kahuku Ranch Wood Shop is a single-story wood frame structure built on a concrete stem wall and slab with a corrugated metal shed roof. It has a regular footprint and measures approximately 20'3" by 20'3." The exterior is board and batten siding painted green and the interior is cream in color. Built-in cupboards are located within the bump-outs at the north east corner of the building. The wood shop is located within the developed area, northeast and of the Dorm Residence, accessed by a driveway on the east side of the cul-de-sac that spurs form Kahuku Road. The Kahuku Base Camp DOE mentions that the Kahuku Ranch Wood Shop was constructed after 1972, which photo analysis confirms, and is non-contributing.

Kahuku Ranch Storage Shed (Non-contributing)
Resource ID: 1168496
Building 405
Built: 1973
The Kahuku Ranch Storage Shed is a single-story wood frame structure constructed on concrete pier blocks, topped with a corrugated metal shed roof. It is regular in footprint, and measures 19'10" x 39'11." Some of the framing wood is peeled 'ōhi'a posts. The floor is compacted red cinder, and the walls are constructed of corrugated metal, with upper sections constructed of opaque fiberglass. The entire south wall consists of two large swinging double doors. The Kahuku Ranch Storage Shed is located in the developed area at the northern end of the cul-de-sac that spurs from Kahuku Road. It is surrounded by the generator to the west, a water tank foundation to the east, and the storage structure and a water tank to the north. The Kahuku Ranch Storage Shed was built in 1973, after the period of significance and is non-contributing.

Kahuku Ranch Barn (Non-contributing)
Resource ID: 1168494
Building 401
Date constructed: 1989
The Kahuku Ranch Barn is a single-story wood frame structure built on a concrete slab foundation, topped with a corrugated metal side-gabled roof. The structure, oriented northward, is regular in footprint and measures 26' x 116'-8." The siding is constructed with corrugated metal. There are two sliding garage doors on the west wall and one on the north wall. The entire structure is painted dark green. The Kahuku Ranch Barn is located in the developed area and accessed by a spur road off of Kahuku Road that leads to the cul-de-sac, on the west side north of the Visitor Center. Because the barn was constructed outside of the period of significance, it is non-contributing.

Kahuku Ranch Vault Toilet (Non-contributing)
Resource ID: 1168633
Date constructed: 2006 by NPS
The Kahuku Ranch Restroom is a single-story wood frame structure built on a concrete slab, with wood siding and a front gabled roof of corrugated metal. It is regular in footprint, and its dimension are needed. It is located along the entrance to the developed area, on the west side of Kahuku Road across from the Visitors Center, set amongst a canopy of trees. The earliest dates available in facilities records indicate that it was constructed in the early 1990s, and it is visibly of newer construction. Because the Kahuku Ranch Restroom was constructed outside of the period of significance, it is non-contributing.

Kahuku Ranch Lumber Mills (Non-contributing)
Resource ID: 1168660, 1168654, 1168659 (KA74)
There are (3) Kahuku Ranch Lumber Mills located within the unit boundary that were developed throughout Kahuku Ranch. One lumber mill is located near the developed area, another is located in the far northern pastures, east of Kahuku Road, and Lumber Mill KA74 is centrally located amongst the larger unit area pastures, east of Kahuku Road along a secondary north-south ranch road. From the history section of this inventory, the lumber mills appear to have been primarily constructed during the Glover era, from 1947-1958. Since this is outside of the period of significance, the lumber mills are non-contributing.

Kahuku Ranch Picnic Shelter (Non-Contributing)
Resource ID: 1168634

Date constructed: post-2012 by NPS, likely after the Visitor Contact Station
Kahuku Ranch Picnic Shelter is a simple structure built of four wood beams, a green corrugated metal gabled roof, and open sides for outdoor shelter. It is located in the developed area to the south of the Visitor Center, accessed on the west side of the spur from Kahuku Road that leads to the cul-de-sac. Kahuku Ranch Picnic Shelter is determined non-contributing based on the construction materials and compilation, which do not appear to be from the period of significance, and is non-contributing.

Kahuku Ranch Visitor Center (Non-contributing)
Resource ID: 1168632
Date constructed: 2012
The Kahuku Ranch Visitor Center is a single-story wood frame building topped with a front-gabled roof of corrugated metal. The building, situated northwestward, is regular in footprint. A large porch utilizes the front section of the gable roof, supported by six wooden posts. To the rear of the building is a shed, a pumphouse, and a water tank. with a storage building adjacent on the north side. The Visitor Center is accessed by a paved driveway from main road into the developed area, along the spur of Kahuku Road that terminates into a cul-de-sac. According to the last field visit, the Visitor Center is newly constructed and not historic. They also noted that water infiltration occurring -rising through the slab even though slab is on an elevated site pad; likely constructed without proper installed moisture barrier. While the exact construction date is unknown, the building is visibly newer, constructed outside of the period of significance, and is non-contributing.

Kahuku Ranch Smoke House (Non-Contributing)
Resource ID: 1168678
Date constructed: Unknown
The Kahuku Ranch Smoke House is a small addition on to the rear of the Single Residence (403), south of the woodshop. It is constructed on a concrete slab, topped with a green corrugated shed roof, and has wood siding that has been painted green. It is regular in footprint, and its dimensions are needed. It is set back into a canopy of trees to the east and appears in good condition. It is unclear when this structure was built, though since it is an addition to the rear of a building built in 1972, it likely dates 1972 or later, and is therefore non-contributing.

Kahuku Ranch Storage Building (Non-Contributing)
Resource ID: 1168495
Building 402
Date: 1948
The Kahuku Ranch Storage Building is a single-story wood frame structure built on a concrete slab foundation. The roof is a front-gable. Both the siding and roof are constructed with corrugated metal. The structure dimensions are 28'1" x 38'2." There are two sliding garage doors one located on the north wall and the other on the south wall. The entire structure is painted dark green. It's currently used for vehicle and equipment storage. The storage building is located within the developed area, north of the barn. It is set against a canopy of trees to the west. This was constructed in association with Glover's sawmill, and since it was constructed after the period of significance, it is non-contributing.

Kahuku Ranch Sheds (Non-contributing)
Resource ID: 1168700, 1168702, 1168694, 1168686, 1168687
Dates constructed: Unknown
The Kahuku Ranch Sheds consist of six temporary make-shift sheds found through The Kahuku Ranch cultural landscape. They are constructed with frames of metal, logs, or wood poles; siding of corrugated metal, painted wood, or tarps, with shed or hipped rooves of wood or corrugated metal. Some sheds have

been disassembled, with the pieces left in-situ. Of the six sheds found across the Kahuku Ranch, five of these structures are determined non-contributing based on their location. Two of these sheds (1168702, 1168694) are located in the base camp area, one shed (1168700) is located in the eastern pastures, near water tanks KA34 & KA35, and two sheds (1168686, 1168687) are located in the northeast corner of the larger unit area near the logging station. As all developments at the base camp dating to the period of significance fall under the military historic context, these two sheds would not contribute to the Kahuku Ranch cultural landscape's ranching context, even if dated to the Parker era. Similarly, as the eastern paddocks were developed post-period of significance, the shed near KA34 and KA35, east of Kahuku Road, is most likely associated with the Damon Estate era of development. Based on the close proximity the non-contributing logging station, the two sheds in the northeastern section of the unit boundary are likely associated with the logging enterprise and are therefore non-contributing. Some of these sheds also may have been used to protect the salt licks during the cattle operation.

Kahuku Ranch Kennel (Non-Contributing)
Resource ID: 1168676
Date constructed: Post-period of significance, circa 1970s
The Kahuku Ranch Kennel is a metal frame structure, angled for a non-present shed roof, with a chain link fence façade, and semi-present corrugated metal siding. It appears in disrepair, as siding and roofing is missing. It is located in the developed area to the north of the Single Residence, accessed by the cul-de-sac that spurs from Kahuku Road. Although the exact date of construction of the Kahuku Ranch Kennel is unknown, its location within the Base Camp suggests a date no earlier than the 1940s, post-period of significance. The kennel was likely built in association with the ranching activities that followed, for the dogs owned by the cowboys. The Kahuku Ranch Kennel is therefore a non-contributing resource to the cultural landscape.

Undetermined Features:

Kahuku Ranch Shed, Building 416 (Undetermined)
Resource ID: 1168655
Date constructed: Unknown
Kahuku Ranch Shed, Building 416, is the one shed of six found across Kahuku Ranch that is undetermined in status. Constructed of ʻōhiʻa poles with a corrugated metal shed roof and three walls, this structure is located immediately south of the cluster of water features at the 5,000-foot level, which was the northernmost extent of the historic water conveyance system. It is possible that this shed was constructed in association with the water features, or as a cattle salt lick structure. The structure is currently in a state of severe deterioration and is closer to a ruin. Lacking information on use and construction date, this structure is undetermined in status.

Summary

The buildings and structures at Kahuku Ranch illustrate the continual development that was the result of changing ranching and the operational needs. One building contributes, twenty-four buildings and structures do not contribute, and one structure is currently undetermined in status.

Contributing Features:

Kahuku CCC Cabin
Resource ID: 789376 (1168508)

Undetermined Features:

Kahuku Ranch Shed
Resource ID: 1168655

Non-Contributing Features:

Kahuku Ranch Dorm Residence
Resource ID: 1168507

Kahuku Ranch Bunker Tunnel and Bunker Vent
Resource ID: 1168504

Kahuku Ranch Generator
Resource ID: 1168497

Kahuku Ranch Storage Structure
Resource ID: 1168503

Kahuku Ranch Fuel Storage Shed
Resource ID: 1168499

Kahuku Ranch Carport
Resource ID: 1168672

Kahuku Ranch Single Residence
Resource ID: 1168506

Kahuku Ranch Wood Shop
Resource ID: 1168500

Kahuku Ranch Storage Shed
Resource ID: 1168496

Kahuku Ranch Barn
Resource ID: 1168494

Kahuku Ranch Vault Toilet
Resource ID: 1168633

Kahuku Ranch Lumber Mill
Resource ID: 1168660

Kahuku Ranch Lumber Mill
Resource ID: 1168654

Kahuku Ranch Lumber Mill KA74
Resource ID: 1168659

Kahuku Ranch Picnic Shelter
Resource ID: 1168634

Kahuku Ranch Visitor Center
Resource ID: 1168632

Kahuku Ranch Smoke House
Resource ID: 1168678

Kahuku Ranch Storage Building
Resource ID: 1168495

Kahuku Ranch Shed
Resource ID: 1168700

Kahuku Ranch Shed
Resource ID: 1168702

Kahuku Ranch Shed
Resource ID: 1168694

Kahuku Ranch Shed
Resource ID: 1168686

Kahuku Ranch Shed
Resource ID: 1168687

Kahuku Ranch Kennel
Resource ID: 1168676

Small-scale Features

Small-scale features are defined as the elements which provide detail and diversity for both the functional needs and the aesthetic concerns in the landscape. At Kahuku Ranch, small-scale features are comprised of a variety of resources that supported ranching activities, including equipment, fences and rock walls, gas tanks, cattle ramps, and corrals.

Contributing

Kahuku Ranch Eastern Boundary Fence (Contributing)
Resource ID: 1168637
Date constructed: circa 1913
The Kahuku Ranch Eastern Boundary Fence is a resource that was established during the first years of the period of significance and has been a functional feature in the historic ranching landscape of Kahuku since its initial construction. First constructed around 1913, following the boundary survey by G.F. Wright, to clearly delineate the line of property ownership, this fence was rebuilt in the late 1930s, in an arrangement made with the Civilian Conservation Corps (CCC), to increase its effectiveness in holding cattle within the ranch lands. Through the following decades of ranching operation, this eastern boundary fence has undergone numerous repairs and replacements to continue its function as an enclosure to keep the cattle within the ranch property. However, although the eastern boundary fence has lost integrity in historic material and workmanship through these repairs, the extant fence line is overall consistent with the alignment established during the period of significance, along the boundary established for the property, and therefore retains integrity in design, location, and setting. The fence continues to separate the historic ranch lands from the forested Ka'ū forest reserve to the east and thus retains its historic setting and displays its association with the ranching landscape on the slopes of Mauna Loa. The Kahuku Ranch Eastern Boundary Fence is therefore a contributing resource to the cultural landscape.

Kahuku Ranch Rock Walls (Contributing)
Resource ID: 1168638
Date constructed: 1913
In 1913, a three-thousand-foot stone wall was built at Kahuku Ranch, that runs along major circulatory features. It is three feet wide at the bottom and taper to two feet on top, with a height of four feet high at most and only three and one-half feet in many places. Though the exact location of portions of the wall are unknown, two long stretches of rock wall can be found primarily at the southern end of Kahuku Ranch, including one that defines the southern edge along Māmalahoa Hwy/Hawaii Belt Road, one intersecting and within the Pu'u o Lokuana trail loop, two within the developed area, one to the north of the developed area, and at the far northeast of the unit boundary. The rock walls lining the Kahuku Road were likely rebuilt in 1976. While sections of the rock wall were repaired and reconstructed, both within and outside of the period of significance, the modifications were done in order to maintain the larger rock wall system, and were responses to the natural systems acting upon the resource. The Kahuku Ranch Rock Walls are considered contributing.

Non-Contributing

Kahuku Ranch Pasture Fences (Non-Contributing, Compatible)
Resource ID: TBD
Historically, fences were constructed as functional features across the Kahuku Ranch landscape. The four paddocks established under Carter's management, during the period of significance, are known to have been fenced. Other areas such as watershed, roads, and enclosures were also likely present during this

time. Additional fences were also constructed in the decades of cattle operations following the period of significance to serve the needs of the ranch. These fences, generally concentrated in the eastern pasture-paddocks dating to the Damon era and post-dating the period of significance, contributed to the historic land use of the Kahuku pastures.

Because the fences across the Kahuku pastures were often moved and repaired to support the ongoing ranch operations, it is difficult to determine their age. Further, as information on the exact historic alignment of the pasture fences is lacking, the fences' integrity in design, setting, and location are impossible to determine. As such, the Kahuku Ranch Pasture Fences are non-contributing to the cultural landscape; however, these pasture fences play an important role in defining the historic land use, the fences are compatible with the historic character of the cultural landscape.

Kahuku Ranch Cattle Ramp KA59 (Non-contributing)
Resource ID: 1168548
Date constructed: Unknown
KA 59 is a wooden and basalt slab cattle ramp. The base of the ramp is constructed of basalt slabs stacked 3-5 courses in height. The wooden fence of the ramp connects to a wood and metal corral fence. It is in fair condition. Although its construction date is unknown, its location in the eastern paddocks, which were developed post-period of significance, suggests that the cattle ramp was constructed post-period of significance and is non-contributing.

Kahuku Ranch Cattle Ramp (Non-contributing)
Resource ID: 1168669
Although its construction date is unknown, its location in the eastern paddocks, which were developed post-period of significance, suggests that the cattle ramp was constructed post-period of significance and is non-contributing.

Kahuku Ranch Equipment (Non-contributing)
Resource ID: 1168695
Date constructed: Unknown
The Kahuku Ranch Equipment is located in the northeast part of the ranch, northeast of Exclosure Site #4. It appears to consist of a mechanical agitator, left in-situ, but further description and dimensions are needed. Although its construction or placement date is unknown, its location in the eastern paddocks, which were developed post-period of significance, suggests that the equipment was utilized post-period of significance and is non-contributing.

Kahuku Ranch Exclosure Sites 1-4 (Non-Contributing)
Four exclosures are experimental forest restoration areas developed by the NPS in 2005 to test methods for facilitating forest recovery. The areas measure approximately 10 acres (4 hectares) each and were designed to keep out ungulate animal species. Although these were recorded in CRIS as cultural resources, they are a recent development constructed after the period of significance, and are non-contributing.

Kahuku Ranch Exclosure Site 1
Resource ID: 1168685

Kahuku Ranch Exclosure Site 2
Resource ID: 1168701

Kahuku Ranch Exclosure Site 3
Resource ID: 1168681

Kahuku Ranch Exclosure Site 4
Resource ID: 1168682

Kahuku Ranch Gas Tanks (Non-contributing)
Resource ID: 1168699, 1168698, 1168691
Date constructed:
The Kahuku Ranch Gas Tanks consist of (3) gas tanks that are located amidst the base camp area. While the dates of construction of these gas tanks are unknown, developments at the base camp area during the period of significance fall under the military historic context and are therefore non-contributing to the ranching context of the Kahuku Ranch cultural landscape. Additionally, any ranching-related developments at the base camp area occurred post-period of significance; the gas tanks are non-contributing.

Kahuku Ranch Corrals (Non-contributing)
Resource ID: 1168670, 1168684, 1168668, 1168695, 1168667, 1168689, 1168693
Date constructed: Unknown
Corrals can be found throughout Kahuku Ranch, and could have been used for vaccinating, loading trucks, and sorting. They are primarily adjacent to major circulation intersections at the corners of fields and are often associated with the cattle ramps. The corrals are generally staked with short metal posts, and either wood, metal, or wire railing, and may have metal gates. There are twelve corrals found throughout the Kahuku Ranch landscape. For the purpose of this CLI, based on the historical information that has determined the eastern pasture-paddock development to date post-period of significance, the ranching infrastucture in these areas are also determined to date after the period of significance and non-contributing. There are seven corrals located in the eastern pastures.

Kahuku Ranch Nēnē Pen (Non-contributing)
Resource ID: 1168692
Date Constructed: 1970s, rebuilt circa 2003
A rectangular area enclosed by metal post and wire fencing is located immediately east of the Kahuku Road. This site was originally developed in the 1970s as a nēnē release site and was rebuilt around 2003 after the park acquired the area. This enclosure post-dates the period of significance and is not related to the ranching development on site; it is a non-contributing resource to the Kahuku Ranch cultural landscape.

<u>Undetermined</u>

Kahuku Ranch Cattle Ramps
Cattle ramps were used as a ramp structure to guide cattle onto a platform, where they could then be loaded up onto a trailer. The cattle ramps can be found throughout the pastures of Kahuku Ranch, primarily at major circulation intersections of ranch roads, where trailers would have had access. The cattle ramps at Kahuku Ranch are constructed of rocks, wood posts, metal gates and railings, and some have wood siding. Four ramps are located in the western pastures. These resources are undetermined in status as the exact construction dates are not known but are within the historically developed area.

Kahuku Ranch Cattle Ramp KA56 (Undetermined)

Resource ID: 1168545
Date constructed:
KA 56 is a wooden and basalt slab cattle ramp. The base of the ramp is constructed of basalt slabs stacked 3-5 courses in height. The wooden fence of the ramp connects to a wood and metal corral fence.

Kahuku Ranch Cattle Ramp KA40 (Undetermined)
Resource ID: 1168675
KA 40 is a wooden cattle ramp, as determined by a photo form which it can be viewed at a distance. Further field investigation is needed to determine the features foundation, dimensions, and condition.

Kahuku Ranch Cattle Ramp
Resource ID: 1168665

Kahuku Ranch Cattle Ramp
Resource ID: 1168662

Kahuku Ranch Corrals (Undetermined)
Resource ID: 1168664, 1168666, 1168673, 1168674
Corrals can be found throughout Kahuku Ranch, and could have been used for vaccinating, loading trucks, and sorting. They are primarily adjacent to major circulation intersections at the corners of fields and are often associated with the cattle ramps. The corrals are generally staked with short metal posts, and either wood, metal, or wire railing, and may have metal gates. There are (12) corrals found throughout the Kahuku Ranch landscape. For the purpose of this CLI, based on the historical information that has determined the eastern pasture-paddock development to date post-period of significance, the ranching infrasture in these areas are also determined to date after the period of significance and non-contributing. There are four corrals located in the eastern pastures in close proximity to the water feature clusters supplying the western pastures. This close spatial association with the western pasture developments suggest the potential that the corral structure was contructed as a part of the Parker era developments. Until further information is available, this feature is undetermined in status.

Kahuku Ranch Enclosure KA57 (Undetermined)
Resource ID: 1168546
KA 57 is a wooden enclosure (or exclosure). The enclosure is 12′ x 12′ and 3′ in height. The feature is constructed with wood corner posts and wooden planks overlain with hog wire as a fence. It is overgrown with kikuyu grass and in poor condition. Based on the coordinates listed in CRIS, the enclosure is located west of the tip of the lava flow and northeast of Kahuku Ranch Cattle Ramp KA56. Because the exact date of construction is not known, these are considered undetermined.

Kahuku Ranch Wood Box KA87 (Undetermined)
Resource ID: 1168567
KA 87 is a wood box constructed over a water pipeline station. The structure is 2′11″ in width, 4′ in length and 1′5″ in height. The box lid is constructed of wood and corrugated metal roofing material. It is in good condition. As the construction date is unknown, it is considered undetermined.

Summary

The small-scale features together comprise a fabric of resources that once supported the ranching operations of Kahuku Ranch, and thus influenced the development of the landscape. There are two contributing resources, eighteen non-contributing resources, four of which, previously identified cultural resources, have been determined to be natural resource project areas, and eleven undetermined features. Changes to small-scale features since the end of the period of significance likely occurred, due to the continued operational needs of the ranch, but nonetheless help convey the historic land use of Kahuku Ranch.

Contributing

Kahuku Ranch Eastern Boundary Fence
Resource ID: 1168637

Kahuku Ranch Rock Wall
Resource ID: 1168638

Non-Contributing

Kahuku Ranch Pasture Fences
Resource ID: TBD

Kahuku Ranch Cattle Ramp KA59
Resource ID: 1168548

Kahuku Ranch Cattle Ramp
Resource ID: 1168669

Kahuku Ranch Exclosure Site 1
Resource ID: 1168685

Kahuku Ranch Exclosure Site 2
Resource ID: 1168701

Kahuku Ranch Exclosure Site 3
Resource ID: 1168681

Kahuku Ranch Exclosure Site 4
Resource ID: 1168682

Kahuku Ranch Equipment
Resource ID: 1168695

Kahuku Ranch Gas Tank
Resource ID: 1168699

Kahuku Ranch Nēnē Pen
Resource ID: 1168692

Kahuku Ranch Gas Tank
Resource ID: 1168698

Kahuku Ranch Gas Tank
Resource ID: 1168691

Kahuku Ranch Corrals
Resource ID: 1168670

Kahuku Ranch Corrals
Resource ID: 1168684

Kahuku Ranch Corrals
Resource ID: 1168668

Kahuku Ranch Corrals
Resource ID: 1168695

Kahuku Ranch Corrals
Resource ID: 1168667

Kahuku Ranch Corrals
Resource ID: 1168689

Kahuku Ranch Corrals
Resource ID: 1168693

Undetermined

Kahuku Ranch Cattle Ramp KA56
Resource ID: 1168545

Kahuku Ranch Cattle Ramp KA40
Resource ID: 1168675

Kahuku Ranch Cattle Ramp
Resource ID: 1168665

Kahuku Ranch Cattle Ramp
Resource ID: 1168662

Kahuku Ranch Enclosure KA57
Resource ID: 1168546

Kahuku Ranch Corrals
Resource ID: 1168664

Kahuku Ranch Corrals
Resource ID: 1168666

Kahuku Ranch Corrals
Resource ID: 1168664

Kahuku Ranch Corrals
Resource ID: 1168673

Kahuku Ranch Wood Box KA87
Resource ID: 1168567

Constructed Water Features

Constructed water features are defined as the built features and elements which utilize water for aesthetic or utilitarian functions in the landscape. Constructed water features at Kahuku Ranch primarily served utilitarian purposes that supported ranching activities and have changed overtime in support of operational needs and include reservoirs, rainsheds, tanks, troughs, pipes, and remnant foundations of water features all of which have supported the decades of ranching activities.

Parker-era Water Conveyance System - Contributing
Water shortage had posed a challenge to ranchers since the beginning of the cattle operation in the mid-nineteenth century and fueled the extensive development of a water conveyance system during the period of significance under Alfred Carter's management. Between 1912 and 1947, at least two rainsheds were built and over 10,000 feet of pipes were laid, known as the Kahuku Pipeline, to impound and divert water across the ranch. Additional lengths of pipes were also installed during this period, although the exact locations have not been specified. Associated with this development, numerous water tanks, including one 50,000-gallon and two 100,000-gallon tanks, and troughs were constructed along the water conduit. Based on the knowledge that pastures were developed largely to the west of the mauka (north) road during the period of significance, specifically bound by the Kahuku Road and the present-day Glover Trail (east branch of the Kahuku-'Āinapō Trail), these water features likely served the lands spanning immediately east of the pipeline westward to the western boundary.

Topographic maps from 1922 and 1924 confirm that this water system extended downslope along the western branch of the Kahuku-'Āinapō Trail from at least an elevation of 4,500 feet, where a shed impounded and diverted rainwater. By this time, the Kahuku Pipeline diverted water from the 3,500-foot elevation, where another rainshed and an associated water tank contributing to this water system were located, downslope to supply the makai (southern) lands. It is possible that the additional sections of pipes installed connected the 4,500-foot elevation rainshed with the Kahuku Pipeline. While troughs were too small in scale to be represented in these maps, it is likely that these features also dotted the course of the water system. (See Appendix G for the distribution of the constructed water features on a topographic basemap.)

This alignment and pattern of clustering of water features, as represented in the 1920s topographic maps, is visible in the 1954 aerial photograph, between the western branch of the trail and the Kahuku Road. The aerial imagery shows distinct ground disturbances in areas matching those marked as watersheds in the maps, and even displays a number of small structures surrounding these areas, particularly at 3,500 feet, which potentially represent water tanks and troughs. There is also a similar ground disturbance visible at approximately 5,000-foot elevation in the 1954 aerial that suggests a third rainshed or reservoir, though this feature is not depicted in the 1924 topographic map. Historical data confirms that a form of water catchment was constructed in this area prior to the Damon Estate era but does not offer a specific period of construction. As available historical research suggests that most of the developments under James Glover between 1947 and 1958 were associated with his timber harvesting and cinder mining ventures, this water catchment depicted in the 1954 aerial is likely attributed to Alfred Carter and the extensive water system developed during the period of significance. This water catchment, likely a rain shed, was replaced by a large asphalt-lined reservoir and catchment around 1959 to expand and enhance the water storage and catchment capacity in the area. While the workmanship and material of the Parke-era structure has been lost, the 1959 water catchment basin, constructed in the same location as the water shed (as evidenced by remnant collapsed wooden water tanks to the north of the existing catchment basin), retains the original design and spatial alignment of the overall water conveyance system from the Parker era. As such, the water conveyance system established during the period of significance

encompasses all water features supplying the western pastures between 5,000 feet in elevation to the southern boundary of the cultural landscape.

These concentrations of troughs and tanks to the west of the Kahuku-ʻĀinapō Trail are still visible today, and effectively represent the comprehensive Parker-era water conveyance system.

Although individual components of this historic water system have been repaired and replaced to support the decades of ranching operations that followed the period of significance, the comprehensive system of water conveyance from the Parker era remains intact, as evidenced by the spatial distribution of the water troughs and tanks, and contributes to the Kahuku Ranch cultural landscape.

Post-Parker-era Water Conveyance System Expansion – Non-Contributing
The water conveyance system established during the period of significance was expanded during the Damon Estate era to include at least three reservoirs and clusters of water features at the center of each paddock-pasture quadrants. Based on the land development patterns during the Damon Estate era, the water features to the east of the mauka (north) road were developed during the 1960s and 1970s to supply the eastern pastures of the mauka, northern, lands. These post-Parker era water conveyance system expansions are therefore non-contributing to the cultural landscape.

The following is an assessment of the individual components of the comprehensive water conveyance system. These components include water tanks and water troughs of a variety of materials. The constructed within the eastern pastures are considered to be a part of the post-Parker-era expansion and are non-contributing.

Water tanks are found throughout the ranch landscape, primarily located along main ranch roads and near the developed area, and are constructed of redwood, metal, or plastic. Water troughs are constructed from metal, concrete, fiberglass, or plastic. The plastic and fiberglass water troughs found throughout Kahuku Ranch appear in a variety of colors and shapes. Water tanks and troughs were also updated through the time following the period of significance. Any tanks or troughs constructed of galvanized metal, fiberglass, and plastic are not from the period of significance due to the availability of the material technology at the time.

Contributing

Redwood Water Tanks (Contributing)
Redwood Water Tanks can be found throughout the Kahuku Ranch landscape. Constructed of redwood, they are held together with metal braces, and have a variety of roofing materials and configurations (each listed below). There is a total of five redwood water tanks that are still extant: KA 9, KA 10, KA 11, and KA 13. It has been determined that the redwood water tanks generally date to a time within the period of significance, as these wood tanks decreased in favor through the mid-century due to increasingly demanding maintenance needs. As such, the redwood water tanks supplying the western pastures are determined to be contributing features to the Kahuku Ranch landscape, if they are extant.

> Kahuku Ranch Water Tank KA 9
> Resource ID: 1168510
> Kahuku Ranch Water Tank KA 9 water system consists of KA 9a, KA 9b, and KA 9c. KA 9 is a redwood water tank constructed on concrete pier blocks with a corrugated flat tin roof. The tank has a 7′ 5″ radius and is 10′ in height. A 6” pipe line exits from the base of the tank (KA 9) and

extends over seven braces and terminates approximately 8' above KA 9a. KA 9a is a water tank foundation consisting of 14 1 ½' x 1' x 1 ½' concrete pier blocks. Near the base of the seventh pipeline brace is KA 9b. KA 9b is rectangular rock and concrete mortar terrace with three small stairs in the center. KA 9c is located south of KA 9 and consists of nine concrete bars that may have used as a foundation for a water tank. The longest concrete bar is 30' x 1' x 1 ½'. One "Honolulu Sake Brewery & Ice Cold" sake bottle was located at the base of KA 9. It is not currently functional, and in poor condition.

Kahuku Ranch Water Tank System KA10
Resource ID: 1168511
Kahuku Ranch KA 10 consists of three features; KA 10a is a water tank, and KA 10b/c are water tank foundations. KA 10a is constructed of redwood and has a radius of 8′ and is 8′ in height and has a foundation of concrete pier blocks. There is a basalt stone and soil ramp located on the eastern side of the tank and a elevated pipeline extends from KA 10a to KA 10b. KA 10 b/c are constructed of 9 concrete bars each. Each concrete bar is 1′ in height and 1′ in width and the longest bar is 33′7″ and the shortest is 12′. Redwood planks and metal strapping litter the area around the foundations.

Kahuku Ranch Water Tank KA11
Resource ID: 1168512
Kahuku Ranch KA 11 is a redwood water tank, measuring 15' in diameter and 7' in height, constructed on flat rock slabs supporting girder timbers arranged in a circular shape with three intermediate girders. The tank is uncovered and is functional.

Kahuku Ranch Water Tank KA13
Resource ID: 1168514
Kahuku Ranch KA 13 is a redwood water tank constructed on concrete bars (beams) with a corrugated conical tin roof. The tank has a 15′ radius, is15′ at the roof peak and 10′ at tank side. A 6″ pipe line exits from the base of the tank (KA 13) and terminates because of extreme decay. There are five braces between KA 13 and KA 14 that would have held the pipeline, which is now located on the ground. The pipeline would have terminated at the top of KA 14. The tank is no longer functional; many of the redwood siding planks are damage and much of the roof is damaged or missing. It is in poor condition.

Kahuku Ranch Water Tank KA14
Resource ID: 1168515
Kahuku Ranch KA 14 is a redwood water tank constructed on concrete pier blocks with no roof cover. The tank has a 6′ radius, is 8′ in height and the foundation is 2′ in height. A cement mortar and rock ramp (KA 14A) is located approximately 1-2ft east of the tank in direct line with the with the pipeline braces extending from KA 13.

Metal Water Tanks (Contributing)
Historically, metal water tanks were constructed during the period of significance. Although metal water tanks continued to be constructed at Kahuku Ranch post-period of significance, these later water tanks were generally made of galvanized metal. For this analysis, if a metal tank shows considerable patina and corrosion, exhibiting the effects of the environment on the material through time, it will be considered from the period of significance and thus contributing. There are two metal water tanks that meet these conditions as a contributing resource.

Kahuku Ranch Metal Water Tank KA32
Resource ID: 1168519
Kahuku Ranch Metal Water Tank KA32 is a metal tank with a flat metal top. The tank has a 1′ 6″ ft radius and is 5′in height. A four rung latter and small platform provides access to the top of the tank. KA 32 is located mid-way the larger boundary area, along the main ranch road, Kahuku Road.
The tank is functional, currently in use, and is in good condition. Although the survey noted this tank in good condition, its sidewalls are severely corroded, top and latter fully rusted, and is thus considered from the period of significance and contributing.

Kahuku Ranch Metal Water Tank KA36
Resource ID: 1168523
Kahuku Ranch Metal Water Tank KA 36 is a round metal water tank with no lid. The tank has a 3′ radius and is 6′ in height. The tank is still functional, but is in poor condition, as its sidewalls are severely corroded and rusted. For this reason, along with its simple cylindrical shape, it is considered from the period of significance and contributing.

Non-Contributing

Reservoir #1 KA89 (Non-Contributing)
Resource ID: 1168568
Date constructed: 1966
Reservoir #1 KA89 is a landscape feature that is located toward the northeastern corner of the unit boundary, southwest of the northeast extension. It consists of three elements; KA 89a is the reservoir, KA 89b is the runoff catchment area, and KA 89c is the spillway leading to Reservoir #2 KA 90. The reservoir, runoff catchment area and spillway are lined with tar and chip-seal. The reservoir is 180′ in width, 292′ in length with an unknown depth. The runoff catchment area (KA 89b) is 154′ in width and 463′ in length, and the spillway (KA 89c) is 10′ in width and 101′ in length. It is in good condition. Reservoir #1 KA89 is non-contributing because it was one of the two reservoirs constructed in 1966 to supplement the previously constructed reservoirs at Kahuku Ranch.

Reservoir #2 KA90 (Non-Contributing)
Resource ID: 1168569
Date constructed: 1966
Reservoir #2 KA90 is a landscape feature that is located toward the northeastern corner of the unit boundary, southwest of the northeast extension and east of Reservoir #1 KA89. It is a landscape feature that consists of a reservoir lined with tar and chip-seal, and measures164′ in width, 220′ in length, and an unknown depth. It is in good condition. Reservoir #2 KA90 is non-contributing because it was one of the two reservoirs constructed in 1966 to supplement the previously constructed reservoirs at Kahuku Ranch.

Kahuku Ranch Reservoir #3 KA73 (Non-contributing)
Resource ID: 1168561
Reservoir #3 KA73 is a landscape feature that is located midway up the main portion of the unit boundary, close to the eastern border. It consists of a semi-circular excavated area, approximately 239 ft in width, 282 ft in length and 6 to 8 ft in depth. The reservoir is lined with black plastic and is functional. It dates to the Damon estate era, and is considered non-contributing.

Kahuku Ranch Reservoir #4 KA61 (Non-Contributing)

Resource ID: 1168550
KA 61 is a landscape feature and consists of a large semi-circular excavated area, approximately 206 ft in width, 282 ft in length and 6 to 8 ft in depth. The excavated area may be a seasonal or overflow reservoir that is down slope from Reservoir #3 (KA 73). Reservoir #4 does not appear on a 1977 aerial photograph, and was likely constructed after that, so is therefore considered non-contributing.

Plastic Water Tanks
There are (4) plastic water tanks located throughout Kahuku Ranch pastures. While water tanks are part of the historic character of the water system, because the tanks have been replaced with incompatible materials they are non-contributing.

Kahuku Ranch Plastic Water Tank System KA39 (Non-Contributing)
Resource ID: 1168526
KA 39 is a water system that consists of four white plastic tanks. The tanks have a 3′ radius and are 6′ in height. KA 39A-D, along with KA 34, are enclosed within a barbed wire and wood fence. They are in good condition.

Kahuku Ranch Portable Water Tank KA50 (Non-Contributing)
Resource ID: 1168536
KA 50 is a black plastic portable water tank. The tank has a 3′ radius and is 6′ in height. Currently the tank is not in use but is in good condition.

Kahuku Ranch Plastic Water Tank KA63 (Non-Contributing)
Resource ID: 1168552
Ka 63 is a green plastic water tank. The sides of the tank are corrugated and the top is smooth with one large plastic bar in the center, and has a 3′ radius. The water tank is surrounded by an electrified fence and is functional in good condition.

Kahuku Ranch Plastic Water Tank KA72 (Non-Contributing)
Resource ID:1168560
KA 72 is a corrugated black plastic water tank. The tank is surrounded by a peeler pole and barbed wire fence and is functional. The tank has a 3′ radius and is 8′ in height. It is in good condition.

Plastic Water Troughs (Non-Contributing)
There are seven plastic water troughs located throughout Kahuku Ranch pastures. While they contribute to the pasture and ranching landscape, the plastic material has been determined to be from outside of the period of significance, and thus the Plastic Water Troughs are not contributing.

Kahuku Ranch Plastic Water Trough KA51 (Non-Contributing)
Resource ID: 1168537
KA 51 is a functional round black plastic water trough with a 2′ 2.5″ radius. It is in good condition.

Kahuku Ranch Plastic Water Trough KA54 (Non-Contributing)
Resource ID: 1168540
KA 54 is a black plastic oval water trough located between two stone pads. The water trough is 5′ in width and 12′ in length. The stone pad is constructed of stone slabs that vary in size and are approximately 6 inches in thickness and are mortared in place. The water trough is functional and in good condition.

Kahuku Ranch Plastic Water Trough KA81 (Non-Contributing)
Resource ID: 1168563
KA 81 is a black plastic oval functional water trough. The trough is 3′7″ in width and is 4′5″ in length. It is fair condition.

Kahuku Ranch Plastic Water Trough KA83 (Non-Contributing)
Resource ID: 1168564

KA 83 is a black plastic rectangular water trough. The trough is not currently in use although water pipelines do connect to it. The trough is 2′1″ in width and 3′10″ in length. It is fair condition.

There is no GIS data available for this resource and the trough therefore is not be mapped.

Kahuku Ranch Plastic Water Trough KA84 (Non-Contributing)
Resource ID: 1168565
KA 84 is a functional round black plastic water trough. The trough has a 4′5′ radius. It is fair condition.

Kahuku Ranch Plastic Water Trough KA86 (Non-Contributing)
Resource ID: 1168566
KA 86 is a functional round black plastic water trough. The trough has a 4′5″ radius. It is fair condition.

Kahuku Ranch Portable Water Tank KA50 (Non-Contributing)
Resource ID: 1168536
KA 50 is a black plastic portable water tank. Currently the tank is not in use. The plastic water troughs are likely non-contributing, based on the lifespan of plastic.

Fiberglass Water Troughs (Non-Contributing)
There are eight fiberglass water troughs located throughout Kahuku Ranch pastures. While water troughs are part of the historic character of the water system, because the troughs have been replaced with incompatible materials they are non-contributing.

Kahuku Ranch Fiberglass Water Trough KA43 (Non-Contributing)
Resource ID: 1168529
KA 43 is a rectangular yellow fiberglass water trough with a flat base located between two stone pads. The stone pads are constructed of stone slabs that vary in size and are approximately 6 inches in thickness and are mortared in place. The overall stone pads measure 6′ 8″ in width and 19′ 5″ in length. The trough is functional but in fair condition.

Kahuku Ranch Fiberglass Water Trough KA44 (Non-Contributing)
Resource ID: 1168530
KA 44 is a rectangular white fiberglass water trough with a flat base located between two stone pads. The stone pads are constructed of stone slabs that vary in size and are approximately 6 inches in thickness and are mortared in place. The overall stone pads measure 6 ft in width and 12 ft in length. The trough is functional but in fair condition.

Kahuku Ranch Fiberglass Water Trough KA45 (Non-Contributing)
Resource ID: 1168531

KA 45 is a rectangular white fiberglass water trough with a flat base. The trough is 3′ in width and 12′ in length. The trough is functional but in fair condition.

Kahuku Ranch Fiberglass Water Trough KA47 (Non-Contributing)
Resource ID: 1168533
KA 47 is a yellow rectangular fiberglass water tough with a flat base. The trough is 3′in width and 12′ in length. The trough is functional but in fair condition.

Kahuku Ranch Fiberglass Water Trough KA48 (Non-Contributing)
Resource ID: 1168534
KA 48 is a rectangular white fiberglass water trough with a flat base. The trough is 2′ in width and 6′ in length. The trough is functional but in fair condition.

Kahuku Ranch Fiberglass Water Trough KA58 (Non-Contributing)
Resource ID: 1168547
KA 58 is a rectangular white fiberglass water trough. The trough is 3′ in width and 12′ in length. The trough is functional but in fair condition.

Kahuku Ranch Fiberglass Water Trough KA62 (Non-Contributing)
Resource ID: 1168551
KA 62 is a rectangular white fiberglass water trough located between two stone pads. The stone pads are constructed of stone slabs that vary in size and are approximately 6 inches in thickness and are mortared in place. The water trough is 3′ in width and 12′ in length, and the uphill (mauka) stone pad is 6′ in width and 12′ in length and the downhill (makai) stone pad is 8′ in width and 17′ in length. The uphill (mauka) stone pad is 6 ft in width and 12 ft in length and the downhill (makai) stone pad is 8 ft in width and 17 ft in length. The trough is functional but in fair condition.

Kahuku Ranch Fiberglass Water Trough KA67 (Non-Contributing)
Resource ID: 1168556
KA 67 is a rectangular yellow fiberglass water trough with a flat base. The trough is 2′ in width and 12′ in length, the stone pad is 9′5″ in width, 11′5″ in length and 1′5″ in height, and the concrete step is 1′5″ in width, 11′5″ in length and 5″ in height. Located on the south (makai) lengthwise side of the trough is a concrete step and a stone pad. The step is 1′5′ in width, 11′5″ in length, and 5″ inches in height. The stone pad is 9′5″ in width, 11′5″ in length and 1′5″ in height and is constructed of basalt slabs mortared together with concrete. The northern (mauka) side of the trough may have also had a concrete step and/or pad although the area is completely obscured by thick soil and manure. It is in fair condition.

Metal Water Tanks
Metal water tanks may have been used during the period of significance or brought into the landscape after the period of significance. For this reason, further analysis of each tanks exact metal material is needed for determination. However, for the purpose of this CLI, based on the historical information that has determined the eastern pasture-paddock development to date post-period of significance, water features within the eastern paddocks are also determined non-contributing. There are nine non-contributing metal water tanks.

Kahuku Ranch Metal Water Tank KA12 (Non-contributing)
Resource ID: 1168513

KA 12 is a corrugated metal tank with plastic liner and a flat wood roof frame covered with corrugated metal. The tank is in good condition and is currently in use. The tank has a 7′ 6′ radius and is 8′ in height. It is in fair condition and shows some signs of corrosion. This tank is located in the eastern pastures and is non-contributing.

Kahuku Ranch Metal Water Tank KA17 (Non-contributing)
Resource ID: 1168517
KA 17 is a corrugated metal water tank with a flat corrugated metal roof, and it has a 10′ radius and is 7′ 5″ in height. It is in fair condition and shows some signs of corrosion. This tank is located in the eastern pastures and is non-contributing.

Kahuku Ranch Metal Water Tank KA34 (Non-contributing)
Resource ID: 1168521

KA 34 is a corrugated metal tank with a plastic liner and a black plastic cover. The tank has an 11′ radius and is 7′ 6″ in height. A three rung wooden latter and platform provides access to the tank top. KA 39A-D (four plastic water tanks) are located approximately 5 feet west of structure KA 34. KA 34 and KA 39A-D plastic tanks are enclosed with a barbed wire and wood fence. The ladder to KA 34 also provides access into the fenced area. KA 34 is functional, currently in use, in fair condition and shows some signs of corrosion. This tank is located in the eastern pastures and is non-contributing.

Kahuku Ranch Metal Water Tank KA52(Non-contributing)
Resource ID: 1168538
KA 52 is a round smooth metal water tank with a smooth conical metal roof. There is a small fence constructed of metal piping surrounding the tank. The tank is functional and is currently in use. It exhibits some signs of rust and corrosion. This tank is located in the eastern pastures and is non-contributing.

Kahuku Ranch Metal Water Tank KA60 (Non-contributing)
Resource ID: 1168549
KA 60 is corrugated metal tank with plastic liner and a flat wood roof frame covered with corrugated metal. The tank has a 4′ radius and is 7′ in height. The tank is in fair condition, is currently in use, and shows only minor signs of corrosion. This tank is located in the eastern pastures and is non-contributing.

Kahuku Ranch Metal Water Tank KA65 (Non-contributing)
Resource ID: 1168554
KA 65 is a cylindrical metal water tank surrounded by an electrified fence and there is a metal pipe latter that provides access to the tank. The tank has a 3′ radius, is 6′ in height and 12′ in length. The tank is functional, in good condition, and while its tank, latter, and fence are severely rusted, it does not show significant corrosion. This tank is located in the eastern pastures and is non-contributing.

Kahuku Ranch Metal Water Tank KA66(Non-contributing)
Resource ID: 1168555
KA66 is a corrugated metal water tank with a plastic liner and black mesh cover. The tank is surrounded by an electrified fence. The tank has a 7′ 6″ radius and is 6′ in height. As of 2020, the tank is severely collapsed. Photos from 2006 show the tank with no signs or rust or corrosion,

which had changed significantly in 2020, when the collapsed side walls were severely rusted. This tank is located in the eastern pastures and is non-contributing.

Kahuku Ranch Metal Water Tank KA68 (Non-contributing)
Resource ID: 1168557
KA 68 is a corrugated metal water tank and has a white plastic liner with no cover. The tank has a 6 ft radius, is 7ft 5 inches in height and is functional. A round pipe fence surrounds the tank. It is in fair condition, and only shows minor signs of rusting. This tank is located in the eastern pastures and is non-contributing.

Kahuku Ranch Concrete Water Trough KA53 (Non-contributing)
Resource ID: 1168539

Kahuku Ranch Concrete Water Trough KA53 is a rectangular concrete water trough located between two stone pads. The stone pads are constructed of stone slabs that vary in size and are approximately 6 inches in thickness and are mortared in place. The overall stone pads measure 3 ft in width and 14 ft in length. The water trough is functional, but encroached upon by vegetation, and the stone pads are in poor condition. Located in the eastern paddocks that were developed post-period of significance, this feature is non-contributing in status.

Kahuku Ranch Water Tanks at Kahuku Base Camp
There are an additional eleven water tanks located at the Kahuku Ranch developed area, or the Kahuku Base Camp. While little is known about these water tanks, including their construction date, taking into consideration that all development that took place in this area during the period of significance was under the military historic context and did not contribute to the period of significance of the ranching landscape, and that all ranching-related improvements in the area post-dated the Parker era, these water tanks are non-contributing.

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168656

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168657

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168658

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168653

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168651

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168652

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168649

Kahuku Ranch Water Tank (Non-contributing)

Resource ID: 1168648

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168646

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168647

Kahuku Ranch Water Tank (Non-contributing)
Resource ID: 1168671

Undetermined

Metal Water Tanks
Metal water tanks may have been used during the period of significance or brought into the landscape after the period of significance. As ranching records lack the information on dates of installation to make a research-based determination of contributing or non-contributing status, the metal water tanks have been deemed undetermined.. However, for the purpose of this CLI, based on the historical information that has determined the eastern pasture-paddock development to date post-period of significance and therefore non-contributing, only the water features within the western paddocks are undetermined in status. Modern metal water tanks, from the post-period of significance, were often constructed of galvanized metal. There are two metal water tanks that are undetermined in status.

Kahuku Ranch Metal Water Tank KA33 (Undetermined)
Resource ID: 1168520

KA 33 is a metal tank with a flat metal top. The tank has a 1′ 6″ ft radius and is 5′in height. A five rung latter and small platform provides access to the top of the tank. The tank is functional, currently in use, and in good condition, and shows signs of maintenance with a patchy coat of black paint. As rust and corrosion are not visible for dating the material, the tank is undetermined in status.

There is no GIS data available for this water tank and the tank therefore could not be mapped.

Kahuku Ranch Metal Water Tank KA38 (Undetermined)
Resource ID: 1168525

KA 38 is a cylindrical metal water tank. The tank has a 2′ 2 ½ ″ radius, is 17′ in length and is 5′ 5″ in height. The tank is nonfunctional with many old nonfunctional water pipes leading to it. It is in poor condition and shows significant signs of corrosion and rust. Given its proximity to the historic water system and the western pasture, this tank cannot be definititively determined non-contributing; however, its location, without an installation date, is not sufficient to determine the tank contributing. Tank KA38 is therefore undetermined in status.

Kahuku Ranch Metal Water Troughs
While water troughs are part of the historic character of the water system, further identification of each trough and its metal material is needed for determination. There are 6 metal water troughs that are located in the western pastures and closely along the Kahuku Road/Kahuku-ʻĀinapō Trail that suggest that they are potentially associated with the Parker era developments. However, like the metal water

tanks above, ranching records lack the information on dates of installation to make a research-based determination of contributing or non-contributing status. As such, these troughs are undetermined in status..

Kahuku Ranch Metal Water Trough KA37 (Undetermined)
Resource ID: 1168524
KA 37 is a large rectangular metal water trough. The trough is 4′ 6″ at the top and tapers to approximately 3′ at the base. It is in poor condition. Given its proximity to the historic water system and the western pasture, this tank cannot be definititively determined non-contributing; however, its location, without an installation date, is not sufficient to determine the trough contributing. Trough KA37 is therefore undetermined in status.
Kahuku Ranch Metal Water Trough KA41 (Undetermined)
Resource ID: 1168527
KA 41 is a rectangular metal water trough with a flat base. The trough is 3′ in width and 12′ in length. The trough is functional but in fair condition. Given its location in the western pasture, this trough cannot be definititively determined non-contributing; however, its location, without an installation date, is not sufficient to determine the trough contributing. Trough KA41 is therefore undetermined in status.

Kahuku Ranch Metal Water Trough KA42 (Undetermined)
Resource ID: 1168528

KA 42 is a rectangular metal water trough with a curved base located in the center of a stone pad. The water trough is 4′ in width and 12′ in length, and the stone pad is 18′ in width and 32′ in length. The stone pad is constructed of stone slabs that vary in size and are approximately 6 inches in thickness and are mortared in place. The overall stone pad measures 18 ft in width and 21ft in length. The trough is functional but in fair condition, and the stone pad is in poor condition. Given its location in the western pasture, this trough cannot be definititively determined non-contributing; however, its location, without an installation date, is not sufficient to determine the trough contributing. Trough KA42 is therefore undetermined in status.

Kahuku Ranch Metal Water Trough KA46 (Undetermined)
Resource ID: 1168532

KA 46 is a rectangular metal water trough with a flat base. The trough is 4′ in width and 5′ in length. The trough is non-functional and in poor condition. Given its location in the western pasture, this trough cannot be definititively determined non-contributing; however, its location, without an installation date, is not sufficient to determine the trough contributing. Trough KA46 is therefore undetermined in status.

Kahuku Ranch Metal Water Trough KA69 (Undetermined)
Resource ID: 1168558
KA 69 is a rectangular metal water trough. The tank is nonfunctional due to vegetation encroachment and rust covering the entire interior surface. The trough is 3′ in width and 5′ in length. It is in poor condition. Given its location in the western pasture, this trough cannot be definititively determined non-contributing; however, its location, without an installation date, is not sufficient to determine the trough contributing. Trough KA69 is therefore undetermined in status.

Kahuku Ranch Metal Water Trough KA70 (Undetermined)
Resource ID: 1168559

KA 70 consists of a rectangular nonfunctional metal water trough and 16 cinder blocks. The cinder blocks are scattered south of the trough and may have originally been used as a foundation for the trough. The trough is 4′ in width and 5′ in length. It is in poor condition. Given its location in the western pasture, this trough cannot be definititively determined non-contributing; however, its location, without an installation date, is not sufficient to determine the trough contributing. Trough KA70 is therefore undetermined in status.

Kahuku Ranch Water Trough Foundation KA55 (Undetermined)
Resource ID: 1168541
KA 55 is stone pads constructed of stone slabs that vary in size, are approximately 6 inches in thickness and are mortared in place. The overall stone pads measure 3′ in width and 14′ in length. It is in fair condition. Located in the western pastures developed during the period of significance, this feature potentially dates to the Parker era. Lacking any indication of its construction date, however, its status cannot be determined.

Kahuku Ranch West Rainshed (Undetermined)
Resource ID: 1168501
The Rain shed structure is constructed of post and beam with a corrugated metal shed roof with a large gutter system. The rain shed is no longer functional; many of the gutters and roof panels are missing or damaged. The shed under the roof is constructed with a wood frame and canec exterior siding. The windows in the shed are double hung. The dimensions are 100' x 135' with a 16'9" x 20' shed under the roof. This was used for water collection and is currently abandoned and in poor or unstable condition. Lacking any indication of its construction date, its status cannot be determined.

There is no GIS data available for this water tank and the tank therefore could not be mapped.

Summary

At this time, seven constructed water features have been determined contributing to the landscape. Forty-three features are considered non-contributing, and twenty-two are considered undetermined, as they could have been added during the ranching operations that continued past the period of significance.

Contributing

Kahuku Ranch Water Tank KA9
Resourc ID: 1168510

Kahuku Ranch Water Tank System KA10
Resourc ID: 1168511

Kahuku Ranch Water Tank KA11
Resource ID: 1168512

Kahuku Ranch Water Tank KA13
Resource ID: 1168514

Kahuku Ranch Water Tank KA14

Resource ID: 1168515

Kahuku Ranch Metal Water Tank KA32
Resource ID: 1168519

Kahuku Ranch Metal Water Tank KA36
Resource ID: 1168523

Non-Contributing
Reservoir #1 KA89
Resource ID: 1168568

Reservoir #2 KA90
Resource ID: 1168569

Kahuku Ranch Reservoir #3 KA73
Resource ID: 1168561

Kahuku Ranch Reservoir #4 KA61
Resource ID: 1168550

Kahuku Ranch Plastic Water Tank System KA39
Resource ID: 1168526

Kahuku Ranch Portable Water Tank KA50
Resource ID: 1168536

Kahuku Ranch Plastic Water Tank KA63
Resource ID: 1168552

Kahuku Ranch Plastic Water Tank KA72
Resource ID: 1168560

Kahuku Ranch Plastic Water Trough KA51
Resource ID: 1168537

Kahuku Ranch Plastic Water Trough KA54
Resource ID: 1168540

Kahuku Ranch Plastic Water Trough KA81
Resource ID: 1168563

Kahuku Ranch Plastic Water Trough KA83
Resource ID: 1168564

Kahuku Ranch Plastic Water Trough KA84
Resource ID: 1168565

Kahuku Ranch Plastic Water Trough KA86
Resource ID: 1168566

Kahuku Ranch Portable Water Tank KA50
Resource ID: 1168536

Kahuku Ranch Fiberglass Water Trough KA43
Resource ID: 1168529

Kahuku Ranch Fiberglass Water Trough KA44
Resource ID: 1168530

Kahuku Ranch Fiberglass Water Trough KA45
Resource ID: 1168531

Kahuku Ranch Fiberglass Water Trough KA47
Resource ID: 1168533

Kahuku Ranch Fiberglass Water Trough KA48
Resource ID: 1168534

Kahuku Ranch Fiberglass Water Trough KA58
Resource ID: 1168547

Kahuku Ranch Fiberglass Water Trough KA62
Resource ID: 1168551

Kahuku Ranch Fiberglass Water Trough KA67
Resource ID: 1168556

Kahuku Ranch Metal Water Tank KA12
Resource ID: 1168513

Kahuku Ranch Metal Water Tank KA17
Resource ID: 1168517

Kahuku Ranch Metal Water Tank KA34
Resource ID: 1168521

Kahuku Ranch Metal Water Tank KA52
Resource ID: 1168538

Kahuku Ranch Metal Water Tank KA60
Resource ID: 1168549

Kahuku Ranch Metal Water Tank KA65
Resource ID: 1168554

Kahuku Ranch Metal Water Tank KA66
Resource ID: 1168555

Kahuku Ranch Metal Water Tank KA68
Resource ID: 1168557

Kahuku Ranch Concrete Water Trough KA53
Resource ID: 1168539

Kahuku Ranch Water Tank
Resource ID: 1168656

Kahuku Ranch Water Tank
Resource ID: 1168657

Kahuku Ranch Water Tank
Resource ID: 1168658

Kahuku Ranch Water Tank
Resource ID: 1168653

Kahuku Ranch Water Tank
Resource ID: 1168651

Kahuku Ranch Water Tank
Resource ID: 1168652

Kahuku Ranch Water Tank
Resource ID: 1168649

Kahuku Ranch Water Tank
Resource ID: 1168648

Kahuku Ranch Water Tank
Resource ID: 1168646

Kahuku Ranch Water Tank
Resource ID: 1168647

Kahuku Ranch Water Tank
Resource ID: 1168671

Undetermined

Kahuku Ranch Metal Water Tank KA33
Resource ID: 1168520

Kahuku Ranch Metal Water Tank KA38
Resource ID: 1168525

Kahuku Ranch Water Tank
Resource ID: 1168690

Kahuku Ranch Water Tank
Resource ID: 1168663

Kahuku Ranch Water Tank
Resource ID: 1168679

Kahuku Ranch Water Tank
Resource ID: 1168650

Kahuku Ranch Water Tank
Resource ID: 1168683

Kahuku Ranch Water Tank Foundation KA16
Resource ID: 1168516

Kahuku Ranch Water Tank Foundation KA30
Resource ID: 1168518

Kahuku Ranch Water Tank Foundation at Kahuku Base Camp KA49
Resource ID: 1168535

Kahuku Ranch Water Tank Foundation KA75
Resource ID: 1168562

Kahuku Ranch Metal Water Trough KA37
Resource ID: 1168524

Kahuku Ranch Metal Water Trough KA41
Resource ID: 1168527

Kahuku Ranch Metal Water Trough KA42
Resource ID: 1168528

Kahuku Ranch Metal Water Trough KA46
Resource ID: 1168532

Kahuku Ranch Metal Water Trough KA69
Resource ID: 1168558

Kahuku Ranch Metal Water Trough KA70
Resource ID: 1168559

Kahuku Ranch Concrete Water Trough KA53
Resource ID: 1168539

Kahuku Ranch Water Trough
Resource ID: 1168697

Kahuku Ranch Water Trough
Resource ID: 1168696

Kahuku Ranch Water Trough Foundation KA55
Resource ID: 1168541

Kahuku Ranch West Rainshed
Resource ID: 1168501

Archaeological Features

Archaeological sites inventoried by the CLI include the location of ruins, traces, or deposited artifacts in the landscape that are associated with the period of significance and are evidenced by the presence of either surface or substance features. The CLI does not disclose the location of sensitive archeological sites to preserve the resources. Built features that once supported operations at Kahuku Ranch have either fallen into ruin or have been taken down within the past recent years. These include remnants of the shop building, the east rain shed ruins, and multiple collapsed water tanks or remaining water feature foundations. These features help to convey the historic spatial organization and land use of the ranch.

Contributing

Kahuku Ranch East (Main Pasture) Rain Shed (Contributing)
Resource ID: 1168502
Condition: Poor
The Kahuku Ranch East (Main Pasture) Rain Shed was constructed of post and beam with a corrugated metal shed roof with a large gutter system. This rain shed is located along the Kahuku-ʻĀinapō Trail and is likely associated with the Parker-era development of the water system, and thus contributes. In 2005 the rain shed was no longer functional; many of the gutters and roof panels are missing or damaged. By 2020 the structure has collapsed or been taken down.

Kahuku Ranch Water Tank KA13 (Contributing)
Resource ID: 1168514
Condition: Poor
Kahuku Ranch Water Tank KA13 was a redwood water tank constructed on concrete bars (beams) with a corrugated conical tin roof. A 6″ pipeline exits from the base of the tank (KA 13) and terminates because of extreme decay. There are five braces between KA 13 and KA 14 that would have held the pipeline, which is now located on the ground. The pipeline would have terminated at the top of KA 14. The tank was no longer functional in 2005, as many of the redwood siding planks are damage and much of the roof is damaged or missing. In 2020 the Kahuku Ranch Water Tank KA13 was found collapsed. Despite its state of collapse, its building material and its location within the western pastures suggest that this water tank dates to the period of significance and is therefore contributing.

Non-contributing

Kahuku Ranch Shop (Non-Contributing)
Resource ID: 1168498
Building 407
Constructed: ca. 1958
The building has corrugated metal siding and roofing all painted green. The main building has a shed style roof and the small shed off the south wall has a flat roof. The entire east wall consists of two sets of double doors. The interior of the structure is partitioned and a 7'3" by 17'7" equipment room is built in the north western corner. In 2019 the ranch shop was demolished, and in 2020 only the concrete slab remains. As it was built after the period of significance, it is non-contributing.

Kahuku Sawmill (State Site # 50-10-73-31,157) (Non-Contributing)

Resource ID:
This site is an old 20th century lumber mill used by the Kahuku Ranch in the mid-20th century for milling koa and ʻōhiʻa trees from the upper mountain regions of the former Kahuku Ranch. It is located a few meters to the west of the main entrance road just before the road turns into a Y and heads up into the upper regions of the park. The site measures approximately 24.0 x 40.0 meters and contains 39 individual features from concrete slabs to remnants of women's shoes. This site was previously buried under 3 feet of backfilled red cinder. It was discovered inadvertently by the Roads and Trails crew of the HAVO Maintenance Division during the attempted construction of a new visitor contact station. As it was established under Glover management in association with his lumber ventures, it is non-contributing.

Undetermined

Kahuku Ranch Water Tank
Resource ID: 1168688
Condition: Poor
By 2020, the Kahuku Ranch Water Tank was destroyed, and materials largely removed, but some remaining material was left piled on site.

Kahuku Ranch Water Tank KA11
Resource ID: 1168512
Condition: Poor
Kahuku Ranch Water Tank KA11was a redwood water tank constructed on flat rock slabs supporting girder timbers arranged in a circular shape with three intermediate girders. The tank currently exists only as remnants of semi-standing parts.

Kahuku Ranch Water Tank KA14
Resource ID: 1168515
Condition: Poor
Kahuku Ranch Water Tank KA14 was a redwood water tank constructed on concrete pier blocks with no roof cover. A cement mortar and rock ramp (KA 14A) is located approximately 1-2ft east of the tank in direct line with the with the pipeline braces extending from KA 13. As of 2020, the water tank has completely collapsed, and pieces remain in-situ.

Kahuku Ranch Water Tank KA35
Resource ID: 1168522
Condition: Poor
KA 35 is a redwood tank constructed on concrete pier blocks supporting girder timbers arranged in an octagonal shape at the perimeter with three intermediate girders. As of 2020, the water tank has collapsed and left in-place.

Kahuku Ranch Water Tank Foundation KA16
Resource ID: 1168516
Condition: Poor
Kahuku Ranch Water Tank KA35 is a foundation for a water tank. The foundation is constructed of 14 large flat rock slabs in a circle with a diameter of 10 feet. Two metal pipes extend east of the foundation circle toward KA 17. As of 2020, it appears that the foundation has been encroached upon by vegetation, and potentially no longer extant.

Kahuku Ranch Water Tank System KA10
Resource ID: 1168511
Condition: Poor
Kahuku Ranch Water Tank System KA10 was a redwood water storage tank and piping system (to catchment); that is now collapsed, though the piping and frame are still intact.

Kahuku Ranch Water Tank System KA9
Resource ID: 1168510
Condition: Poor
Kahuku Ranch Water Tank System KA9 is now the remnants of a water tank, piping, foundations, and associated masonry walls.

Kahuku Ranch Water Tank Foundation
Resource ID: 1168703

Kahuku Ranch Water Tank Foundation at Kahuku Base Camp KA49
Resource ID: 1168535
Condition: Poor

Kahuku Ranch Water Tank Foundation KA30
Resource ID: 1168518
Condition: Fair

Kahuku Ranch Water Tank Foundation KA75
Resource ID: 1168562
Condition: Fair

Kahuku Ranch Water Trough Foundation KA55
Resource ID: 1168541
Condition: Fair
The stone pads are constructed of stone slabs that vary in size, are approximately 6 inches in thickness and are mortared in place. The overall stone pads measure 3 ft in width and 14 ft in length.

Summary

There is one contributing archaeological feature that falls under the historic ranching context at Kahuku. Two features are non-contributing and thirteen features are unknown in status. These features help to convey the historic spatial organization and land use of the ranch.

Contributing

Kahuku Ranch East (Main Pasture) Rain Shed
Resource ID: 1168502

Non-contributing

Kahuku Ranch Shop

Resource ID: 1168498

Kahuku Sawmill
Resource ID: TBD

Undetermined

Kahuku Ranch Water Tank
Resource ID: 1168688

Kahuku Ranch Water Tank KA11
Resource ID: 1168512

Kahuku Ranch Water Tank KA14
Resource ID: 1168515

Kahuku Ranch Water Tank KA35
Resource ID: 1168522

Kahuku Ranch Water Tank Foundation KA16
Resource ID: 1168516

Kahuku Ranch Water Tank KA13
Resource ID: 1168514

Kahuku Ranch Water Tank System KA10
Resource ID: 1168511

Kahuku Ranch Water Tank System KA9
Resource ID: 1168510

Kahuku Ranch Water Tank Foundation
Resource ID: 1168703

Kahuku Ranch Water Tank Foundation at Kahuku Base Camp KA49
Resource ID: 1168535

Kahuku Ranch Water Tank Foundation KA30
Resource ID: 1168518

Kahuku Ranch Water Tank Foundation KA75
Resource ID: 1168562

Kahuku Ranch Water Trough Foundation KA55
Resource ID: 1168541

Condition

Condition Assessment and Impacts

Condition Assessment: Poor

Assessment Date: 08/21/2020

Condition Assessment Explanatory Narrative:

Through the analysis and evaluation of landscape characteristics and features, it has been determined that Kahuku Ranch is in "Poor" condition. The landscape shows clear evidence of major disturbances and rapid deterioration by natural and/or human forces. Immediate corrective action is required to protect and preserve the remaining historical resources throughout the site. Pastures are overgrown, fences are deteriorating, and water tanks have collapsed in recent years.

Impacts

Type of Impact: Volcanic/Earthquake Activity

External or Internal: External

Impact Description: In the past lava flows have destroyed ranching resources and pasture lands. This activity can occur at any time. Atmospheric conditions and acidic rain degrade the material integrity of contributing resources such as metal roofing, metal bands on the water tanks, and metal fence posts. These components have to be replaced more often than in average environmental conditions.

Type of Impact: Weather/Exposure to Elements

External or Internal: External

Impact Description: Many of the buildings are susceptible to extensive damage by heavy rains and wind when roofs, windows, doors, and exterior walls are not properly maintained.

Type of Impact: Deferred maintenance

External or Internal: Internal

Impact Description: Due to the large number of historic features within Kahuku Ranch, and the large acreage of the ranch there is a shortage of staff time that is dedicated to maintaining the pastures, fences,

walls, water tanks, reservoirs, troughs, and buildings. Many of these resources are deteriorating. If action is not taken within the next one to two years, some of these resources will be lost.

Treatment

Approved Treatment: Preservation

Treatment Document: General Management Plan

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Communities ," #120325, October 26, 2009.

"Remove Nonnative Ungulates from Upper Elevation Kahuku Unit, Hawaii Volcanoes NP," #170168, November 2, 2015.

"Stabilize Zig-Zag Corral." #105092, December 14, 2006.

NPS Planning, Environment & Public Comment (PEPC)

"Kahuku Buildings Repair and Rehab Work," #82257, July 18, 2018.

"Protect Rare & Endangered Species," #16340, June 15, 2009.

"Rehab Kahuku Gates at 2 Locations," #16994, March 1, 2007.

"Remove Invasive Weeds Planted Around Kahuku Facilities," #16706, October 1, 2006.

"Replace Kahuku Upper Pasture and Kau Boundary Fence," #14851, March 1, 2006

"Restore Rare Forest In Puu Akihi Special Ecological Area, Kahuku Unit," #40956, May 1, 2013.

"Search and Remove Highly Invasive Monterey Pine, upper Kahuku Nene Cabin," #45616, March 1, 2013.

"Kahuku Visitor Contact Station," #39804, May 1, 2012.

"Kahuku Buildings Repair and Rehab Work," #82257, August 20, 2018.

"Replace Waterlines at Kahuku Ranch," #16343, October 1, 2007.

"Install a Temporary Water Tank at the Kahuku Administrative Area," #55114, December 1, 2014.

Facilities Management Software System (FMSS):

"Kahuku CCC Cabin Redwood Water Tank," Asset Number 419290.

Supplemental Information

Title: Appendix A Kahuku Ranch Site Plan

Description: Full-size site plans of the inventory unit.

Supplemental Information

Title: Appendix B Kahuku Ranch Existing Condition Photos

Description: Existing condition photos for all ranching resources within the inventory unit.

Supplemental Information

Title: Appendix C Kahuku Ranch Historic Pasture Analysis

Description: Graphic analysis of historic pasture development based on historic aerial photographs.

Supplemental Information

Title: Appendix D Ahupua'a of Kahuku

Description: The boundary of the traditional land division, overlaid with the CLI unit boundary and lava flow data.

Supplemental Information

Title: Appendix E Kahuku Ranch Parker-Era Western Pastures

Description: Delineation of the four pastures developed during the Parker Era (1912-1947).

Supplemental Information

Title: Appendix F Kahuku Ranch Location Map

Description: Full-size image of the Kahuku Ranch location map in relation to Hawai'i Volcanoes National Park and southern Island of Hawai'i.

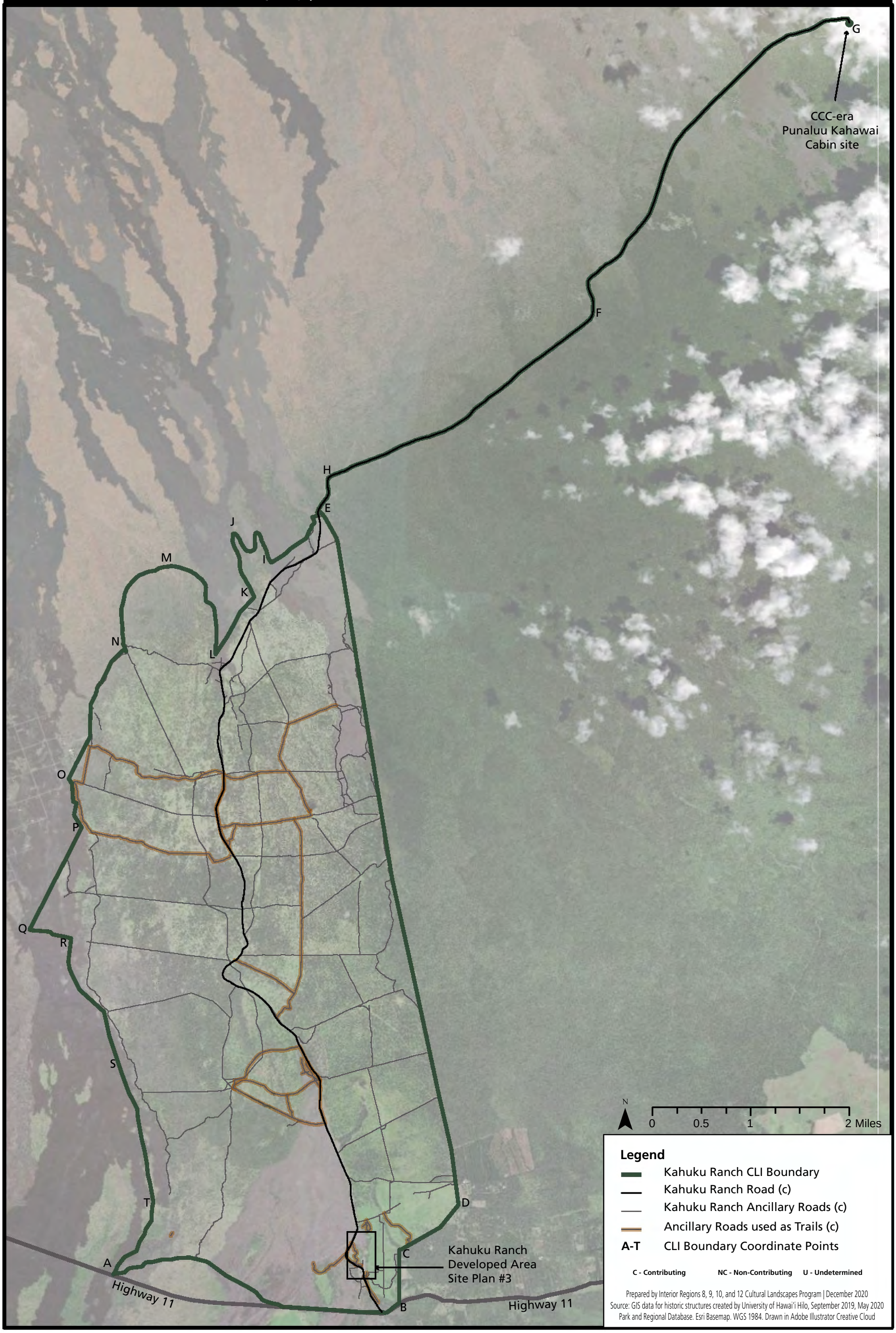
Supplemental Information

Title: Appendix G Kahuku Ranch Pastures Topographic Map

Description: Full-size image of the Kahuku Ranch Pastures and its constructed water features on a topographic basemap.

Kahuku Ranch Cultural Landscape Inventory
Hawai'i Volcanoes National Park
Site Plan #1: Kahuku Ranch CLI Boundary Map | December 2020

National Park Service
U.S. Department of the Interior



Prepared by Interior Regions 8, 9, 10, and 12 Cultural Landscapes Program | December 2020
Source: GIS data for historic structures created by University of Hawai'i Hilo, September 2019, May 2020 Park and Regional Database. Esri Basemap. WGS 1984. Drawn in Adobe Illustrator Creative Cloud

Kahuku Ranch Cultural Landscape Inventory
Hawai'i Volcanoes National Park
Site Plan #2: Kahuku Ranch Pasture Existing Conditions | April 2021

National Park Service
U.S. Department of the Interior

Water Tanks
KA9 (1168510)
KA11 (1168512)
KA12 (1168513)
KA13 (1168514)
KA14 (1168515)
KA16 (1168516)
KA17 (1168517)
KA30 (1168518)
KA32 (1168519)
KA34 (1168521)
KA35 (1168522)
KA36 (1168523)
KA38 (1168525)
KA52 (1168526)
KA60 (1168549)
KA63 (1168552)
KA65 (1168554)
KA66 (1168555)
KA68 (1168557)
KA72 (1168560)

Water Troughs
KA37 (1168524)
KA41 (1168527)
KA42 (1168528)
KA43 (1168529)
KA44 (1168530)
KA45 (1168531)
KA46 (1168532)
KA47 (1168533)
KA48 (1168534)
KA51 (1168537)
KA53 (1168539)
KA54 (1168540)
KA58 (1168547)
KA62 (1168551)
KA67 (1168556)
KA69 (1168558)
KA70 (1168559)
KA81 (1168563)
KA83 (1168564

Plastic Troughs
KA 84 (1168565)
KA86 (1168566)

Cattle Ramps
KA56 (1168545)
KA40 (1168675)
KA59 (1168548)

Lumber Mill
KA74 (1168659)

Water Tank Systems
KA 10 (1168511)

Water Tank Foundations
KA75 (1168562)

Trough Foundation
KA55 (1168541)

Shed
KA88 (1168700)

Exlcosure
KA57 (1168546)
M

1. Reservoir #1(1168568) (nc)
2. Reservoir #2 (1168569) (nc)
3. Reservoir #3 (1168561) (nc)
4. Reservoir #4 (1168550) (nc)
5. East (Main Pasture) Rainshed (1168502) (c)

Kahuku Ranch Western Pastures (c)
Kahuku Ranch Eastern Pastures (nc)

(c) Contributing
(nc) Non-Contributing
(u) Undetermined

Legend
Exclosure (nc)
Corrals, Chutes, Cattle Ramp (u)
Corrals, Chutes, Cattle Ramp (nc)
Buildings and Structures (u)
Buildings and Structures (nc)
Foundations and Ruins
Lumber Mill and Logging Site (nc)
Reservoirs (nc)
Kahuku Road (c)
Kahuku Ranch Western Pasture Roads (c)
Kahuku Ranch Eastern Boundary Fence (c)
Kahuku Ranch Fences (nc-compatible)
Kahuku-'Āinapō Trail (c)
Kahuku Ancillary Roads (nc)
Kahuku Base Camp Access Road (nc)
Water Tanks (c)
Water Tanks (nc)
Water Tanks (u)
Water Troughs (c)
Water Troughs (nc)
Water Troughs (U)
Ranch Equipment (nc)
Rock Walls (c)

Shed (1168687)
Logging Station (1168661)
Shed (1168686)
1926 Lava Flow
Building 416 (1168655)
KA10
KA11
KA37
(1168683)
KA38
KA70
KA36
KA69
Corral (1168693)
(1168695)
KA68
KA67
Corral (1168664) and Cattle Ramp (1168662)
KA9
KA72
KA42
KA12
(1168660)
KA66
KA9
(1168688)
(1168690)
Glover Trail
(1168689)
KA65
KA64
(1168663)
Kahuku Kona Trail
Corral (1168666) and Cattle Ramp (1168665)
(1168650)
KA11
KA43
KA44
KA63
KA62
Corral (1168667)
KA32
Nēnē Pen/Enclosure (1168692)
KA12
KA13
(1168697)
KA14
KA13
Corral (1168673) Cattle Ramp KA40
KA41
(1168696)
KA45
KA74
Cattle Ramp KA59 Corral (1168695)
KA60
KA46
Shed KA88 (1168700)
KA34
KA35
KA58
KA39A-D
Cattle Ramp KA56 Corral (1168674)
KA54
KA55
Kahuku Palm Trail
1887 Lava Flow
KA52
KA53
Corral (1168684)
KA47
Cattle Ramp (1168669) Corral (1168668)
KA48
Corral (1168670)
1868 Lava Flow
KA86
KA51
KA84
KA17
KA16
Pu'u o Lokuana Trail
Base Camp Area
KA81
KA75
Old Māmalahoa Hwy
Highway 11
KA30
Kahuku Base Camp Access Road (nc)

Prepared by Interior Regions 8, 9, 10, and 12 Cultural Landscapes Program | December 2020
Source: GIS data for historic structures created by University of Hawai'i Hilo, September 2019, May 2020 Park and Regional Database. Esri Basemap. WGS 1984. Drawn in Adobe Illustrator Creative Cloud

Historic pasture delineations were determined by a combination of the Parker-era water conveyance route (as represented in the 2002 "Water System & Grazing Unit Map") and an analysis of the 1957 historic aerial.

0 0.375 0.75 1.5 Miles
N

Kahuku Ranch Cultural Landscape Inventory
Hawai'i Volcanoes National Park
Site Plan #3: Kahuku Ranch Base Camp Area Existing Conditions | April 2021

National Park Service
U.S. Department of the Interior

CRIS CLI Feature Name and ID (Park building number on Site Plan)

01. Kahuku Ranch Generator Building (Bldg 406) (1168497)
02. Kahuku Ranch Storage Shed (Bldg 405) (1168496)
03. Kahuku Ranch Shop (Bldg 407) 1168498)
04. Kahuku Ranch Storage Structure (1168503)
05. Kahuku Ranch Shed (1168702)
06. Kahuku Ranch Kennel (1168676)
07. Kahuku Ranch Dorm Residence (Bldg 404) (1168507)
08. Kahuku Ranch Carport (1168507)
9a. Kahuku Ranch Bunker Tunnel (Bldg 415) (1168504)
9b. Kahuku Ranch Bunker Vent (Bldg 415) (1168504)
10. Kahuku Ranch Single Residence (Bldg 403) (1168506)
11. Kahuku Ranch Wood Shop (Bldg 409) (1168500)
12. Kahuku Ranch Smoke House (1168678)
13. Kahuku Ranch Storage Building (Bldg 402) (1168495)
14. Kahuku Ranch Barn (Bldg 401) (1168494)
15. Kahuku Ranch Shed (1168694)
16. Kahuku Ranch Pump House (1168677)
17. Kahuku Ranch Visitor Center (1168632)
18. Kahuku Ranch Restroom (1168633)
19. Kahuku Ranch Lumber Mill (1168654)
20. Kahuku Ranch Fuel Storage Shed (Bldg 408) (1168499)
21. Kahuku Ranch Gas Tank (1168699)
22. Kahuku Ranch Gas Tank (1168698)
23. Kahuku Ranch Gas Tank (1168691)
24. Kahuku Ranch Plastic Water Trough KA83 (11684564)
25. Kahuku Ranch Water Tank (1168671)
26. Kahuku Ranch Water Tank Foundation KA 49 (1168703)
27. Kahuku Ranch Water Tank (1168651)
28. Kahuku Ranch Water Tank (1168652)
29. Kahuku Ranch Water Tank (1168653)
30. Kahuku Ranch Water Tank (1168656)
31. Kahuku Ranch Water Tank (1168657)
32. Kahuku Ranch Water Tank (1168658)
33. Kahuku Ranch Water Tank (1168649)
34. Kahuku Ranch Water Tank (1168648)
35. Kahuku Ranch Water Tank (1168646)
36. Kahuku Ranch Water Tank (1168647)
37. Kahuku Ranch Water Tank (1168679)
38. Kahuku Ranch Water Tank Foundation at Khuku Base Camp KA49 (1168535)
39. Kahuku Ranch Portable Water Tank KA50 (1168649)

Prepared by Interior Regions 8, 9, 10, and 12 Cultural Landscapes Program | December 2020
Source: GIS data for historic structures created by University of Hawai'i Manoa, September 2019, May 2020 Park and Regional Database. Esri Basemap. WGS 1984. Drawn in Adobe Illustrator Creative Cloud

Kahuku Pu'u o Lokuana Trail

Legend

- Buildings and Structures (nc)
- Foundations and Ruins
- Water Tanks (nc)
- Lumber Mill Site (nc)
- Water Troughs (nc)
- Kahuku Base Camp Access Road (nc)
- Kahuku Ranch Ancillary Roads (nc)
- Rock Walls (c)

C - Contributing NC - Non-Contributing U - Undetermined

0 0.0125 0.025 0.05 Miles

N

Appendix B

Landscape Characteristic: Circulation



1168635 Kahuku Ranch Roads



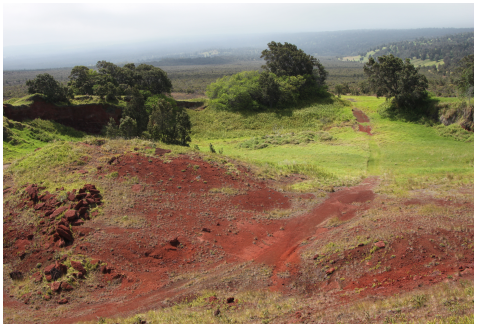
1168636 Kahuku Ranch Kahuku-Ainapo Trail



1168639 Kahuku Ranch Palm Trail
(from NPS Gallery)



1168643 Kahuku Ranch Kona Trail
(from NPS Gallery)



1168641 Kahuku Ranch Pu`u o Lokuana Trail
(from NPS Gallery)



1168644 Kahuku Ranch Glover Trail
(from NPS Gallery)

Landscape Characteristic: Buildings and Structures



1168509 Kahuku Ranch Upper Cabin



789376 Kahuku CCC Cabin



1168494 Kahuku Ranch Barn



1168506 Kahuku Ranch Dorm Residence



1168633 Kahuku Ranch Vault Toilet



1168507 Kahuku Ranch Single Residence



1168495 Kahuku Ranch Storage Building



1168632 Kahuku Ranch Visitor Center



1168500 Kahuku Ranch Wood Shop



1168660 Kahuku Ranch Lumber Mill
(One of three lumber mill sites)
(from Kahuku Archaeology Inventory)



One of the typical forms of sheds found across the landscape.
Pictured: 1168694 Kahuku Ranch Shed



One of the typical forms of sheds found across the landscape.
Pictured: 1168505 Kahuku Ranch Shed



Ranch sheds in various states of condition.
Pictured: 1168686Kahuku Ranch Shed



One of the typical forms of sheds found across the landscape.
Pictured: 1168687 Kahuku Ranch Shed



1168702 Kahuku Ranch Shed



1168504 Kahuku Ranch Bunker Tunnel and Vent



1168672 Kahuku Ranch Carport



1168499 Kahuku Ranch Fuel Storage Shed



1168497 Kahuku Ranch Generator



1168676 Kahuku Ranch Kennel



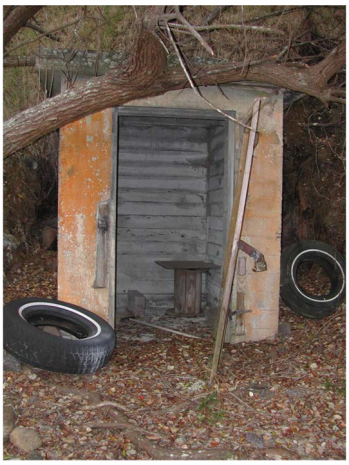
1168634 Kahuku Ranch Picnic Shelter



1168678 Kahuku Ranch Smoke House



1168496 Kahuku Ranch Storage Shed



1168503 Kahuku Ranch Storage Structure

Landscape Characteristic: Small-Scale Features



Typical cattle ramp found on landscape.
Pictured: Kahuku Ranch Cattle Ramp KA40



Typical cattle ramp found on landscape.
Pictured: Kahuku Ranch Cattle Ramp KA56



Typical cattle ramp found on landscape.
Pictured: Kahuku Ranch Cattle Ramp KA 59 (2005 Photo)



Typical cattle ramp found on landscape.
Pictured: 1168662 Kahuku Ranch Cattle Ramp



Typical cattle ramp found on landscape.
Pictured: 1168665 Kahuku Ranch Cattle Ramp facing NW



789394 Kahuku Ranch Zigzag Corral and Chute



Typical corral found on landscape.
Pictured: 1168664 Kahuku Ranch Corral facing W



Typical corral found on landscape.
Pictured: 1168666 Kahuku Ranch Corral facing S



Typical corral found on landscape.
Pictured: 1168693 Kahuku Ranch Corral



Typical corral found on landscape.
Pictured: 1168668 Kahuku Ranch Corral



Typical corral found on landscape.
Pictured: 1168670 Kahuku Ranch Corral



Typical corral found on landscape.
Pictured: 1168673 Kahuku Ranch Corral



Typical corral found across landscape.
Pictured: 1168674 Kahuku Ranch Corral



Typical corral found across landscape.
Pictured: 1168689 Kahuku Ranch Corral



Typical corral found across landscape.
Pictured: 1168692 Kahuku Ranch Corral



1168546 Kahuku Ranch Enclosure KA57
(2005 Photo)



1168695 Kahuku Ranch Equipment



1168661 Kahuku Ranch Logging Station



11168685 Kahuku Ranch Exclosure Site 1



1168638 Kahuku Ranch Rock Walls



1168681 Kahuku Ranch Exclosure Site 3



1168682 Kahuku Ranch Exclosure Site 4



1168637 Kahuku Ranch Fence



Typical gas tank found in developed area.
Pictured: 1168691 Kahuku Ranch Gas Tank



1168567 Kahuku Ranch Wood Box KA87
(2005 Photo)

Landscape Characteristic: Constructed Water Features



Typical metal water tank found on landscape.
Pictured: 1168520 Kahuku Ranch Metal Water Tank KA33 (2005 Photo)



Typical metal water trough found on landscape.
Pictured: 1168527 Kahuku Ranch Metal Water Trough KA41 (2005 Photo)



1168535 Kahuku Ranch Water Tank Foundation (2005 Photo)



Typical portable water tank found on landscape.
Pictured: 1168536 Kahuku Ranch Portable Water Tank KA50 (2005 Photo)



Typical plastic water trough found on landscape.
Pictured: 1168537 Kahuku Ranch Plastic Water Trough KA5l (2005 Photo)



Typical metal water tank found on landscape.
Pictured: 1168538 Kahuku Ranch Metal Water Tank KA52 (2005 Photo)



Typical plastic water trough found on landscape.
Pictured: 1168540 Kahuku Ranch Plastic Water Trough KA54 (2005 Photo)



Typical metal water tank found on landscape.
Pictured: 1168549 Kahuku Ranch Metal Water Tank KA60 (2005 Photo)



1168550 Kahuku Ranch Reservoir #4 KA61 (2005 Photo)



Typical metal water tank found on landscape.
Pictured: 1168552 Kahuku Ranch Plastic Water Tank KA63 (2005 Photo)



1168561 Kahuku R anch R eservoir #3 KA73 (from Kahuku Archaeology Inventory)



Typical plastic water trough found on landscape.
Pictured: 1168563 Kahuku Ranch Plastic Water Trough KASI (2005 Photo)



Typical plastic water trough found on landscape.
Pictured: 1168564 Kahuku Ranch Plastic Water Trough KA83



Typical plastic water trough found on landscape.
Pictured: 1168565 Kahuku Ranch Plastic Water Trough KA84 (2005 Photo)



Typical Plastic water trough found on landscape.
Pictured: 1168566 Kahuku Ranch Plastic Water Trough KA86



Typical metal water trough found on landscape.
Pictured: 1168697 Kahuku Ranch Water Trough



Typical fiberglass water trough found on landscape.
Pictured: Kahuku Ranch Plastic Water Trough KA43 &44



Typical fiberglass water trough found on landscape.
Pictured: Kahuku Ranch Plastic Water Trough KA45



Typical fiberglass water trough found on landscape.
Pictured: Kahuku Ranch Fiberglass Water Trough KA47



Typical fibrglass water trough found on landscape.
Pictured: Kahuku Ranch Fiberglass Water Trough KA48



Typical fiberglass water trough found on landscape.
Pictured: Kahuku Ranch Fiberglass Water Trough KA58



Typical fiberglass water trough found on landscape.
Pictured: Kahuku Ranch Fiberglass Water Trough KA62



Typical fiberglass water trough found on landscape.
Pictured: Kahuku Ranch Fiberglass Water Trough KA64



Typical fiberglass water trough found on landscape.
Pictured: Kahuku Ranch Fiberglass Water Trough KA67



Typical metal and plastic water tanks found on landscape.
Pictured: Kahuku Ranch Plastic Water Tank KA39 & Metal Water Tank KA34



Typical metal water tank found on landscape.
Pictured: Kahuku Ranch Metal Water Tank KA12



Kahuku Ranch Metal Water Tank KA17 and Water Tank Foundation KA16



Typical metal water tank found on landscape.
Pictured: 1168523 Kahuku Ranch Metal Water Tank KA36



Typical metal water tank found on landscape.
Pictured: 1168523 Kahuku Ranch Metal Water Tank KA38



Typical metal water tank found on landscape.
Pictured: 1168523 Kahuku Ranch Metal Water Tank KA65



VVarying state of condition of metal water tanks found on landscape.
Pictured: 1168523 Kahuku Ranch Metal Water Tank KA36



Typical metal water tank found on landscape.
Pictured: Kahuku Ranch Metal Water Tank KA68



Typical metal water tank found on landscape.
Pictured: Kahuku Ranch Metal Water Tank KA37



Typical metal water trough found on landscape.
Pictured: Kahuku Ranch Metal Water Trough KA46



Typical metal water trough found on landscape. Pictured: Kahuku Ranch Metal Water Trough KA69



Typical metal water trough found on landscape.
Pictured: Kahuku Ranch Metal Water Trough KA70



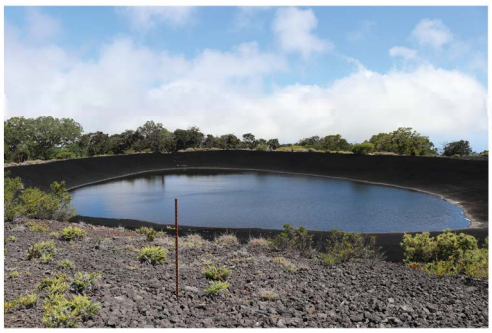
Typical wooden water tank found on landscape.
Pictured: 1168690 Kahuku Ranch Water Tank



Typical plastic water tank found on landscape.
Pictured: Kahuku Ranch Plastic Water Tank System KA39



Kahuku Ranch Reservoir #1 KA89



Kahuku Ranch Reservoir #2 KA90



Typical metal water tank found on landscape.
Pictured: Kahuku Ranch Water Tank KA32



Typical metal water tank found on landscape.
Pictured: 1168663 Kahuku Ranch Water Tank



Typical portable water tank found on landscape.
Pictured: 1168671 Kahuku Ranch Water Tank



Typical portable water tank found on landscape.
Pictured: 1168679 Kahuku Ranch Water Tank

Landscape Characteristic: Archaeology



1168541 Kahuku Ranch Water Trouch Foundation



1168502 Kahuku Ranch Main Pasture Rainshed



1168498 Kahuku Ranch Ranch shop



1168516 Kahuku Ranch Water Tank Foundation KA16



1168518 Kahuku Ranch Water Tank Foundation KA30



1168562 Kahuku Ranch Water Tank Foundation KA75 (2005 Photo)



1168535 Kahuku Ranch Water Tank Foundation at Kahuku Base Camp



1168512 Kahuku Ranch Water Tank Foundation KA11



1168514 Kahuku Ranch Water Tank KA13



1168515 Kahuku Ranch Water Tank KA14



Kahuku Ranch Water Tank KA35



1168510 Kahuku Ranch Water Tank System KA9



1168511 Kahuku Ranch Water Tank System KA10



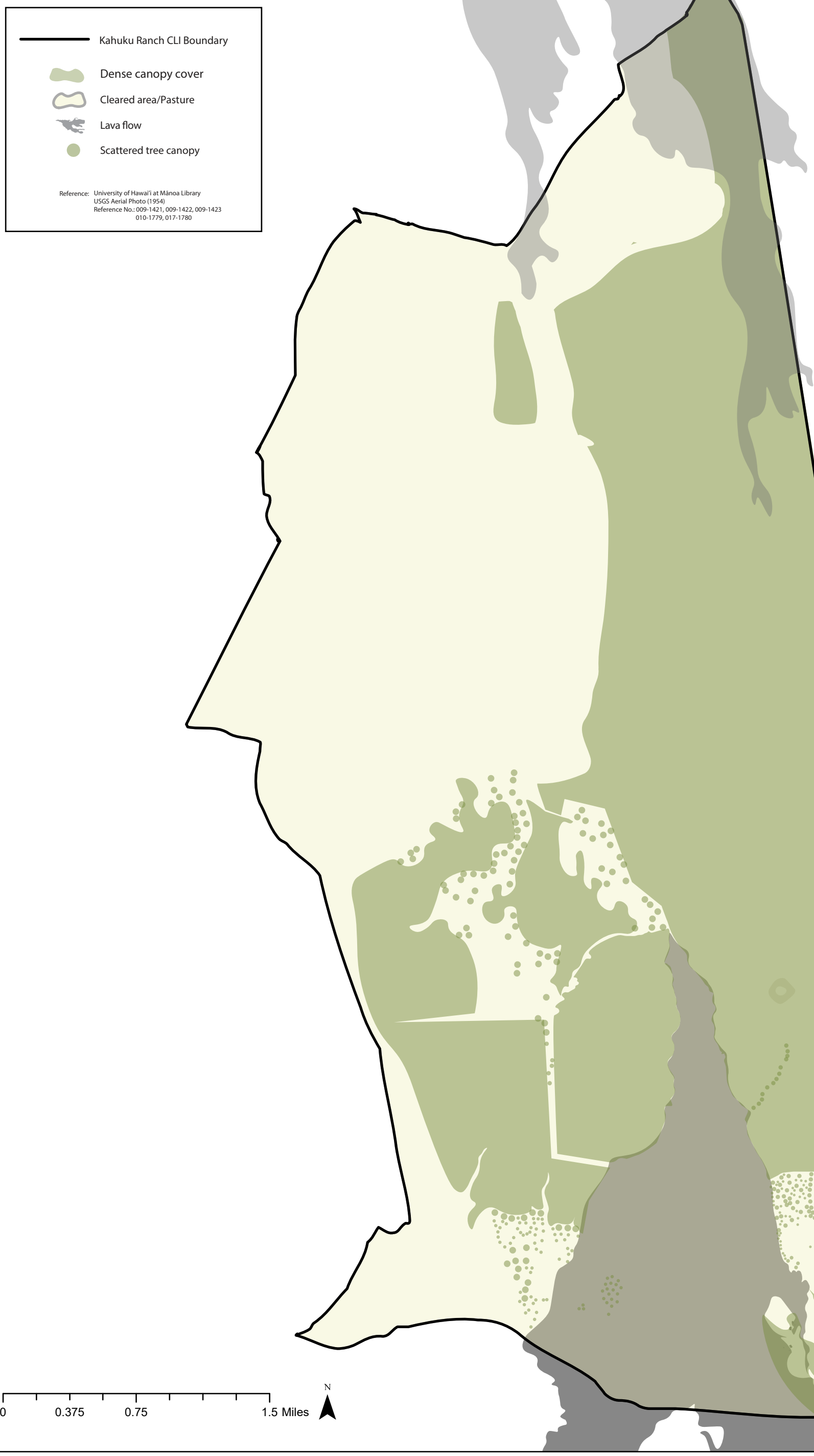
1168688 Kahuku Ranch Water Tank

Kahuku Ranch Cultural Landscape Inventory

Hawai'i Volcanoes National Park - 1954 Vegetation Plan

Appendix C: Kahuku Ranch Historic Pasture Analysis | April 2021

National Park Service
U.S. Department of the Interior



Kahuku Ranch Cultural Landscape Inventory

Hawai'i Volcanoes National Park - 1977 Vegetation Plan

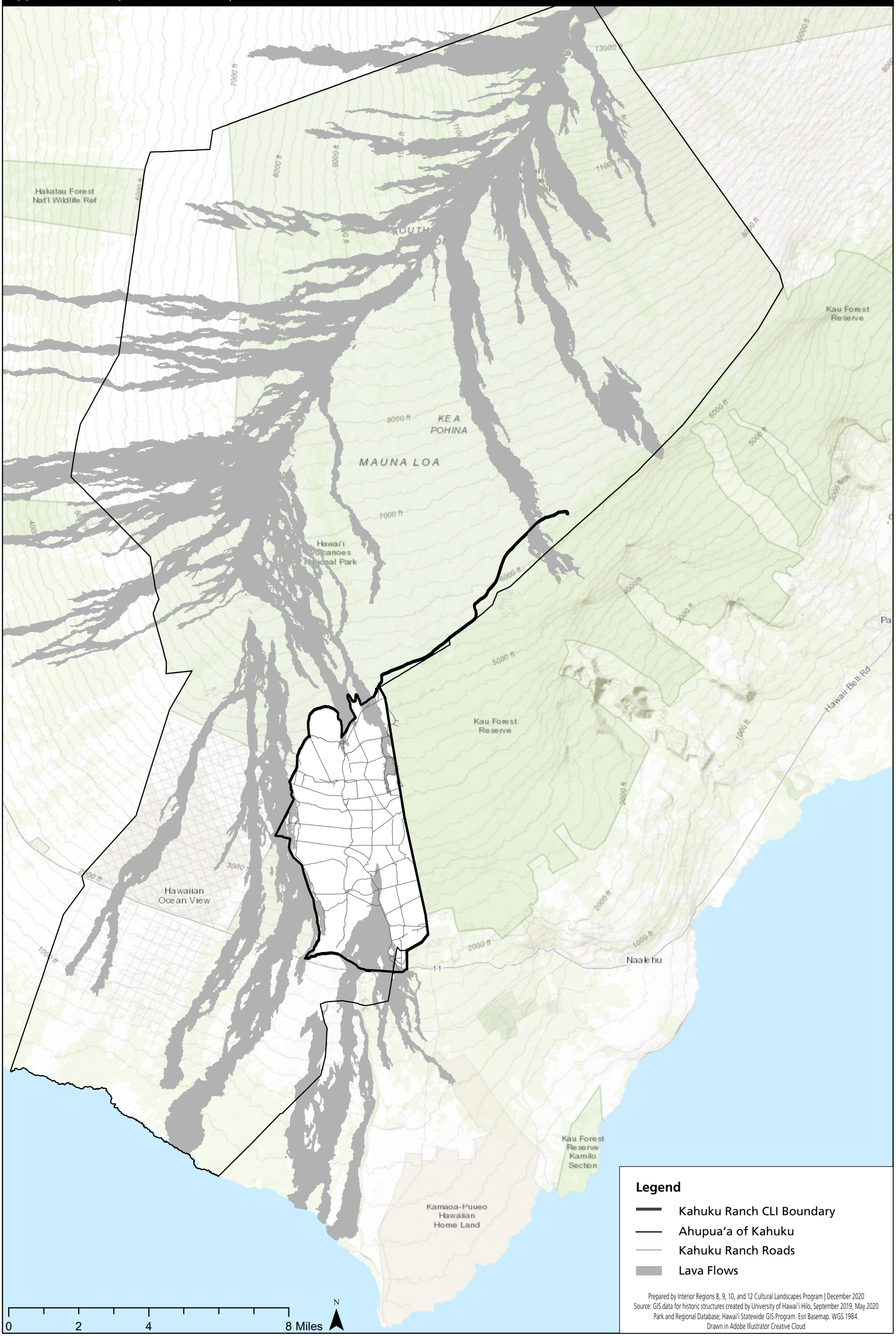
Appendix C: Kahuku Ranch Historic Pasture Analysis | April 2021

National Park Service
U.S. Department of the Interior



Kahuku Ranch Cultural Landscape Inventory
Hawai'i Volcanoes National Park
Appendix D: Ahupua'a of Kahuku | October 2021

National Park Service
U.S. Department of the Interior



Prepared by Interior Regions 8, 9, 10, and 12 Cultural Landscapes Program | December 2020
Source: GIS data for historic structures created by University of Hawai'i Hilo, September 2019, May 2020
Park and Regional Database; Hawai'i Statewide GIS Program. Esri Basemap. WGS 1984.
Drawn in Adobe Illustrator Creative Cloud

Kahuku Ranch Cultural Landscape Inventory
Hawai'i Volcanoes National Park
Appendix E: Kahuku Ranch Parker-Era Western Pastures | October 2021

National Park Service
U.S. Department of the Interior

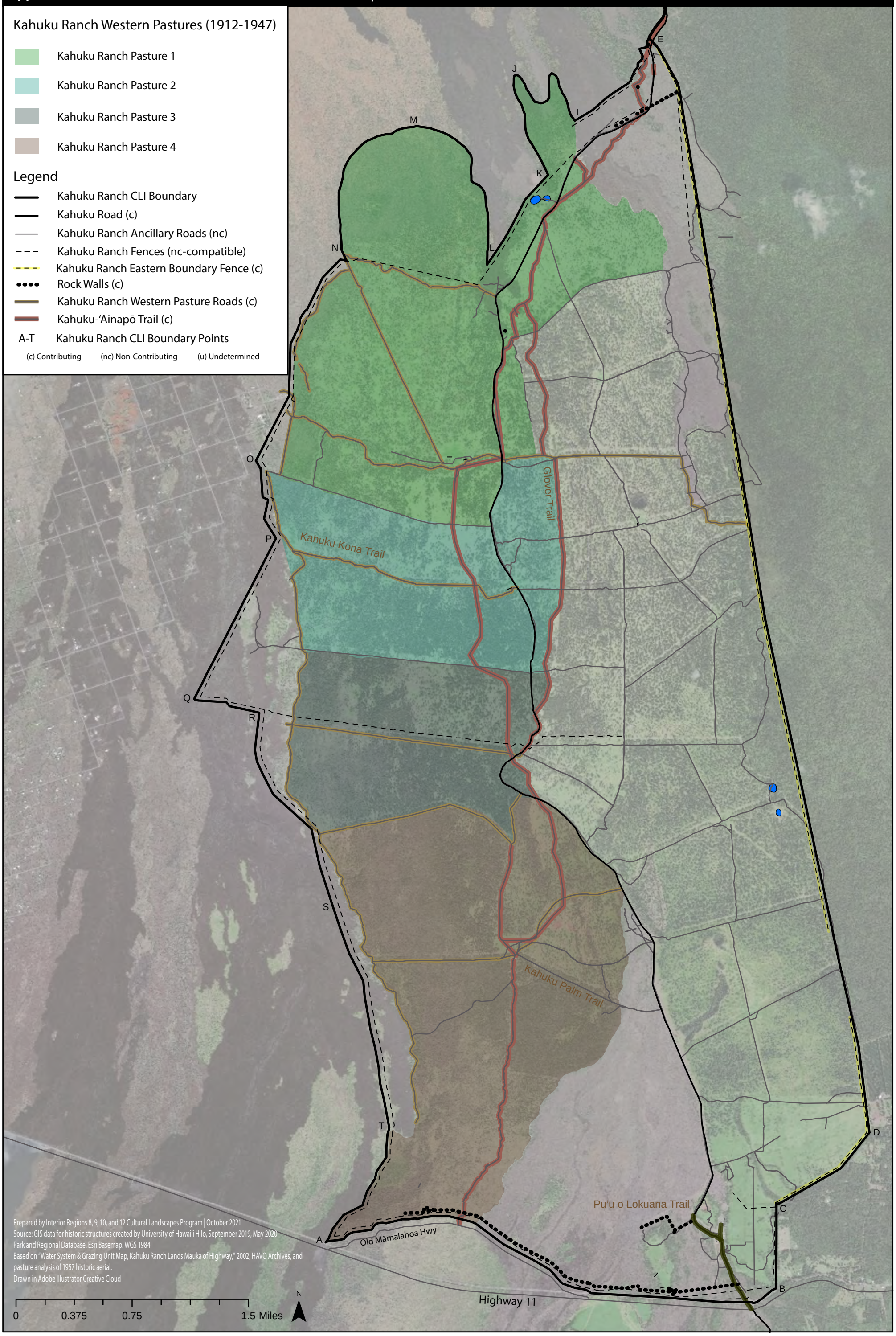
Kahuku Ranch Western Pastures (1912-1947)

- Kahuku Ranch Pasture 1
- Kahuku Ranch Pasture 2
- Kahuku Ranch Pasture 3
- Kahuku Ranch Pasture 4

Legend

- Kahuku Ranch CLI Boundary
- Kahuku Road (c)
- Kahuku Ranch Ancillary Roads (nc)
- Kahuku Ranch Fences (nc-compatible)
- Kahuku Ranch Eastern Boundary Fence (c)
- Rock Walls (c)
- Kahuku Ranch Western Pasture Roads (c)
- Kahuku-'Ainapō Trail (c)
- A-T Kahuku Ranch CLI Boundary Points

(c) Contributing (nc) Non-Contributing (u) Undetermined

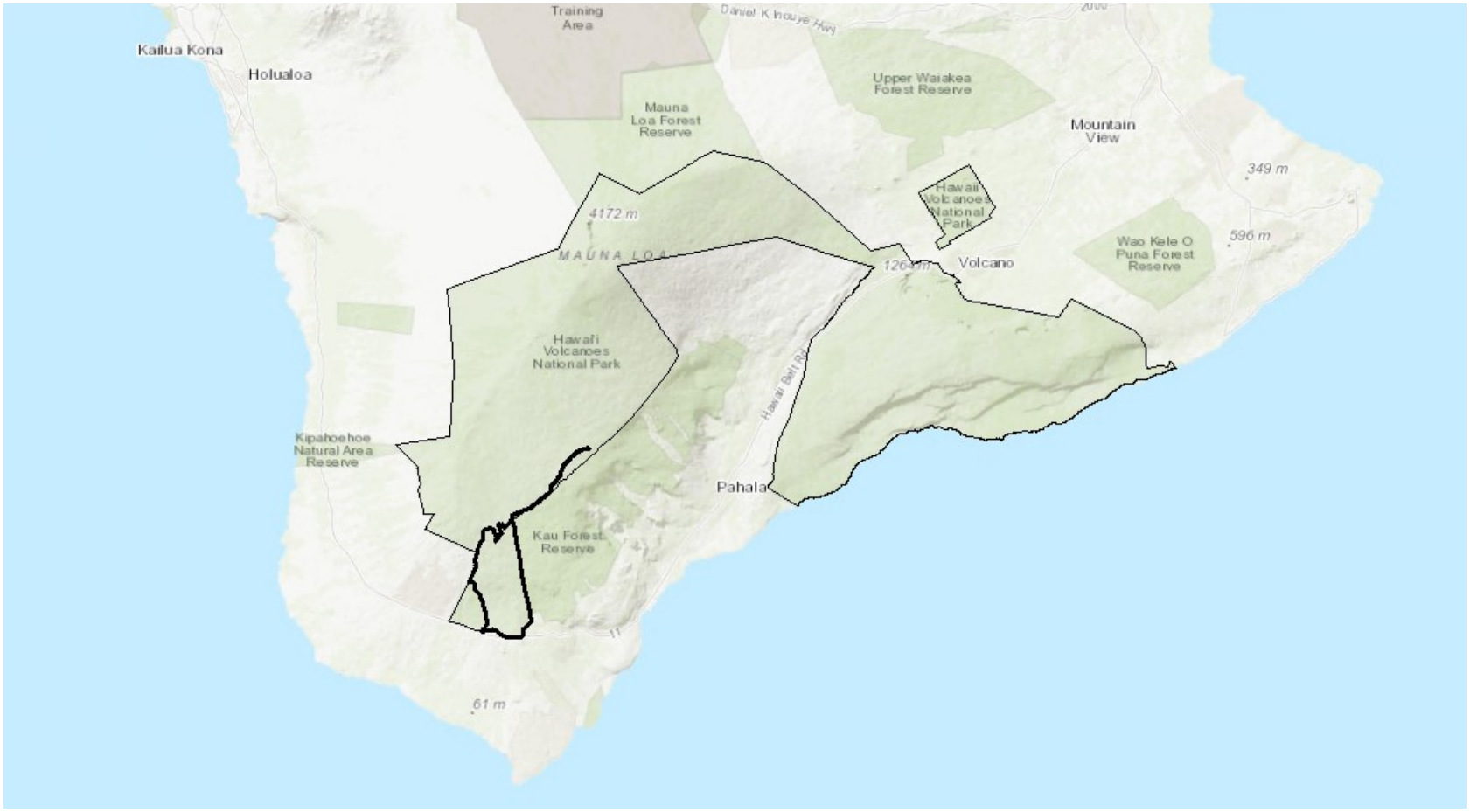


Prepared by Interior Regions 8, 9, 10, and 12 Cultural Landscapes Program | October 2021
Source: GIS data for historic structures created by University of Hawai'i Hilo, September 2019, May 2020 Park and Regional Database. Esri Basemap. WGS 1984.
Based on "Water System & Grazing Unit Map, Kahuku Ranch Lands Mauka of Highway," 2002, HAVO Archives, and pasture analysis of 1957 historic aerial.
Drawn in Adobe Illustrator Creative Cloud

0 0.375 0.75 1.5 Miles

N

Appendix F



Location Map: Kahuku Ranch is represented in the heaviest line weight, with the lighter line weight representing the entire boundary of Hawai'i Volcanoes National Park.

Kahuku Ranch Cultural Landscape Inventory
Hawai'i Volcanoes National Park
Appendix G: Kahuku Ranch Pasture Topographic Map | December 2023

National Park Service
U.S. Department of the Interior

