KALIHIWAI RESERVOIR **HAER No. HI-174**
2.1 miles south of Kalihiwai Bay
Kīlauea Vicinity
Kauai County
Hawaii

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
U.S. Department of the Interior
National Park Service
Heritage Documentation Programs,
1849 C Street NW, Room 7408
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David Franzen, Photographer

November 2023

HI-174-1	View along the crest of the main section of the Kalihiwai Reservoir Dam. View facing west.
HI-174-2	View along the crest of the main section of the Kalihiwai Reservoir Dam. View facing east.
HI-174-3	View along the crest of the west section of the Kalihiwai Reservoir Dam. View facing southwest.
HI-174-4	View showing the back side (downstream slope) of the west section of the Kalihiwai Reservoir Dam. View facing north-northeast.
HI-174-5	Spillway of the reservoir as it approaches Kalihiwai Gulch. View facing northwest.
HI-174-6	Overview of the Kalihiwai Reservoir with the west section of the dam on the left. View facing north.
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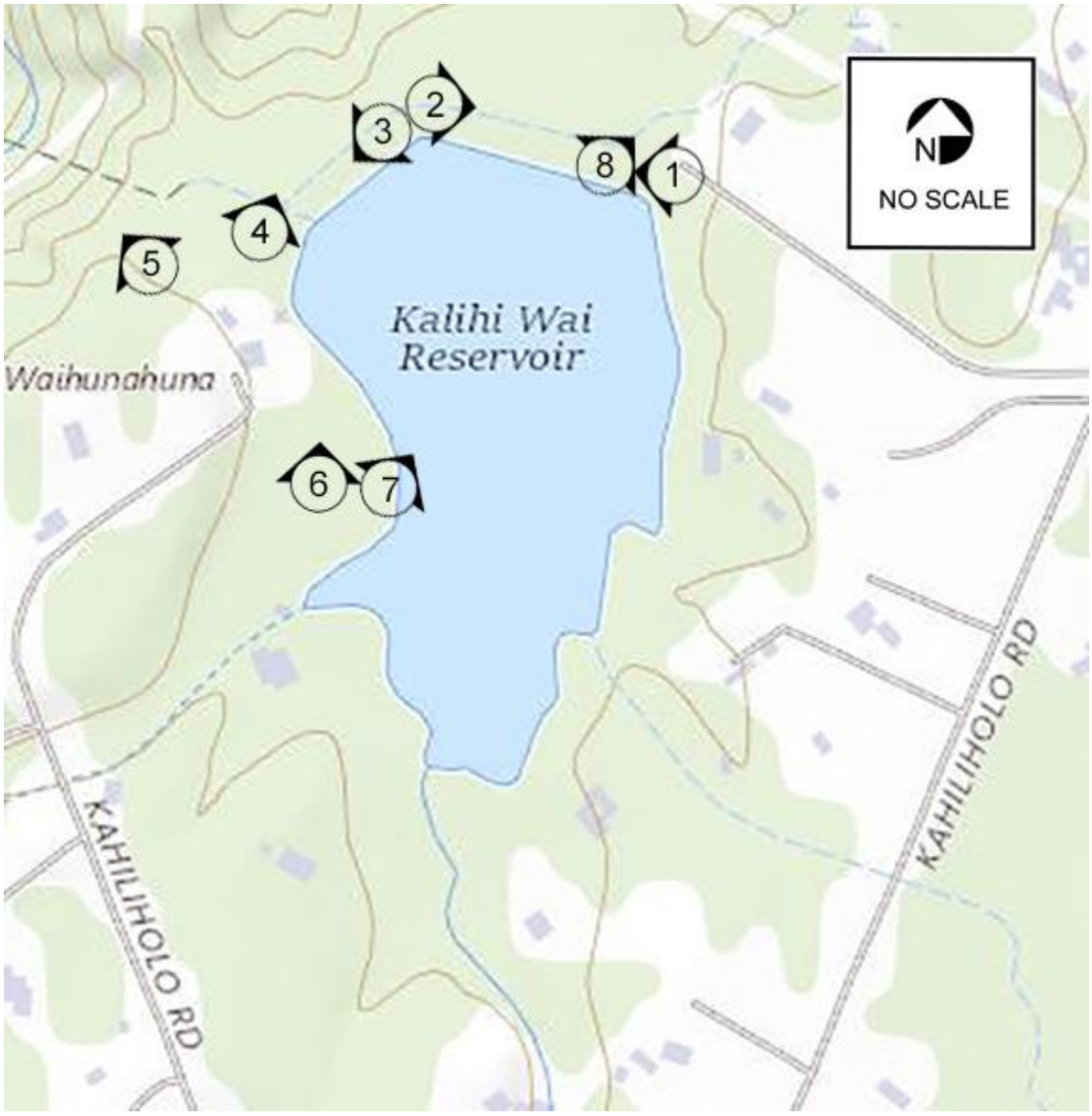
HI-174-8	Detail of the outlet works piping and valves. View facing northeast.

Photo Key. *Map: USGS Hanalei HI Quadrangle, 2022.*



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KALIHIWAI RESERVOIR

HAER No. HI-174

Location: 2.1 miles south of Kalihiwai Bay.
Kīlauea Vicinity
Kauaʻi County
Hawaiʻi

The Kalihiwai Reservoir is located at latitude: 22.186305, longitude: -159.431905. This point was obtained on December 12, 2023 using Google Earth (WGS84). There is no restriction on its release to the public.

Date of Construction: ca. 1910

Designer: Kilauea Sugar Co.

Original Owner/Use: Kilauea Sugar Co./ Water reservoir

Present Owner/Use: Kalihiwai Ridge Community Association/ Water reservoir

Significance:
The Kalihiwai Reservoir is significant for its association with the development of the irrigation facilities of the Kilauea Sugar Co. (KSC), a major sugar producer on Kauaʻi. The reservoir was an important part of KSC's gravity flow irrigation system. The reservoir is also significant for embodying the distinctive characteristics of the method of earthen dam and unlined earthen reservoir construction in Hawaiʻi during the early twentieth century. This method of earthen construction was typically chosen during this period for its relative ease of construction that required few additional materials.

DESCRIPTION:

The Kalihiwai Reservoir is an earthen dam-impounded reservoir that lies at an elevation of about 393' above sea level and just east of Kalihiwai Gulch, about 2.1 miles south of Kalihiwai Bay on the north shore of Kauaʻi. It is impounded by an L-plan earthen dam with a total length of about 1,000' that was built across an unnamed swale. The main section of the dam is oriented northwest -southeast and is about 600' long. The west section of the dam, which forms the base of the L, is about 400' long and oriented to the southwest from the west end of the main section. See Figure 1. The dam is about 25' high along the downstream slope, with a hydraulic height of about 17' to 20' on the upstream side. The dam has dense vegetation along the downstream slope and has mown grass on the approximately 15' wide crest, which can accommodate a vehicle. The historic, principal spillway is an earthen channel off the west side of the reservoir (southwest of the left embankment) that drains water into Kalihiwai River Gulch. As it leaves the reservoir, this spillway is shallow and wide (approximately 55' wide). The spillway narrows into a water channel about 15' wide and 10' deep as it approaches the gulch.

The historic discharge (outlet) is located near the east end of the dam. This is an approximately 24" diameter metal pipe that pierces the dam with its outlet aperture on the downslope face about 18' below the crest. This aperture is stabilized by a U-plan masonry retaining wall of coursed, quarry-faced, lava rock ashlar with cement mortar that is set against the sloping grade of the embankment. This masonry has a 4'-0" high x 4'-6" wide section up against the embankment where the 24" pipe exits the dam. At each side of the 4'-6" wide masonry there are

perpendicular 9'-0" long wings of similar masonry stabilizing the embankment slope. Within the U-shaped plan of this masonry, the discharge pipe has a large metal gate valve. Down-flow of this valve, the discharge pipe is reduced to approximately 18" diameter before a T fitting divides it into two approximately 12" diameter pipes that are run into vertical filter units that contain stainless steel screening to filter the water. The outlets from the two filters are joined (using another T fitting) back into a single approximately 18" diameter steel pipe that is routed downslope. It is not known if water from the reservoir is flowing through this discharge piping. The inlet of this discharge piping is under the reservoir's water level and was not observable.

Near the west end of the dam embankment, just north of the spillway, there are two, approximately 24" diameter corrugated PVC pipes that were installed in 2018 when heavy rains threatened to overtop the reservoir. These emergency outlet pipes were installed on the location of the historic concrete headwall of the ca. 1922 reservoir inlet from the Hanalei Ditch that crossed Kalihiwai Gulch in a siphon. This headwall was demolished when the emergency outlet pipes were installed. Reservoir water is currently flowing out through these pipes and routed westward, away from the reservoir in an earthen ditch that follows the path of the former Hanalei Ditch. There is no control gate for these emergency outlet pipes, they flow water out of the reservoir when it reaches their level. This maintains the maximum water level of the reservoir (during normal weather) at an undetermined capacity that is well below the crest of the dam. This outflow water is sent along an approximate 400' length of the historic route of the Hanalei Ditch, which then dumps the water over the lip of the Kalihiwai Gulch and into Kalihiwai River. Note that the current flow direction of this outlet water is opposite the historic inlet flow direction of the former Hanalei Ditch.

The principal inlet for the reservoir is now the flow of runoff water coming down the swale from the south. An additional inlet is located at the east side of the reservoir. This is the Kalihiwai Ditch that historically drew water from Pōhakuhonu Stream about ¾ mile southeast of the reservoir. It is not known if this inlet is adding water to the reservoir, it could not be accessed due to the adjacent private property.

HISTORIC CONTEXT

The Kalihiwai Reservoir was built sometime before 1910 by the Kilauea Sugar Co. (KSC) to store water for irrigation of their sugar cane fields. It also supplied domestic water to the plantation town of Kīlauea and supplied water to the KSC mill there.[1]

The KSC began in 1877 when James Ross and E.P. Adams purchased ranch land near Kīlauea on Kaua'i's north shore and began a sugar operation. The recently signed (1875) Treaty of Reciprocity that allowed Hawaiian sugar into the United States without an import duty helped the new plantation financially by making it profitable to sell sugar to markets in the United States. By 1880 the KSC mill in Kīlauea was producing sugar from about 600 acres of cultivated cane.

The Kalihiwai Reservoir was one of six reservoirs built by KSC in the early 1900s to supply irrigation water to the KSC cane fields located between Kalihiwai Gulch on the west and Moloa'a

[1] USGS, "Kīlauea Quadrangle," topographic map, 1/31680 scale. 1910. Carol Wilcox*, Sugar Water, Hawai'i's Plantation Ditches*. (Honolulu: University of Hawai'i Press). 1996. 84.

Gulch on the east.[2] These reservoirs were joined together by a series of ditches, forming an interconnected system that was "a good illustration of what a small system, using modest, unlined ditches and reservoirs, can accomplish." The system, including Kalihiwai Reservoir, had a total capacity of over 730 million gallons and irrigated over 3,000 acres of cane fields cultivated by KSC.[3]

Originally, the Kalihiwai Reservoir was filled by runoff down the unnamed swale the reservoir was built in and by the supply from a ditch that entered the reservoir on its east side. This ditch tapped mountain sources about one mile south of the reservoir and also collected some water from Pōhakuhonu Stream. This eastern supply ditch is named Kalihiwai Ditch on 1983 USGS topographic maps.[4] The supply to the reservoir was augmented upon the ca. 1922 completion of the Hanalei Ditch, which entered the reservoir on the west side. The Hanalei Ditch drew water from the Kalihiwai River at about the 425' elevation level (about two miles southwest of the reservoir) and routed it along the west side of Kalihiwai Gulch to a point directly west of the reservoir. From there the ditch water entered a large siphon, about 1,000' long that brought it across Kalihiwai River Gulch and into a short, 400'-long section of open ditch that fed the reservoir. This siphon across Kalihiwai River Gulch was originally wood stave construction. The engineer for the Hanalei Ditch was Fritz C. Koelling, who began initial survey work in 1917.[5]

The Hanalei Ditch, with a supply capacity of ten to fifteen million gallons per day (mgd) was the longest supply ditch in the KSC irrigation and reservoir system, at about 3¾ linear miles from its Kalihiwai River source to Kalihiwai Reservoir. Other ditches in the KSC irrigation system that transported water among the six main reservoirs were longer, but as a supply ditch from a water source, it was the longest. The Puʻu Ka Ele Reservoir was fed by the ¾ mile long Puʻu Ka Ele Ditch from Puʻu Ka Eele Stream, and Kaloko Reservoir from the approximately three mile long Kaloko Ditch from upland sources. The two lower reservoirs in the KSC system (Morita and Waiakalua Reservoirs) were supplied by connecting ditches from the upper reservoirs. The Morita Reservoir was supplied by the Lawrence Ditch that ran from Puʻu Ka Ele Reservoir and the Waiakalua Reservoir was supplied by the Koʻolau Ditch from Kalihiwai and Stone Dam Reservoirs.[6]

By 1931 KSC had about 33 miles of mostly unlined ditch that supplied and interconnected its six main reservoirs, which irrigated 3,875 acres of sugar cane. All irrigation water used by the plantation was gravity supplied and delivered. Water pumped from wells was not available to KSC. Their irrigation system was an exemplary utilization of water resources that, along with innovations in field practices, enabled KSC to maintain respectable sugar yields per ton of cultivated cane despite the plantation's challenges of limited water resources, rocky soil, and typically poor weather conditions.[7]

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[2] In addition to Kalihiwai Reservoir, the others were named; Stone Dam, Puu Ka Ele, Morita, Waiakalua, and Kaloko. See Figure 2 for a 1963 map showing the locations of these reservoirs.
[3] Wilcox, *Sugar Water*. 84. Gordon A. MacDonald, Harold T. Stearns, D.C. Cox, and D.A. Davis, "Geologic and Topographic Map of the Island Of Kauai, Hawaiʻi. 1/62500 scale." (Washington DC: Geological Survey, U.S. Department of the Interior). 1960.
[4] USGS, "Hanalei, HI Quadrangle," topographic map, 1/24,000 scale. 1983.
[5] Wilcox, *Sugar Water*. 85. "Personals," *Hawaiian* [Honolulu] *Gazette*. April 27, 1917. 4. "Local and Personal Notes," *Garden Island*. May 1, 1917. 8.
[6] Wilcox, *Sugar Water*. 85. USGS, "Hanalei, HI Quadrangle," topographic map, 1/24,000 scale. 1983.
[7] A. B. Gilmore, *The Hawaiian Sugar Manual, 1939*. (New Orleans: A.B. Gilmore). 1939. 152-154. A. B. Gilmore, *The Hawaiian Sugar Manual, 1936*. (New Orleans: A.B. Gilmore). 1936. 4. Wilcox, *Sugar Water*. 85.

C. Brewer, Ltd. of Honolulu became agent for KSC in the early 1930s and by 1935 the plantation owned over 2,600 acres of land and leased another 2,200 with about 3,600 acres under irrigation. During the late 1960s the plantation experienced several consecutive, unprofitable years and in 1970 announced to its 225 employees that it was closing operations following the 1971 harvest. The plantation and mill closed in November 1971.[8] Up until 2018, the reservoir had a normal storage capacity of about forty six million gallons. In 2018, heavy rains caused a near-overtopping of the dam that necessitated the emergency installation of an additional outlet of large-diameter piping. This piping maintains the maximum water level that is well below the crest of the dam.

SOURCES

A. Architectural Drawings:
No drawings of the Kalihiwai Reservoir or Dam were located for this report.

B. Early Views:
No early views were located for this report.

C. Bibliography:

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[8] William H. Dorrance and Francis S. Morgan, *Sugar Islands, The 165-year Story of Sugar in Hawai'i.* (Honolulu: Mutual Publishing). 2000. 32. "Hawai'i Sugar Plantation History, No. 12, Kīlauea, Island of Kaua'i," *Honolulu Star Bulletin*. May 25, 1935. 5. Hank Soboleski, "Kīlauea Sugar Co. Closed in November of 1971." *Garden Island*. January 3, 2021. B2.

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_____. Aerial photographs. Various dates.

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PROJECT INFORMATION

This HAER documentation was produced on the request of the Hawai'i State Preservation Division, (SHPD) in advance of a project to decommission the Kalihiwai Dam by breaching. This request was contained in SHPD Document No. 2307MK19. This decommissioning project has no NHPA Section 106 trigger and this HAER is to be donated to the Heritage Documentation Program (HABS/HAER/HALS).

This report was researched and written by Dee Ruzicka Mason Architects, Inc., Honolulu, Hawai'i. Archival photographs were taken by David Franzen of Franzen Photography, Inc., Kailua, Hawai'i.

Location Map: Kalihiwai Reservoir. North at top. *Map: USGS Hanalei HI Quadrangle, 2022.*

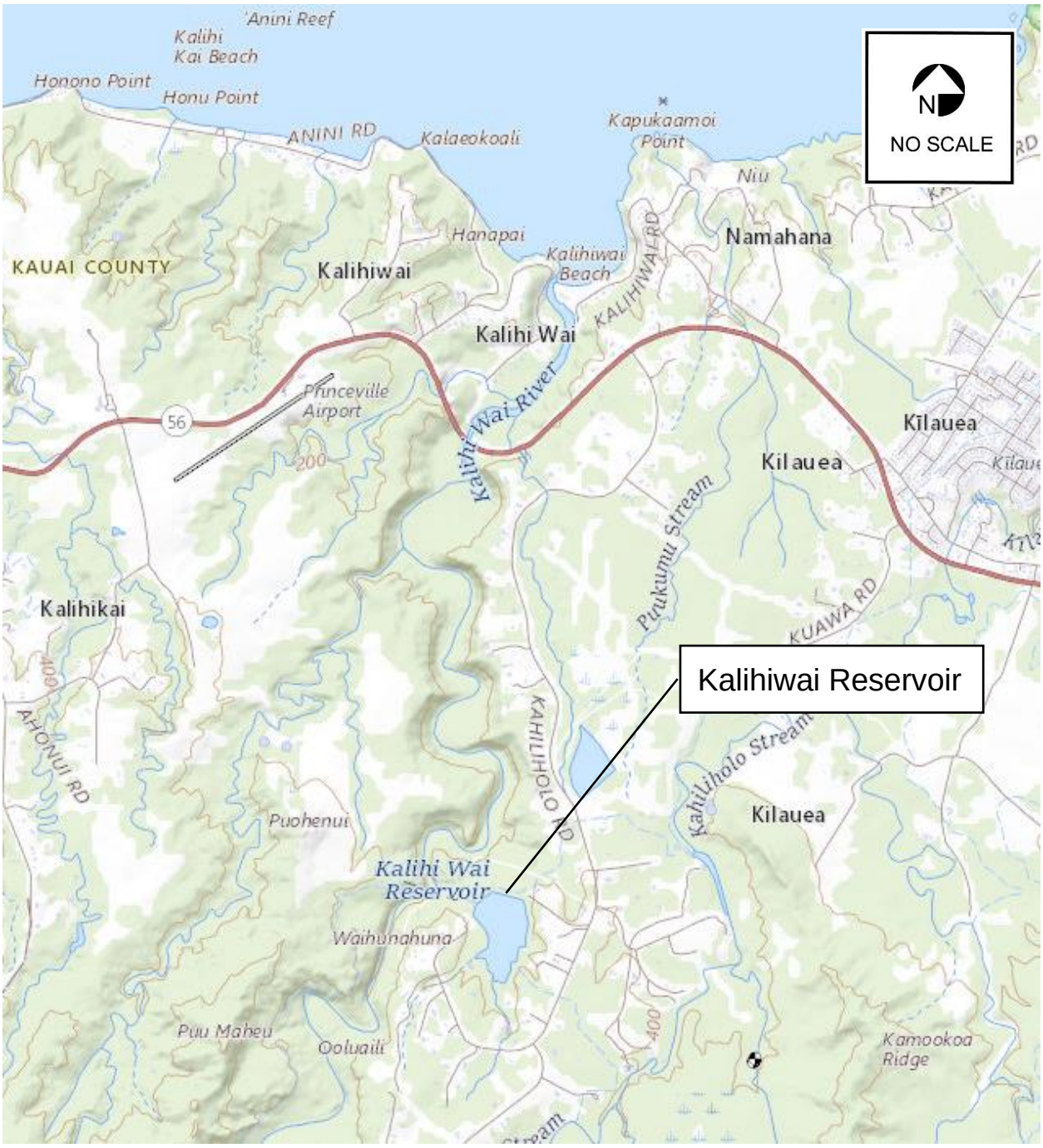
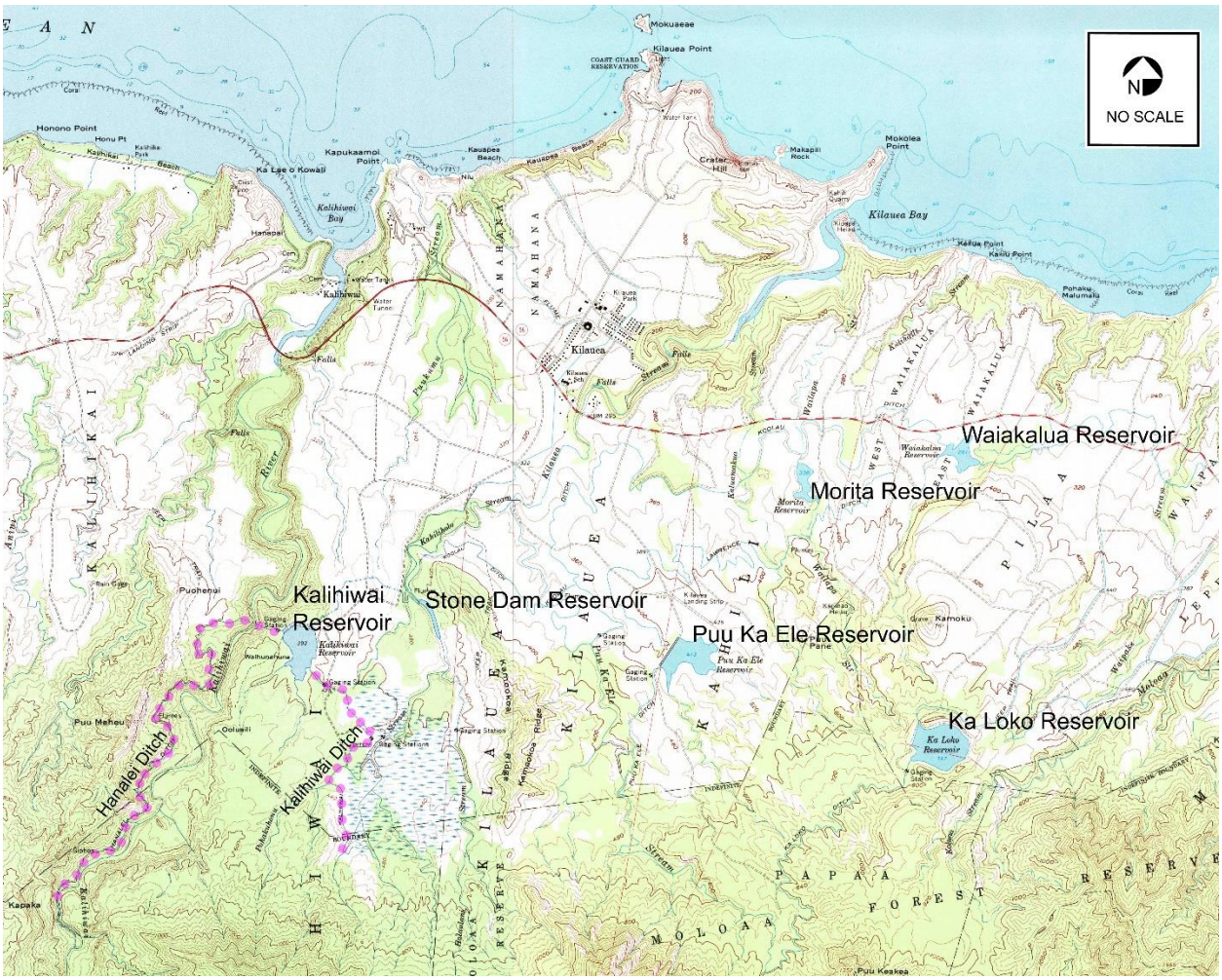


Figure 1. This 1950 aerial has added highlighting and labeling to indicate the Kalihiwai Reservoir and the nearby Census-Designated-Place of Kīlauea. Note that this photo shows the L-plan of the dam, at the north end of the reservoir. *Photo: USGS, Flight Line GSMF, Photo K-2-38. November 22, 1950.*

Figure 2. This 1963 map has added labeling to show the six reservoirs of the KSC irrigation system. The added dotted lines indicate the two supply ditches for the Kalihiwai Reservoir, the Hanalei Ditch and the Kalihiwai Ditch. *Map: USGS Hanalei and Anahola Quadrangles, 7.5 minute series. 1963.*



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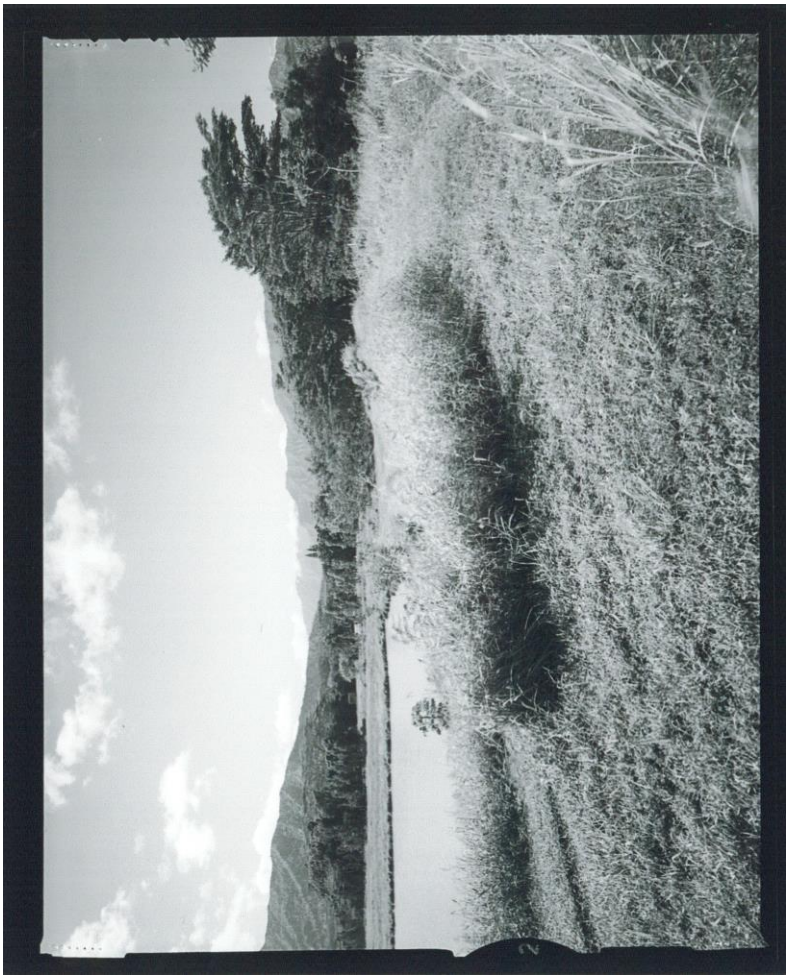

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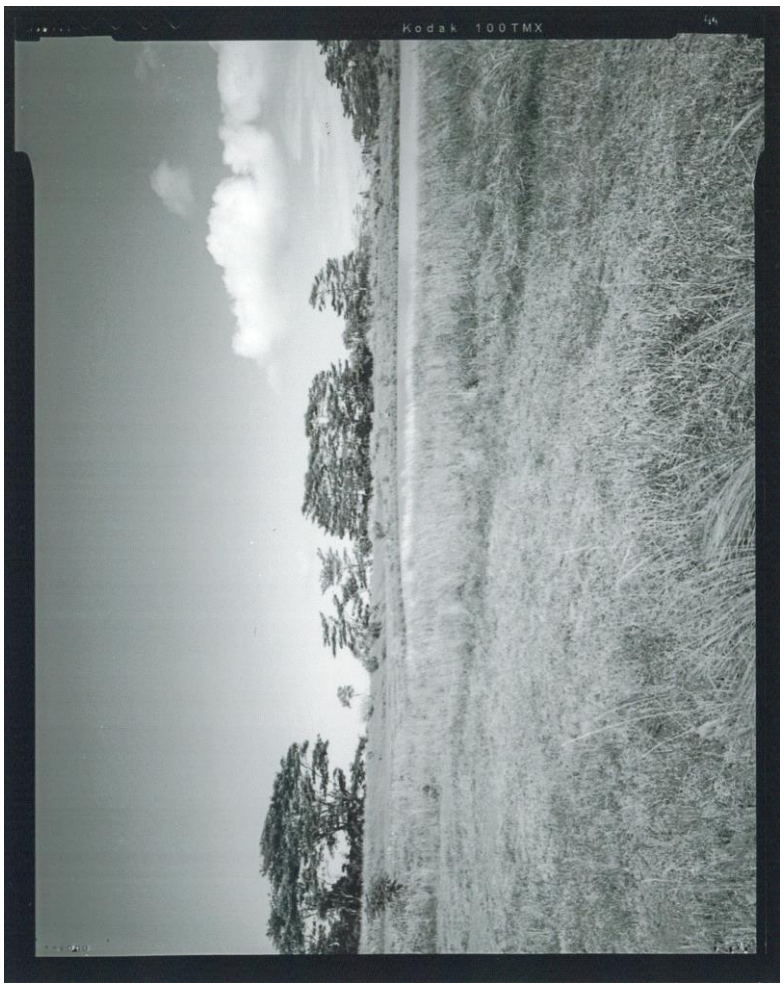

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